SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Miami University - Johnston Hall Career Services

B. Owner's Name: Miami University.

C. Architect's Name: Shyft Collective.

D. The Project consists of the alteration of existing circulation, office and storage space to create a new office suite for the Middletown Campus' Career Services Department.

1.02 WORK BY GENERAL CONTRACTOR

A. Scope of work outlined in the Contract Documents (i.e. Owner/Contractor Agreement, Drawings and Specifications) shall be provided by the General Contractor, unless noted otherwise. This generally includes, but is not limited to:
   1. Demolition (i.e. general trades, MEPT, etc).
   2. New interior partitions, doors/frames/hardware, interior storefront & glass, finishes, built-in millwork, whiteboards & lockers.
   3. New fire protection, plumbing, HVAC, electrical, fire alarm and technology work.
   4. Audio-Visual (AV) equipment, including cabling, wall mounts, and any other accessories.

1.03 WORK BY OTHERS

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner (OFOI) or a separate Contractor, beginning and completing at milestones indicated in the Bid Form (section 00 41 13). These items include, but are not limited to:
   1. Abatement of Hazardous Materials
   2. Loose Furnishings (workstations, pedestal files, task & guest chairs, etc).
   3. Miscellaneous Equipment (computer towers & monitors, printers, etc).

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.

B. Owner intends to occupy the Project upon Substantial Completion.

C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

D. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas required to complete the work. Coordinate with Owner prior to start of work.

B. Arrange use of site and premises to allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Work by Owner.
   4. Use of site and premises by the public.
   5. Adjacent operations.

C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.
   3. Alternative entrances, exits and Interim life safety procedures will be required if the main entrance or any fire exits are closed during construction. Coordinate durations with Owner.

4. Provide full access and protection to the Django [Restaurant] patrons and workers.

D. Time Restrictions:
   1. Limit conduct of especially noisy interior work to hours agreed to with the University, which may include hours prior to 7:30AM or after 6PM.

E. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Do not disrupt or shut down life safety systems, including but not limited to, limited area fire sprinklers and fire alarm system, without providing notice to Owner outlined in the general conditions.
   3. Prevent accidental disruption of utility services to other facilities.

1.06 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner and A/E.

B. Coordinate work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.

C. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practical; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. Execute cutting and patching to integrate elements of Work, uncover ill-timed, defective, and non-conforming Work, provide openings for penetrations of existing surfaces, and provide samples for testing if required. Seal penetrations through floors, walls, and roof.

1.08 DEFINITIONS AND EXPLANATIONS

A. Imperative language is used generally in the specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor as if preceded by the phrase “The Contractor shall”.

B. The term “provide” means furnish and install, complete, and ready for intended use. Except as otherwise defined in greater detail, the term “furnish” means supply and deliver to the project site, including unloading, unpacking, inspecting, and storing until ready for receipt by Owner, installation, etc., as applicable.

C. Except as otherwise defined in greater detail, the term “install” is used to describe operations at project site including assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations, as applicable.

D. The term “indicated” is as cross-reference to graphics, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in contract documents. Where terms such as “shows”, “noted”, “schedules”, and “specified” are used in lieu of “indicated”, it is for purpose of helping reader locate cross-reference, and no limitations of location is intended.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

C. Documentation of changes to Contract Sum and Contract Time.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

Alternate No. 01 – Storage Room 105I:

Base Bid: Provide new finish flooring, base and paint as indicated on finish floor plan and schedule, and also included in specifications. Existing ceiling, lighting, HVAC diffusers & ducts and sprinklers would all remain as part of the base bid.

Alternate: In addition to base bid work, provide replacement ceiling, lighting, HVAC diffusers and flex duct and new sprinkler heads.

Alternate No. 02 – Common Corridor 100, Existing Walls & Door Frames to Remain:

Base Bid: Face of existing walls and door frames on far west, north and east sides of Common Corridor 100 within the area of renovation indicated on architectural floor plan (including door niche recesses) shall remain existing color, and shall only be touched-up as they are impacted (i.e. damage, scuffed, etc) by completion of new work in this area.

Alternate: Face of existing walls and door frames on far west, north and east sides of Common Corridor 100 within the area of renovation indicated on architectural floor plan (including door niche recesses) shall be painted. Walls shall be “P1” and door frames shall be “P2”, refer to finish schedule.

Alternate No. 03 – Common Corridor 100, Existing Ceilings, Lighting & HVAC Diffusers:

Base Bid: Existing ceilings, lighting and HVAC diffusers in Common Corridor 100 located outside the footprint of the new Career Services Suite shall be temporarily supported in place, or removed, stored and reinstalled at the completion of the project. GC shall make determination as to whether temporarily supporting or removal, storage, and reinstall is most prudent. The reinstalled existing ceiling will then finish into the west, north and east walls/soffits of the new suite.

Alternate: New ceilings, lighting and HVAC diffusers shall be provided in Common Corridor 100, as indicated on the architectural reflected ceiling plan, electrical lighting plan and HVAC plans, and also as included in specifications. Modification of the existing ceiling system (i.e. cutting and re-supporting mains, cutting tiles, etc) will be required to provide finished aesthetic at rooms to west, north and east of this corridor outside of the scope of this project.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. References and standards.

C. Control of installation.

D. Mock-ups.

E. Tolerances.

F. Manufacturers' field services.

G. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Compliance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

D. Notify Architect seven (7) working days in advance of dates and times when mock-ups will be constructed.

E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within five (5) working days of initial review and each subsequent follow up review of each mock-up.

I. Accepted mock-ups shall be a comparison standard for the remaining Work.

J. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work .
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities: Electricity, lighting, heat, ventilation, gas.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers and enclosures.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

I. Field offices.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.03 GENERAL

A. Install temporary facilities and utilities in conformance with State and Local Codes and requirements.

B. Trade Contractors to obtain and pay for required applications, permits and inspections.

C. Maintenance: Temporary facilities and utilities are to be maintained and kept in good operating condition. Maintenance men necessary to perform this work shall be provided in accordance with requirements. Maintenance time will include normal working hours for all trades and start up and shut down overtime as required.

D. Removals: Subject to approval of General Contractor, contractor providing temporary facilities or services shall remove same when no longer required or when their function is replaced by authorized use of permanent facilities. Other removal time may be directed by General Contractor.

E. Install temporary work in such a manner as not to interfere with the permanent construction.

F. Disclaimer: Specific administrative and procedural minimum actions are specified in this section, as extension of provisions in General Conditions and other contract documents. These requirements have been included for special purposes as indicated. Nothing in this section is intended to limit types and amounts of temporary work required, and no omission from this section will be recognized as an indication by Architect, Engineer or General Contractor that such temporary activity is not required for successful completion of the work and compliance with requirements of contract documents. Provisions of this section are applicable to, but not by way of limitation, utility services, construction facilities, security/protection provisions, and support facilities.

1.04 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power , consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.

B. Provide and pay for all ventilation required for construction purposes.
   1. General Responsibilities: Temporary heating responsibilities and equipment types relate to the extent of building enclosure and work performed as follows:

C. Ventilation: The Mechanical Contractor shall provide ventilation for the building and to prevent building up of harmful dusts and fumes and to remove excess moisture. During warm weather, provide an adequate supply of fresh air (minimum 1 to 1-1/2 air changes per hour) when necessary to properly ventilate for moisture, dust, fumes from paints, cements, or adhesives in tightly enclosed area where natural ventilation will not be sufficient. Ventilation requirements may be supplemented by the building's permanent HVAC system but primary responsibility rests with the designated trade contractor.
   1. Mechanical Trade Contractor Responsibilities:
      a. Maintain as to temperatures and ventilation required for work in various parts of the building as follows:
         1) Stored Materials: As recommended by manufacturer.
         2) Installed Materials: As recommended by manufacturer for the length of time following installation.
      b. Maintain that portion of any floor thereof which has been constructed, or partly constructed, at a temperature and humidity that will ensure against damage due to warping, buckling, excessive shrinkage, etc., and adequate ventilation until the permanent HVAC system is operating. Trade Contractor will be responsible for damage to work under other contracts due to smoke or other damage caused by improper temporary heating.
      c. Installation, connection, operation, and maintenance of temporary heating and ventilating devices to be performed by tradesmen proficient in the skills required and meet requirements of applicable regulator agencies.
      d. Temperature Requirements:
         1) Provide temperatures required in various parts of the buildings as specified herein below:
         2) All Trades: provide the range of temperatures required for temporary heat, so the temperature as recommended by the manufacturer of the material concerned is maintained while such materials as mentioned above are stored in the building or being installed, and for the length of time recommended following installation. In those portions of the building where work is in progress or completed, it must be protected from freezing if subject to damage there from.
   2. During General Contract Work: Provide the following:
      a. During installation of gypsum wallboard or gypsum lath, a temperature of not less than 55 deg F during working hours, and a temperature of at least 40 deg F at all other times throughout the heating season.
      b. Wall before plaster work or joint work for gypsum wall board begins and continuous throughout setting and drying periods, a temperature range between 50 and 75 deg F shall be maintained day and night. During this period, no finish woodwork, resilient flooring or flexible wall coverings shall be installed or stored in the buildings, and no finish painting or applying of finish wall coatings shall be undertaken.
      c. For a period of 10 days previous to the placing of interior wood finish and throughout the placing of this and other interior finishing, varnishing, painting, etc., and until final acceptance of the work or until fully occupied by the Owner, provide sufficient heat to produce a temperature of not less than 60 deg F.
   3. Prior to Final Inspection:
      a. Replace temporary filters with new filters.
      b. Thoroughly clean coils and other equipment.
      c. Clean traps and devices, adjust and renew any and all materials and equipment not functioning correctly.
      d. Vacuum clean the duct system.
      e. Restore equipment to like new condition.

D. Temporary light and power:
   1. Each Trade Contractor:
      a. Provide and pay for its own extensions for lights or power tools beyond the receptacle outlets provided below.

2. Electrical Trade Contractor:
    a. Provide temporary light and power distribution for construction purposes for all trades including the cost of running temporary service from the utility supply. The temporary lighting and power system shall comply with all applicable OSHA regulations.
        1) Temporary power to be sufficient to operate all "light tools" and equipment (electric arc welders excluded) and permanent building equipment including elevators and HVAC system.
        2) Additional temporary power required by other trades to be furnished, at their cost, up to the power available.
3. Temporary lighting distribution to be made from the temporary panels indicated above. Each circuit shall consist of "pigtail" receptacles on 20 foot centers with 200 watt lamps installed in every other receptacle leaving the alternate receptacles for added concentration of lighting as needed. Wire fixtures with #8 AWG wire and suspend at least 10'-6" above the floor.
    a. As interior partitions are erected, revise the temporary lighting arrangements so that not less than 1 lamp is provided in each space if needed for work or required for safety. Also, install lights as directed by General Contractor, in smaller areas where required to provide adequate light for work being carried out in the space.
    b. Receptacle Outlets: See temporary light and power.
    c. Furnish and install 200 Watt lamps for general circuit lighting and all fuses as may be required for a complete job.
    d. Replace lamps, fuses, including theft, throughout the life of the project.
    e. Install and maintain a reasonably balanced system and take current readings on the feeders at regular intervals as required. Correct any serious phase unbalance.
    f. Protect the installation against weather damage, normal operations of other trades, and other persons on the site. Be responsible for the proper use and maintenance of temporary wiring systems until they are removed.

1.05 TELECOMMUNICATIONS SERVICES

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

B. Telecommunications services shall include:
    1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
    2. Internet Connections: Minimum of one; DSL modem or faster.

1.06 TEMPORARY SANITARY FACILITIES

A. Use of existing facilities is permitted.

1.07 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations .

B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 INTERIOR ENCLOSURES

A. Provide temporary partitions as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
    1. STC rating of 35 in accordance with ASTM E90.
    2. Maximum flame spread rating of 25 in accordance with ASTM E84.

C. Provide all shoring and bracing required for safety and proper execution of the work. Remove the items when the work is completed.

D. Paint surfaces exposed to view from Owner-occupied areas.

1.09 PROTECTION OF INSTALLED WORK

A. Protect installed work and provide special protection to protect work by other contractors.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects by protecting with durable sheet materials.

E. Prohibit traffic or storage on waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendation for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.10 SECURITY

A. Provide security and facilities to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.11 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

D. Provide and maintain access to fire hydrants, free of obstructions. Leave fire lanes and aisles to fire fighting equipment unobstructed at all times. Do not pile material in front of fire equipment, fire doors, or hydrants.

E. Designated existing on-site roads may be used for construction traffic.

F. Parking for Contractor's firm owned vehicles is limited, in number and location, to parking spaces designated by Owner. No parking or obstructing egress to and from Parking Areas will be allowed unless authorized by Owner.

G. Parking of private vehicles of workers shall be in an area allocated by the Owner.

H. Traffic and parking regulations of the Owner and the City are applicable and violators are subject to fines for infractions.

1.12 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition. Locate in area designated by Owner and General Contractor.

B. Carts, trucks, etc. used to transport materials shall be loaded in a safe manner. Materials shall not protrude beyond the sides of conveyance used.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

E. Materials shall not be thrown or dropped from scaffolds or other overhead areas.

F. Gasoline or other highly flammable liquids shall not be brought inside facilities.

G. Spills of any materials creating hazards shall be cleaned up immediately.

1.13 HAUL ROUTES

A. Haul routes shall be designated by Owner.

B. Confine construction traffic to designated route.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

1.14 PROJECT IDENTIFICATION

A. Provide project identification sign of design, construction, and location approved by Owner.

B. No other signs are allowed without Owner permission except those required by law.

1.15 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture and drawing display table.
   1. Review proposed location within Project Site with Owner
   2. Provide space for Project meetings, with table and chairs to accommodate 12 persons.

B. Field Offices shall be maintained until final acceptance and then be removed by the responsible party, no later than fifteen (15) days after acceptance of building, unless the General Contractor orders or approves earlier removal.

C. Expenses:
   1. General Contractor: All expenses in connection with his Field Offices, including the installation costs and use of telephones, heat, air-conditioning, light, water and janitor service shall be paid for by the General Contractor and will be fully reimbursed by the Owner.
   2. Prime or Trade Contractors: All expenses associated with their offices including utility installation costs shall be included in their bid.
   3. Toll Costs: All long distance calls to be paid for by party placing call including Architect, Owner's representative, and contractors.

D. Each Trade Contractor: To keep a complete set of drawings, and specifications kept marked up to date with revision, Addenda, as-built drawings, and all permits and approved shop drawings on file.

1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 USE OF PERMANENT SYSTEMS AND FACILITIES

A. Obtain written agreement with Owner, establishing start of warranties and conditions of use:

B. Systems complete, with utility connections and safety devices.

C. Automatic controls operational.

D. Temporary filters and items required for protection of equipment and finishes are in place.

E. Replace items damaged during temporary service use.

3.02 TOOL AND EQUIPMENT USE

A. All tools and equipment must conform to OSHA Safety Code and State Codes. All contractors' equipment must be removed upon completion of the job.

B. Necessary precaution and protection is to be exercised to prevent fires and damage from falling sparks from welding and cutting operations.

3.03 CLEAN-UP AND MATERIAL MOVING

A. Keep working area as clean as possible at all times. Do not allow refuse and debris to accumulate. All refuse and debris must be removed from work area by contractor each day and disposed of in a legal dumping site.

B. Each Trade Contractor and their subcontractors shall do their own clean-up, move materials that are in the way of construction, and repair and replace damage they do.

C. If the above work is not accomplished in a reasonable length of time, the Owner will do the required work. Cost of the work will be charged to the Trade Contractor.

D. Each Contractor shall do all cleaning of finish surfaces relative to their work prior to acceptance of their work. Each Contractor shall comply with all special cleaning instructions contained in the Specification.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.

B. Section 01 10 00 - Summary: Identification of Owner-supplied products.

C. Section 01 60 10 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

D. Section 01 60 10.01 - Substitution Request Form

E. Section 01 40 00 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

B. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is indicated in the documents.
   1. See Section 01 10 00 for list of items required to be salvaged for reuse and relocation.
   2. If reuse of other existing materials or equipment is desired, submit substitution request.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.
   2. Made of wood from newly cut old growth timber.
   3. Containing lead, cadmium, or asbestos.

C. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions.
   2. If wet-applied, have lower VOC content.
   3. Are extracted, harvested, and/or manufactured closer to the location of the project.

4. Result in less construction waste. See Section 01 74 19

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

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

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 60 10 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01 10 00 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Protect items until installation.
   4. Handle, store, install and finish products.
   5. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 60 10
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

B. Section 01 60 10.01 - Substitution Request Form

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution Requests made after contract award and for the Contractor's convenience will be subject to review fees, and possibly redesign fees, by the design team. These will be processed as a deductive change order to the contractor and paid to the design team by the Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms included in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Section 00 21 13 - Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

B. Submittal Form (before award of contract):
   1. Submit substitution requests by completing the form provided in Section 016011. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
   1. Submit substitution requests by completing the form provided in Section 01 60 11. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
   1. Contractor is responsible for ensuring that the proposed substitution is of equal to or superior to the basis of design in performance, appearance, quality and function prior to Architect’s review.
   2. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   3. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
   4. Bear the costs engendered by proposed substitution of:
      a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request. These will be processed as a deductive change order to the contractor and paid to the design team by the Owner.
      b. Other construction by Owner.
      c. Other unanticipated project considerations.

D. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record.

END OF SECTION

SECTION 02 41 00
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

B. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Sequencing and staging requirements.

C. Section 01 10 00 - Summary: Description of items to be removed by Owner.

D. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

E. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

F. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

G. Divisions 21-28 for additional utility demolition requirements.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Indicate locations of items and materials scheduled for salvage and reuse in the project.
   3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove portions of existing buildings as indicated in the Demolition Drawings.

B. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.

3. Provide, erect, and maintain temporary barriers and security devices.
4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
6. Do not close or obstruct roadways or sidewalks without permit.
7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation only.
1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Remove existing work as indicated and as required to accomplish new work.
1. Remove items indicated on drawings.
2. Salvage items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. Verify that abandoned services serve only abandoned facilities before removal.
4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

END OF SECTION

SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

B. Comply with manufacturer's written storage instructions.

C. Comply with manufacturer's written handling instructions prior to mixing.

1.05 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Low Gloss Clear Sealer:
   1. Use at following locations: all areas indicated as "SC" (sealed concrete).
   2. Apply to existing concrete

2.02 DENSIFIERS AND HARDENERS

A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
   1. Composition: silicate and siliconate polymers.
   2. Products:
      a. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
      b. Concrete Sealers USA; PS103 or PS107: www.concretesealersusa.com.
      c. CureCrete; Ashford Formula; www.ashfordformula.com
      d. Dayton Superior Corporation; Sure Hard Densifier J17: www.daytonsuperior.com.
      e. Euclid Chemical Companhy; EucoDiamond Hard; www.euclidchemical.com
      f. Kaufman Products Inc; SureHard LS: www.kaufmanproducts.net/#sle.
      g. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; SEAL HARD: www.lmcc.com/#sle.
      h. L.M. Scofield Company; SCOFIELD Formula One Lithium Densifier MP: www.scofield.com.
      i. Nox-Crete Products Group; Duro-Nox LS: www.nox-crete.com/#sle.
      j. PROSOCO, Inc; Consolideck LS/CS: www.prosoco.com/consolideck/#sle.

k. SpecChem, LLC; LithSeal SC: www.specchemllc.com/#sle.
l. W. R. Meadows, Inc; Liqui-Hard: www.wrmeadows.com/#sle.
m. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 COATINGS

A. Low Gloss Clear Sealer: Transparent, non-yellowing, solvent-based coating.
1. Composition: Acrylic polymer-based.
2. Nonvolatile Content: 15 percent, minimum, when measured by volume.
3. Products:
a. Concrete Sealers USA; TS202 Acrylic WB-25 Topical Sealer w/ Low Gloss: www.concretesealersusa.com.
b. Spartan Concrete Seal; www.spartanchemical.com
c. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items, including:
   1. Slotted Channel Adjustable Framing System

B. Miscellaneous angles, channels, tubes, plates, brackets and fasteners, as required to complete the project.

C. Miscellaneous angles, channels, tubes, plates, brackets and fasteners, as required to complete the project, including but not limited to:

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on prefabricated items/components.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.05 QUALITY ASSURANCE

A. Design members and connections for items carrying loads under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Fabricate steel items in accordance with AISC "Steel Construction Manual."

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Bolts, Nuts, and Washers: ASTM A307, galvanized to ASTM A153/A153M where connecting galvanized components.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

K. Anchoring Devices:
   1. Anchor Rods: Anchor rods used with structural steel members shall be plain steel rods conforming to ASTM F1554 (Grade 36), complete with suitable nuts and washers, unless noted otherwise.
   2. Expansion Bolts: Expansion anchors shall consist of one-piece wedge type carbon steel anchor bolts with heavy-duty nuts and washers. All components shall be zinc plated in accordance with ASTM B633.
      a. Structural Applications
         1) Acceptable products must have a valid and current ICC report, as listed at www.icc-es.org <http://www.icc-es.org>.
      b. Non-Structural Applications
         1) Acceptable Manufacturers and products: Hilti Fastening Systems- Kwik Bolt III Anchor; ITW Red Head Mechanical Anchoring Systems - Trubolt Wedge Anchor; Powers Fastening Inc - Power-Stud Anchor; (or approved equivalent)
   3. Epoxy Adhesive Anchoring System: Epoxy anchoring shall consist of a threaded rod and the epoxy adhesive cartridge.
      a. Structural Applications
         1) Acceptable products must have a valid and current ICC report, as listed at www.icc-es.org <http://www.icc-es.org>.
      b. Non-Structural Applications
      c. Acceptable Manufacturers and products: Hilti Fastening System - HIT RE 500; ITW Red Head Adhesive Anchoring Systems - Epcon C6 Adhesive; Powers Fastening Inc. - PE1000+; (or approved equivalent.

L. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 5,000 psi at 28 days.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds, where welding is indicated.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

G. Welded Joints: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld corners and seams continuously where visible or where exposed to moisture, even if intermittent or stitch welds are structurally adequate, and to comply with the following:
   1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by continuous welds.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.03 FABRICATED ITEMS

A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and other non-structural members; prime paint finish.

B. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.
   1. Product: System of channel members and bolted connections fabricated to support loads without welded connections.
   2. Fittings and accessories shall be fabricated from hot rolled, pickled and oiled steel plates meeting the requirements of ASTM A 575.
   3. Nuts and screws shall be Unified and American coarse screw thread meeting the requirements of ASTM A 576 GR1015 (nut), and ASTM A 307 and SAE J429 GR2 (screw).
   4. Nuts and screws shall be electro-galvanized (EG) coated to commercial standards meeting the requirements of ASTM B 633 Type III SC1 finish.
   5. Finish: Adjustable framing shall be pre-finished with Unistrut's Perma-Green II; B-Line's Dura Green; or equal. All miscellaneous accessories, brackets, and fittings shall match framing.
   6. Manufacturer: Unistrut Corporation Unistrut; B-Line Systems, Inc. Powerstruct; or equal.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be imbedded in masonry, and all exterior items.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prime Painting: One coat.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Examine substrates and site area for conditions that might prevent satisfactory installation.

1. Where installing items to precast concrete, concrete or masonry, propose connections not detailed for structural engineer approval.

C. Verify that dimensions of supporting structure are within plus/minus 1/8 inch of dimensions shown on shop drawings.

D. Verify that all adjacent painting, roofing, masonry work, and other work that might damage prefinished items has been completed prior to installation.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete.

C. Remove all mill scale, rust, grease, foreign matter and surface imperfections from steel components that will be painted to ensure a smooth, even appearance of finish.

3.03 INSTALLATION

A. Install premanufactured items in accordance with manufacturer's installation instructions.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Anchor units to structure as indicated on the drawings.

E. Field weld components as indicated on shop drawings.
1. Perform field welding in accordance with AWS D1.1/D1.1M.

F. Obtain approval prior to site cutting or making adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

H. 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. Grout voids as required to result in secure installation.

I. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story or 10 feet, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch in 10 feet.

C. Maximum Out-of-Position: 1/4 inch in 48 inches.

3.05 CLEANING

A. Clean exterior surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.06 PROTECTION

A. Protect items after installation to prevent damage due to other work until Date of Substantial Completion

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials.

B. Fire retardant treated wood materials.

C. Communications and electrical room mounting boards.

D. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: painting of exposed mounting boards.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. AWPA U1 - Use Category System: User Specification for Treated Wood.

C. PS 1 - Structural Plywood.

D. PS 20 - American Softwood Lumber Standard.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on panel products.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Lumber fabricated from old growth timber is not permitted.

C. Engineered wood products containing added urea-formaldehyde are not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Fire-retardant treated.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 1 or Construction Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Concealed Backing for wall-mounted items- provide backing as required for loading from one of the following:
   1. All wood backing to be fire-rated.
   2. Dimension Lumber: as noted above
   3. Contractor's option: proprietary fire-resistance-treated blocking and bracing in width indicated or required for loading: ClarkDietrich Building Systems LLC Danback Fire-Treated Wood Backing Plate.
   4. Plywood: as noted below

C. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber in contact with masonry or concrete.
      c. Treat lumber less than 18 inches above grade.
      d. Treat lumber in other locations as indicated.

2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
    a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
    b. Treat plywood in contact with roofing, flashing, or waterproofing.
    c. Treat plywood in contact with masonry or concrete.
    d. Treat plywood less than 18 inches above grade.
    e. Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.01 PREPARATION

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
    1. Cabinets and shelf supports.
    2. Wall brackets.
    3. Handrails.
    4. Grab bars.
    5. Towel and bath accessories.
    6. Wall-mounted door stops.
    7. Chalkboards, tack boards and marker boards.
    8. Wall paneling and trim.
    9. Wall-protection items, including corner guards.
    10. Owner-provided wall-mounted equipment, whether owner-installed or contractor-installed.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
    1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
    2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
    3. Install adjacent boards without gaps.

3.05 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.06 CLEANING

A. Waste Disposal:
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

3.07 SCHEDULES

A. Comm/Electrical Room Mounting Boards: 8 feet tall, all walls, painted white.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Cabinet hardware and accessories.

C. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 07 92 00 - Joint Sealers: sealant at millwork and countertops at walls

C. Section 12 36 00 - Countertops.

D. Division 22 - Plumbing: coordination of drop-in sinks, plumbing fixture trim and connections

E. Division 26 - Electrical: coordination of lighting and electrical trim and connections.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0.

C. NEMA LD 3 - High-Pressure Decorative Laminates.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Provide casework locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required. Indicate materials, component profiles, configurations, assembly methods, fastening methods, jointing details, utility and service requirements and locations, accessory listings, hardware location and schedule of finishes.

1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Product Data: Provide data for hardware accessories.

1.05 DESIGN REQUIREMENTS

A. Reinforce frame and support counters in all areas, to safely support a load of 200 lbs (90 kg) concentrated on one square foot (0.093 sq m) in any area with no indentation showing on surface and with permanent set not exceeding 0.005 inch (0.127 mm).

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept casework on site. Inspect on arrival for damage.

B. Protect units from moisture, soiling, or damage during handling and installation.

C. Protect work surfaces throughout the construction period with corrugated cardboard covering the top and securely taped to edges.

1.08 FIELD CONDITIONS

A. Coordinate casework installation with size, location and installation of service utilities.

B. Coordinate layout and installation of blocking and reinforcement in walls for support of casework.

C. Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the work.

D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

E. Do not deliver product until the following conditions are met:
   1. Windows and doors are installed and the building is secure and weathertight.
   2. Ceiling, overhead ductwork and lights are installed.
   3. All painting is completed and floor tile is installed.

F. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

1.09 SCOPE OF THE CASEWORK SUPPLIER/INSTALLER:

A. Casework and accessories: Furnish to building, and unpad and/or uncrate, set in place, level and fasten all specified casework and equipment.

B. Clean up: Remove debris, dirt, and rubbish accumulated as a result of delivery of this equipment and leave premises broom clean and orderly.

C. ADA-Americans With Disabilities Act Requirements: The following special requirements shall be met, where specifically indicated on architectural plans as “ADA,” at public spaces or by General Note. To be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:
   1. Countertop height: with or without cabinet below, not to exceed a height of 34 inches A.F.F., (Above Finished Floor), at a surface depth of 24 inches.
   2. Kneespace clearance: to be a minimum 27 inches A.F.F., and 30 inches clear span width. ¾” inch deep shelving, adjustable of fixed: not to exceed a range from 9 inches A.F.F. to 54 inches A.F.F.
   3. Sink cabinet clearances: in addition to F.1., 2. above, upper kneespace frontal depth to be no less than 8 inches, and lower toe frontal depth to be no less than 11 inches, at a point 9 inches A.F.F.

D. Fillers, scribes, access holes: Provide all necessary fillers and scribes for a complete job. Provide all access holes in cabinets and countertops required by mechanical, electrical, and HVAC contractors.

1.10 SCOPE NOT COVERED BY CASEWORK SUPPLIER/INSTALLER:

A. Service to and within equipment: Furnishing piping system, traps, drain lines, and conduit within equipment, in service turrets or tunnels, through, under or along backs of working surfaces and in reagent racks above countertops.

B. Setting of plumbing fixtures and accessory fixtures, and final connections of such.

C. Plumbing services: Furnishing, installation and connection of traps, drain lines, drop-in sinks, vents, steam fittings and special plumbing fixtures or piping to meet local codes, whether or not specifically called for in the contract documents.

D. Electrical services: Furnishing and installation of rigid and flexible conduit, fittings, and special electrical equipment and accessories, wire, pulling of wire, and wiring and connection to electrical boxes, receptacles, switches, lights, and flush plates. Work shall be in accordance with local codes, whether or not specifically called for in the contract documents.

E. Bracing and supports: Furnishing and installation of all framing and reinforcements of wall, floors and ceilings necessary to adequately support the equipment, and all bucks and plaster grounds required for proper installation of equipment. Casework supplier/installer to direct others as to the type of bracing required and the location needed.

F. Base molding 4” or 6” high applied to casework, furnished and installed by flooring contractor.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Cabinets:
   1. Finish - Exposed Interior Surfaces: Decorative laminate.
   2. Finish - Exposed Interior Surfaces: Same as exterior
   3. Finish - Semi-Exposed Surfaces: Decorative laminate
   4. Finish - Concealed Surfaces: Decorative laminate, white.
   5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   6. Casework Construction Type: Type A - Frameless.
   7. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
      a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
   8. Adjustable Shelf Loading: 50 lbs. per sq. ft.
      a. Deflection: L/144.
   9. Cabinet Style: Flush overlay.
   10. Cabinet Doors and Drawer Fronts: Flush style.
   11. Drawer Construction Technique: Dovetail joints.
   12. Toe Kicks: Heights vary. See elevations for height of base.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

A. Softwood Lumber: NIST PS 20; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as follows:
   1. Concealed Surfaces: Species - contractors choice.

2.04 PANEL MATERIALS

A. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with marine-grade waterproof adhesive to suit application; no formaldehyde permitted; sanded faces; thickness as required.
   1. Face species where exposed: White Oak, stained with transparent finish.
   2. 48 pounds per cubic foot density.
   3. Thickness:
      a. 1” thick for countertop core
      b. ¾-inch thick for all sides (including tops) on cabinets, shelves, and door/drawer fronts.
      c. 5/8-inch thick for drawer bodies.

B. Softwood Plywood, Not Exposed to View: Any face species, veneer core; PS 1 Grade A-B, glue type as recommended for application.

2.05 LAMINATE MATERIALS

A. Manufacturers:
   1. Formica Corporation: www.formica.com.
   2. Panolam Industries International, Inc; Nevamar: www.nevamar.com.
   3. Panolam Industries International, Inc: Pionite: www.pionitelaminates.com.
   4. Wilsonart LLC: www.wilsonart.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
   1. Manufacturers/Product/Style/Color: See Interior Finish Schedule.

C. Provide specific types as follows:
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as scheduled.
   3. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 COUNTERTOPS

A. Countertops are specified in Section 12 36 00.

2.07 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

2.08 HARDWARE

A. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome or satin chrome finish, for nominal 1 inch spacing adjustments.
   1. Product: 346ANO manufactured by Knape and Vogt.

B. Drawer and Door Pulls: bar/ladder pull, 4-inch, satin nickel finish..
   1. Product: 108.76.731 by Hafele

C. Drawer Slides:
   1. Type: Full extension with overtravel.
   2. Static Load Capacity: Heavy Duty grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.
   6. Manufacturers:
      a. Accuride International, Inc: www.accuride.com.
      b. Grass America Inc: www.grassusa.com.
      c. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

D. Hinges: European style concealed self-closing type, steel with satin finish.
   1. Manufacturers:
      a. Grass America Inc: www.grassusa.com.
      b. Hafele; www.hafele.com
      c. Hardware Resources: www.hardwareresources.com.
      d. Julius Blum, Inc: www.blum.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Soft Close Adapter: Concealed, frame-mounted, screw-adjustable damper ; steel with satin finish.

F. Wall Cleats: French cleats for stud wall partitions, with lower cleat fastened to wall and upper cleat fastened to millwork.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
   1. Run grain vertically at all panels.

F. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Fully finish exposed cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets and counter bases to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

H. Seal joint between back/end splashes and vertical surfaces.

I. Provide matching casework filler panel to occupy remaining space between casework and adjacent walls as necessary to accommodate for field dimensions.

3.03 INSTALLATION ITEMS BY TRADE CONTRACTOR

A. Install plumbing and electrical service to and within equipment.

B. Set plumbing fixtures and accessory fixtures, and make final connections of such.

C. Complete wiring and connection to electrical boxes, receptacles, switches, lights, and flush plates. Work shall be in accordance with local codes, whether or not specifically called for in the contract documents.

D. Close ends of units, splash aprons, shelves and bases with sealant.

3.04 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.05 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

B. Clean all materials provided under this section and all adjacent materials, which may have become soiled from this work.

1. High Pressure Laminates (HPL): refer to NEMA publication Ld3-2005 Annex B Care and Cleaning of Laminates.

C. Wipe out millwork interiors and empty drawers of dirt and debris. Remove pencil marks and other blemishes from millwork surfaces.

D. Remove foreign matter that could affect operation or appearance of hardware.

E. Make final adjustments to drawers and doors. Doors shall swing freely. All doors shall be aligned both vertically and horizontally. Drawers shall open and close smoothly, without binding or excessive slide and play.

3.06 PROTECTION OF FINISHED WORK

A. Do not permit finished casework to be exposed to continued construction activity.

B. Cover with protective cover, taped to casework.

C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
   1. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies.

D. ITS (DIR) - Directory of Listed Products.

E. FM (AG) - FM Approval Guide.

F. SCAQMD 1168 - Adhesive and Sealant Applications.

G. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems.

H. UL (FRD) - Fire Resistance Directory.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
   1. VOC Data: provide printed statement of VOC content of non-preformed sealants

D. Sustainable Design Submittal: Submit VOC content documentation for all non-preformed materials.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated, ASTM E119, and ASTM E814.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by manufacturer.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. A/D Fire Protection Systems Inc: www.adfire.com.
   3. Hilti, Inc: www.us.hilti.com/#sle.
   4. Nelson FireStop Products: www.nelsonfirestop.com.
   5. Specified Technologies Inc: www.stifirestop.com/#sle.
   6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 “Performance Requirements” Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

2.04 MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specified diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

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

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

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillow/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
   2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
   3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.05 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

B. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.06 FIRESTOPPING SYSTEMS

A. Firestopping:
   1. Fire Ratings: See drawings for required systems and ratings.

B. Firestopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches or less: Any material meeting requirements.
   1. Available UL-Classified Systems: C-BJ-2001-2999 and W-L-2001-2999.

C. Firestopping at Insulated Pipes, of diameter 4 inches or less: Any material meeting requirements.
   1. Available UL-Classified Systems:C-BJ-5001-5999 and W-L-5001-5999.

D. Firestopping at Cable Tray Penetrations: Any material meeting requirements.
   1. Available UL-Classified Systems:W-L-4001-4999.

E. Firestopping at Cable Penetrations, not in Conduit or Cable Tray: Any material meeting requirements.
   1. Available UL-Classified Systems: C-BJ-3001-3999, W-L-6001-6999 and W-L-3001-3999.

F. Firestopping at Control Joints (without Penetrations): Any material meeting requirements.
   1. Available UL-Classified Systems: C-BJ-0001-0999 and W-L-0001-0999.

G. Firestop Systems for Miscellaneous Penetrants: Any material meeting requirements.
   1. Available UL-Classified Systems:W-J-7001-7999 and W-L-7001-7999.

H. Firestop Systems for Groupings of Penetrants: Any material meeting requirements.
   1. Available UL-Classified Systems:C-BJ-8001-8999 and W-L-8001-8999.

2.07 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time,

and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

B. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

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

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Firestopping sealants.

B. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

B. ASTM C834 - Standard Specification for Latex Sealants.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants.

F. SCAQMD 1168 - Adhesive and Sealant Applications.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Installation Plan: Submit at least four weeks prior to start of installation.

F. Installation Log: Submit filled out log for each length or instance of sealant installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.

C. Installation Plan: Include schedule of sealed joints, including the following.
   1. Installation Log Form: Include the following data fields, with known information filled out.
      a. Location on project.
      b. Substrates.
      c. Sealant used.
      d. Stated movement capability of sealant.

e. Primer to be used, or indicate as "No primer" used.
f. Size and actual backing material used.
g. Date of installation.
h. Name of installer.
i. Actual joint width; provide space to indicate maximum and minimum width.
j. Actual joint depth to face of backing material at centerline of joint.
k. Air temperature.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.
1. For silicone sealants within 20 years.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
1. Adhesives Technology Corporation: www.atcepoxy.com.
2. Bostik Inc: www.bostik-us.com.
3. Chem Link, Inc: www.chemlinkinc.com.
4. Dow Corning Corporation: www.dowcorning.com/construction/sle.
5. Fortifiber Building Systems Group: www.fortifiber.com/sle.
6. Hilti, Inc: www.us.hilti.com/#sle.
7. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
8. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/sle.
9. Pecora Corporation: www.pecora.com/?sle.
10. **BASIS OF DESIGN:** PPG Paints
11. Sherwin-Williams Company: www.sherwin-williams.com.
12. Sika Corporation: www.usa-sika.com.
13. Specified Technologies Inc: www.stifirestop.com/#sle.
14. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
15. W.R. Meadows, Inc: www.wrmeadows.com/sle.
16. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.03 NONSAG JOINT SEALANTS

A. Acoustical Sealant- Acrylic-Urethane Sealant: Water-based; ASTM C920, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
2. Hardness Range: 15 to 40, Shore A, when tested in accordance with ASTM C661.
3. Color: White.
4. Applications:
a. In sound-rated wall assemblies, and where not indicated as fire-rated:

1) gaps between top stud runner and structure, between bottom stud track and floor, between gypsum wall board and floor, and between gypsum wall board and structure.
2) gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.

B. General Purpose Interior Sealant - Elastomeric Siliconized Acrylic Latex: Water-based; ASTM C834, flexible, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: white, Type OP (opaque).
   2. Paintable, for joints up to 1/2-inch
   3. Grade: ASTM C834; Grade - Minus 18 Degrees C.
   4. Manufacturers:
      a. PPG: Top Gun 200 1414
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   5. Applications:
      a. Interior wall and ceiling control joints in non-wet areas.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Other interior joints for which no other type of sealant is indicated.

2.04 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates and joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
   1. Width/depth ratio of 2:1.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Do not seal the following types of joints.
   1. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   2. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   3. Joints where installation of sealant is specified in another section.
   4. Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.

I. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

3.06 FIELD QUALITY CONTROL

A. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Repair of existing door frames.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking.

B. Section 07 92 00 - Joint Sealants.

C. Section 08 14 16 - Flush Wood Doors

D. Section 08 71 00 - Door Hardware.

E. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

F. Section 09 91 23 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. SDI: Steel Door Institute.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

H. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities.

J. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames.

K. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames.

L. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames.

M. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.

N. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Door and Frame Schedule: Indicate door numbers, sizes, handing, etc. for approval.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

1.08 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

B. Doors and/or frames which are not manufactured to specified size and planar tolerances shall be removed from the site and replaced without charge to the Owner.

1.09 WARRANTY

A. Provide manufacturer's standard warranty, to include rehanging at no cost to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames: (note: exterior doors are required to be thermally-broken, not all manufacturers may have this available).
   1. Ceco or Curries, an Assa Abloy Group company: www.assaabloydss.com.
   2. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
   3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   4. Steelcraft, an Allegion brand: www.allegion.com/sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Hinged edge square, and lock edge beveled.
   5. Typical Door Face Sheets: Flush. Smooth, seamless, joints mitered, interlocked, welded and ground smooth.
   6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Flush.
   7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
      a. Steel Door Reinforcing:
         1) Minimum 10 gauge steel of equivalent thread depth for hinges.
         2) Minimum 12 gauge steel for lock front, closers, and overhead hold open/stop arms.
         3) Minimum 14 gauge steel for other hardware.

b. Steel Frame Reinforcing:
   1) Minimum 7 gauge steel of equivalent thread depth for hinges.
   2) Minimum 12 gauge steel for closers and overhead hold open/stop arms.
   3) Minimum 14 gauge steel for strikes and other hardware.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Interior Doors, Non-Fire Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
   2. Core Material: 20 gage vertical steel stiffeners, sound insulation core.
   3. Door Thickness: 1-3/4 inch, nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. General:
   1. Comply with the requirements of grade specified for corresponding door.
      a. ANSI A250.8 Level 2 and 3 Doors: 14 gauge frames.
      b. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 3, 16 gauge.
      c. Doors over 4’-0” wide: 14 gauge frames.
      d. Other doors: 16 gauge.
   2. Face Width: as indicated.
   3. Frame Depth: Coordinate to fit actual wall thicknesses, wrapping drywall.
   4. Frame Profile: Double rabbet, unless otherwise indicated.
   5. Hospital / Terminated Stops: not required.
   6. Knock-down frames are prohibited.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

G. Transom Bars: Fixed, of profile same as jamb and head.

H. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
   1. Coordinate with painter so that silencers are not painted.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

E. Body Filler for repair of existing door frames: repair putty for filling dents and gouges in galvanized and non-galvanized hollow metal doors and frames; Bondo All-Purpose Putty by 3M or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions, related requirements of specified door and frame standards or custom guidelines indicated, and NAAMM HMMA 840.

B. Coordinate frame anchor placement with wall construction.

C. Install batt insulation at frames in gypsum board walls.

D. Install door hardware as specified in Section 08 71 00.

E. Comply with glazing installation requirements of Section 08 80 00.

F. Touch up damaged factory finishes.

3.03 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; non-rated.

B. Transom panels.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 71 00 - Door Hardware.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

D. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door veneer, 6 by 6 inch in size illustrating wood grain, stain color, and sheen.

E. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors: Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty:

1. Algoma Hardwoods: www.algomahardwoods.com
2. Eggers Industries: www.eggersindustries.com.
3. Marshfield DoorSystems, Inc: www.marshfielddoors.com.

4. VT Industries: www.vtindustries.com..
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

A. Doors: Refer to drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
   3. No added urea-formaldehyde.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Wood veneer facing with factory transparent finish.

C. Transom Panels: Same construction and finish as door; same performance rating as door.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red Oak or Maple (as selected by Architect if not in Finish Schedule), veneer grade in accordance with quality standard indicated, rift cut (only red and white oak), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer, lumber or veneer (ME), or compatible hardwood (CE), sanded ease; visible joints allowed on hinge edge.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.
   3. Transoms: Continuous match to doors.

B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 11, Polyurethane, Catalyzed.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.
      d. Color: stain as selected from manufacturer's full range.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: As specified in Section 08 11 13.

B. Glazing: As specified in Section 08 80 00.

C. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.

D. Door Hardware: As specified in Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
   2. Install smoke and draft control doors in accordance with NFPA 105 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 087100
DOOR HARDWARE

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. Mechanical hardware for:
   a. Swinging doors.

2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

1.3 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers’ technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

   a. Door Index; include door number, heading number, and Architects hardware set number.
   b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
   c. Type, style, function, size, and finish of each hardware item.
   d. Name and manufacturer of each item.
   e. Fastenings and other pertinent information.
   f. Location of each hardware set cross-referenced to indications on Drawings.
   g. Explanation of all abbreviations, symbols, and codes contained in schedule.
   h. Mounting locations for hardware.
   i. Door and frame sizes and materials.
   j. Name and phone number for local manufacturer's representative for each product.
      1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

4. Key Schedule:

   a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
   b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
      1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product Certificates for electrified door hardware, signed by manufacturer:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Certificates of Compliance:
   a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
   b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.

4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:

   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Name, address, and phone number of local representative for each manufacturer.
   d. Parts list for each product.
   e. Final approved hardware schedule, edited to reflect conditions as-installed.
   f. Final keying schedule
   g. Copies of floor plans with keying nomenclature
   h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
   i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note:

   Certain products have been selected for their unique characteristics and particular project suitability.)

   a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.

2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

   1. Warehousing Facilities: In Project's vicinity.
   2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
   3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
   4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

   1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
   2. Can provide installation and technical data to Architect and other related subcontractors.
   3. Can inspect and verify components are in working order upon completion of installation.
   4. Capable of producing wiring diagrams.
   5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

   1. Provide electrified door hardware from same manufacturer as mechanical door hardware,

unless otherwise indicated.
2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.

I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
2. Maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
    b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
    c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.

J. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Attendees: Owner, Contractor, Architect, Installer, Owner's security consultant, and Supplier's Architectural Hardware Consultant.
2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Address for delivery of keys.

K. Pre-installation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Review required testing, inspecting, and certifying procedures.

L. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

a. Attendees: Door hardware supplier, door hardware installer, Contractor.
b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.

2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

D. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers:
   1) Mechanical: 30 years.
b. Exit Devices:
   1) Mechanical: 3 years.
c. Locksets:
   1) Mechanical: 3 years.
d. Continuous Hinges: Lifetime warranty.
e. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation,

improper use or abuse.

1.9 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and particular project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work,

to match finish of this other work including prepared for paint surfaces to receive painted finish.

3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.3 HINGES

A. Provide five-knuckle, ball bearing hinges.

1. Manufacturers and Products:
   a. Scheduled Manufacturer and Product: Ives 5BB series
   b. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series

B. Requirements:

1. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

2. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

3. 2 inches or thicker doors:
   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins

d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
8. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.

2.4 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:
   a. Scheduled Manufacturer: Ives.
   b. Acceptable Manufacturers: Markar, Select, Stanley.

2. Requirements:
   a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.25, Grade 2.
   b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.
   c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
   d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
   e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
   f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
   g. Install hinges with fasteners supplied by manufacturer.
   h. Provide hinges with symmetrical hole pattern.

2.5 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series
2. Acceptable Manufacturers and Products: No Substitute.

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Indicators: Where specified, provide indicator window measuring a minimum 2 inch x 1/2 inch with 180 degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
    a. Occupied Indicator: Provide indicator above cylinder for visibility while operating the lock that identifies the trim as occupied/unoccupied status of the door. Indicator in unoccupied state has a white background with black text and icon. Indicator in the occupied state has a red background with white text and icon.

3. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
    a. Lever Design: Schlage 07A.
    b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.6 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Best
2. Acceptable Manufacturers: No substitute.

B. Requirements:

1. Provide cylinders/cores, from the same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder

   face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
    a. Conventional cylinder with interchangeable core (SFIC) core with open keyway.
    b. Keying: Manufacturer-keyed permanent cylinders/cores, configured into keying system per "KEYING" article herein.
    c. Features: Cylinders/cores shall incorporate the following features.

3. Nickel silver bottom pins.
4. Replaceable Construction Cores.
    a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
        1) 12 construction change (day) keys.
    b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.7 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
    a. Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features.
    a. Material: Nickel silver

4. Identification:
    a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
    b. Identification stamping provisions must be approved by the Architect and Owner.
    c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
    d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
    e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.
    a. Change (Day) Keys: 3 per cylinder/core.
    b. Permanent Control Keys: 3.
    c. Master Keys: 6.
    d. Unused balance of key blanks shall be furnished to Owner with the cut keys.
    e. Extra Keys:

1) 12 Construction Keys

2.8 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series
2. Acceptable Manufacturers and Products: No Substitute.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter, with 5/8 inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.9 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives, Rockwood
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide push plates 8 inches (204 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
3. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
4. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.10 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
   a. Kick Plates: 8 inches (204 mm) high by 1-1/2 inches (38 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
   b. Mop Plates: 4 inches (102 mm) high by 1-1/2 inches (38 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.11 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior doors.
2. Provide heavy surface mounted overhead stop or holder for interior doors as specified.

2.12 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where wall stop cannot be used, provide overhead stop.

2.13 SEALS, DOOR SWEEPS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: National Guard Products
2. Acceptable Manufacturers: Pemko, Zero International

B. Requirements:

1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds::
   a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
   b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.14 SILENCERS

A. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.15 FINSHES

A. Finish: BHMA 626/652 (US26D); except:

1. Continuous Hinges: BHMA 628 (US28)

2. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
3. Protection Plates: BHMA 630 (US32D)
4. Overhead Stops and Holders: BHMA 630 (US32D)
5. Door Closers: Powder Coat to Match
6. Wall Stops: BHMA 626 (US262D)
7. Weatherstripping: Clear Anodized Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
   a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
   b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
   c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

C. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

E. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

F. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

G. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Furnish permanent cores to Owner for installation.

H. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

I. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

J. Stops: Provide floor stops for doors unless wall or other type stops are indicated in

door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

K. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame

3.4 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Engage qualified Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

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

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three (3) months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain

door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training".

3.8 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. It is intended that the following schedule includes all items of the finish hardware necessary to complete the work. If a discrepancy is found in the schedule, such as a missing item, improper hardware for a frame, door or fire codes, it shall be the responsibly of the hardware supplier to supply the proper materials.

Hardware Sets:

Set #01

Openings: 101, 103A, 103B

1 ea	Continuous Hinge	112HD	628	Ives
1 ea	Classroom Deadbolt	L463L x XB11-720 @ 48"AFF	626	Schlage
1 ea	Mortise Cylinder	1E74	626	Best
1 ea	Push Plate	8200 4" x 16 CFC	630	Ives
1 ea	Pull Plate	8305-8 4" x 16 CFT	630	Ives
1 ea	Closer	4040XP	689	LCN
1 ea	Wall Stop	WS401/402CVX (@ 308 only)	626	Ives

Set #02

Openings: 104, 105, 106, 107

3 ea	Hinges	5BB1 4.5 x 4.5	652	Ives
1 ea	Office Lock	L9050L 07A	626	Schlage
1 ea	Mortise Cylinder	1E74	626	Best
1 ea	Wall Stop	WS401/402CVX	626	Ives

Set #03

Openings: 103C

3 ea	Hinges	5BB1 4.5 x 4.5	652	Ives
1 ea	Storeroom Lock	L9080L 07A	626	Schlage
1 ea	Mortise Cylinder	1E74	626	Best
1 ea	Closer	4040XP	689	LCN
1 ea	Wall Stop	WS401/402CVX	626	Ives

Set #04

Openings: 102

3 ea	Hinges	5BB1 4.5 x 4.5	652	Ives
1 ea	Passage Set	L9010 07A	626	Schlage
1 ea	Wall Stop	WS401/402CVX	626	Ives

Set #05

Openings: 110, 111

3 ea	Hinges	5BB1 4.5 x 4.5	652	Ives
1 ea	Storeroom Lock	L9080L 07A	626	Schlage
1 ea	Mortise Cylinder	1E74	626	Best
1 ea	Wall Stop	WS401/402CVX	626	Ives

Set #06

Openings: 112

3 ea	Hinges	5BB1 4.5 x 4.5	652	Ives
1 ea	Push Plate	8200 4” x 16	630	Ives
1 ea	Pull Plate	8305-8 4” x 16	630	Ives
1 ea	Closer	4040XP-Cush	689	LCN

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing units, for interior glazing.

B. Plastic films.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

C. Section 08 43 13 - Aluminum-Framed Storefronts: Storefront assembly requiring glazing.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants.

F. GANA (GM) - GANA Glazing Manual.

G. GANA (SM) - GANA Sealant Manual.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Glazing Unit and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

C. Installer Qualifications: Company approved by manufacturer.

1.06 FIELD CONDITIONS

A. Store products in manufacturer's unopened packaging until ready for installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. AGC Glass North America, Inc: www.agc-yourglass.com/#sle.
   2. Cardinal Glass Industries: www.cardinalcorp.com.
   3. Guardian Glass, LLC: www.guardianglass.com.
   4. Pilkington North America Inc: www.pilkington.com/na/#sle.
   5. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com.
   6. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   7. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
   2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.03 GLAZING UNITS

A. Type G-1 - Monolithic Interior Vision Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch, nominal.
      a. Provide 3/8-inch where spans exceed 6 feet.
      b. Provide 1/2-inch for spans 8 feet or greater
   5. Glazing Method: Dry glazing method, gasket glazing.

2.04 PLASTIC FILMS

A. Decorative Plastic Film: Polyester type.
   1. Application: Locations as indicated on drawings.
   2. Series Type and Color: as selected by Architect from manufacturer's full range.
   3. Manufacturers:
      a. 3M Window Films; Fasara; www.3m.com.
      b. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
   1. Width: 1 inch.
   2. Thickness: 1/8 inch.

C. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color black.

D. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry immediately before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum wallboard.

F. Joint treatment and accessories.

G. Painting of above-ceiling firewall warning signs required by code.

1.02 RELATED REQUIREMENTS

A. Section 01 50 00 - Construction Facilities and Temporary Controls: temporary partition requirements

B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

I. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.

J. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

K. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

N. ASTM E413 - Classification for Rating Sound Insulation.

O. GA-216 - Application and Finishing of Gypsum Board.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.

B. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Marino: www.marinoware.com.
   3. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
   4. The Steel Network, Inc: www.SteelNetwork.com.
   5. PAC International, Inc. www.pac-intl.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
      a. Gauge: 20-gauge (0.032 inch), minimum. 18-gauge where indicated.
      b. Depth: 3-5/8 inches unless otherwise indicated.
      c. Spacing: Maximum of 16 inches on center unless otherwise indicated.
   2. Runners (track): U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Z-Furring: Z furring channel, minimum 0.0179 inch thick base metal; depths as indicated

D. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
   1. Products:
      a. Same manufacturer as other framing materials.

E. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Continental Building Products: www.continental-bp.com.
   4. Georgia-Pacific Gypsum: www.gpgypsum.com.
   5. National Gypsum Company: www.nationalgypsum.com.
   6. PABCO Gypsum: www.pabcogypsum.com.
   7. USG Corporation: www.usg.com.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

C. Impact Resistant Wallboard:
   1. Application: Public Corridor side of suite, full-height.
   2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   7. Type: Fire resistance rated Type X, UL or WH listed.
   8. Thickness: 5/8 inch.
   9. Edges: Tapered.
   10. Products:
      a. American Gypsum Company; M-Bloc IR Type X.
      b. Certainteed Extreme Impact (M2Tech)
      c. Georgia-Pacific Gypsum; DensArmor Plus Impact-Resistant.
      d. National Gypsum Company; Gold Bond HI-Impact XP Gypsum Board.
      e. National Gypsum Company; Gold Bond eXP Interior Extreme IR Gypsum Panel.
      f. USG SR Glass-Mat MT VHI Type X
      g. Substitutions: See Section 01 60 00 - Product Requirements.

D. Board For Non-Wet (Damp) Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: untiled toilets and janitorial areas, areas around sinks and equipment with a water supply.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type X Thickness: 5/8 inch.
   4. Regular Board Thickness: 5/8 inch.
   5. Edges: Tapered.
   6. Products:
      a. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
      b. Georgia-Pacific Gypsum; DensArmor Plus.
      c. National Gypsum Company; Gold Bond XP Gypsum Board.
      d. USG: Sheetrock Brand Mold Tough Gypsum Panels

e. Substitutions: See Section 01 60 00 - Product Requirements.

E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 5/8 inch.
3. Edges: Tapered.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, unfaced. Thickness as required to meet STC rating indicated.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, or stainless steel, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
2. Joint Compound: Drying type, vinyl-based, ready-mixed.
3. Joint Compound: Setting type, field-mixed.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as permitted by standard unless noted more restrictively on drawings.
1. Level ceiling system to a tolerance of 1/1200.
2. Laterally brace entire suspension system.

C. Studs: Space studs as permitted by standard unless noted more restrictively on Drawings.
1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete, masonry, and existing walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
1. Orientation: Vertical.

F. Blocking: Install wood blocking or mechanically fastened steel sheet blocking for support of:
   1. Framed openings.
   2. Countertop and shelf supports
   3. Wall mounted cabinets.
   4. Plumbing fixtures.
   5. Wall mounted door hardware.
   6. Handrails
   7. Corner guards
   8. Wall hooks
   9. Chalkboards, tack boards, and marker boards.
   10. Owner provided wall mounted equipment, whether owner-installed or contractor-installed.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
   1. Do not compress insulation.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

D. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Cementitious or Glass-Mat Board: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish, walls with continuous planes greater than 30' in any direction, tall lobby walls, and other areas specifically indicated.
      a. Include walls of public corridors.
   2. Level 4: Walls and ceilings to receive other paint finishes, unless otherwise indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
   5. Level 0: Temporary partitions.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling and sanding is not required at base layer of double layer applications.

E. Where Level 5 finish is indicated, slightly thin all-purpose joint compound, roll on wall with 24-inc roller and wipe down with drywall knife.

3.07 FIRE WALL MARKING

A. Refer to Code Analysis Plans and to Reflected Ceiling Plans. At all fire-rated or smoke-partition walls that are located adjacent to accessible (acoustical) ceiling tiles or an accessible attic/ceiling space, provide permanent stenciling indicating hourly rating.
   1. Lettering shall be a minimum 3-inch high with 3/8-inch minimum stroke in a contrasting color incorporated the suggested wording, “FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS” or similar wording.
   2. Markings shall be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet, measure horizontally along the wall or partition.
   3. Markings shall be on both sides of all rated partitions and in every adjacent room.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

B. Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling.

C. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Acoustical Units: Quantity equal to 2 percent of total installed.
   2. Turn over to owner, for storage on-site or off-site.

1.06 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Ceiling Tiles and Grid: Provide manufacturer's warranty for fifteen (15) years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.

B. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   4. **BASIS OF DESIGN:** USG: www.usg.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

C. Suspension Systems:
   1. Same as those listed above for acoustical units.
   2. Chicago Metallic.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Tile: acoustically transparent membrane faced mineral fiber, ASTM E1264 Type IV, with the following characteristics:
   1. Size: 24 by 24 inches.
   2. Composition: Wet-felted.
   3. Edge: Beveled tegular.
   4. Surface Color: As indicated on drawings.
   5. Suspension System: Exposed grid.
   6. Products:
      a. as identified in Interior Finish Schedule.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System: Formed galvanized steel with aluminum caps, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 9/16 inch wide face.
   2. Construction: Double web.
   3. Finish: White painted.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Locate system on room axis according to reflected plan.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.
   2. Double cut and field paint exposed reveal edges.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 68 13 - Tile Carpeting; flooring requiring resilient base

1.03 REFERENCE STANDARDS

A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

D. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.

E. ASTM F1700 - Standard Specification for Solid Vinyl Tile.

F. ASTM F1861 - Standard Specification for Resilient Wall Base.

G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

H. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance From Various Sources Using Static Environmental Chambers.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Verification Samples: Submit two samples, 2 by 4 inch in size illustrating color and pattern for each resilient flooring product specified, including welding rods.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 10 percent (but not less than 1 carton) of each type and color
   3. Extra Wall Base: 50 linear feet (but not less than 1 carton) of each type and color.
   4. Turn over to owner, for storage on-site or off-site.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum five years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.08 WARRANTY

A. Typical Wear: five years

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.

B. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
   1. Manufacturers:
      a. Armstrong World Industries, Inc: www.armstrong.com/#sle.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      c. Mannington Mills, Inc: www.mannington.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   3. Size: 12 by 12 inch.
   4. Thickness: 0.125 inch.
   5. Manufacturer/Style/Pattern/Tile Size: [as indicated in Interior Finish Schedule].
   6. Color: As indicated on drawings.

C. Luxury Vinyl Tile (LVT): Solid vinyl with color and pattern throughout thicknessPrinted film type, with transparent or translucent wear layer.
   1. Manufacturers:
      a. Mannington Commercial
      b. Shaw Contract
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. Mold and Microbial Resistance: Highly resistant when tested in accordance with ASTM D6329; certified in accordance with UL 2824.
   5. Total Thickness: 0.125 inch.
   6. Manufacturer/Style/Pattern/Tile Size: as indicated in Interior Finish Schedule.
   7. Color: As shown on drawings.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set styles as noted below.
   1. Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.
   2. Manufacturers:
      a. Burke Flooring: www.burkemercer.com.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com.
      c. Mannington Commercial Flooring;
      d. Roppe Corp: www.roppe.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

3. Height: 4 inch.
4. Thickness: 0.125 inch.
5. Top Set Style:
   a. Style B Coved; locations as indicated in Interior Finish Schedule
6. Finish: Satin.
7. Length: Roll.
8. Color: as indicated in Interior Finish Schedule or as selected by Architect from manufacturer's full range.
9. Accessories: Premolded external corners; and internal corners at Contractors options.

2.03 ACCESSORIES

A. Subfloor Filler: cementitious; type recommended by adhesive material manufacturer.
   1. Product: Ardex K-55 or approved equal

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: as follows:
   1. Carpet to Concrete: Resilient (rubber, same as base)
      a. Color: as indicated in Interior Finish Schedule or as selected by Architect from manufacturer's full range.
   2. Carpet to Resilient: Resilient (rubber, same as base)
      a. Color: as indicated in Interior Finish Schedule or as selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of products to substrate.
   1. The surface shall be free from any paint, wax, oil, grease, and film forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds. The surface should not have any alkaline salts, laitance, mold, mildew, residual adhesive, chemical adhesive removers or anything that may prevent appropriate products bonding to it.
   2. If not sufficiently clean, then the contractor shall provide mechanical means to remove them, such as a dustless diamond grinding, bead-blast or similar with a suitable Hepa vacuum attachment. Review and comply with all relevant local, state and federal regulations.

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 resilient base.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
   1. Test in accordance with ASTM F710.
   2. Testing should be performed at the correct, controlled ambient service temperature and humidity following the protocol of ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes, using a Wagner Rapid RH probes only.
   3. Valid tests and acceptable test results should be provided to the end user and flooring contractor, including documenting with photographs, the location of all tests, recorded % relative humidity levels and temperature of both the concrete subfloor and ambient conditions prior to flooring installation.
   4. When tested at the correct ambient temperature and humidity the maximum allowable should be 85% RH for the correct wet adhesive and dryfix adhesive or 75% RH for others.
   5. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Vacuum and clean substrate. If required, only use water based sweeping compounds. Do not use any wax or oil based compounds that leave behind a residue that may interfere with the adhesive bond.

E. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

F. Perform mat bond tests in each major area (1 per ~1,000 sq. ft.) consisting of the proposed subfloor preparation, mitigation and leveling or smoothing products. Do not proceed with installation until all the results of the bond test are acceptable.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of substrate conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install square tile to indicated pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners, or use premolded units. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

B. Prevent all traffic for a minimum of 12 hours and rolling loads for 72 hours to allow the adhesive to cure.

1. If required, after 12 hours protect the flooring from damage during construction operations using Masonite, plywood or a similar product, ensuring first that the flooring surface is free of all debris. Lay panels so that the edges form a butt joint and tape the joint to prevent both movement and debris entrapment underneath them. Inspect immediately before covering and after removal for final acceptance.

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Accessories

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors, water vapor-reducing admixture.

B. Section 09 65 00 - Resilient Flooring; resilient base and flooring transitions.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

D. CRI 104 - Standard for Installation of Commercial Carpet.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints and direction of carpet pile.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 10 percent of total installed of each color and pattern installed.
   3. Turn over to owner, for storage on-site or off-site.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum five years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

1.07 WARRANTY

A. Typical Wear: three years

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.

B. Tile Carpeting:
   1. As indicated in Interior Finish Schedule.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting: Heterogenous construction of nylon tufted level loop, manufactured in one color dye lot.
   1. Tile Size: Refer to Interior Finish Schedule.
   2. Style/Colors/Patterns: Refer to Interior Finish Schedule.
   3. Install Method: Refer to Interior Finish Schedule.
   4. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   5. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2.03 ACCESSORIES

A. Sub-Floor Filler: cementitious; type recommended by flooring material manufacturer.
   1. Product: Ardex K-55 or approved equal

B. Edge Strips: See 09 65 00 - Resilient Flooring, color as selected by Architect.

C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; permanent type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

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 tile.

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. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Test in accordance with ASTM F710.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

F. Fully adhere carpet tile to substrate.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Prime surfaces to receive wall coverings.
   3. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
   4. Gypsum Board: Finish all surfaces exposed to view.
   5. Steel Doors and Frames: Finish all surfaces exposed to view
      a. Paint all surfaces, including top and bottom edge surfaces
   6. Wood: Finish all surfaces exposed to view, except those indicated to prefinished and not specified to receive additional field finishing.
   7. Shop-Primed Metal Items: Finish all surfaces exposed to view

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
   6. Floors, unless specifically indicated.
   7. Ceramic and other tiles.
   8. Glass.
   9. Acoustical materials, unless specifically indicated.
   10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames: Doors and frames requiring field-painting

B. Section 09 21 16 - Gypsum Board Assemblies: Substrate requiring paint; painting of above-ceiling firewall warning signs.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

D. SSPC-SP 1 - Solvent Cleaning.

E. SSPC-SP 6 - Commercial Blast Cleaning.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   3. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.

B. Paints:
1. PPG Paints: www.ppgpaints.com.
2. No Substitiutions

C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
5. Supply each paint material in quantity required to complete entire project's work from a single production run.
6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. For interior wall and ceiling finish (all coats), anti-corrosive paints on interior ferrous metal, clear wood stains and finishes, sanding sealers, other sealers, shellac, and floor coatings-provide coatings that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Architectural coatings VOC limits of the State in which the Project is located
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Colors: Match colors indicated in Interior Finish Schedule, or if not indicated, as selected from manufacturer's full range of available colors.
1. Allow for same number of colors indicated in Finish Schedule, plus three additional samples, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

A. See Interior Finish Schedule for Products, Colors and Sheens

B. Ferrous Metals, Unprimed, Waterborne Acrylic , 3 Coat:
1. One coat of latex primer.
a. PPG Low-VOC Multi-Purpose Primer 7-281
b. PPG Pitt-Tech Primer 90-712
2. Semi-gloss: Two coats of latex enamel.
a. PPG Tpitt Tech Plus Semi-gloss 90-1210

C. Gypsum Board/Plaster, Latex, 3 Coat: Walls and ceilings scheduled for painting, except those to receive epoxy or dry erase coatings:
   1. One coat of latex primer sealer.
      a. PPG 147-921 Seal Grip
   2. Eggshell / Satin: Two coats of low-VOC, low-odor latex enamel.
      a. PPG Pitt Tech Satin 90-474

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces and to achieve the finishes specified whether specifically indicated or not; commercial quality

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

H. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied. When manufacturer does not specify, allow 24 hours for interior paint and 48 hours for exterior paint to dry.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 IDENTITY PAINTING

A. Paint firewall warning signs at rated wall construction above the ceilings as indicated in Section 09 21 16 - Gypsum Board Assemblies.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.07 COLOR SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 10 11 01
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

B. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard.

B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations.

D. Samples: Submit color charts for selection of color and texture of markerboard.

E. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:
   1. AARCO Products Inc.
   2. Best-Rite Manufacturing
   3. **BASIS OF DESIGN:** Claridge Products and Equipment, Inc; LCS Deluxe: www.claridgeproducts.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

A. Markerboards (Magnetic Whiteboards): Porcelain enamel on steel, laminated to core.
   1. Color: LCS-11 92 Standard Gloss white or approved equal.
   2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
   3. Core: Particleboard, 3/8 inch thick, laminated to face sheet.
   4. Backing: Aluminum foil, laminated to core.
   5. Size: As indicated on drawings.
   6. Frame: Extruded aluminum, with concealed fasteners.
   7. Frame Finish: Anodized, natural.
   8. Accessories: Provide chalk tray and map rail.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

C. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

D. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 to 2 inch wide, full width of frame.

B. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.
   1. Provide 2 map hooks for every 48 inches or rail or fraction thereof.

C. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

D. Chalk Tray: Aluminum, manufacturer's standard profile, one piece full length of chalkboard, molded ends, concealed fasteners, same finish as frame.

E. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings, and as required for owner-provided boards.

C. Verify flat wall surface for frameless adhesive-applied boards.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Install with bottom of perimeter frame at 36 inches above finished floor.

C. Secure units level and plumb, and at the height indicated.

D. Butt Joints: Install with tight hairline joints.

3.03 CLEANING AND PROTECTION

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame. Protect installed markerboards from damage during construction.

C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.
   1. Wall-mounted frames

1.02 RELATED REQUIREMENTS

A. Electrical: Exit signs required by code.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities.

1.04 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate sign styles, lettering, locations and dimensions of each interior sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of experience.

B. Regulatory Requirements: Comply with requirements of ICC/ANSI A117.1 and ADAAG.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.08 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.

B. Framed Signs:
   1. ASI Signs;
   2. Best Sign Systems, Inc: www.bestsigns.com.
   3. FASTSIGNS: www.fastsigns.com/#sle.
   4. Inpro: www.inprocorp.com.
   5. Seton Identification Products: www.seton.com/aec/#sle.
   6. Vista System, www.vistasystem.com
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GENERAL

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Quantities and Locations: Contractor shall assume approximately one name/number sign per room door.

C. Where signs are required to be installed on glass, provide blank sign of same size and install on opposite side of glass from sign to conceal two-face tape visible from back of sign.

D. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with applied character panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: as indicated
   4. Sign Height: as indicated.
   5. Rooms off Public Corridors, Lobbies or Foyers: Identify with room names and numbers to be determined later, not those indicated on drawings.
   6. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
   7. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

2.03 FRAMED SIGNS

A. Flat Signs: Signage media without frame.
   1. Laminated-Sheet Sings: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to product composite sheet.
      a. Thickness: as indicated
      b. Surface-Applied Graphics: Applied vinyl film
      c. Subsurface Graphics: Slide-in changeable insert.
   2. Edges: Square.
   3. Corners: Square.
   4. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: as selected by Architect or Owner from manufacturer's full range.
   4. Character Color: Contrasting color.
   5. Braille: Grade II Raster Braille with domed surface

2.04 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal at interior. Stainless Steel at exterior.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

3.04 PROTECTION

A. Protect from damage until Substantial Completion; repair or replace damaged items.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 22 13
WIRE MESH PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wire mesh systems for walls and ceilings.

B. Access gates.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

D. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for screen materials, finishes.

C. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, anchorage, and type and location of fasteners.
   1. Show field measurements on shop drawings.

PART 2 PRODUCTS

2.01 WIRE MESH PARTITIONS

A. Wire Mesh Partitions: Factory-fabricated modular assemblies of panels, doors, anchors, hardware, and accessories as required to provide a complete system.
   1. Design Criteria:
      a. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
      b. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.02 COMPONENTS

A. Woven Wire Mesh: Standard duty.
   1. Material: ASTM A510/A510M uncoated crimped steel wire.
   2. Wire Size: 10 gage, 0.135 inch.
   3. Mesh Opening Size: 1-1/2 inch diamond shape.
   4. Mesh Weave: Plain weave, inter-crimped.

B. Framing and Support Members:
   1. Material: ASTM A36/A36M steel shapes and ASTM A500/A500M cold-formed steel.
   2. Framing, Corner Posts, and Intermediate Support Members: Manufacturer's standard sizes for system specified and as indicated on drawings.
   3. Vertical Stiffeners: As required for partitions greater than 144 inches in height.

C. Doors: Same material as partitions, fully framed; manufacturer's standard construction and hardware for swing operation.
   1. Locking: Integrated padlock hasps for padlocks provided by Owner.

2.03 FASTENERS

A. Bolts, Nuts and Washers: Hot dip galvanized.

B. Anchorage Devices: Provide power driven and drilled expansion bolts.

C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of structure.

2.04 ACCESSORIES

A. Bracing: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

B. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

C. Post Caps: Manufacturer's standard.

D. Floor and Ceiling Pilaster Shoe: Manufacturer's standard.

E. Floor Base: Manufacturer's standard.

2.05 FABRICATION

A. Fit and assemble in largest practical sections for delivery to site, ready for installation.

B. Make exposed joints flush or tight.

C. Provide components required for anchorage to adjacent construction.

2.06 FINISHES

A. Galvanized Finish: In accordance with requirements of ASTM A123/A123M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that substrate surfaces and required openings are ready to receive work.

3.02 PREPARATION

A. Clean substrate surfaces.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. After installation, touch-up scratched or damaged surfaces with shop applied finish.

3.04 ADJUSTING

A. Adjust doors to achieve free movement.

3.05 CLEANING

A. Remove temporary protection to prefinished surfaces.

END OF SECTION

SECTION 10 26 01
WALL PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking for wall and corner guard anchors.

B. Section 09 21 16 - Gypsum Board Assemblies; mud-in corner trim.

C. Section 09 65 00 - Resilient Flooring; coordination with base height

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, anchorage details, rough-in measurements, and color/finish.

C. Samples: Submit two sections of each type of corner guard, 6 inch (150 mm) long, illustrating component design, configuration, color and finish.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum ten years of experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of experience.

1.06 WARRANTY

A. Provide 1 year manufacturer's written warranty against defects in material and workmanship.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect packaged adhesive from temperature cycling and cold temperatures.

B. All materials are to be stored lying flat, under cover and protected from the elements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.

B. Wall and Corner Guards:
   1. Babcock-Davis: www.babcockdavis.com.
   2. Construction Specialties, Inc: www.c-sgroup.com.
   3. Inpro: www.inprocorp.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Corner Guards - Surface Mounted:
   1. Material: High impact vinyl.
   2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
   3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   4. Width of Wings: 1-1/8 inches.
   5. Corner: Eased.

6. Color: As selected from manufacturer's standard colors.
7. Length: One piece from base to ceiling typical unless other noted otherwise. 1/4" gap allowed at base and ceiling.
8. Mounting: adhesive tape or countersunk screws through factory-drilled mounting holes.

2.03 ACCESSORIES

A. Adhesive: As recommended by manufacturer

B. Joint Sealant: Sealant shall be mildew-resistant silicone of a matching solid color from manufacturer’s standard selection.

C. Substrate Primer and Sealer: As recommended by manufacturer.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Corner Guards:
1. Position bottom of corner guard at top of wall base, typically 4” from floor line (field verify).
2. Coordinate installation of corner guard with wall finishes.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

A. Clean components of excess adhesive, dust, dirt, and other contaminants.

B. Refer to manufacturer's specific cleaning recommendations.

C. Do not use abrasive cleaners

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguisher cabinets.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 09 91 23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. ADAAG - Americans with Disabilities Act Accessibility Guidelines, 2010

B. UL (DIR) - Online Certifications Directory.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide color and finish and anchorage details.

C. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and locations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. Ansul, a Tyco Business: www.ansul.com.
   2. JL Industries, Inc: www.jlindustries.com.
   3. Kidde, a unit of United Technologies Corp: www.kidde.com.
   4. **BASIS OF DESIGN:** Larsen's Manufacturing Co; Architectural Series 2409-6R: www.larsensmfg.com.
   5. Nystrom, Inc: www.nystrom.com.
   6. Potter-Roemer: www.potterroemer.com.
   7. Pyro-Chem, a Tyco Business: www.pyrochem.com.
   8. Strike First Corporation of America: www.strikefirstusa.com.
   9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire extinguishers: Provided by Owner.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed aluminum

B. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.
   2. Exterior nominal dimensions of 13 inch wide by 27-1/2 inch high by 6 inch deep.
   3. Projected Trim: Returned to wall surface, with 2-1/2 inch projection, and 1-1/2 inch wide face.
   4. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with theft-deterrent keyed cylinder. Hinge doors for 180 degree opening with continuous piano hinge.

D. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: brushed aluminum.

H. Finish of Cabinet Interior: manufacturer's standard brushed aluminum or white.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Cabinet Signage: Label “FIRE EXTINGUISHER” in red letters, vertical on hinge side.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 48 inches from finished floor to highest operable part.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of owner-selected:
   1. Countertops for architectural cabinet work.
   2. Wall-hung counters and vanity tops.
   3. Accessories

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry; installation of concealed blocking

B. Section 06 41 00 - Architectural Wood Casework.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0.

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.

E. NEMA LD 3 - High-Pressure Decorative Laminates.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Provide Basis of Design manufacturer listed, or a standard or custom product from one of the other listed manufacturers with equivalent performance, material properties, features, general configuration, appearance, and warranty.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.

1. Laminate Sheet: NEMA LD 3, Grade HGP, for postforming, 0.048 inch nominal thickness.
   a. Manufacturers:
      1) Formica Corporation: www.formica.com.
      2) Lamin-Art, Inc: www.laminart.com.
      3) Panolam Industries International, Inc Nevamar: www.nevamar.com.
      4) Panolam Industries International, Inc Pionite: www.pionitelaminates.com.
      5) Wilsonart: www.wilsonart.com.
      6) Substitutions: See Section 01 60 00 - Product Requirements.
   b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   c. NSF approved for food contact.
   d. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
   e. Finish: Matte or suede, gloss rating of 5 to 20.
   f. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
3. Back and End Splashes: Same material, same construction.
4. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.

C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 3/4 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) Avonite Surfaces: www.avonitesurfaces.com.
         2) Dupont; Corian: www.corian.com.
         3) Formica Corporation: www.formica.com.
         4) Wilsonart: www.wilsonart.com.
         5) Substitutions: See Section 01 60 00 - Product Requirements.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      d. Color and Pattern: As selected by Architect from manufacturer's full line.
   3. Other Components Thickness: 1/2 inch, minimum.
   4. Exposed Edge Treatment: Built up to minimum 1-1/2 inch thick; square profile with eased edges..
   5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

2.02 MATERIALS

A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

B. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide brackets as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 21 00 00
FIRE SUPPRESSION – GENERAL

PART 1 GENERAL

1.01 REFERENCES

A. Sections 21 11 00 through 21 13 13 (as included), cover Fire Protection work specifically.

B. Refer to Sections 21 00 00 through 21 06 00 (as included), for items of general nature which apply to this portion of work.

C. Applicable construction codes, standards and guidelines for all Fire Protection Contract elements, including but not limited to the following:

1. State of Ohio Building Code, including Fire Protection portions thereof.

2. Local Fire Department.

3. Local Fire Marshall's Office.

5. NFPA pamphlet no. 13, INSTALLATION OF SPRINKLER SYSTEMS.

6. NFPA pamphlet no. 14, INSTALLATION OF STANDPIPE AND HOSE SYSTEMS.

7. NFPA pamphlet no. 70, NATIONAL ELECTRIC CODE.

8. NFPA pamphlet no. 72, NATIONAL FIRE ALARM CODE.

9. City of Oxford Division of Water the water utility provider.

9. American National Standards Institute (ANSI) standards for materials and construction.

10. American Society of Mechanical Engineers (ASME) standards for materials and construction.

11. American Society for Testing and Materials (ASTM) standards for materials, construction and testing.

12. American Water Works Association (AWWA) standards for materials and construction.

13. Underwriter's Laboratories (UL) standards for materials and construction.

14. Factory Mutual (FM) standards for materials and construction.

15. The manufacturer's installation guidelines and recommendations for individual items and/or systems indicated herein.

16. The Owner's insurance underwriter's material and installation guidelines and/or standards.

1.02 SCOPE

A. The Fire Protection Contractor shall furnish all labor, materials, tools, incidentals and details necessary to provide a complete system of Fire Protection work as herein specified, as shown on plans, and as indicated or required by work under separate contract included with complete project documentation. Coordinate installation and interface requirements with the appropriate contractors in advance.

B. The Fire Protection Contractor is responsible for satisfactorily addressing all review and inspection authorities' requirements and directives in regard to methods of installation necessary for final approval.

C. The edition of all applicable NFPA Pamphlet's as recognized and amended by the Building Code Inspection/Approval Authority shall be the minimum requirement for all materials and methods. Unless indicated otherwise, and as a quality standard only, all materials shall be listed by Underwriter's Laboratories, Inc., and Factory Mutual Laboratories as approved for fire protection installations, when such is available.

D. Fire protection sprinkler installation to be as required to provide "fully sprinkled" protection/coverage for the entire structure.

E. In brief, the Scope of the Work shall include, but is not limited to the following:

1. Modifications to existing Automatic Sprinkler Systems in the remodeled portion of the structure per Ohio Building Code, Ohio Fire Code and NFPA 13.
2. Layout Drawings, including all required design calculations and flow tests.
3. Installation of all fire systems shall meet the requirements of the Owners Insurance Underwriter.

F. The Fire Protection Contractor shall not submit or bid the sprinkler system as a gridded type system.

G. This Contractor to be licensed by the State of Ohio for installation and service of fire protection systems, including alarm, detection, control and extinguishing components as indicated herein.

H. Failure on the part of the Fire Protection Contractor to fulfill the above requirements will not relieve him of the responsibility of executing all work necessary for a complete and approved installation without extra expense to the Owner.

1.03 PERMITS AND FEES

A. Unless directed otherwise by the General Conditions portion of project documentation, the Fire Protection Contractor shall apply for and pay any review, inspection, permit, license, testing and/or other service fees required by all review/inspection/approval authorities in connection with the work under this Contract.

B. Unless directed otherwise by the General Conditions portion of project documentation, the Fire Protection Contractor shall apply for and pay any procurement, tap, capacity, metering, testing and/or other service fees required by the Water Service Utility Provider in connection with the work under this Contract. This shall include procurement, execution and return of any forms and/or applications required; and participation in an initial design/installation consultation with the provider if required.

C. The Fire Protection Contractor shall include in his Bid the cost for flow test information and hydraulic calculations required for design and approvals. The flow test is to be arranged with the Water Authority, the Local Fire Department and the Owner's Insuring Agency in advance to allow observation and supervision.

1.04 DESIGN

A. The Contractor is required to read the Specifications covering all branches of the work and will be held responsible for coordination of his work with work performed under all other Contracts.

B. Sprinkler systems shall be designed, sized hydraulically and installed according to NFPA Pamphlet No. 13, and the rules and regulations of all review, inspection and approval authorities (required for final approval). See Plans for specific design information, including zoning, flow and density, allowances and head spacing.

C. If the Contractor has any questions concerning the Plans and Specifications, he is to feel free to contact the Engineer for clarification before Bids, and to fully understand the extent and responsibilities of his work.

D. Unless indicated otherwise at specific areas and/or locations, location of all sprinkler heads shall be determined by the Fire Protection Contractor, as required for protection specified, and final approval.

E. The Fire Protection Contractor is responsible for locating all sprinkler heads in one of the optional ceiling tile installation points as detailed on drawings for gridded lay-in ceilings.

F. Location of sprinkler heads by the Fire Protection Contractor is subject to approval by the Architect in review of the “Preliminary” Plans Submittal specified herein. The Architect reserves the right to relocate heads during this review, providing sprinkler protection is not compromised, and no conflicts occur with NFPA or inspection/approval authorities requirements as a result of relocations.

1.05 FIRE PROTECTION SUPPLEMENTAL INFORMATION

A. Water Source and Supply:

1. Connection to existing underground public utility site water main.

B. Building Information:

1. See Architectural Documentation for detailed building code, occupancy classification(s) and construction information.

2. See complete Architectural documentation, including plans, elevations, sections and details for additional information affecting fire protection work.

C. Contact the Miami University Fire Marshall for any information regarding water Flow Test Information. Note that this information does not rescind the Fire Protection Contractor’s requirement to arrange a new flow test as specified herein, unless existing test information is acceptable to the review/inspection/approval authorities for fire protection design.

1.06 TESTING AND INSPECTION

A. Testing:

1. Sprinkler Installation; per NFPA Pamphlet No. 13.

2. Upon completion, and prior to the acceptance of the installation, the Contractor shall furnish the Owner with four (4) copies of the certification required. Testing of all piping for the Fire Protection system is to be made in accordance with the National Fire Protection Association and in the presence of a representative of the Owner and Insurance Company. As a minimum, a copy of "Contractors Certificate of Materials and Tests" properly executed and verifying satisfactory tests shall be furnished to the Owner upon completion of the tests.

B. Inspection: When all work has been completed, the Contractor shall conduct a preliminary but complete inspection and testing of the installation. The system, as a whole, and all component parts thereof, shall receive all inspections and tests necessary to assure that the materials, equipment, devices and all functional operations meet the requirements of this specification and standards referenced herein.

C. The Architect shall be notified of all scheduled tests at least 48 hours in advance so that he may witness same. If the Contractor performs any test or adjustment without the Architect present or without properly notifying the Architect, the Contractor will be required to perform the test or adjustment a second time in the presence of the Architect.

1.07 COORDINATION

A. All work shall be done in a neat and workmanlike manner and this Contractor shall coordinate his work with all other Contractors on the project to ensure that his work does not interfere with the proper installation of work by other trades.

1.08 FIRE PROTECTION PLANS AND CALCULATIONS

A. Prepare plans and calculations for review and approval by the Architect, the Insuring Agency and the review/inspection/approval authorities. Documentation (including plans and calculations) to be as specified in NFPA Pamphlet No. 13.

B. Submit four (4) sets of plans and calculations to the Architect for “Preliminary” review. The Fire Protection Contractor shall address all comments generated by this review to the satisfaction of the Architect, prior to submittal to the inspection/approval authorities.

C. Submit three (3) sets of plans and calculations to the Insurer for “Preliminary” review. The Fire Protection Contractor shall address all comments generated by this review to the satisfaction of the insurer, prior to submittal to the inspection/approval authorities.

D. After plans and calculations have been reviewed and approved for construction by the review/inspection/approval authorities, provide four (4) sets of the documentation with all required stamps and approvals to the Architect for “Final” review and record.

E. If applicable, wiring diagrams for all items included in the fire protection system shall be submitted for review, along with equipment submittals, plans and calculations. This includes manufacturer’s standard diagrams for pre-wired items/elements such as tamper and flow switches, as well as any custom configured items/elements such as detection/control panels.

1.09 SUPERVISION

A. This Contractor shall have in charge of the work, on the job as required, during construction, a competent superintendent experienced in the work installed under this Contract.

1.10 GUARANTEE

A. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after final payment is approved by the Architect/Engineer/Owner's Representative.

PART 2 PRODUCTS

2.01 Where items are indicated herein to be listed/approved, the intent of this specification is that said item shall be listed by all applicable material/construction standards, and subject to final approval (including methods of installation) by all review/inspection/approval authorities.

2.02 Unless indicated otherwise, all Fire Protection Contract items (pipe, fittings, valves, specialties, fixtures, equipment, etc.) materials, construction, performance, testing and methods of installation to be as listed/approved by all applicable material/construction/installation standards for same, and be in accordance with the requirements of all review/inspection/approval authorities. This includes, but is not limited to, the standards and authorities referenced in this specification. In the absence of such standards and/or requirements, the item/element manufacturer's recommendations, as confirmed by the Fire Protection Contractor in advance, shall be followed.

2.03 All Fire Protection Contract items shall have the manufacturer's mark or name and the quality of the product or identification of same cast, embossed, stamped or indelibly marked on each item/element in accordance with the standards under which they are accepted and approved per applicable code(s).

2.04 Unless indicated otherwise, all Fire Protection piping shall be in accordance with the following standards in regard to materials, construction, dimensions/tolerances and methods of installation (as applicable), and shall be so listed. Final approval for use is subject ot the requirements of the review and inspection authorities:

A. Steel pipe, malleable and cast iron fittings and joining methods; per applicable ASTM/ANSI/ASME standards.

B. Ductile iron pipe, fittings and joining methods; per applicable ASTM/ANSI/ASME/AWWA standards. In addition, where combination fire protection and domestic water service is utilized, all elements shall be per applicable NSF standards.

PART 3 EXECUTION

3.01 Where standards, codes or guidelines are referenced herein and throughout the Fire Protection Contract documentation, including plans and specifications, the latest version/edition shall be applied, unless the Building Code references another version/edition, which shall take precedence.

3.02 Refer to project documentation furnished with the complete construction package in advance of work for overall coordination and verification of requirements at work of other trades relating to, interfacing with, and/or impacting work in the Fire Protection Contract. This includes exact locations, quantities, physical sizes, rough-in details, pipe routing, connection sizes, etc., for items included both in the Fire Protection Contract and under separate contract. Coordinate installation and interface requirements with the appropriate contractor(s) in advance of work.

3.03 Include any minor details, items essential to necessary approvals and successful operation in addition to the items specified herein and shown on plans.

3.04 See general "FIRE PROTECTION NOTES" on plans for additional conditions and requirements relative to the Fire Protection Contract.

3.05 Fire Protection items shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls, surfaces and other structures through installation, bearing support or subsequent usage of Fire Protection items and elements. No framing or other support structure shall be cut, notched or bored in excess of limitations specified in the Building Code, or by the manufacturer of the framing or other support structure, as confirmed in advance of work by the Fire Protection Contractor.

END OF SECTION

SECTION 21 05 00
FIRE SUPPRESSION GENERAL PROVISIONS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Furnish all labor, materials, tools, incidentals and details necessary to provide a complete fire protection system, ready to operate, including but not limited to the items listed under the Fire Protection Indexes.

B. Include any minor details essential to successful operation and any other items specified or shown on the Drawings.

C. The Contractor is required to read the Specifications covering all branches of the work and will be held responsible for coordination of his work with work performed under all other Contracts.

D. The Contractor is required to visit the site and fully inform himself concerning all conditions affecting the scope of his work. Failure to visit the site shall not relieve the Contractor from any responsibility in the performance of his Contract.

E. The Contractor should feel free to contact the Architect immediately if there is any question regarding the meaning or intent of either Plans or Specifications, or if he notices any discrepancies or omissions in either Plans or Specifications.

F. Other than minor adjustments shall be submitted to the Architect for approval before proceeding with the work.

G. The Contractor shall submit on his letterhead, along with the Bid, the manufacturer's name and the names of all Subcontractors to whom he intends to sublet the work. If the Contractor fails to provide this information with the Bid, the owner shall have the right to select the manufacturers and Subcontractors with no additional charge.

H. Scheduling of all work performed by this Contractor shall be completely coordinated with the Construction Manager.

I. All material hoisting by trade involved.

J. All connections to, or revisions in, piping layout or facilities shall be done at such time as agreed to by the Architect and the Owner and all work shall be scheduled as required under "General Conditions". Revisions to the existing piping systems must be done with the minimum of shutdown time. All piping shall be run to the point of new connections and new equipment installed and ready to operate before any connections are to be made.

K. Extreme care shall be taken to avoid interference with equipment and work of other trades. Consult with the Construction Manager regarding any points where interference is likely to occur and follow dimensions carefully where given on the Drawings. Pay particular attention to minimum clear heights when indicated on the Drawings.

L. It is mandatory that dust and debris be held to a minimum.

M. The Contractor, insofar as this Contract is concerned, shall at all times keep the premises and the building in a neat and orderly condition. This includes using a vacuum cleaner in the office areas.

N. At the completion of the project, this Contractor shall promptly clean up and remove from the site, all debris and excess materials.

1.02 DRAWINGS

A. Consult all Contract Drawings which may affect the locations of any equipment, apparatus, piping and ductwork and make minor adjustments in location to secure coordination.

B. Piping and duct layout is schematic and exact locations shall be determined by structural and other conditions and verified in the field. This shall not be construed to mean that the design of the system may be changed, it refers only to the exact location of piping and ductwork to fit into the building as constructed, and to coordination of all work with piping and equipment included under other Divisions of the Specifications.

C. The layout shown on the Drawings is based on a particular make of equipment. If another make of equipment is used which requires modifications or changes of any description from the Drawings or Specifications, this Contractor shall be responsible for making all such modifications and changes, including those involving other trades, as a part of this Contract and the cost thereof shall be included in his Bid. In such case, the Contractor shall submit Drawings and Specifications showing all such modifications and changes prior to starting work, which shall be subject to the approval of the Engineer.

D. The Architect and Engineer reserves the right to make minor changes in the location of piping and equipment up to the time of rough-in without additional cost to the Owner.

E. Where certain grades and/or elevations are given on the Drawings, they have been obtained from the best information available; however, they are not guaranteed. This Contractor MUST assume the full responsibility of verifying present elevations in the field and making any adjustments as may be necessary, all of which must be included in his Bid Price.

F. Due to the scale of the Drawings, it is impossible to show all offsets and transitions which may be required. This Contractor shall carefully investigate the conditions affecting all work and shall furnish all elbows, fittings, transitions, etc., required to accomplish the desired result at no additional cost.

G. Install all work as close as possible to walls, structural, members, etc., consistent with the proper space for covering, access, etc., so as to occupy the minimum of space and allow as much space as possible between ductwork, piping, etc. and the ceiling.

H. Actual dimensions shown on the Drawings and field dimensions shall take precedence over scaled dimensions.

1.03 PERMITS, INSPECTIONS AND CODES

A. Completed installations shall conform with all applicable Federal, State and Local Laws, Codes and Ordinances, including but not limited to the latest editions of the following:

1. Ohio Building Code, State of Ohio.

2. Life Safety Code, Bulletin No. 101, National Fire Protection Association.

B. Nothing contained in the Plans and Specifications shall be construed to conflict with these laws, codes and ordinances and they are hereby made a part of these Specifications.

1.04 OPERATING AND MAINTENANCE INSTRUCTIONS

A. This Contractor shall thoroughly instruct and supervise the Owner's Maintenance Personnel in the proper operation and maintenance of the mechanical system equipment. This Contractor shall be responsible for arranging for the instruction and supervision at a time convenient to the Owner and notifying the Engineer of the time at least 48 hours in advance.

Instructions shall include the following:

1. Location of equipment and explanation of what it does.

2. Reference to "Operating Instruction Manuals" for record and clarity.

3. Coordination of written and verbal instruction so that each is understood by all personnel.

4. Specific maintenance to be performed by Owner.

B. Furnish one (1) copy of the printed Operating and Maintenance Instructions for the Mechanical Systems for review. Copy shall be neat, legible and bound in a hardback 3-ring notebook. After final approval, provide four (4) copies of Operation and Maintenance Instructions for submittal to Owner. Instructions shall consist of the following items:

1. Title Page: Title of Project, address, date of submittal, name and address of Contractor, name of Engineer.

2. Second Page: Index of Manual Contents.

3. First Section: A copy of each approved shop drawing and submittal with an index at the beginning of the section.

4. Second Section: A list of all equipment used on the project, together with supplier's name and address.

5. Manufacturer's maintenance manuals for each item of equipment furnished under this contract. Manuals shall include such items as parts list, detailed lubrication instructions, procedures for performing normal maintenance functions, preliminary trouble shooting procedures and wiring diagrams.

6. Complete wiring diagrams for the mechanical systems as actually wired including control and interlock wiring.

7. Brief but complete instructions for start-up, shut- down and routine maintenance of each system.

8. Routine and 24-hour emergency information:

a. Name, address and telephone number of servicing agency.

b. Include names of personnel to be contacted for service arrangements.

1.05 RECORD DOCUMENTS

A. The Contractor shall keep an accurate record of all deviations from Contract Drawings and Specifications. He shall neatly and correctly enter in colored pencil any deviations on Drawings affected and shall keep the Drawings available for inspection. Extra sets of Drawings will be furnished for this purpose.

B. At the completion of project and before final approval, make any final corrections to Drawings and certify to the accuracy of each print by signature and deliver same to the Architect.

1.06 SUPERVISION

A. This Contractor shall have in charge of the work, on the job during construction, a competent superintendent experienced in the work installed under this Contract.

1.07 UNACCEPTABLE WORK AND OBSERVATION REPORTS

A. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.

B. The Contractor shall promptly correct all work found unacceptable by the Engineer or the Owner whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work, including compensation for the Engineer's or Owner’s additional services made necessary thereby.

C. During the course of construction, the Engineer will prepare "Observation Reports" with a list of items found to be in need of correction. All items listed shall be corrected by the Contractor. A space is provided on the form for the Contractor to note the completion of each item. All prior "Observation Report" items must be completed, the lists signed and returned to the Engineer prior to making the final inspection. After the final list is issued, the same procedure will apply.

1.08 FINAL INSPECTION

A. When the Contractor determines all work is completed and working properly per the Contract Documents, he shall request a "final" inspection by the Engineer in writing. If more than one reinspection is required after this final inspection, the Contractor shall bear all additional costs including compensation for the Engineer's additional services made necessary thereby. A final inspection will not be made until Operating and Maintenance Manuals are submitted and approved and all prior "Observation Report" punch lists completed, signed and returned to the Engineer.

B. As part of the final checkout of the project, the Engineer will be checking out the operation of the various systems. This Contractor shall provide such assistance as required (including manpower and tools) to open and close valves etc. The Contractor (not the Engineer) is responsible to turn on the systems and demonstrate they are operating properly.

1.09 GUARANTEE

A. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after final payment is approved by Architect.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 21 05 05

COMMON WORK RESULTS FOR FIRE SUPPRESSION

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. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Mechanical sleeve seals.
   3. Sleeves.
   4. Escutcheons.
   5. Grout.
   6. Equipment installation requirements common to equipment sections.
   7. Painting and finishing.
   8. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical 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.

F. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Mechanical sleeve seals.
   2. Escutcheons.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 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.

2.3 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Manufacturers:
      a. Link Seal
      b. Advance Products & Systems, Inc.
      c. Calpico, Inc.
      d. Metraflex Co.
      e. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Stainless steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 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 water-stop, unless otherwise indicated.

2.6 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. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

C. One-Piece, Floor-Plate Type: Cast-iron floor plate.

D. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

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

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 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 according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
      e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
      f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Fire-Stopping" for materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 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. 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.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 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 fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.6 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout around anchors.

F. Cure placed grout.

END OF SECTION

SECTION 21 05 16
SLEEVES AND COLLARS

PART 1 GENERAL

1.01 REFERENCE

A. Section 21 05 21 - CUTTING AND PATCHING

1.02 SCOPE

A. This Contractor shall furnish and install all sleeves for his work. Coordinate carefully with the General Contractor.

B. Sleeves shall be provided through all new masonry construction. Sleeves are not required if holes are core drilled through existing walls.

PART 2 PRODUCTS

2.01 Sleeve material: Schedule 40 ASTM A-53 black steel pipe, machine cut, large enough to allow l/4" clearance all around pipe (around pipe covering on chilled water and cold water).

PART 3 EXECUTION

3.01 Sleeves in partitions to have length equal to the thickness of finished partitions. Sleeves in floors of finished areas to project l/8" above finished floor. Sleeves in floors of non-finished areas to project 3" above finished floor. Fill space between pipe and sleeves into exposed areas with sealing compound. Ream all sleeves before installing.

3.02 Where pipes pass through fire rated walls or floors, the space between the pipe and sleeve shall be filled with packing to maintain fire integrity.

3.03 Sleeves to be set in forms before concrete is poured and in partitions at the time same are being built.

3.04 In exposed location, other than in Mechanical Equipment Rooms, bare pipe or insulated pipe shall be provided with chromium plated collars at floor, ceiling, and at partitions.

3.05 Cutting required of any masonry wall or floor after it is in place shall be done by core drilling.

3.06 Piping not allowed to bear on sleeves.

3.07 Sleeves shall be installed plumb and true to line, grade, and position.

3.08 Unused sleeves shall be plugged and finished to match adjacent surface.

END OF SECTION

SECTION 21 05 17
FIRESTOPPING

PART 1 GENERAL

1.01 SCOPE

A. Each Contractor shall be responsible for firestopping around all openings for pipes, ducts, conduits, etc., installed by him at all fire walls and smoke walls. Firestopping shall be performed by an installer who has been trained by manufacturer, or manufacturer's representative, in the installation procedures based on published UL tested fire stop systems.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 REFERENCE

A. Division 1 – General Conditions
B. Division 3 – Concrete
C. Division 4 – Masonry
D. Division 9 – Finishes
E. Section 21 05 16 – Sleeves and Collars

1.04 GENERAL REQUIRMENTS

A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Through-Penetration Firestop Devices (XHCR)
b. Fire Resistance Ratings (BXUV)
c. Through-Penetration Firestop Systems (XHEZ)
d. Fill, Voids, or Cavity Material (XHHW)
e. Forming Materials (XHKU)

C. International Firestop Council Guidelines for Evaluating Firestop Systems Associating Judgments

D. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

E. The Ohio Building Code (OBC)

F. NFPA 101 - Life Safety Code

1.05 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

1.06 SUBMITTALS

A. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.07 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary 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.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. 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 the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that is needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, (800)879-8000
2. Tremco Sealants & Coatings, Beachwood, Ohio, (216) 292-5000
3. 3M Fire Protection Products, St. Paul, Minnesota, (612) 736-0203

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device
2. Fox Coupling, Inc. "Cast-In-Place Firestop Coupling".
3. Proset Cast-In-Place Device

C. Sealant or caulking materials for use with non-combustible items including steel pipe & copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25 or Firestop Sealant 2000
3. Tremco Fyre Shield

D. Sealant or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601S Elastomeric Firestop Sealant or CP 606 Flexible Firestop Sealant
2. Tremco Fyre-Shield High Performance Ceramic Firestop Sealant
3. 3M Fire Barrier CP25WB+ or 2000 Silicone Sealant

E. Intumescent sealant or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including pipe and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25WB+
3. Tremco Intumescent Acrylic or TremStop WBM

F. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 642 and CP643 Firestop Collar, CP645 Wrap Strip
2. Tremco TREMstop D Combustible Pipe Intumescent Device System and TremStop WS Wrap Strip
3. 3M Ultra Plastic Pipe Device and Fire Barrier FS-195+ Wrap Strip

G. Materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 635 Trowelable Firestop Compound and FS 657 FIRE BLOCK
2. Tremco TremStop M Fire Rated Mortar and PS Pillows
3. 3M Fire Barrier CS-195+ Composite Sheet

H. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK
2. Tremco PS Firestop Pillows

3. 3M CS Intumescent Sheet

I. Provide a firestop system with an "F" Rating as determined by UL 1479 or ASTM E814. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with the Owner’ Representative and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas. All penetrations are to be labeled in accordance with the University's standard labeling system. The HVAC Contractor shall coordinate all fire stopping requirements with the University prior to start of work.

B. Keep areas of work accessible until inspection and approval have been completed.

C. All fire stopping shall be inspected and approved by a licensed independent Consultant. All unapproved fire stopping products installed by this contractor will be removed and replaced at his expense.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

SECTION 21 05 21
CUTTING AND PATCHING

PART 1 GENERAL

Not Applicable

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 Cutting for openings, when necessary, shall be done by this Contractor with such tools and methods as to prevent unnecessary damage to surrounding areas or equipment.

3.02 The corners of all openings in poured concrete shall be core drilled to minimize overcutting.

3.03 Fill space in all areas where core drilled with packing where required to maintain fire rating. Openings shall be temporarily fire-stopped until permanent fire stopping is done. This includes holes left due to removal of piping or ductwork.

3.04 All holes cut for the installation of piping and equipment shall be neatly patched and refinished with the same materials as, and to match, adjacent surfaces, and damages thereto shall be repaired in kind and to match existing conditions by this Contractor.

3.05 Patching shall match existing surfaces in kind and finish.

3.06 No structural member will be cut into without the expressed permission of the Owner's representative and structural engineer.

END OF SECTION

SECTION 21 05 29
INSERTS, PIPE HANGERS, AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary inserts, beam clamps and auxiliary steel for pipe hangers in the building.

B. Furnish and install necessary pipe hangers and supports to properly support all piping and to maintain uniform elevation.

PART 2 PRODUCTS

2.01 HANGERS

A. Piping shall be adequately supported by means of hangers and supports, and be in compliance with NFPA Pamphlets 13 & 14 as applicable. Furnish required supplemental listed steel framing, bracing, etc. as necessary for support & stabilization.

B. The Following Items Shall Be Provided:

1. Supplementary channels, plates, etc. where supports are required between building structural members, spanning the space and attached to building structural members by welding or bolting.

2. All rods, angles, rails, struts, braces, plates, platforms, etc., required for suspension and/or support of piping, and all miscellaneous specialties and items/elements required for the attachment of hangers and supports to the structure.

C. Unless Otherwise Noted, Hangers Shall Be As Follows:

1. Piping 8” size and smaller, hanger shall be similar to Anvil Fig. 69, with adjustable nut and carbon steel band.

2.02 Wall brackets to be similar to Anvil figure no. 195.

2.03 Riser clamps to be similar to Anvil figure no. 261.

2.04 Hanger support rods to be listed steel all-thread type sized in accordance with the hanger manufacturer’s recommendations for associated piping.

2.05 B-Line, F & S, Elcen, Penn, Fee-Mason, PHD Manufacturing or Modern Pipe Hangers of the same type may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 Riser clamps shall be used at each floor where required.

3.02 Wall bracket pipe supports shall be installed where required.

3.03 Support piping at equipment from floor, ceiling, or walls, so that piping weight is not supported directly from pumps or equipment.

3.04 All beam clamps and supports for piping and ductwork shall be in place prior to the fireproofing of the structural steel.

3.05 Piping to be supported according to the requirements of NFPA pamphlets no. 13 and 14. Support at intervals not to exceed spacing listed or elsewhere as required in accordance with good workmanship. No pipe shall be supported from another pipe. All hangers shall be plumbed before insulation is applied.

3.06 Support plastic pipe at intervals not to exceed 4 feet.

3.07 Support piping at equipment from floor, ceiling, or walls, so that piping weight is not supported directly from equipment.

END OF SECTION

SECTION 21 05 30
INSTALLATION OF PIPING

PART 1 GENERAL

1.01 REFERENCE

A. Section 21 05 19 - PIPING SPECIALTIES
C. Section 21 05 29 - INSERTS, PIPE HANGERS AND SUPPORTS
D. Section 21 05 93 - TESTS AND ADJUSTMENTS
E. Section 21 13 13 - Wet Pipe Sprinkler Systems

1.02 SCOPE

A. The requirements of this Section shall apply to all interior piping systems installed under this Contract, except where otherwise noted on the Drawings or elsewhere in the Specifications.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 All piping systems shall be installed with adequate provisions made for expansion and contraction to prevent stresses on piping, valves and equipment. Anchor and guide piping at all points indicated and/or as required. Type and method of anchoring, guiding and attachments to sustaining members to suit job requirements and conditions and shall be approved by University.

3.02 Provide unions or flanges at each final connection, and at each piece of equipment. Branches from mains to equipment stubs, risers, etc., to have swing joints with at least one change of direction in the horizontal plane, and one change of direction in the vertical plane, before connecting to equipment or fixtures. Piping shall be arranged and unions and flanges located to permit easy removal of parts and equipment for inspection and cleaning without disconnecting any part except unions or flanges. No welded connections shall be made to valves or equipment. Use bronze unions in copper lines. Unions to be downstream of valves.

3.03 Flange bolts shall be cut to proper length so that one thread projects beyond the nut when nut and bolt are tightened.

3.04 Make proper connections to all items of equipment in the Contract as recommended by the Manufacturer or as detailed on the Drawings.

3.05 All piping shall be arranged in accordance with the best standards of the trade with vertical pipes plumb and horizontal runs parallel or perpendicular to the building wall.

3.06 Provide valves and specialties where indicated on the Drawings.

3.07 Provide 3/4" drain valves in piping at low points to provide complete drainage of all systems and as shown on the Drawings.

3.08 Ream ends of pipe and clean before installing.

3.09 All joints in copper piping shall be made with 95-5 solder. Solders and fluxes containing lead are prohibited.

3.10 Use pipe dope on male threads of screwed pipe only. Teflon pipe joint tape may be used, at the Contractor's option.

3.11 Valves to be installed with handwheel at or above center of pipe. Valves outdoors exposed to weather shall be installed with handwheel in the horizontal.

3.12 Make all changes of direction with fittings, rather than bending.

3.13 All valves and unions to be installed so as to be accessible through ceiling, access panels, etc.

3.14 Provide dielectric unions or insulating flanges between dissimilar metals, i.e., copper to steel.

3.15 Bull head connections in any piping service are expressly prohibited.

3.16 At the end of each day's work and otherwise as required or directed, provide caps and/or plugs at all openings in piping for protection. Particular attention must be given to avoid the possibility of any foreign materials entering the pipes, whether it be inadvertent or with malicious intent.

3.17 Flanged joints shall be faced true and square. Flanges shall be same face style as mating surface to which it is connected.

3.18 Install thermometers and gauges so they may be read from floor level.

3.19 Where piping is installed in accessible chases, keep all piping to sides of chase, except portions which must necessarily be in center of chase. Offset vents to side immediately above connection to waste line. All lateral runs are to be located at the floor or minimum 6'-0" above floor, and all vertical piping held close to the wall through that height leaving maximum service space.

3.20 Where pipe drops occur in block walls, pipes to enter and leave walls at block joints. Coordinate with General Contractor.

3.21 Install galvanized sheet metal troughs with drains under pipes crossing electrical equipment. Seal to make water tight.

3.22 Do not run water piping through electrical rooms.

END OF SECTION

SECTION 21 05 93
TESTS AND ADJUSTMENTS

PART 1 GENERAL

1.01 SCOPE

A. After work has been completed but before pipe covering has been applied, the Contractor shall test and adjust the systems he has installed.

B. The Architect shall be notified of all scheduled tests and adjustments at least 48 hours before they are scheduled so that he may witness same. If the Contractor performs any test or adjustment without the Architect present or without properly notifying the Architect, the Contractor will be required to perform the test or adjustment a second time in the presence of the Architect.

C. If the Architect determines that any work requires special inspection, testing, or approval, they will, upon written authorization, instruct the Contractor to order such special inspection, testing or approval. The Contractor shall give timely notice so the Architect may observe the inspections, tests or approvals. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Architect's additional services made necessary by such failure; otherwise the owner shall bear such costs, and an appropriate Change Order shall be issued.

D. Concealed lines shall be tested before being concealed. If this is not done and a leak appears during the final test, this Contractor shall repair leak and all damage resulting therefrom.

E. This Contractor shall adjust all his equipment in the mechanical system to obtain proper operation and shall demonstrate to Owner and the Architect that the entire system will function properly.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 After work has been completed but before pipe covering has been applied, the Contractor shall test the systems in accordance with the requirements of NFPA pamphlets no. 13 and 14.

3.02 Before turning job over to Owner, inspect all valves and repack valves as necessary.

3.03 This Contractor shall adjust all equipment in the Fire Protection system to obtain proper operation and shall demonstrate to Owner and the Architect that the entire system will function properly.

END OF SECTION

SECTION 21 05 94 - PROTECTION AND CLEANING

PART 1 GENERAL

Not Applicable

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 Protect all equipment against damage from any cause whatsoever and pay the cost of replacing and repairing equipment made necessary by failure to provide suitable protection.

3.02 After all piping and equipment has been approved and after all plastering has been completed, bare piping and insulation provided under this Contract shall be thoroughly cleaned of dirt, grease, rust and oil.

3.03 Repair all dents and scratches in factory prime or finish coats on all mechanical equipment to the satisfaction of Associate. If damage is excessive, replacement may be required.

3.04 Flush out all piping systems to remove all dirt and grease from pipes and equipment before systems are placed in operation.

3.05 Cover all equipment, appurtenances, open pipes, etc., to keep out dirt, water and weather during construction.

3.06 This Contractor shall clean up and remove all debris from the site and shall at all times keep the premises in a neat and orderly condition.

END OF SECTION

SECTION 21 06 00
MANUFACTURER'S DRAWINGS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall submit for review six (6) copies of fire protection equipment submittals, hydraulic calculations and sprinkler layout drawings, etc as noted below in three distinct sequential stages:

1. Materials and Equipment List: Include all materials, equipment, and accessories required for work. Include catalog ID numbers, drawings, cut sheets as necessary to define the work. If cut sheets include multiple selections, and or optional selections, then clearly label the included sections and the included options. Submit to the Architect for review.

2. Preliminary Shop Drawings: Include sprinkler head locations only. Include full-size detail representation of each style of sprinkler head to be used. Submit to the Architect for review.

3. Detailed Shop Drawings: Include pipe layout and sizing, sprinkler head locations coordinated onto reflected ceiling drawings, hydraulic calculations, system controls, and all equipment cut sheets, zone valves, zone drain valves, and zone test stations. Submit to all required parties, Architect, Authority Having Jurisdiction (AHJ), the local Fire Chief, State Fire Marshal, and the Owner's Insurance Underwriter, for review and approval by all.

B. The Assocaite will review Contractor's shop drawings and related submittals (as indicated above and below) with respect to the ability of the detailed work, when complete, to be a properly functioning integral element of the overall system designed by the Assocaite. Before submitting a shop drawing or any related material to the Assocaite, Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting it. The Assocaite shall assume that no shop drawing or related submittal comprises a variation unless Contractor advises Assocaite otherwise via a written instrument which is acknowledged by Assocaite in writing. The shop drawings and related material (if any) called for are indicated below:

1. Fire Protection Contract
2. Sprinkler Drawings
3. Fire Protection Equipment
4. Pipe, Hangers, and Fittings
5. Sprinkler Heads
6. Hydraulic Calcuations

C. The Associate shall return shop drawings and related materials with comments provided that each submission has been called for and is stamped by Contractor as indicated above. The Assocaite shall return without comment material not called for or which has not been approved by Contractor.

D. This Contractor shall furnish equipment shop drawings which will indicate power hook up and control connections as required for mechanical equipment. "Stock" wiring diagrams are NOT ACCEPTABLE.

E. The HVAC Contractor is to provide sepias of sheet metal drawings for use in coordinating work of Plumbing, Fire Protection and Electrical with layout of air distributions system and related work. Lighting, ceiling grid and ceiling access doors will be shown lightly to verify coordination. HVAC Contractor to provide initial sepias within 60 days of award of contract. Each Prime Contractor is responsible for overlaying his work onto these sepias; for providing information as to size, elevation and location proposed for all components; and for coordination of his work with that of other Contractors. Final resolution of all items to be determined at project meetings held by Lead Contractor.

F. Associate's review of manufacturer's drawings or schedules shall not relieve the Contractor from compliance with the requirements of the plans and specifications.

1.02 QUANTITIES

A. Items may be referred to in singular or plural on Plans and Specifications. Contractor is responsible for determining quantity of each item.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

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. This Section includes the following fire-suppression piping inside the building:
   1. Wet-Pipe Sprinkler System.

1.3 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.
   1. Cast-Iron Threaded Flanges: ASME B16.1.
   2. Malleable-Iron Threaded Fittings: ASME B16.3.
   3. Gray-Iron Threaded Fittings: ASME B16.4.
   4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
   5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

B. Grooved-End, Standard-Weight Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.
   1. Grooved-Joint Piping Systems:
      a. Manufacturers:
         1) Anvil International, Inc.
         2) National Fittings, Inc.
         3) Southwestern Pipe, Inc.

4) Star Pipe Products; Star Fittings Div.
5) Victaulic Co. of America.
6) Ward Manufacturing.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD.

2.3 SPRINKLERS

A. Sprinklers shall be UL listed and FMG approved, with 175-psig minimum pressure rating.

B. Manufacturers:
1. Globe Fire Sprinkler Corporation.
2. Gem Fire Protection.
3. Reliable Automatic Sprinkler Co., Inc.
4. Victaulic Co. of America.
5. Viking Corp.

C. The use of flexible sprinkler heads is expressly prohibited.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 PIPING APPLICATIONS, GENERAL

A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

3.3 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
1. NPS 2 and Smaller: Threaded-end, black standard-weight schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
2. NPS 2-1/2 to NPS 4: Threaded-end, black, standard-weight schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
3. NPS 2-1/2 to NPS 4: Grooved-end, black, standard-weight schedule 40 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.4 JOINT CONSTRUCTION

A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40.

C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

3.5 PIPING INSTALLATION

A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

E. Install sprinkler piping with drains for complete system drainage.

F. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

G. Install drain valves on standpipes.

H. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

I. Install alarm devices in piping systems.

J. Hangers and Supports: Comply with NFPA 13 for hanger materials.

K. Fill sprinkler system piping with water.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.7 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers and fire suppression piping.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

END OF SECTION

SECTION 22 00 00
PLUMBING GENERAL

PART 1 GENERAL

1.01 REFERENCE

A. Sections 22 00 00 through 22 06 00 (as included), for items of a general nature which apply to the Plumbing Contract, unless indicated otherwise herein.

B. Sections 22 07 19 through 22 40 00 (as included), cover Plumbing work specifically.

C. Applicable Division 1 and General Conditions terms and conditions (if any).

D. Applicable construction codes, standards and guidelines for all Plumbing Contract elements, including but not limited to the following:

1. City of Oxford, Ohio Building Code, including Plumbing, Fuel Gas, Mechanical, handicap accessibility and energy conservation portions thereof.

2. City of Oxford Board of Health.

3. State of Ohio Environmental Protection Agency (E.P.A.).

4. NFPA pamphlet no. 70, NATIONAL ELECTRIC CODE

5. City of Oxford Division of Water utility provider.

6. City of Oxford Sewer and Drain authority.

7. American National Standards Institute (ANSI) standards for materials and construction.

8. American Society of Mechanical Engineers (ASME) standards for materials and construction.

9. American Society of Sanitary Engineering (ASSE) standards for performance and testing.

10. American Society for Testing and Materials (ASTM) standards for materials, construction and testing.

11. American Water Works Association (AWWA) standards for materials, construction and disinfection procedures.

12. National Sanitation Foundation (NSF) standards for materials and construction.

13. Cast Iron Soil Pipe Institute (CISPI) standards for materials and construction.

14. Underwriter’s Laboratories (UL) standards for materials and construction.

15. The manufacturer's installation guidelines and recommendations for individual items, elements and/or systems indicated herein.

16. The Owner's material and installation guidelines and/or standards.

1.02 SCOPE

A. This Contractor shall furnish all labor, materials, tools, incidentals, details, etc., necessary to provide a complete, operational and approved Plumbing System, including but not limited to all items and elements described in the Plumbing Specification and shown on the Plumbing Drawings, and as required for coordination and/or interface with work under separate contract as indicated by complete construction documentation package.

B. The Plumbing Contractor is responsible for satisfactorily addressing all review and inspection authorities' requirements and directives in regard to methods of installation necessary for final approval.

1.03 PERMITS AND FEES

A. Unless directed otherwise by the General Conditions portion of project documentation, the Plumbing Contractor shall apply for and pay any review, inspection, permit, license, testing and/or other service fees required by all review/inspection/approval authorities in connection with the work under this Contract.

B. Unless directed otherwise by the General Conditions portion of project documentation, the Plumbing Contractor shall apply for and pay any procurement, tap, capacity, metering, testing and/or other service fees required by all Utility Providers (Water, Gas, Storm, Sewer etc.) in connection with the work under this Contract. This shall include procurement, execution and return of any forms and/or applications required; and participation in individual, initial design/installation consultations with the providers if required.

1.04 PLUMBING UTILITY CONNECTIONS FOR ITEMS OR ELEMENTS NOT INCLUDED IN THE PLUMBING CONTRACT

A. Provide Plumbing supply, waste, drain, vent, and any other piped utilities included for the project as required, as listed herein, and/or as shown on the Plumbing Drawings for items furnished and/or installed under separate contract requiring same. These items shall include, but not be limited to the following:

1. HVAC equipment; final connection (where applicable) by the HVAC Contractor.

2. Owner provided items; final connection (where applicable) by the Plumbing Contractor.

B. Rough-in Plumbing supply, waste, drain, vent, and any other piped utilities included for the project as required, as listed herein, and/or as shown on the Plumbing Drawings for all future items requiring same.

1.05 Concrete housekeeping and support pads for equipment in the Plumbing Contract are the responsibility of the Plumbing Contractor. Concrete pad construction to be in accordance with specifications provided in the General Contract for same.

PART 2 PRODUCTS

2.01 Where items/elements are indicated herein to be listed/approved, the intent of this specification is that said item/element shall be listed by all applicable material/construction standards and subject to final approval (including methods of installation) by all review/inspection/approval authorities.

2.02 Unless indicated otherwise, all plumbing contract items/elements (pipe, fittings, valves, specialties, fixtures, equipment, etc.) materials, construction, performance, testing and methods

of installation to be as listed/approved by all applicable material/construction/installation standards for same, and be in accordance with the requirements of all review/inspection/approval authorities. This includes, but is not limited to, the standards and authorities referenced in this specification. In the absence of such standards and/or requirements, the item/element manufacturer's recommendations, as confirmed by the Plumbing Contractor in advance, shall be followed.

2.03 Unless indicated otherwise, all Plumbing piping shall be in accordance with the following standards in regard to materials, construction, dimensions/tolerances, type of service/transmission medium (water, air, gas, etc,) and methods of installation (as applicable), and shall be so listed. Final approval for use is subject ot the requirements of the review and inspection authorities:

A. Steel pipe, steel, malleable and cast iron fittings and joining methods; per applicable ASTM/ANSI/ASME standards. In addition, where utilized for potable water service, all elements shall be per applicable NSF and ASTM A53 (for carbon steel) standards.

B. Ductile iron pipe, fittings and joining methods; per applicable ASTM/ANSI/ASME/AWWA/NSF standards.

C. Plastic pipe, fittings and joining methods; per applicable ASTM/ANSI/ASME/AWWA/NSF standards.

D. Cast iron pipe, fittings and joining methods; per applicable ASTM/ANSI/ASME/CISPI standards.

E. Copper/copper alloy/brass pipe/tube, fittings and joining methods; per applicable ASTM/ANSI/ASME standards. In addition, where utilized for potable water service, all elements shall be per applicable NSF standards.

2.04 All Plumbing Contract items/elements shall have the manufacturer's mark or name and the quality of the product or identification of same cast, embossed, stamped or indelibly marked on each item/element in accordance with the standards under which they are accepted and approved per applicable code(s).

2.05 PLUMBING UTILITY CONNECTIONS PROVIDED FOR ITEMS OR ELEMENTS NOT INCLUDED IN THE PLUMBING CONTRACT

A. Unless indicated otherwise, the Plumbing Contractor shall furnish and install all traps and stops (as applicable) as required for items furnished under separate contract. This includes items with connections by the Plumbing Contractor or with connections under separate contract.

B. Unless indicated otherwise, Fixture traps above floor slab connected to the sanitary waste system shall be cast brass P-traps with integral cleanout. P-traps below floor slab to be cast iron, less cleanout. See plans for sizes.

C. Unless indicated otherwise, Fixture traps connected to waste or drain systems other than the sanitary waste system shall be of same material and connection type as the associated piping system. P-trap or S-trap to be provided as indicated on plans.

D. Unless indicated otherwise, All waste and drain rough-ins for future shall terminate with a short nipple and cap and no trap.

E. Unless indicated otherwise, Supply rough-ins to be furnished with accessible shut-offs at connection points. Shut-offs at supply rough-ins for fixtures (sinks, lavatories, etc.) to be

angle type compression stops. Shut-offs at supply rough-ins for equipment or other elements to be in-line valves as specified for individual services. All supply rough-ins for future shall terminate with a short nipple and cap immediately downstream of the shut-off.

F. Unless indicated otherwise, where connection elements described herein are exposed in locations other than restricted access utility or maintenance areas, all metallic components to be furnished with a polished chrome finish. Wall or other structure piping penetrations at these locations to be provided with polished chrome finish escutcheons.

PART 3 EXECUTION

3.01 Where standards, codes or guidelines are referenced herein and throughout the Plumbing Contract documentation, including plans and specifications, the latest version/edition shall be applied, unless the Building Code references another version/edition, which shall take precedence.

3.02 Refer to project documentation furnished with the complete construction package in advance of work for overall coordination and verification of requirements at work of other trades relating to, interfacing with, and/or impacting work in the Plumbing Contract. This includes exact locations, quantities, physical sizes, rough-in details, pipe routing, connection sizes, etc., for items included both in the Plumbing Contract and under separate contract. Coordinate installation and interface requirements with the appropriate contractor(s) in advance of work.

3.03 Include any minor details, items and/or elements essential to necessary approvals and successful operation in addition to the items specified herein and shown on plans.

3.04 See general "PLUMBING NOTES" on plans for additional conditions and requirements relative to the Plumbing Contract.

3.05 Plumbing items and elements shall be installed with due regard to preservation of the strength of structural members and prevention of damage to walls, surfaces and other structures through installation, bearing support or subsequent usage of Plumbing items and elements. No framing or other support structure shall be cut, notched or bored in excess of limitations specified in the Building Code, or by the manufacturer of the framing or other support structure, as confirmed in advance of work by the Plumbing Contractor.

END OF SECTION

SECTION 22 01 05
PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Furnish all labor, materials, tools, incidentals and details necessary to provide a complete mechanical system, ready to operate, including but not limited to the items listed under the Mechanical Specification Indexes.

B. Include any minor details essential to successful operation and any other items specified or shown on the Drawings.

C. The Contractor is required to read the Specifications covering all branches of the work and will be held responsible for coordination of his work with work performed under all other Contracts.

D. The Contractor is required to visit the site and fully inform himself concerning all conditions affecting the scope of his work. Failure to visit the site shall not relieve the Contractor from any responsibility in the performance of his Contract.

E. The Contractor should feel free to contact the Architect immediately if there is any question regarding the meaning or intent of either Plans or Specifications, or if he notices any discrepancies or omissions in either Plans or Specifications.

F. Other than minor adjustments shall be submitted to the Architect for approval before proceeding with the work.

G. The Contractor shall submit on his letterhead, along with the Bid, the manufacturer's name and the names of all Subcontractors to whom he intends to sublet the work. If the Contractor fails to provide this information with the Bid, the Owner shall have the right to select the manufacturers and Subcontractors with no additional charge.

H. Scheduling of all work performed by this Contractor shall be completely coordinated with the Construction Manager.

I. This Contractor shall furnish to Architect a written description of procedure on this job including scheduling of the work to be done for his approval. This shall be submitted within 10 days after the Contract is awarded. There shall be six (6) copies.

J. All material hoisting by trade involved.

K. Arrangements for storage of tools and material, removal of debris, and interruptions of services shall be made with the Construction manager.

L. Extreme care shall be taken to avoid interference and/or conflict with work of other trades. Consult with the Architect regarding any points where interference and/of conflict is likely to occur and follow dimensions carefully where given on the Drawings. Pay particular attention to minimum clear heights when indicated on the Drawings.

M. It is mandatory that dust and debris be held to a minimum. This Contractor shall provide drop cloths, screens, curtains, etc., to protect all equipment and personnel from dust and dirt during the course of his work. All damage to existing construction or finishes shall be repaired by this Contractor upon removal of dirt and dust protection devices. All dirt, dust

and other protection devices shall be approved by the Construction Manager before any work is started in the area involved.

N. The Contractor, insofar as this Contract is concerned, shall at all times keep the premises and the building in a neat and orderly condition.

O. At the completion of the project, this Contractor shall promptly clean up and remove from the site, all debris and excess materials.

1.02 DRAWINGS

A. Consult all Contract Drawings which may affect the locations of any equipment, apparatus, piping and ductwork and make minor adjustments in location to secure coordination.

B. Piping and duct layout is schematic and exact locations shall be determined by structural and other conditions and verified in the field. This shall not be construed to mean that the design of the system may be changed, it refers only to the exact location of piping and ductwork to fit into the building as constructed, and to coordination of all work with piping and equipment included under other Divisions of the Specifications.

C. The layout shown on the Drawings is based on a particular make of equipment. If another make of equipment is used which requires modifications or changes of any description from the Drawings or Specifications, this Contractor shall be responsible for making all such modifications and changes, including those involving other trades, as a part of this Contract and the cost thereof shall be included in his Bid. In such case, the Contractor shall submit Drawings and Specifications showing all such modifications and changes prior to starting work, which shall be subject to the approval of the Architect.

D. The Owner and Architect reserves the right to make minor changes in the location of piping and equipment up to the time of rough-in without additional cost to the Owner.

E. Where certain grades and/or elevations are given on the Drawings, they have been obtained from the best information available; however, they are not guaranteed. This Contractor MUST assume the full responsibility of verifying present elevations in the field and making any adjustments as may be necessary, all of which must be included in his Bid Price.

F. Due to the scale of the Drawings, it is impossible to show all offsets and transitions which may be required. This Contractor shall carefully investigate the conditions affecting all work and shall furnish all elbows, fittings, transitions, etc., required to accomplish the desired result at no additional cost to the Owner.

G. Install all work as close as possible to walls, ceilings, struts, members, etc., consistent with the proper space for covering, access, etc., so as to occupy the minimum of space.

H. Actual dimensions shown on the Drawings and field dimensions shall take precedence over scaled dimensions.

1.03 PERMITS, INSPECTIONS AND CODES

A. The Architect will obtain the general building permit. Any other permits required for the project will be obtained by the Contractor performing the work. Fees will be included in the bid price.

B. Completed installations shall conform with all applicable Federal, State and Local Laws, Codes and Ordinances, including but not limited to the latest editions of the following:

1. Ohio Building Code, State of Ohio.

2. A.S.M.E. Pressure Piping Code - Section B31.1

3. National Electrical Code, Bulletin No. 70, National Fire Protection Association.

4. Life Safety Code, Bulletin No. 101, National Fire Protection Association.

C. Nothing contained in the Plans and Specifications shall be construed to conflict with these laws, codes and ordinances and they are hereby made a part of these Specifications.

1.04 OHIO ENERGY CODE

A. The Mechanical System must comply with all requirements of the State of Ohio "Code for Energy Conservation". This includes, but is not limited to, efficiencies, power factors, insulation thickness, etc.

1.05 UTILITIES

A. The Contractor shall investigate and locate all utilities prior to construction.

B. Each Contractor is responsible for rerouting or replacing existing utilities where necessary to permit installation of his work.

C. Support, protection and restoration of all existing utilities and appurtenances shall be the responsibility of the Contractor. The cost of this work shall be included in the price bid for the various items.

D. The Contractor shall cause notice to be given to the Ohio Utilities Protection Service (telephone 800-362-2764 - toll- free) and to the Owners of underground utility facilities shown on the plans who are not members of a registered underground protection service in accordance with Section 153.64 of the Revised Code. The above mentioned notice shall be given at least 48 hours, excluding Saturdays, Sundays and legal holidays, prior to commencing work.

E. The Contractor shall alert immediately the occupants of nearby premises as to any emergency that he may create or discover on or near such premises of the underground facility, any break or leak on its lines or any dent, gouge, groove or other damage.

1.06 OPERATING AND MAINTENANCE INSTRUCTIONS

A. This Contractor shall thoroughly instruct and supervise the Owner’s Maintenance Personnel in the proper operation and maintenance of the mechanical system equipment. This Contractor shall be responsible for arranging for the instruction and supervision at a time convenient to the Owner and notifying the Architect of the time at least 48 hours in advance.

Instructions shall include the following:

1. Location of equipment and explanation of what it does.

2. Reference to "Operating Instruction Manuals" for record and clarity.

3. Coordination of written and verbal instruction so that each is understood by all personnel.

4. Specific maintenance to be performed by the Owner.

B. Furnish one (1) copy of the printed Operating and Maintenance Instructions for the Mechanical Systems for review. Copy shall be neat, legible and bound in a hardback 3-ring notebook. After final approval, provide four (4) copies of Operation and Maintenance Instructions for submittal to the Owner. Instructions shall consist of the following items:

1. Title Page: Title of Project, address, date of submittal, name and address of Contractor, name of Architect.

2. Second Page: Index of Manual Contents.

3. First Section: A copy of each approved shop drawing and submittal with an index at the beginning of the section.

4. Second Section: A list of all equipment used on the project, together with supplier's name and address.

5. Manufacturer's maintenance manuals for each item of equipment furnished under this contract. Manuals shall include such items as parts list, detailed lubrication instructions, procedures for performing normal maintenance functions, preliminary trouble shooting procedures and wiring diagrams.

6. Complete wiring diagrams for the plumbing systems as actually wired including control and interlock wiring.

7. Brief but complete instructions for start-up, shut- down and routine maintenance of each system.

8. Routine and 24-hour emergency information:

a. Name, address and telephone number of servicing agency.

b. Include names of personnel to be contacted for service arrangements.

C. Frame one (1) copy of brief start-up, shut-down and routine maintenance instructions and complete system wiring diagrams under glass and mount on the Equipment Room wall.

1.07 RECORD DOCUMENTS

A. The Contractor shall keep an accurate record of all deviations from Contract Drawings and Specifications. He shall neatly and correctly enter in colored pencil any deviations on Drawings affected and shall keep the Drawings available for inspection. Extra sets of Drawings will be furnished for this purpose.

B. At the completion of project and before final approval, make any final corrections to Drawings and certify to the accuracy of each print by signature and deliver same to Architect

1.08 SUPERVISION

A. This Contractor shall have in charge of the work, on the job during construction, a competent superintendent experienced in the work installed under this Contract.

1.09 UNACCEPTABLE WORK AND OBSERVATION REPORTS

A. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.

B. The Contractor shall promptly correct all work found unacceptable by the Architect and/or Construction Manager or the Owner whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work, including compensation for the Architect's or the Construction Manager's additional services made necessary thereby.

C. During the course of construction, the Architect will prepare "Observation Reports" with a list of items found to be in need of correction. All items listed shall be corrected by the Contractor. A space is provided on the form for the Contractor to note the completion of each item. All prior "Observation Report" items must be completed, the lists signed and returned to the Architect prior to making the final inspection. After the final list is issued, the same procedure will apply.

1.10 FINAL INSPECTION

A. When the Contractor determines all work is completed and working properly per the Contract Documents, he shall request a "final" inspection by the Architect in writing. If more than one reinspection is required after this final inspection, the Contractor shall bear all additional costs including compensation for the Architect's additional services made necessary thereby.

B. As part of the final checkout of the project, the Architect will be checking out the operation of the various systems. This Contractor shall provide such assistance as required (including manpower and tools) to start and stop the various systems, open and close valves etc. The Contractor (not the Architect) is responsible to turn on the systems and demonstrate they are operating properly.

1.11 GUARANTEE

A. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after final payment is approved by the Architect.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 22 05 17
FIRESTOPPING

PART 1 GENERAL

1.01 SCOPE

A. Each Contractor shall be responsible for firestopping around all openings for pipes, ducts, conduits, etc., installed by him at all fire walls and smoke walls. Firestopping shall be performed by an installer who has been trained by manufacturer, or manufacturer's representative, in the installation procedures based on published UL tested fire stop systems.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 REFERENCE

A. Division 1 – General Conditions
B. Division 3 – Concrete
C. Division 4 – Masonry
D. Division 9 – Finishes
E. Section 22 05 16 – Sleeves and Collars

1.04 GENERAL REQUIRMENTS

A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Through-Penetration Firestop Devices (XHCR)
b. Fire Resistance Ratings (BXUV)
c. Through-Penetration Firestop Systems (XHEZ)
d. Fill, Voids, or Cavity Material (XHHW)
e. Forming Materials (XHKU)

C. International Firestop Council Guidelines for Evaluating Firestop Systems Associating Judgments

D. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

E. The Ohio Building Code (OBC)

F. NFPA 101 - Life Safety Code

1.05 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

1.06 SUBMITTALS

A. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.07 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary 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.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. 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 the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that is needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, (800)879-8000
2. Tremco Sealants & Coatings, Beachwood, Ohio, (216) 292-5000
3. 3M Fire Protection Products, St. Paul, Minnesota, (612) 736-0203

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device
2. Fox Coupling, Inc. "Cast-In-Place Firestop Coupling".
3. Proset Cast-In-Place Device

C. Sealant or caulking materials for use with non-combustible items including steel pipe & copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25 or Firestop Sealant 2000
3. Tremco Fyre Shield

D. Sealant or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601S Elastomeric Firestop Sealant or CP 606 Flexible Firestop Sealant
2. Tremco Fyre-Shield High Performance Ceramic Firestop Sealant
3. 3M Fire Barrier CP25WB+ or 2000 Silicone Sealant

E. Intumescent sealant or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25WB+
3. Tremco Intumescent Acrylic or TremStop WBM

F. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 642 and CP643 Firestop Collar, CP645 Wrap Strip
2. Tremco TREMstop D Combustible Pipe Intumescent Device System and TremStop WS Wrap Strip
3. 3M Ultra Plastic Pipe Device and Fire Barrier FS-195+ Wrap Strip

G. Materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 635 Trowelable Firestop Compound and FS 657 FIRE BLOCK
2. Tremco TremStop M Fire Rated Mortar and PS Pillows
3. 3M Fire Barrier CS-195+ Composite Sheet

H. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK
2. Tremco PS Firestop Pillows
3. 3M CS Intumescent Sheet

I. Provide a firestop system with an "F" Rating as determined by UL 1479 or ASTM E814. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated.

PART 3 EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with the Owner' Representative and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas. All penetrations are to be labeled in accordance with the Architect's standard labeling system. The HVAC Contractor shall coordinate all fire stopping requirements with the Architect/Construction Manager prior to start of work.

B. Keep areas of work accessible until inspection and approval have been completed.

C. All fire stopping shall be inspected and approved by a licensed independent Consultant. All unapproved fire stopping products installed by this contractor will be removed and replaced at his expense.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Bronze ball valves.
   2. Iron, single-flange butterfly valves.
   3. Iron, grooved-end butterfly valves.
   4. Bronze swing check valves

B. Related Sections:
   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.1 for power piping valves.

3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Set butterfly valves closed or slightly open.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to 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 and smaller.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
1. 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.
2. Butterfly Valves: With extended neck.

F. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   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.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Hammond Valve.
      c. Milwaukee Valve Company.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-67, Type I.
      b. CWP Rating: 200 psig.
      c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
      d. Body Material: ASTM A 126, cast iron.
      e. Seat: EPDM.
      f. Stem: One-piece stainless steel.
      g. Disc: Aluminum bronze.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Hammond Valve.
      c. Milwaukee Valve Company.
      d. Powell Valves.
      e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-80, Type 3.
      b. CWP Rating: 200 psig.

c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

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 check valves for proper direction of flow and as follows:
1. Swing Check Valves: 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 or butterfly valves.
2. Throttling Service: Ball valves.
3. Pump-Discharge Check Valves:
a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

B. Select valves, except wafer types, with the following end connections:
   1. For Copper Tubing, NPS 2 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: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2-1/2 and Smaller:
   1. Ball Valves: Two piece or three piece, full port, bronze with stainless-steel trim.
   2. Bronze Swing Check Valves: Class 150, bronze disc.

B. Pipe NPS 3 and Larger:
   1. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
   2. Bronze Swing Check Valves: Class 150; single plate; resilient seat.

END OF SECTION 22 05 23

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SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
2. Metal framing systems.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

B. Related Sections:
1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Metal framing systems.
2. Pipe stands.
3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut Corporation; Tyco International, Ltd.
g. Wesanco, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Metallic Coating: Electroplated zinc.

8. Paint Coating: Epoxy.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.

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.

2.4 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, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-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.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal 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 the building structure.

B. Metal 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 for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

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 for use in lightweight concrete or concrete slabs less than 4 inches thick 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. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. 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 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.

L. Load Distribution: Install hangers and supports so that 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 to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:
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 allowed by 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.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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 bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 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/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

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

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

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

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are 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 carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. 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.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   8. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
   9. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   10. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

I. 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 24.

J. 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 for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. 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. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. 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.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
10. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
11. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
12. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. 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.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
   2. Pipe labels.
   3. Valve tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1-inch for name of units if viewing distance is less than 24 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be framed and mounted on the wall in the central mechanical rooms. An additional copy shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:
1. Domestic Water Piping:
a. Background Color: Blue.
b. Letter Color: White.
2. Sanitary Waste and Storm Drainage Piping:
a. Background Color: Purple.
b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:

a. Cold Water: 2 inches, round.

2. Valve-Tag Color:
   a. Cold Water: Green.
3. Letter Color:
   a. Cold Water: White.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 05 93 - TESTS AND ADJUSTMENTS

PART 1 GENERAL

1.01 SCOPE

A. After work has been completed but before pipe covering has been applied, the CM shall test and adjust the systems he has installed.

B. The Architect shall be notified of all scheduled tests and adjustments at least 48 hours before they are scheduled o that he may witness same. If the CM performs any test or adjustment without the Architect present or without properly notifying the Architect the CM will be required to perform the test or adjustment a second time in the presence of the Architect.

C. If the Architect determines that any work requires special inspection, testing, or approval, he will, upon written authorization from the Owner, instruct the CM to order such special inspection, testing or approval. The CM shall give timely notice so the Architect may observe the inspections, tests or approvals. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the CM shall bear all costs thereof, including compensation for the Architect's additional services made necessary by such failure; otherwise the Owner shall bear such costs, and an appropriate Change Order shall be issued.

D. Concealed lines shall be tested before being concealed. If this is not done and a leak appears during the final test, this CM shall repair leak and all damage resulting therefrom.

E. This CM shall adjust all his equipment in the mechanical system to obtain proper operation and shall demonstrate to the Owner and Architect that the entire system will function properly.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 TESTS

A. After work has been completed but before pipe covering has been applied, the CM shall test the systems as follows. At these pressures, the circulation shall be free and the piping free of leaks.

System	Test Medium	Pressure Not Less Than	Time Not Less Than	Notes
Water lines	water	125 lbs	6 hrs	no drop

Gas	air	50 lbs	24 hrs	no drop
Drainage systems	In accordance with applicable plumbing codes			

3.02 Purge gas system to outdoors. Purge and test to be witnessed by Gas Company and Architect.

3.03 The CM, before starting any pumping unit with pump and driver mounted on a common base plate with a flexible couplings, shall check the unit for proper alignment.

3.04 Before turning job over to Owner, inspect all valves and repack valves as necessary.

3.05 This CM shall adjust all equipment in the mechanical system to obtain proper operation and shall demonstrate to the Owner and Engineer that the entire system will function properly.

END OF SECTION 22 05 93

SECTION 22 05 94

PROTECTION AND CLEANING

PART 1 GENERAL

Not Applicable

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 Protect all mechanical equipment against damage from any cause whatsoever and pay the cost of replacing and repairing equipment made necessary by failure to provide suitable protection.

3.02 After all piping and equipment has been approved and after all plastering has been completed, bare piping and insulation provided under this Contract shall be thoroughly cleaned of dirt, grease, rust and oil.

3.03 Repair all dents and scratches in factory prime or finish coats on all mechanical equipment to the satisfaction of Associate. If damage is excessive, replacement may be required.

3.04 Flush out all piping systems to remove all dirt and grease from pipes and equipment before systems are placed in operation.

3.05 Cover all pumps, open pipes, etc., to keep out dirt, water and weather during construction.

3.06 This Contractor shall clean up and remove all debris from the site and shall at all times keep the premises in a neat and orderly condition.

END OF SECTION

SECTION 22 05 97

REMODELING

PART 1 GENERAL

1.01 REFERENCE

A. Division 1 - GENERAL REQUIREMENTS
B. Section 22 05 98 - DEMOLITION

1.02 SCOPE

A. This Contractor shall include the remodeling of and additions to all mechanical work in the areas indicated on the Architectural and Mechanical Drawings and in all areas shown on the Drawings. All necessary or required remodeling or additions to the present mechanical work shall be included in this Contract, as indicated or required, to the end that the work will result in the finished remodeled spaces shown on the Architectural Drawings.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 In all of the remodeling work the mechanical work shall follow the intent of the Mechanical Specification insofar as possible with regard to material and workmanship.

3.02 Where old walls and furrings are removed, exposed piping that will remain in use shall be offset to the nearest available new wall or concealed space and reconnected as necessary or required, using all new material. Note that this shall include piping of every description at both known and unknown locations.

3.03 All piping installed in the remodeling work shall be installed as concealed work. This Contractor shall do all cutting required.

3.04 Existing plumbing fixtures that are to remain but which interfere with the remodeling work of any Contractor shall be removed and replaced later when directed.

END OF SECTION

SECTION 22 05 98

DEMOLITION

PART 1 GENERAL

1.01 REFERENCE

A. Section 22 05 97 - REMODELING

1.02 SCOPE

A. The General Contractor shall be responsible for all plumbing demolition in all areas that will be renovated as part of this project. The plumbing contractor shall be responsible for equipment disconnects and coordination with the general contractor to identify the equipment, piping, etc that is to be removed.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 22 06 00 - MANUFACTURER'S DRAWINGS

PART 1 GENERAL

1.01 SCOPE

A. The CM shall submit for review six (6) copies of plumbing fixture and equipment submittals as noted below in three distinct sequential stages:

1. Materials and Equipment List: Include all materials, equipment, and accessories required for work. Include catalog ID numbers, drawings, cut sheets as necessary to define the work. If cut sheets include multiple selections, and or optional selections, then clearly label the included sections and the included options. Submit to the Architect for review.

2. Preliminary Shop Drawings: Include sprinkler head locations only. Include full-size detail representation of each style of sprinkler head to be used. Submit to the Architect for review.

3. Detailed Shop Drawings: Include all piping, valving, and wiring diagrams as applicable to equipment included herein.

B. The Architect will review CM's shop drawings and related submittals (as indicated above and below) with respect to the ability of the detailed work, when complete, to be a properly functioning integral element of the overall system designed by the Architect. Before submitting a shop drawing or any related material to the Architect, CM shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of CM; approve each such submission before submitting it; and so stamp each such submission before submitting it. The Architect shall assume that no shop drawing or related submittal comprises a variation unless CM advises Architect otherwise via a written instrument which is acknowledged by Architect in writing. The shop drawings and related material (if any) called for are indicated below:

<u>Plumbing Contract</u>
Backflow Preventers
Plumbing Fixtures
Drains and cleanouts
Piping and valves
Firestopping
Trap Primers
Drainage Specialities

C. The Architect shall return shop drawings and related materials with comments provided that each submission has been called for and is stamped by CM as indicated above. The

Architect shall return without comment material not called for or which has not been approved by CM.

D. This CM shall furnish equipment shop drawings which will indicate power hook up and control connections as required for mechanical equipment. "Stock" wiring diagrams are NOT ACCEPTABLE.

E. CM shall create 3-dimensional (3D) coordination model with ability to output 1/4" scale, color coded coordination drawings in PDF and DWG formats for use in coordinating all above ceiling work, including but not limited to existing and new Structure, Plumbing, Fire Protection, Electrical, and Technology scope with the layout of air distribution and piping system. CM shall confirm existing structural conditions upon completion of demolition and abatement of all items to be removed by completing an “As-Built” survey using 3D laser scanning technology compatible with the 3D modeling software to be used in creating the coordination model and drawings. Lighting, ceiling systems (including grid), ceiling access doors, emergency shower heads, ceiling mounted projectors and all other ceiling mounted items and other scope impacting this coordination shall be shown to verify no conflicts exist.

CM shall provide coordination drawings to A/E within 60 days of award of Contract to Subcontractor responsible for Plumbing (Division 22) scope. CM is responsible for providing information as to size, elevation and location proposed for all components, and for coordination of work of all Subcontractors. Final resolution of all items to be determined at project meetings held by the Construction Manager.

F. Architect's review of manufacturer's drawings or schedules shall not relieve the CM from compliance with the requirements of the plans and specifications.

1.02 QUANTITIES

A. Items may be referred to in singular or plural on Plans and Specifications. CM is responsible for determining quantity of each item.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION 22 06 00

SECTION 22 07 19 - PLUMBING PIPING INSULATION

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 insulating the following plumbing piping services:
   1. Domestic cold-water piping.
   2. Domestic hot-water piping.
   3. Domestic recirculating hot-water piping.
   4. Domestic tempered water piping.
   5. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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 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.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation 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, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000-Degree Pipe Insulation.
   c. Manson Insulation Inc.; Alley-K.
   d. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Ramco Insulation, Inc.; Super-Stik.
b. Or Approved equal.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ+ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
d. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
   1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
      b. Vimasco Corporation; 749.
   2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
   5. Color: White.

2.5 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.

2.6 TAPES

A. ASJ+ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ABI, Ideal Tape Division; 428 AWF ASJ.
      b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
      c. Compac Corporation; 104 and 105.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   2. Width: 3 inches.
   3. Thickness: 11.5 mils.
   4. Adhesion: 90 ounces force/inch in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. ASJ+ Tape Disks and Squares: Precut disks or squares of ASJ+ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ABI, Ideal Tape Division; 370 White PVC tape.
      b. Compac Corporation; 130.

c. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.7 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Engineered Brass Company.
b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
c. McGuire Manufacturing.
d. Plumberex.
e. Truebro; a brand of IPS Corporation.
f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

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

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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-in wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inch o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. 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 o.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to 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 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.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 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.
10. Finish insulation on all piping in mechanical rooms, tunnels, storage rooms and in exposed locations with glass cloth (minimum 6 x 6 weave/inch, 4.3 ounces per square yard) vapor barrier jacket applied with Foster No. 30-36 and two coats No. 30-42 over glass cloth. In lieu of the glass cloth and mastic specified, a 14.3 oz. rewettable glass cloth equal to Alpha Maritex Style 84217/9485 RW may be used at the CM's option.
    1). Knauf pipe insulation with an ASJ + jacket or Ownes Corning insulation with "Evolution" paper free ASJ may be used in place of the above specified glass cloth.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. 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.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

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 o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, 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, 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.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 FINISHES

A. Insulation with ASJ+, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. 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.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 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 CM's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS 1 and Smaller: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot, Domestic Tempered and Recirculated Domestic Hot Water Piping:
   1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
      a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 22 07 19

SECTION 22 11 16 - DOMESTIC WATER PIPING SYSTEMS

PART 1 GENERAL

1.01 REFERENCE

A. Section 22 05 23 - GENERAL DUTY VALVES
C. Section 22 05 95 - FLUSHING AND STERILIZATION
D. Section 22 07 19 - PLUMBING PIPING INSULATION
E. Section 22 00 00 - PLUMBING GENERAL

1.02 SCOPE

A. From outlet of primary building backflow prevention devices, as indicated on plans, extend and provide a complete system of domestic water supply distribution piping and all related items/appurtenances required for a complete installation.

B. The domestic water piping system shall include, but not be limited to the following:

1. Cold water supply
2. Hot water supply
3. Hot water return
4. Tempered water supply
5. Trap primer supply

C. All elements specified herein and/or indicated on plans with components/parts in contact with the potable water medium shall be listed for such service, in accordance with referenced code requirements.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Above ground piping up to & including 6” size may be:

1. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
   a. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
   b. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
   c. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

B. Below ground piping 2” diameter and smaller to be listed/approved type K soft copper tubing in a single length with no in-line couplings or joints, and a minimum number of fittings (required by branch take-offs, if any) unless indicated otherwise. Fittings (if required) to be wrot copper with socket solder brazed connections. Completed installation to be rated for 175 psig working pressure. All piping 1” diameter size and smaller below slab on grade to be installed in a schedule 40 PVC 3” diameter conduit.

Install conduit from 2" above slab at entry/exit points, and use long sweep elbows for vertical rise/drop from/to below slab. Unless indicated otherwise, horizontal piping and conduit below slab to run in a straight line direct from entry to exit points.

C. Solder and flux materials shall be certified "lead free" and listed for use with potable water service.

2.02 SHOCK ABSORBERS

A. Similar to Zurn Shocktrol series Z-1700, sized and installed as recommended by the manufacturer for specific conditions at each location.

B. Equal shock absorbers as manufactured by Zurn, J.R. Smith, Josam, Sioux Chief or Precision Plumbing Products may be provided at the CM's option.

2.03 HOSE BIBBS; as specified on plans, unless indicated otherwise.

A. Interior hose bibbs in utility, service, mechanical or similar rooms/areas shall be ball valves as specified in Section 15027 - VALVES. Furnish with permanently affixed vacuum breaker and 3/4" hose thread connection at outlet.

B. Equal hose bibbs as manufactured by Zurn, J.R. Smith, Josam, Wade, Watts, Woodford or Murdock may be furnished at the CM's option.

2.04 TRAP PRIMER ASSEMBLIES; as specified on plans.

A. Equal trap primer assemblies as manufactured by Zurn, J.R. Smith, Josam, Precision Plumbing Products, Wade, Sloan, Mifab or Sioux Chief may be furnished at the CM's option.

2.05 TEMPERING/MIXING VALVE ASSEMBLIES; as specified on plans.

A. Assemblies shall be furnished with adjustable position inlets and outlet, incoming temperature range of 120 to 180 degrees F., and nominal pressure differential of 10 psig unless indicated otherwise. Flow capacities, outlet temperature setting and inlet/outlet temperature differential as indicated on plan. Provide assemblies as required to operate properly with temperature differential as indicated.

B. Equal tempering/mixing valve assemblies as manufactured by Leonard, Powers, Lawler, T & S or Symmons may be furnished at the CM's option.

2.06 BACKFLOW PREVENTORS

A. For backflow preventors not specified herein, see plans and/or section 15028 - PIPING SPECIALTIES.

B. <u>Dual check backflow preventor assemblies:</u>

Backflow preventers shall be line size and similar to Watts model series 7 with union connection body, bronze construction, two (2) plastic check modules, buna "N" seals, stainless steel springs and "O" ring check module and union seals. Unit to comply with ASSE standard 1024 and be so listed. Size as indicated by piping size where installed on plans. Assembly to be rated for 125 psig working pressure.

C. At all hose thread outlet connections to the domestic water supply system not furnished with an integral backflow prevention device, provide an vacuum breaker similar to Watts model no. NF8 permanently affixed, with ¾" hose thread connection at outlet.

D. Reduced pressure backflow preventer 2" and smaller:
Unit to be based on a Ames model 4000ss reduced pressure principle backflow preventer assembly. Unit shall be non-corrosive 300 series stainless steel construction, unit to be fully serviceable while in-line. Unit shall have a 175 psi. working pressure, straight through flow design, ASSE 1013 approved and labeled, air gap fitting, and strainer upstream with isolation quarter turn ball valves for isolation.

E. Unless indicated otherwise, backflow prevention assemby size as indicated by piping size where installed on plans. Equal assemblies as manufactured by Watts, Zurn, Wilkins, Febco, Conbraco, Hersey, Ames or Lawler may be furnished at the CM's option.

2.07 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following;
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. McDonald, A. Y. Mfg. Co.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   f. Wilkins; a Zurn company.

b. Description:
   a. Standard: ASSE 1079.
   b. Pressure Rating: 125 psig minimum at 180 deg F.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.
   d. joint copper alloy and threaded ferrous.

C. Dielectric-Flange Insulating Kits:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.

b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

b. Description:
a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

D. Dielectric Nipples:

c. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Elster Perfection.
b. Grinnell Mechanical Products.
c. Matco-Norca, Inc.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.

d. Description:
a. Standard: IAPMO PS 66
b. Electroplated steel nipple. complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.

E. All Aquatherm® Greenpipe® shall be installed using socket-fustion, electrofusion, or butt-fusion as applicable for the fitting type. All fusion-weld joints shall be mande in accordance with the pipe and fitting Manufacturer's specifications and product standards.

F. Prior to joining, the pipe and fittings shall be prepared in accordance with F 2389 and the Manufacturer's specifications.

G. Joint preparation, setting and alignment, fusion process, collding times and working pressure shall be in accordance with the pipe and fitting Manufacturer's specifications.

H. 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.

I. Install shutoff valve immediately upstream of each dielectric fitting.

J. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

K. Install domestic water piping level without pitch and plumb.

L. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

M. 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.

N. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

O. Install piping adjacent to equipment and specialties to allow service and maintenance.

P. Install piping to permit valve servicing.

Q. 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.

R. Install piping free of sags and bends.

S. Install fittings for changes in direction and branch connections.

T. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

U. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

V. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

W. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

X. Install sleeves for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Apply appropriate tape or thread compound to external pipe threads.
   b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

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 valves for piping NPS 2-1/2 and smaller. Use butterfly or ball valves for piping NPS 3 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."
   a. Hose-End Drain Valves: At low points in water mains, risers, and branches.
   b. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2-1/2 and smaller. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
   a. Vertical Piping: MSS Type 8 or 42, clamps.
   b. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.
   c. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   d. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   a. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
   b. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
   c. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   d. NPS 2-1/2: 108 inches with 1/2-inch rod.
   e. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 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:

a. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
b. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
c. 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.
d. 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 and larger.

3.7 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.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:
a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. 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.
c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:
a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. 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.
c. 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.
d. Cap and subject piping to static water pressure of 50 psig 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.

e. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
f. 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.

3.9 ADJUSTING

A. Perform the following adjustments before operation:
a. Close drain valves, hydrants, and hose bibbs.
b. Open shutoff valves to fully open position.
c. Open throttling valves to proper setting.
d. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
b. Adjust calibrated balancing valves to flows indicated.
e. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
f. Remove and clean strainer screens. Close drain valves and replace drain plugs.
g. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
h. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
a. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
b. 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 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 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. Clean non-potable domestic water piping as follows:
a. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

b. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 1/2 and larger, shall be the following:
   a. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B; cast- or wrough- copper solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   a. Shutoff Duty: Use ball valves for piping NPS 2-1/2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 3 and larger.
   b. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
   c. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

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. This Section includes the following domestic water piping specialties:
   1. Backflow preventers.
   2. Balancing valves.
   3. Strainers.
   4. Hose bibbs.
   5. Wall hydrants.
   6. Water hammer arresters.
   7. Trap-seal primer valves.

B. Related Sections include the following:
   1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 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. NSF Compliance:
   1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.

2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: 3 NPS.
6. Design Flow Rate: 120 gpm.
7. Body: Stainless steel for NPS 2-1/2 and larger.
8. End Connections: Flanged for NPS 2-1/2 and larger.
9. Configuration: Designed for horizontal, straight through flow.
10. Accessories:
a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check Backflow-Prevention Assemblies <Insert drawing designation if any>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size: 6 NPS - 8 NPS.
6. Design Flow Rate: 500 gpm – 1000 gpm.
7. Body cast iron with interior lining complying with AWWA C550 or that is FDA approved or steel with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
8. End Connections: Flanged for NPS 2-1/2 and larger.
9. Configuration: Designed for horizontal, straight through flow.
10. Accessories:
a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.2 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron[with interior lining complying with FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
   a. Strainers NPS 2 and Smaller: 0.033 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.

2.3 HOSE BIBBS

A. Hose Bibbs:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. Prier Products, Inc.
   c. Woodford Manufacturing Company.
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze.
10. Finish for Service Areas: Chrome or nickel plated.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle.
13. Operation for Service Areas: Wheel handle.
14. Operation for Finished Rooms: Loose key.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.4 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. Prier Products, Inc.
   c. Woodford Manufacturing Company.
2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.

7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Nozzle and Wall-Plate Finish: Rough bronze.
10. Operating Keys(s): One with each wall hydrant.

2.5 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. PPP Inc.
   c. Sioux Chief Manufacturing Company, Inc.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.6 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. PPP Inc.
   c. Sioux Chief Manufacturing Company, Inc.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install water hammer arresters in water piping according to PDI-WH 201.

G. Install air vents at high points of water piping.

H. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. 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 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:
Pipe, tube, and fittings.
Specialty pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

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

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.6 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.

1.7 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class (es).

B. Gaskets: ASTM C 564, rubber.

1.8 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Mission Rubber Company; a division of MCP Industries, Inc.
2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

PART 2 PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class (es).

B. Gaskets: ASTM C 564, rubber.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Mission Rubber Company; a division of MCP Industries, Inc.
2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
   1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
   2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   3. Shielded, Nonpressure Transition Couplings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.

c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. 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.

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 to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. 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 two 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.

K. 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.

L. 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 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
3. Vent Piping: Down toward vertical fixture vent or toward vent stack.

M. 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."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Install underground PVC piping according to ASTM D 2321.

P. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads 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.

D. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

E. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, non-pressure transition couplings.
a. NPS 8 and Smaller: Fitting-type transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION; See specification section 22 05 29.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. 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.
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.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
6. 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 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 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.

    A. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

    B. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

    C. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

3. 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 separate report for each test, complete with diagram of portion of piping tested.
4. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
5. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
6. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
7. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
8. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

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.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 6 and smaller shall be the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
2. Service class, cast-iron soil piping; push gasket joints and hub fittings.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

C. Aboveground, vent piping NPS 6 and smaller shall be one of the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

D. Underground, soil, waste, and vent piping in Mechanical Room Floor, shall be the following:
1. Service class, cast-iron soil piping; push gasket joints and hub fittings.

E. Underground, soil and waste piping shall be one of the following:
1. Service class, cast-iron soil piping; push gasket joints and hub fittings.
2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

END OF SECTION 22 13 16

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SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

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. This Section includes the following sanitary drainage piping specialties:
1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Through-penetration firestop assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
1. Floor drains
2. Cleanouts
3. Flashing material
4. Piping Specialties.

B. Shop Drawings: Show fabrication and installation details.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
b. Tyler Pipe; Wade Div.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.
e. Josam Company; Blucher-Josam Div.
2. Standard: ASME A112.3.1 for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: PVC soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, plastic plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Josam Company; Josam Div.
b. Tyler Pipe; Wade Div.
c. Watts Drainage Products Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.
e. Josam Company; Blucher-Josam Div.
2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron and PVC.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron set-screws or other device.
10. Frame and Cover Material and Finish: Stainless steel.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Standard: ASME A112.3.1.
14. Size: Same as connected branch.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Body Material: Gray iron.
3. Outlet: Bottom.
4. Top or Strainer Material: Nickel bronze.
5. Top Shape: Round.
6. Top Loading Classification: Medium Duty.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. 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 1 inch 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.

2.4 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., 0.0625-inch thickness.
   2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
   3. Burning: 6-lb/sq. ft, 0.0938-inch thickness.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. 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. Use NPS 4 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 for piping NPS 4 and smaller and 100 feet 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 or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
      b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
      c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch 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 above floor.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

I. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

J. Install wood-blocking reinforcement for wall-mounting-type specialties.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

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 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft, 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 23 01 05

HVAC GENERAL PROVISIONS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Furnish all labor, materials, tools, incidentals and details necessary to provide a complete mechanical system, ready to operate, including but not limited to the items listed under the Mechanical Specification Indexes. The scope of work summary is as follows:

1. The existing return air tracking VAV box for the Lecture Hall shall be removed. The box will be replaced with a sheetmetal transition piece with a manual balance damper.

2. Existing pneumatically controlled VAV box serving the Lecture Hall will be replaced. New boxes will be DDC controlled variable air volume type with hot water terminal reheat.

3. Existing air devices will be replaced. Limited low pressured sheetmetal modifications will be required in each room as shown on the drawings.

4. Existing finned radiation will be re-piped and new DDC control valves will be installed such that the finned radiation and the VAV box for the Lecture Hall are controlled together.

5. VAV box in the Lecture Hall shall be controlled through the occupancy sensor installed for lighting control. The box shall be indexed to the unoccupied position when the room is unoccupied.

B. Include any minor details essential to successful operation and any other items specified or shown on the Drawings.

C. The Contractor is required to read the Specifications covering all branches of the work and will be held responsible for coordination of his work with work performed under all other Contracts.

D. The Contractor is required to visit the site and fully inform himself concerning all conditions affecting the scope of his work. Failure to visit the site shall not relieve the Contractor from any responsibility in the performance of his Contract.

E. The Contractor should feel free to contact the A/E immediately if there is any question regarding the meaning or intent of either Plans or Specifications, or if he notices any discrepancies or omissions in either Plans or Specifications.

F. Other than minor adjustments shall be submitted to the A/E for approval before proceeding with the work.

G. The Contractor shall submit on his letterhead, along with the Bid, the manufacturer's name and the names of all Subcontractors to whom he intends to sublet the work. If the Contractor fails to provide this information with the Bid, A/E shall have the right to select the manufacturers and Subcontractors with no additional charge.

H. Scheduling of all work performed by the Contractor shall be completely coordinated with University.

I. All material hoisting by trade involved.

J. Arrangements for storage of tools and material, removal of debris, and interruptions of services shall be made with University.

K. All connections to, or revisions in, existing piping or facilities shall be done at such time as agreed to by the University and all work shall be scheduled as required under "General Conditions". Revisions to the existing piping systems must be done with the minimum of shutdown time. All piping shall be run to the point of new connections and new equipment installed and ready to operate before any connections are to be made.

L. Extreme care shall be taken to avoid interference with University's equipment, especially in the existing portion of the building. Consult with the A/E regarding any points where interference is likely to occur and follow dimensions carefully where given on the Drawings. Pay particular attention to minimum clear heights when indicated on the Drawings.

M. It is mandatory that dust and debris be held to a minimum. The Contractor shall provide drop cloths, screens, curtains, etc., to protect University equipment and personnel from dust and dirt during the course of his work. All damage to existing construction or finishes shall be repaired by the contractor upon removal of dirt and dust protection devices. All dirt, dust and other protection devices shall be approved by University before any work is started in the area involved.

N. The Contractor, insofar as this Contract is concerned, shall at all times keep the premises and the building in a neat and orderly condition. This includes using a vacuum cleaner in the office and classroom areas.

O. At the completion of the project, the contractor shall promptly clean up and remove from the site, all debris and excess materials.

1.02 DRAWINGS

A. Consult all Contract Drawings which may affect the locations of any equipment, apparatus, piping and ductwork and make minor adjustments in location to secure coordination.

B. Piping and duct layout is schematic and exact locations shall be determined by structural and other conditions and verified in the field. This shall not be construed to mean that the design of the system may be changed, it refers only to the exact location of piping and ductwork to fit into the building as constructed, and to coordination of all work with piping and equipment included under other Divisions of the Specifications.

C. The layout shown on the Drawings is based on a particular make of equipment. If another make of equipment is used which requires modifications or changes of any description from the Drawings or Specifications, the Contractor shall be responsible for making all such modifications and changes, including those involving other trades, as a part of this Contract and the cost thereof shall be included in his Bid. In such case, the Contractor shall submit Drawings and Specifications showing all such modifications and changes prior to starting work, which shall be subject to the approval of the A/E.

D. The A/E reserves the right to make minor changes in the location of piping and equipment up to the time of rough-in without additional cost to University.

E. Where certain grades and/or elevations are given on the Drawings, they have been obtained from the best information available; however, they are not guaranteed. The Contractor MUST assume the full responsibility of verifying present elevations in the field and making any adjustments as may be necessary, all of which must be included in his Bid Price.

F. Due to the scale of the Drawings, it is impossible to show all offsets and transitions which may be required. The Contractor shall carefully investigate the conditions affecting all work and shall furnish all elbows, fittings, transitions, etc., required to accomplish the desired result at no additional cost to University.

G. Install all work as close as possible to walls, ceilings, struts, members, etc., consistent with the proper space for covering, access, etc., so as to occupy the minimum of space.

H. Actual dimensions shown on the Drawings and field dimensions shall take precedence over scaled dimensions.

1.03 PERMITS, INSPECTIONS AND CODES

A. The Contractor shall file all Drawings, pay all necessary charges and fees, and obtain all necessary permits and certificates of inspection relative to his work.

B. Completed installations shall conform with all applicable Federal, State and Local Laws, Codes and Ordinances, including but not limited to the latest editions of the following:

1. Ohio Building Code, Department of Industrial Relations, State of Ohio.

2. Specific Safety Requirements Relating to Building and Construction Work, Industrial Commission and Department of Industrial Relations, State of Ohio.

3. Specific Safety Requirements Covering the Installation of Pressure Piping Systems, Industrial Commission and Department of Industrial Relations, State of Ohio.

4. Ohio Pressure Piping Systems Rules, Ohio Board of Building Standards and Department of Industrial Relations, State of Ohio.

5. A.S.M.E. Pressure Piping Code - Section B31.1

6. National Electrical Code, Bulletin No. 70, National Fire Protection Association.

7. Air Conditioning and Ventilating, Bulletin No. 90 A, National Fire Protection Association.

8. Life Safety Code, Bulletin No. 101, National Fire Protection Association.

9. All Work Under Jurisdiction of Local Fire Marshal shall conform to requirements set forth by Fire Marshal's Office and National Fire Protection Association.

C. Nothing contained in the Plans and Specifications shall be construed to conflict with these laws, codes and ordinances and they are hereby made a part of these Specifications.

1.04 OHIO ENERGY CODE

A. The Mechanical System must comply with all requirements of the State of Ohio "Code for Energy Conservation". This includes, but is not limited to, efficiencies, power factors, insulation thickness, etc.

B. All motors 1 HP or more shall be “energy efficient” motors meeting all requirements of ASHRAE Standard 90.1 - 2010.

1.05 UTILITIES

A. The Contractor shall investigate and locate all utilities prior to construction.

B. Each Contractor is responsible for rerouting or replacing existing utilities where necessary to permit installation of his work.

C. Support, protection and restoration of all existing utilities and appurtenances shall be the responsibility of the Contractor. The cost of this work shall be included in the price bid for the various items.

D. The Contractor shall alert immediately the occupants of nearby premises as to any emergency that he may create or discover on or near such premises of the underground facility, any break or leak on its lines or any dent, gouge, groove or other damage.

E. Procedure for making connections to existing utilities shall be planned at least two weeks in advance of the work and the work shall be executed in a manner to provide reasonably continuous service throughout the construction period. **Connections shall be made only at times approved by the University.** For interruption of service in major utility systems, the Contractor must submit to the A/E a step-by-step sequence of operations planned to accomplish the work. Outline must show tentative dates and times of day for shut-off and restoration of services. The A/E will review the information given with the University Architect, who, upon approval of the planned operations, will make arrangements with appropriate University personnel for interruption of services. If University assistance is anticipated for utility connections/disconnections consult with the Utilities Division Director, Department of Physical Facilities to obtain current construction outage charges. Charges for University assistance for building systems outages may be obtained by consulting with the Maintenance Division Director, Department of Physical Facilities. **Caution to Bidders: Bidders are cautioned that the University will probably schedule interruption of services at times other than the contractors' normal working hours and that only designated University personnel are authorized to interrupt services.** Frequently, outages are scheduled between quarters to reduce disruption of classes.

1.06 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The contractor shall thoroughly instruct and supervise University's Maintenance Personnel in the proper operation and maintenance of the mechanical system equipment. The contractor shall be responsible for arranging for the instruction and supervision at a time convenient to University and notifying the A/E of the time at least 48 hours in advance.

B. Furnish one (1) copy of the printed Operating and Maintenance Instructions for the Mechanical Systems for review. Copy shall be neat, legible and bound in a hardback 3-ring notebook. After final approval, provide four (4) copies of Operation and Maintenance Instructions for submittal to Owner. Instructions shall consist of the following items:

1. Title Page: Title of Project, address, date of submittal, name and address of Contractor, name of A/E.

2. Second Page: Index of Manual Contents.

3. First Section: A copy of each approved shop drawing and submittal with an index at the beginning of the section.

4. Second Section: A list of all equipment used on the project, together with supplier's name and address.

5. Manufacturer's maintenance manuals for each item of equipment furnished under this contract. Manuals shall include such items as parts list, detailed lubrication instructions, procedures for performing normal maintenance functions, preliminary trouble shooting procedures and wiring diagrams.

6. Complete wiring diagrams for the mechanical systems as actually wired including control and interlock wiring.

7. Brief but complete instructions for start-up, shut- down and routine maintenance of each system.

8. Routine and 24-hour emergency information:

   a. Name, address and telephone number of servicing agency.

   b. Include names of personnel to be contacted for service arrangements.

C. Frame one (1) copy of brief start-up, shut-down and routine maintenance instructions and complete system wiring diagrams under glass and mount on the Equipment Room wall. Temperature Control schematics may be laminated with plastic at the Contractor's option.

1.07 RECORD DOCUMENTS

A. The Contractor shall keep an accurate record of all deviations from Contract Drawings and Specifications. He shall neatly and correctly enter in colored pencil any deviations on Drawings affected and shall keep the Drawings available for inspection. Extra sets of Drawings will be furnished for this purpose.

B. At the completion of project and before final approval, make any final corrections to Drawings and certify to the accuracy of each print by signature and deliver same to University.

1.08 SUPERVISION

A. The contractor shall have in charge of the work, on the job during construction, a competent superintendent experienced in the work installed under this Contract.

1.09 UNACCEPTABLE WORK AND OBSERVATION REPORTS

A. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.

B. The Contractor shall promptly correct all work found unacceptable by the A/E or University whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work, including compensation for the A/E's or University's additional services made necessary thereby.

C. During the course of construction, the A/E will prepare "Observation Reports" with a list of items found to be in need of correction. All items listed shall be corrected by the Contractor. A space is provided on the form for the Contractor to note the completion of each item. All prior "Observation Report" items must be completed, the lists signed and returned to the A/E prior to making the final inspection. After the final list is issued, the same procedure will apply.

1.10 FINAL INSPECTION

A. When the Contractor determines all work is completed and working properly per the Contract Documents, he shall request a "final" inspection by the A/E in writing. If more than one re-inspection is required after this final inspection, the Contractor shall bear all additional costs including compensation for the A/E's additional services made necessary thereby. A final inspection will not be made until Operating and Maintenance Manuals and Air Balance Reports are submitted and approved and all prior "Observation Report" punch lists completed, signed and returned to the A/E.

B. As part of the final checkout of the project, the A/E will be checking out the operation of the various systems. The contractor shall provide such assistance as required (including manpower and tools) to start and stop the various systems, open and close valves etc. and simulate summer, winter and other temperature control sequences. The Contractor (not the A/E) is responsible to turn on the systems and demonstrate they are operating properly.

1.11 GUARANTEE

A. The contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after final payment is approved by A/E.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 23 01 10

MANUFACTURER'S DRAWINGS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall submit to the A/E for review, within one week after date of contract, ten (10) copies of manufacturer's drawings, wiring diagrams, fan curves or data. The Engineer will review Contractor's shop drawings and related submittals (as indicated below) with respect to the ability of the detailed work, when complete, to be a properly functioning integral element of the overall system designed by the Engineer. Before submitting a shop drawing or any related material to the Engineer, Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting it. The Engineer shall assume that no shop drawing or related submittal comprises a variation unless Contractor advises Engineer otherwise via a written instrument which is acknowledged by Engineer in writing. The shop drawings and related material (if any) called for are indicated below:

Heating, Ventilating and Air Conditioning Contract

Registers, Grilles, Diffusers and Dampers
HVAC Insulation
VAV Boxes
Piping Specialties

Temperature Controls Contract

Temperature Control Products
Control Sequences
Wiring Diagrams
See Section 25 00 00 for other submittal requirements

B. The Engineer shall return shop drawings and related materials with comments provided that each submission has been called for and is stamped by Contractor as indicated above. The Engineer shall return without comment material not called for or which has not been approved by Contractor.

C. The contractor shall furnish equipment shop drawings which will indicate power hook up and control connections as required for mechanical equipment. "Stock" wiring diagrams are NOT ACCEPTABLE.

D. The manufacturer shall provide a statement on submittals that equipment furnished complies with the Ohio Energy Code. This previously relates to high efficiency motors, EER's, COP's, etc. If this is not done, submittals will be rejected.

E. A/E's review of manufacturer's drawings or schedules shall not relieve the Contractor from compliance with the requirements of the plans and specifications.

1.02 QUANTITIES

A. Items may be referred to in singular or plural on Plans and Specifications. Contractor is responsible for determining quantity of each item.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 23 05 13

ELECTRICAL WORK

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 01 05 - Paragraph 1.05 - OHIO ENERGY CODE
B. Section 25 00 00 - TEMPERATURE CONTROLS
C. Division 26 - ELECTRICAL

1.02 SCOPE

A. The contractor shall furnish all motors for his equipment. Motor starters, safety switches and wired junction boxes shall be furnished and installed by the Electrical Contractor except where specifically specified to be furnished with certain mechanical equipment.

1.03 WORK INCLUDED - Contractor:

A. Temperature Control wiring by Temperature Control Contractor except as noted below by Electrical Contractor.

B. 120 volt wiring required for mechanical equipment when not shown or specified elsewhere.

1.04 WORK INCLUDED - Contractor.

A. All power wiring.

B. All conduit and wiring incidental to Temperature Controls, including switches, controls, transformers and relays shall be by the Temperature Control Contractor, except wiring as indicated on the Electrical Drawings will be by the Electrical Contractor.

C. Motor starters, contactors, and disconnects where noted under "PRODUCTS" below.

D. Electrical Contractor shall provide 120 volt control power to a wired junction box near the Temperature Control Cabinets. Final connections to be made by the Temperature Control Contractor.

1.05 SHOP DRAWINGS:

A. The Contractor shall furnish to the Electrical Contractor, equipment shop drawings which will indicate power hook-up and control connections as required for mechanical equipment. "Stock" Wiring Diagrams are Not Acceptable.

B. Prepare, as a part of Temperature Control shop drawings, complete terminal-to-terminal wiring diagrams. These will show terminal designations on control items and equipment. Wiring diagrams to be compatible with Electrical Drawings.

PART 2 PRODUCTS

2.01 Refer to Section 23 01 05 - Paragraph 1.05 for "Energy Code" requirements (Particularly power factor correction)

2.02 Refer to Division 16 - ELECTRICAL.

2.03 All motors 1/2 HP and larger shall be three phase; all motors, 1/3 HP and smaller shall be single phase unless specified otherwise.

2.04 All single-phase motors provided by the contractor to have built-in thermal overload protection.

2.05 All motors furnished shall have copper windings and all motors five (5) horsepower and greater shall have factory installed lifting eyebolts. All motors shall conform to ANSI and NEMA standards.

2.06 Motor starters, contactors, and disconnects are provided and installed by the Electrical Contractor, unless part of packaged equipment furnished by the contractor, or otherwise specified.

2.07 All motors used in variable speed applications shall be high efficiency type and shall be rated for use with variable frequency drives.

PART 3 EXECUTION

3.01 All wiring, conduits, etc., shall be in strict accordance with the requirements of the latest edition of the National Electrical Code and Division 26, Electrical specification.

3.02 All wiring, including low voltage wiring, shall be run in conduit.

3.03 Low voltage wiring may be size and type recommended by the Manufacturer and/or Temperature Control Contractor.

END OF SECTION

SECTION 23 05 16

SLEEVES AND COLLARS

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 21 - CUTTING AND PATCHING

1.02 SCOPE

A. The contractor shall furnish and install all sleeves for his work. Coordinate carefully with the General Contractor.

B. Sleeves are not required if holes are core drilled through existing walls and floors.

PART 2 PRODUCTS

2.01 Sleeve material: black steel pipe, machine cut, large enough to allow l/4" clearance all around pipe (around pipe covering on heating water and cold water).

PART 3 EXECUTION

3.01 Sleeves in partitions to have length equal to the thickness of finished partitions. Sleeves in floors of finished areas to project l/8" above finished floor. Sleeves in floors of non-finished areas to project 3" above finished floor. Fill space between pipe and sleeves into exposed areas with sealing compound. Ream all sleeves before installing. Sleeves in floors of all Mechanical Rooms shall project 6" above floor and sealed to create a curb.

3.02 Where pipes pass through fire rated walls or floors, the space between the pipe and sleeve shall be filled with packing to maintain fire integrity.

3.03 In exposed location, other than in Mechanical Equipment Rooms, bare pipe or insulated pipe shall be provided with chromium plated collars at floor, ceiling, and at partitions.

3.04 Cutting required of any existing masonry wall or floor shall be done by core drilling.

3.05 Piping not allowed to bear on sleeves.

3.06 Sleeves shall be installed plumb and true to line, grade, and position.

3.07 Unused sleeves shall be plugged and finished to match adjacent surface.

END OF SECTION

SECTION 23 05 17

FIRESTOPPING

PART 1 – GENERAL

1.01 REFERENCE

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Divisions 01 Specifications Sections, apply to this Section.

1.02 SCOPE

A. The CM shall be responsible for firestopping around all openings for pipes, ducts, conduits, etc., installed by him at all fire walls and smoke walls. Firestopping shall be performed by an installer who has been trained by manufacturer, or manufacturer's representative, in the installation procedures based on published UL tested fire stop systems.

1.03 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.04 GENERAL REQUIRMENTS

A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Through-Penetration Firestop Devices (XHCR)
b. Fire Resistance Ratings (BXUV)
c. Through-Penetration Firestop Systems (XHEZ)
d. Fill, Voids, or Cavity Material (XHHW)
e. Forming Materials (XHKU)

C. International Firestop Council Guidelines for Evaluating Firestop Systems Construction Managering Judgments

D. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

E. The Ohio Building Code (OBC)

G. NFPA 101 - Life Safety Code

1.05 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate CM personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural Construction Manager prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's Construction Manager judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Construction Manager judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

1.06 SUBMITTALS

A. Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.

B. Manufacturer's Construction Manager judgment identification number and drawing details when no UL system is available for an application. Construction Manager judgment must include both project name and CM’s name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.07 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training

to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the CM or to an Installer engaged by the CM does not in itself confer qualification on the buyer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 – PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. 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 the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that is needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, (800)879-8000
2. Tremco Sealants & Coatings, Beachwood, Ohio, (216) 292-5000
3. 3M Fire Protection Products, St. Paul, Minnesota, (612) 736-0203

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device
2. Fox Coupling, Inc. "Cast-In-Place Firestop Coupling".
3. Proset Cast-In-Place Device

C. Sealant or caulking materials for use with non-combustible items including steel pipe & copper pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25 or Firestop Sealant 2000
3. Tremco Fyre Shield

D. Sealant or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601S Elastomeric Firestop Sealant or CP 606 Flexible Firestop Sealant
2. Tremco Fyre-Shield High Performance Ceramic Firestop Sealant
3. 3M Fire Barrier CP25WB+ or 2000 Silicone Sealant

E. Intumescent sealant or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25WB+
3. Tremco Intumescent Acrylic or TremStop WBM

F. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 642 and CP643 Firestop Collar, CP645 Wrap Strip
2. Tremco TREMstop D Combustible Pipe Intumescent Device System and TremStop WS Wrap Strip
3. 3M Ultra Plastic Pipe Device and Fire Barrier FS-195+ Wrap Strip

G. Materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 635 Trowelable Firestop Compound and FS 657 FIRE BLOCK
2. Tremco TremStop M Fire Rated Mortar and PS Pillows
3. 3M Fire Barrier CS-195+ Composite Sheet

H. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate multiple steel and copper pipes, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK
2. Tremco PS Firestop Pillows
3. 3M CS Intumescent Sheet

I. Provide a firestop system with an "F" Rating as determined by UL 1479 or ASTM E814. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated.

PART 3 – EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with mechanical Construction Manager and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas. All penetrations are to be labeled in accordance with the Construction Manager’s standard labeling system. The CM shall coordinate all fire stopping requirements with the Construction Manager prior to start of work.

B. Keep areas of work accessible until inspection and approval have been completed.

C. All fire stopping shall be inspected and approved by a licensed independent Consultant. All unapproved fire stopping products installed by the CM will be removed and replaced at his expense.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

SECTION 23 05 19

PIPING SPECIALTIES

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary piping specialties to include air vents, Pete's Plugs, pipe strainers, etc., for piping systems included under this Contract.

PART 2 PRODUCTS

2.01 Air Vents

A. Air vents shall be as manufactured by Bell and Gossett, Taco, Trane, Thrush, Dunham Bush or Hoffman. Install at high points of system on each heating and cooling coil and at other locations subject to air binding.

1. Manual air vents shall be ball valves piped as detailed on the drawings. For use on individual heating elements.

2.02 Strainers

A. All water lines – Splirax/Sarco style IF-125 (flanged) or IT (threaded) 125 psig, Y-pattern, cast iron body with stainless steel screen for water. Threaded for 2-1/2" and smaller, flanged for 3" and larger.

B. Dunham-Bush, Spirax/Sarco, Armstrong, Trane, McAlear, Mueller, Metraflex, Wheatley or V. D. Anderson strainers may be furnished at the CM's option.

2.03 Pete's Plug -

A. 1/4" MPT fitting to receive either a temperature or pressure probe, 1/8" O.D. fitting and caps shall be brass with valve core of Nordel, rated at 1000 psig.

B. Provide XL (extra long) type Pete's plug in insulated lines.

C. Sisco plugs may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 All specialties to be installed in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 23 05 20

PAINTING

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 53 - TAGGING AND CODING

1.02 SCOPE

A. All steel supports shall have minimum one (1) coat of metal primer after fabrication.

B. Factory finished equipment which has rusted or been damaged shall be cleaned at the completion of the project and rust spots and marred areas shall be refinished and restored to the original factory finish.

PART 2 PRODUCTS

2.01 Paint shall be as manufactured by ICI/Devoe.

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 23 05 21

CUTTING AND PATCHING

PART 1 GENERAL

Not Applicable

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 Cutting for openings, when necessary, shall be done by the contractor with such tools and methods as to prevent unnecessary damage to surrounding areas or equipment.

3.02 The corners of all openings in poured concrete shall be core drilled to minimize overcutting.

3.03 Fill space in all areas where core drilled with packing where required to maintain fire rating. Openings shall be temporarily fire-stopped until permanent fire stopping is done. This includes holes left due to removal of piping or ductwork.

3.04 All holes cut for the installation of piping, ductwork and equipment shall be neatly patched and refinished with the same materials as, and to match, adjacent surfaces, and damages thereto shall be repaired in kind and to match existing conditions by the contractor. This includes patching existing ceilings and floors where required and patching holes left by removal of existing piping, ductwork, equipment, etc.

3.05 Patching shall match existing surfaces in kind and finish.

3.06 No structural member will be cut into without the expressed permission of A/E.

END OF SECTION 23 05 21

SECTION 23 05 22

FOUNDATIONS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall furnish welded steel frames and supports for all equipment requiring same. Furnish auxiliary steel as required for supporting pipes.

PART 2 PRODUCTS

2.01 All steel for frames and supports shall be standard weight black steel pipe or standard structural steel shapes.

2.02 All exterior frames and supports shall be galvanized.

PART 3 EXECUTION

3.01 Grind all sharp corners and projections on supporting steel after fabrication. All steel shall have one (1) coat of metal primer after fabrication. All steel supports exposed to the weather shall be finished with a heavy coat of bitumastic.

END OF SECTION

SECTION 23 05 23

VALVES

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary valves for piping systems and equipment in the building required to provide proper shut off and balancing of systems included under this Contract.

PART 2 PRODUCTS

2.01 Check valves shall be Crane, Milwaukee, or Watts and shall all be by the same manufacturer.

2.02 Ball valves shall be as manufactured by Grinnell, Apollo, Watts, or any of the manufacturer's listed herein for gate, globe and check valves. All ball valves to be by the same manufacturer.

2.03 Ball Valves

A. 3" size and smaller may be two-piece bronze body ball valve, screwed piping connections, union connection body, teflon seats, full port, blowout proof stem, adjustable packing gland, stainless steel ball, and lever handle labeled for service controlled. Rated for 150 S.W.P. and 400 WOG. Equal to Milwaukee BA-400s

B. All ball valves shall be full port type.

2.04 Drain valves shall be ball valves as specified above with hose nipple and cap.

2.05 Check Valves

A. 3" and larger - iron body, bronze mounted, horizontal swing check with bronze disc, flanged, 125 lb. S.W.P.

B. 2-1/2" and smaller - all bronze, horizontal swing check with bronze or TFE disc, screwed, 125 lb. S.W.P.

C. Clow, McAlear, Mueller or Metraflex non-slam check valves are acceptable manufacturers as well as previously listed manufacturers.

2.06 Combination Balance and Stop Valve - Bell and Gossett "Circuit Setter Plus", bronze body, screwed combination balance and stop ball valve. 2½" and smaller screwed. 3" and larger flanged. Valves to have readout ports, 1/4" drain port, memory stop indicator,

calibrated nameplate, 300 lb. W.O.G. Valves shall be designed for a pressure drop of 2 to 5 feet heat. Same type Illinois, Spirax Sarco, Flow Design, Taco or Tour & Anderson stop and balance valves may be furnished at the CM's option.

PART 3 EXECUTION

3.01 The contractor shall install all valves in strict accordance to the manufacturer's recommendations.

3.02 Where the Drawings call for both a shut-off valve and a balance valve or fitting, the Contractor may, at his option, furnish a combination balance and stop valve.

3.03 Where drain lines are not piped to floor drains, furnish hose end adapters. Provide caps for all hose end adapters.

3.04 Ball valves designated with an “M” shall be furnished with memory stops.

END OF SECTION

SECTION 23 05 29

INSERTS, PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install all necessary inserts, beam clamps and auxiliary steel for pipe hangers in the building.

B. Furnish and install necessary pipe hangers and supports to properly support all piping and to maintain uniform elevation.

PART 2 PRODUCTS

2.01 HANGERS

A. Hangers for copper lines, 2" and smaller, shall be similar to Grinnell Fig. CT-99, adjustable carbon steel pipe ring, with 3/8" hanger rods. All copper plated.

B. Hangers for copper lines 2-1/2" to 4" shall be similar to Grinnell Fig. CT-65, adjustable carbon steel clevis, with proper size rods, all copper plated. Unplated clevis may be used if full round lead sleeves 2" wider than the clevis are secured to the pipe at each hanger.

C. When copper lines are insulated and hangers are sized for outside of insulation, provide steel hangers as described below.

D. Hangers for steel lines 2" and smaller shall be similar to Grinnell Fig. 97, adjustable pipe ring, galvanized steel band with 3/8" hanger rods.

E. Hangers for steel lines 2-1/2" and larger shall be similar to Grinnell Fig. 260, adjustable carbon steel clevis, heavy duty, with proper size rods.

F. Hangers for chilled water lines 1-1/4" and larger shall be sized for outer diameter of insulation. Furnish 1/2 round galvanized sheet metal insulation protectors minimum 12" long similar to Grinnell Fig. 167 on bottom half of insulation for heating and chilled water lines 1-1/4" and larger at each pipe hanger.

2.02 B-Line, F & S, Elcen, Penn, Fee-Mason, PHD Manufacturing or Modern Pipe Hangers of the same type may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 Riser clamps shall be used at each floor where required.

3.02 Wall bracket pipe supports shall be installed where required.

3.03 All copper piping is to be shielded from steel pipes or electrical conduit with sheet lead or electrical tape wherever pipes would touch each other.

3.04 Galvanized hangers and strap hangers will not be permitted for supporting copper lines except for hangers sized for outside of insulation.

3.05 Provide pipe anchors and guides where required to properly control pipe. Method to suit job conditions.

3.06 Support piping at equipment from floor, ceiling, or walls, so that piping weight is not supported directly from pumps or equipment.

3.07 All beam clamps and supports for piping and ductwork shall be in place prior to the fireproofing of the structural steel.

3.08 Piping to be supported according to the following schedule. Support at intervals not to exceed spacing listed or elsewhere as required in accordance with good workmanship. No pipe shall be supported from another pipe. All hangers shall be plumbed before insulation is applied and all hangers shall be double nutted.

SPACING

(1) Steel Pipe			(2) Copper Pipe	
Pipe Size	Rod	Spacing	Pipe Size	Spacing
Thru 1"	3/8"	7'0"	Thru 3/4"	6'0"
1-1/4"	3/8"	9'0"	1"	7'0"
1-1/2"	3/8"	9'0"	1-1/4"	9'0"
2"	3/8"	10'0"	2"	9'0"
2-1/2"	1/2"	11'0"	2-1/2"	11'0"
3"	1/2"	12'0"	3"	11'0"
4"	5/8"	14'0"	4"	11'0"
6"	3/4"	17'0"	6"	14'0"

END OF SECTION

SECTION 23 05 30

INSTALLATION OF PIPING

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 19 - PIPING SPECIALTIES
B. Section 23 05 23 - VALVES
C. Section 23 05 29 - INSERTS, PIPE HANGERS AND SUPPORTS
D. Section 23 05 93 - TESTS AND ADJUSTMENTS

1.02 SCOPE

A. The requirements of this Section shall apply to all interior piping systems installed under this Contract, except where otherwise noted on the Drawings or elsewhere in the Specifications.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 All piping systems shall be installed with adequate provisions made for expansion and contraction to prevent stresses on piping, valves and equipment. Anchor and guide piping at all points indicated and/or as required. Type and method of anchoring, guiding and attachments to sustaining members to suit job requirements and conditions and shall be approved by University.

3.02 Provide unions at each screwed valve, final connection, and at each piece of equipment. Branches from mains to equipment stubs, risers, etc., to have swing joints with at least one change of direction in the horizontal plane, and one change of direction in the vertical plane, before connecting to equipment or fixtures. Piping shall be arranged and unions and flanges located to permit easy removal of valves, parts, and equipment for inspection and cleaning without disconnecting any part except unions or flanges. No welded connections shall be made to valves or equipment. Use bronze unions in copper lines. Unions to be downstream of valves.

3.03 Flange bolts shall be cut to proper length so that one thread projects beyond the nut when nut and bolt are tightened.

3.04 Make proper connections to all items of equipment in the Contract as recommended by the Manufacturer or as detailed on the Drawings.

3.05 All piping shall be arranged in accordance with the best standards of the trade with vertical pipes plumb and horizontal runs parallel or perpendicular to the building wall.

3.06 Provide valves and specialties where indicated on the Drawings.

3.07 Provide 3/4" drain valves in piping at low points to provide complete drainage of all systems and as shown on the Drawings.

3.08 Ream ends of pipe and clean before installing.

3.09 All joints in copper piping shall be made with 95-5 solder. Solders and fluxes containing lead are prohibited.

3.10 Use pipe dope on male threads of screwed pipe only. Teflon pipe joint tape may be used, at the Contractor's option.

3.11 Valves to be installed with handwheel at or above center of pipe. Valves outdoors exposed to weather shall be installed with handwheel in the horizontal.

3.12 Make all changes of direction with fittings, rather than bending.

3.13 All valves and unions to be installed so as to be accessible through ceiling, access panels, etc.

3.14 Provide dielectric unions or insulating flanges between dissimilar metals, i.e., copper to steel.

3.15 Bull head connections in any piping service are expressly prohibited.

3.16 At the end of each day's work and otherwise as required or directed, provide caps and/or plugs at all openings in piping for protection. Particular attention must be given to avoid the possibility of any foreign materials entering the pipes, whether it be inadvertent or with malicious intent.

3.17 Install thermometers and gauges so they may be read from floor level.

3.18 Install Pete's Plugs as close as possible to control valves, coils, etc., as shown on the Drawings, and arranged so that a probe may be inserted into the plug.

3.19 Where piping is installed in accessible chases, keep all piping to sides of chase, except portions which must necessarily be in center of chase. Offset vents to side immediately above connection to waste line. All lateral runs are to be located at the floor or minimum 6'-0" above floor, and all vertical piping held close to the wall through that height leaving maximum service space.

3.20 Where pipe drops occur in block walls, pipes to enter and leave walls at block joints. Coordinate with General Contractor.

3.21 Install galvanized sheet metal troughs with drains under pipes crossing electrical equipment. Seal to make water tight.

3.22 Do not run water or steam piping through electrical rooms.

3.23 Properly support all relief valve discharge piping and provide no more than one 90° ell.

END OF SECTION

SECTION 23 05 53

TAGGING AND CODING

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install pipe markings, equipment labels and valve tags as described below.

PART 2 PRODUCTS

2.01 MATERIALS

A. Snap around pipe markers.

B. Tags shall be non-ferrous metal with number and service abbreviation engraved in the tag.

PART 3 EXECUTION

3.01 EQUIPMENT

A. Each piece of equipment shall be labeled by means of 2" high stenciled, painted lettering, and by a permanent metal tag fastened to the unit. The stamped marking shall be permanent on the metal tag.

B. Labeling shall consist of the unit designation as shown on the drawings and in addition, labeling of exhaust fans shall indicate the rooms or areas being served. Room numbers shall be from the Miami University numbering system, not those indicated on the drawings.

C. Insure that nameplates are provided in readable locations. If they are not, they shall be removed and replaced in a visible location.

3.02 PIPE MARKINGS

A. Markings shall be applied to all new piping after installation, insulation and final painting. Markings shall consist of 1" high black letters, a color coded band and a direction arrow. Markers shall be placed at 25 foot centers on both exposed and concealed piping. Painting letters by use of stencils is acceptable. Color code as follows:

Item	Color Bands	Abbr.
Heating Water Supply	Yellow-Red	HHWS
Heating Water Return	Yellow-Orange	HHWR

3.03 VALVE TAGS

A. Each valve, including those installed adjacent to equipment for isolation of that item, shall be identified with a stamped aluminum or brass tag attached with a brass “S” hook or flexible metal wire. A printed schedule shall be prepared and framed under clear plastic or glass describing each valve by consecutive number, location and service for which used. On renovation work, begin new numbering with the last number used in the existing sequence. Two additional unframed copies shall be furnished, all being turned over to the A/E with a letter of transmittal. Copies shall also be included in the Owner’s Maintenance manual.

END OF SECTION

SECTION 23 05 54

EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE

A. The contractor shall label all disconnects, motor starters, switches and equipment furnished under this Contract.

PART 2 PRODUCTS

2.01 Labels shall be 1/16" thick laminated plastic nameplates or 0.020" thick aluminum nameplates. Background shall be black with 3/16" letters engraved on the face. Letters shall be white or natural aluminum.

PART 3 EXECUTION

3.01 Secure plates with screws. Do not attach to covers where covers can be easily mixed up. Coordinate with the Contractor so that all nameplates are the same type and design.

END OF SECTION 23 05 54

SECTION 23 05 93

TESTS AND ADJUSTMENTS

PART 1 GENERAL

1.01 SCOPE

A. After work has been completed but before pipe covering has been applied, the Contractor shall test and adjust the systems he has installed.

B. University and the A/E shall be notified of all scheduled tests and adjustments at least 48 hours before they are scheduled so that he may witness same. If the Contractor performs any test or adjustment without the A/E present or without properly notifying the A/E, the Contractor will be required to perform the test or adjustment a second time in the presence of the A/E.

C. If University or the A/E determines that any work requires special inspection, testing, or approval, they will, upon written authorization, instruct the Contractor to order such special inspection, testing or approval. The Contractor shall give timely notice so the A/E may observe the inspections, tests or approvals. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the A/E's additional services made necessary by such failure; otherwise University shall bear such costs, and an appropriate Change Order shall be issued.

D. Concealed lines shall be tested before being concealed. If this is not done and a leak appears during the final test, the contractor shall repair leak and all damage resulting therefrom.

E. The contractor shall adjust all his equipment in the mechanical system to obtain proper operation and shall demonstrate to University and the A/E that the entire system will function properly.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 After work has been completed but before pipe covering has been applied, the Contractor shall test the systems as follows. At these pressures, the circulation shall be free and the piping free of leaks.

System	Test Medium	Pressure Not Less Than	Time Not LessThan	Notes
Heating water	Water	125 lbs	24 hrs	no drop

3.02 Balancing Air and Water Systems:

A. The contractor shall procure the services of an independent company which specializes in the testing and balancing of air and water systems. All balancing work shall be done under the direct supervision of a qualified Heating and Ventilating Engineer. It shall be the responsibility of the contractor to make all necessary arrangements with the Balancing Company for balancing the air and water systems after all equipment, ductwork, outlets, piping and accessories have been installed. A detailed report on all balancing work shall be prepared and submitted, in triplicate, to the A/E for review. Each copy of the report shall be dated, signed by the supervising Engineer of the Balancing Company and bound in a suitable cover. The Balancing Company shall be selected by the Contractor from the following qualified firms:

1. Kahoe Air Balance Company
2. Any member of the Associated Air Balance Council

B. Balancing procedures and report to be in accordance with procedures set forth by the Associated Air Balance Council. **Report shall also include fan curves for all equipment and written procedures for balancing each piece of equipment.**

C. Where Pete's Plugs are installed, report shall include pressure drop readings across coils, control valves (Cv), etc., to confirm flow rates.

D. Balance reports shall include starter element sizes, and amperage ratings for each motor. If starter elements amperage rating is more than 10 percent greater or less than motor nameplate amperage, the contractor shall inform the Electrical Contractor to furnish and install proper size elements. Balance report shall include the corrected proper size starter element sizes and amperage ratings.

E. Balance Subcontractor shall report by letter to the A/E on preliminary results of balancing before the final balance report is prepared. This report shall include any problems encountered during balancing or major deviations from specified conditions.

F. If required, a meeting shall be arranged between the contractor, the Balance Subcontractor and the A/E to resolve any problems or deviations from the Contract Drawings and Specifications before the final balance work is completed and final report is submitted for review by the A/E.

3.04 All dampers, damper operators and motor operated valves shall be checked and adjusted for proper operation and travel.

3.05 Before turning job over to University, inspect all valves and repack valves as necessary.

3.06 The contractor shall adjust all equipment in the mechanical system to obtain proper operation and shall demonstrate to University and the A/E that the entire system will function properly.

END OF SECTION

SECTION 23 05 94

PROTECTION AND CLEANING

PART 1 GENERAL

Not Applicable

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 Protect all mechanical equipment against damage from any cause whatsoever and pay the cost of replacing and repairing equipment made necessary by failure to provide suitable protection.

3.02 After all piping, equipment and ductwork has been approved and after all plastering has been completed, bare piping and insulation provided under this Contract shall be thoroughly cleaned of dirt, grease, rust and oil.

3.03 Repair all dents and scratches in factory prime or finish coats on all mechanical equipment to the satisfaction of A/E. If damage is excessive, replacement may be required.

3.04 Flush out all piping systems to remove all dirt and grease from pipes and equipment before systems are placed in operation. Clean strainers after each flushing until the strainer remains clean.

3.05 The HVAC Contractor shall clean all water piping systems under this Contract. After systems have been flushed thoroughly and drained, clean as follows:

A. Completely fill, air vent, and circulate systems for four (4) hours at design temperatures with the following solution:

One pound of trisodium phosphate for each 50 gallons of water or one pound of sodium carbonate for each 30 gallons of water.

B. Completely drain and refill with fresh clear water.

C. After venting and circulating, check pH.

D. If system pH is below 7, add small amounts of cleaner until pH is between 7 and 8.

3.06 Ductwork and air handling equipment is to be cleaned out and blown out.

3.07 Ducts serving renovated areas shall be capped during construction. Return air grilles in renovated rooms shall also be sealed closed to prevent duct from being drawn into the building air handling system. Temporary exhaust shall be provided to keep the renovated rooms negative with respect to adjacent areas during construction.

3.08 Cover all motors, fans, open pipes, etc., to keep out dirt, water and weather during construction.

3.09 The contractor shall clean up and remove all debris from the site and shall at all times keep the premises in a neat and orderly condition.

END OF SECTION

SECTION 23 05 96

SUBSTITUTIONS

PART 1 GENERAL

1.01 SCOPE

A. The Base Bid shall be based on equipment as specified. Where items are mentioned thusly, "may be furnished at the Contractor's option", the Contractor may use any one of the items named for his Base Bid. Proposals for substitutions are welcomed, but must be noted separately from the Base Bid and applied for in writing at Bid submittal.

B. Where the Contractor furnishes equipment or material specified as equal or which is accepted as a substitution, he is responsible for all modifications required for his work, and work of all other trades to install the equipment and insure performance as originally specified.

C. Equipment and materials furnished as equal must be equal in quality, design, features, performances, arrangement, and appearance to that specified as standard.

1.02 Read instruction to Bidders and General and Special Conditions for requirements for substitutions.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 23 05 97

REMODELING

PART 1 GENERAL

1.01 REFERENCE

A. Division 1 - GENERAL REQUIREMENTS
B. Section 23 05 98 - DEMOLITION

1.02 SCOPE

A. The contractor shall include the remodeling of and additions to all mechanical work in the areas indicated on the Architectural and HVAC Drawings and in all areas shown on the Drawings. All necessary or required remodeling or additions to the present mechanical work shall be included in this Contract, as indicated or required, to the end that the work will result in the finished remodeled spaces shown on the Architectural Drawings.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 In all of the remodeling work the mechanical work shall follow the intent of the HVAC Specification insofar as possible with regard to material and workmanship.

3.02 Where old walls and furrings are removed, exposed piping that will remain in use shall be offset to the nearest available new wall or concealed space and reconnected as necessary or required, using all new material. Note that this shall include piping of every description at both known and unknown locations.

3.03 All piping installed in the remodeling work shall be installed as concealed work. The contractor shall do all cutting required.

END OF SECTION

SECTION 23 05 98

DEMOLITION

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 97 - REMODELING

1.02 SCOPE

A. The Contractor shall be responsible for all HVAC demolition in all areas that will be renovated as part of this project. Refer to the demolition drawings and demolition notes. The contractor shall be responsible for equipment disconnects and coordination with the general contractor to identify the equipment, piping, etc that is to be removed.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

Not Applicable.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.01 SCOPE

A. Extent of Work - Insulate pipes and other surfaces as follows:

Hot Water Heating Piping
Supply Air Ducts
Hot Water Reheat Coils
Tops of Supply Air Diffusers

B. Repair all existing insulation damaged by work of this project in kind and to match existing covering.

PART 2 PRODUCTS

2.01 All insulating materials, including jackets, cements, adhesives, vapor barriers, etc., shall be U.L. listed with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50.

2.02 Molded plastic fitting covers shall be U.L. approved with a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50.

2.03 Pipe insulation shall be Johns Manville "Micro-Lok" glass fiber insulation rated for 850°F. with factory applied AP-1 all purpose, self-sealing vapor barrier jacket. Butt strips shall be minimum 3" wide of same material as jacket.

2.04 Duct insulation shall be Johns Manville rigid type as noted with FSK glass fiber reinforced foil faced flame resistant kraft paper vapor barrier facing.

2.05 Insulation thicknesses are based on insulation having thermal resistance in the range of 4.0 Hr F ft.^{2}/BTU to 4.6 Hr F ft^2/BTU per inch of thickness on a flat surface at a mean temperature of 75°F. Minimum insulation thickness shall be increased for materials having R values less than 4.0 or may be reduced for materials having R values greater than 4.6 to give equivalent "R" values.

PART 3 EXECUTION

3.01 Insulation Thickness Table

A. In the absence of a specified insulation thickness, the following table shall apply:

MINIMUM PIPE INSULATION

INSULATION THICKNESS IN INCHES
FOR PIPE SIZES

Piping System Types	Fluid Temperature	Runouts up to 2"*	1" and less	1-1/4 to 2"	2-1/2" to 4"	5" to 6"	8" and larger
HEATING SYSTEMS hot water							
Low Pressure/Temp	201-250	1	1	1-1/2	1-1/2	2	2
Low Temperature	120-200	1	1	1	1	1	1-1/2

*Runouts not exceeding 12 ft. in length to Individual Terminal Units.

3.02 Cover hot water heating piping as follows:

A. Cover all piping with glass fiber pipe insulation. Minimum insulation thickness to be as shown in the Table (3.01).

B. Fittings shall be wrapped with compressed fiberglass to same thickness and density as adjacent pipe insulation and covered with a molded plastic fitting.

C. All mechanical couplings shall be wrapped with compressed fiberglass to the same thickness as adjacent pipe insulation and covered with a molded plastic fitting.

D. No covering required on supply and return lines inside heating units cabinets.

E. Valves, flanges and unions shall not be covered. Insulation shall be stopped square with valves, etc., and ends sealed with Benjamin Foster "Tight Fit" coating.

3.03 Cover all supply air ducts as follows:

A. All supply air ducts shall be insulated with 1-1/2" thick, 1 lb. density blanket flexible duct insulation.

B. Adhere insulation to duct surface with Foster No. 85-20 adhesive applied in 6" wide strips on 12" centers. Butt all edges of insulation and seal all joints with a foil-skrim-kraft tape or flange adhered over the joint. Secure insulation with flare door staples until the adhesive sets.

C. Seal all breaks and joints in vapor barrier with 2-1/2" wide pressure sensitive tape to match vapor barrier facing. Adhere with Foster 85-20 adhesive where necessary.

D. Cover all round and rectangular high and low pressure ductwork (including that on the downstream side of the air terminal boxes).

3.04 Cover the top of all supply diffusers above ceilings when not in a return air plenum. Insulation to be 1-1/2" thick, 1 lb. density flexible blanket.

3.05 Wrap hot water reheat coils when installed in ductwork or connected to terminal boxes in air conditioning systems. Insulation shall be 1-1/2” thick, 1 lb. density blanket flexible duct insulation properly sealed with adjacent insulation or ductwork. Insulation not required on reheat coils when exposed in the space being served.

3.06 Application shall be made on clean, dry surfaces with all joints butted firmly together.

3.07 All supply air conditioning ducts and all high pressure steam and chilled water pipe insulation to be continuous through floors, walls, ceilings, roofs and pipe hangers.

3.08 Insulation shall not be applied until the general construction has progressed sufficiently to insure against physical or moisture damage to the insulation. All damaged insulation shall be replaced at the contractor's expense.

3.09 Install 20 gauge galvanized steel insulation protectors on all insulated exposed pipes passing through floor. Sleeves to be 12" above the floor.

3.10 Hanger rods must be perpendicular before insulation is installed.

3.11 Longitudinal lap joints and butt strips for glass fiber pipe insulation shall be secured with staples or three (3") inch centers and sealed with an approved vapor barrier adhesive where applicable. Staples are not required when insulation utilizes a "double" adhesive self sealing system.

END OF SECTION

SECTION 23 21 13.23

HOT WATER HEATING PIPING SYSTEM

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 30 - INSTALLATION OF PIPING
B. Section 23 07 00 - HVAC INSULATION

1.02 SCOPE

A. From existing mains to the heating water coils and elsewhere as indicated on the drawings.

PART 2 PRODUCTS

2.01 Pipe – Schedule 40, black steel pipe.

2.02 Fittings for piping 2-1/2" and smaller - 125 lb. black cast iron except the Contractor may, at his option, use weld joints in piping 1-1/2" and larger. Use standard weight welding fittings.

2.03 Fittings for piping 3" and larger - standard weight welding fittings.

2.04 At the Contractor's option, weldolets, butt or threaded type, may be used for branch connections that are less than 2/3 main size. Use welded or screwed fittings for branch connections 2/3 main size or larger. Shaped nipples are not acceptable.

2.05 The Contractor, at his option, may use copper pipe and fittings for all pipe less than 2". Pipe shall be Type L hard drawn copper tubing with wrought copper solder type fittings. All joints shall be made with 95/5 solder.

PART 3 EXECUTION

3.01 Install water mains without pitch. Use eccentric reducing couplings at changes in size, with top of pipes at same elevation. Use concentric reducers in vertical mains.

3.02 Branches to units below mains to be taken from bottom of mains at a 45 degree angle, pitch downward toward units. Branches to units above mains to be taken from top of mains at a 45 degree angle, pitched upward toward units. Pitch not less than 1" in 10'.

3.03 Install manual air vents at high points of the system, as shown on the Drawings and as required for proper air venting of system.

END OF SECTION

SECTION 23 31 13.13

LOW PRESSURE DUCTWORK

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 07 00 - HVAC INSULATION
B. Section 23 33 13 - DAMPERS
C. Section 23 37 00 - REGISTERS, GRILLES AND DIFFUSERS

1.02 SCOPE

A. Furnish, install and insulate low pressure sheet metal work and appurtenances with sizes as shown on Drawings.

B. All sheet metal work including ductwork, dampers, etc., shall be fabricated in accordance with the recommendations of the Sheet Metal and Air Conditioning CMs National Association, Inc., (SMACNA) latest edition of the FOLLOWING:

1. HVAC DUCT CONSTRUCTION STANDARDS, Metal and Flexible.

PART 2 PRODUCTS

2.01 Sheet Metal Ductwork:

A. Unless otherwise noted, all sheet metal ducts and plenums shall be fabricated of lock forming quality, hot-dipped galvanized steel sheets and shall comply with 2" w.g. pressure class construction. Metal gauges shall be in accordance with current SMACNA Standards.

B. Flexible duct shall comply with NFPA requirements, Pamphlet 90A, and shall be UL listed with flame spread rating of 25 or less and smoke developed rating of 50 or less. Duct shall be a factory fabricated assembly composed of: an inner duct of woven and coated fiber glass providing an air seal and bonded permanently to corrosion resistant coated steel wire helix and 1" thick fiber glass insulating blanket and low permeability outer vapor barrier of fiber glass reinforced metalized film laminate.

Flexible duct shall be terminal duct for air system and shall not exceed 5 feet in length. Do not make more than one (1) 90 degree bend with flexible duct. Bend radius shall be minimum of two (2) times duct diameter.

1. Flexible duct shall be Thermaflex MKC.

2. Duct shall be rated for minimum 10" W.G. internal working pressure, for all duct sizes.

3. Vinyl, clear plastic or mylar type liners are expressly prohibited.

4. Flexmaster Type 3M insulated or Wiremold WCK flexible duct meeting all specified requirements may be furnished at the CM's option.

C. All fan flexible connections shall be made with commercial grade neoprene coated glass fabric (heavy duty).

D. All duct sealing compounds and mastics shall meet NFPA 90A standards and shall be UL listed with ratings not to exceed 25 for flame spread and 50 for smoke development.

E. Access doors shall be insulated, airtight, "hinged" and gasketed style, with a minimum of two quick action latches. Door shall be mounted in a galvanized steel frame with an inside "fold-over" flange for duct attachment. Door height shall be 24"; width shall be equal to the duct width or 12", whichever is less, unless otherwise shown or noted on drawings.

F. Sealer for ducts shall be equal to 3M Model EC-800. (Water Based Low VOC).

G. All joints in new low pressure ducts shall be sealed with duct sealer.

PART 3 EXECUTION

3.01 SHEET METAL DUCTS

A. Except as noted or shown otherwise on the Drawings, all sheet metal work including ductwork, dampers, etc., shall be fabricated and supported in accordance with the recommendations of the SMACNA "HVAC Duct Construction Standards".

B. Cross break all flat surfaces or reinforce with a bead approximately 5/16" wide x 3/16" deep on 12" centers, to prevent vibration on all ducts 19" maximum dimension and larger.

C. Sheet metal plenums shall be single wall construction, reinforced with steel angles 2 ft. on center. Provide hinged access doors where shown on the Drawings. Provide close off sheet metal as required. Provide neoprene sponge gaskets between filter frames and housing for mixed air plenums. Gauges same as specified for ducts, unless otherwise noted. At the CM's option, sheet metal ducts and plenums may be put together using "K-Lock", "Ductmate" or "TDC Lockformer" couplings.

3.02 FLEXIBLE AND ROUND DUCT CONNECTIONS

A. Connection of flexible and round ducts to rectangular ducts to be made with spin-in type fittings complete with damper with locking operator.

3.03 FITTINGS AND ACCESSORIES

A. Install flexible connections in all duct connections to fans and air handling units, unless otherwise noted.

B. Install manual balancing dampers with locking quadrants where shown on the Drawings and as required for proper balancing of the systems. Locking quadrants shall be easily accessible. On insulated ducts, locking quadrants shall be installed on outside of insulation.

C. Install double turning vanes in all right angle elbows. Install 45° tap collar for branch ducts and register openings.

D. Provide access doors in ducts to all automatic dampers, fire dampers and elsewhere as shown on drawings unless otherwise noted. Doors shall be minimum 12" x 24", or duct width x 24", whichever is smaller, unless otherwise noted. Access doors at fire dampers shall be located so that fire dampers may be reopened from them in case of fusible link failure.

E. Provide minimum 12" x 12" access doors in each supply air duct where smoke detector element passes through duct.

F. All duct joints in supply and return duct systems shall be made sealed with duct sealer.

G. All "Auto-Control" dampers shall be furnished by the Temperature Control Contracto, but installed by the Contractor. All other dampers, including "motorized dampers", shall be provided by the Contractor.

H. All round ductwork and fittings shall be spiral lockseam construction equivalent to United Sheet Metal. the use of Snap-Lock ductwork is prohibited.

I. The use of multi-piece adjustable angles and elbows is prohibited.

3.04 Exposed duct sealer is not acceptable on exposed ductwork. Ductwork shall be sealed on the inside or gasket ductwork shall be used.

END OF SECTION

SECTION 23 31 13.16

HIGH PRESSURE DUCTWORK

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 05 93 - TESTS AND ADJUSTMENTS
B. Section 23 07 00 - HVAC INSULATION
C. Section 23 33 13 - DAMPERS
D. Section 23 37 00 - REGISTERS, GRILLES AND DIFFUSERS

1.02 SCOPE

A. Furnish and install high pressure, high velocity sheet metal work and appurtenances with sizes as shown on Drawings.

1. All supply air sheetmetal from the connection to the existing mains to the new vav box inlets shall be high pressure construction.

C. All sheet metal work including ductwork, dampers, etc., shall be fabricated in accordance with the recommendations of the Sheet Metal and Air conditioning Contractors National Association, Inc., (SMACNA) latest edition of the "HVAC Duct Construction Standards, Metal and Flexible".

PART 2 PRODUCTS

2.01 All high pressure ducts shall be galvanized steel (unless otherwise noted) and shall comply with 6" w.g. pressure class construction in accordance with current SMACNA Standards.

2.02 All round ducts 60" diameter and smaller shall be spiral lockseam construction of gauges as recommended by SMACNA.

2.03 All flat oval ducts shall be spiral lockseam construction of gauges as recommended by SMACNA.

2.04 All flat oval duct sections shall not be more than 12 foot long and reinforced with angle braces at each joint and as a minimum at the mid-point between joints of each section. Spacing between braces shall not exceed duct manufacturer’s recommendation. Provide SMACNA recommended internal bracing for all flat oval high pressure exhaust ductwork.

2.05 All fittings shall be manufactured from 20 gauge (thru 36" diameter), 18 gauge (37" thru 50" diameter) and 16 gauge (51" and over) zinc- coated steel with continuous corrosion resistant welds.

2.06 All 90 degree elbows in size 3" through 8" diameter shall be die- stamped for minimum air friction loss with continuous corrosion- resistant welds.

2.07 Elbows - 9" diameter and over - 5-piece fabrication.

2.08 Square elbows - Mitered 90 degrees with minimum 4 or 5 turning vanes.

2.09 Tees and laterals - low loss conical type fittings straight or reducing as required.

2.10 Couplings, end caps, slip joints, concentric reducer and transitions to be standard fittings.

2.11 All access doors shall be 20 gauge, (U. S. Standard) reinforced, insulated, gasketed doors with sufficient quick opening fasterners to insure a tight seal, and provided with chain retainer and cover handle. Doors to open inward to serve as vacuum release devices. Minimum size of access doors shall be as follows:

ROUND DUCT		FLAT OVAL DUCT	
Size	Duct Diameter	Major Axis When Mounted On Major Axis	Minor Axis When Mounted On Minor Axis
8" x 12"	8" to 12"	8" to 16"	8" to 11"
12" x 12"	13" to 18"	17" to 24"	12" to 13"
14" x 20"	19" & over	25" & over	14" & over

2.12 All round and flat oval high velocity ductwork and fittings shall be as manufactured by United Sheet Metal, Semco, Tangent Air or Eastern.

2.13 All duct sealing compounds and mastics shall meet NFPA 90A Standards and shall be UL listed with ratings not to exceed 25 for flame spread and 50 for smoke development.

PART 3 EXECUTION

3.01 The conduit shall have been tested for leakage rate, friction loss, bursting and collapsing strength by a reputable independent engineering laboratory. Certified copies of these tests shall be supplied upon request. Material not meeting accepted industry standards will be rejected.

3.02 All circumferential joints shall be slip joints properly sealed with sealing compound inside the joint and mechanically fastened with drive screws. Use minimum number of drive screws to allow sealing compound to set properly. Coat outside of joint with sealing compound.

3.03 Construct square rectangular ducts and transitions with duct sealer in seams. Use mastic or suitable soft gaskets in joints. Bolt flanges with 1/4" bolts maximum 6" on centers.

3.04 See "Tests and Adjustments" Section for testing of high pressure sheet metal work.

3.05 Provide access doors adjacent to all dampers, including fire dampers, and control devices. Access doors at fire dampers shall be located so that fire dampers may be reopened from them in case of fusible link failure. All access doors shall be installed with sufficient quick opening fasteners to insure a tight seal.

3.06 Install flexible connections in all duct connections to all fans. All flexible connections shall be made with commercial grade neoprene coated glass fabric (heavy duty).

END OF SECTION

SECTION 23 33 13

DAMPERS

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 31 13.13 - LOW PRESSURE DUCTWORK
B.

1.02 SCOPE

A. Furnish and install dampers and appurtenances with size and capacities as shown on Drawings.

PART 2 PRODUCTS

2.01 MANUAL BALANCING DAMPERS

A. Based on Ruskin Type MD-35/0B opposed blade with molded synthetic bearings, 6" wide 16 gauge galvanized steel blades, extended shaft and linkage.

1. Balance dampers for round ducts shall be Ruskin MDRS- 25 single blade, 20 gauge galvanized steel.

2. All dampers shall be equipped with locking quadrants.

B. At the Contractor's option, manual balancing dampers shall be manufactured by the Contractor per SMACNA Standards. Dampers shall have locking quadrants on both sides of the duct.

2.02 AUTOMATIC CONTROL DAMPERS

A. Based on Ruskin Type CD-50, opposed blade with self- lubricating molded synthetic bearings, 5" X 1" X .125-6063 T5 extruded aluminum hat channel with hat mounting flanges on both sides of frame. 6" wide 6063 T5 heavy gauge extruded aluminum airfoil shape blades. Anti-leakage jamb seals, vinyl gasket blade seals, extended shaft and linkage. Maximum allowable leakage through dampers, 6 CFM per sq. ft. at 4" of static pressure behind louver.

B. Dampers shall be furnished with a low voltage electric operator by the Temperature Control Contractor. The Temperature Control Contractor shll field installed the actuators. Refer to Section 25 00 00 - TEMPERATURE CONTROLS.

2.03 FIRE DAMPERS

A. Fire dampers in low velocity ductwork shall be Ruskin model DIBD2 Dynamic Type "B" with interlocking hinged blades out of the airstream unless otherwise noted. All dampers shall be UL approved and labeled and shall meet all requirements of NFPA No. 90A. Furnish with UL labeled fusible links with temperature ranges to conform to NFPA recommendations. All fire dampers shall be dynamic type.

1. Furnish and install, at locations shown on the plans, dynamic fire dampers tested, constructed and labeled in accordance with the latest edition of UL Standard 555. Dampers shall have a fire rating of 11/2 hours and shall meet the requirements of the latest edition of NFPA90A.

2. Each damper shall include a 165°F fusible link and shall be labeled for use in dynamic systems. Dampers labeled for use in static systems only are not permitted. The damper shall be rated for dynamic closure at 2000 fpm and 4 inches w.g. static pressure and shall be rated to close with airflow in either direction.

3. Each dynamic fire damper shall include a steel sleeve and mounting angles furnished by the damper manufacturer to ensure appropriate installation. Submittal information shall include the fire protection rating, maximum velocity/pressure ratings and the manufacturer's UL installation instructions. The dampers shall be installed in accordance with the manufacturer’s UL installation instructions.

B. Fire dampers in high velocity ductwork shall be Ruskin multiple blade type FD60. All dampers shall be UL approved and labeled and shall meet all requirements of NFPA No. 90A. Furnish with UL labeled fusible links with temperature ranges to conform to NFPA recommendations. All dampers shall be dynamic type.

1. Furnish and install at locations shown on plans or as described in schedules multiple blade fire dampers constructed and tested in accordance with UL Safety Standard 555 that meet or exceed the following specifications. Damper frame (when size permits) shall be constructed using the UniFrame Design Concept (UDC) and shall be a minimum of 16 gage galvanized (1.52) steel formed into a structural hat shaped steel channel structurally superior to 13 gage (2.3) channel frame. The blades shall be single piece, airfoil shaped with 14 gage (1.90) equivalent thickness. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame.

2. Each fire damper shall have a 11/2 hour fire protection rating, 165°F fusible link, and shall have been tested to close under dynamic airflow conditions in a multiple section size with pressures up to 8" and velocities up to 4000 fpm. In addition, the dampers shall be AMCA licensed for air performance and shall bear the AMCA Certified Ratings Seal.

3. Fire dampers shall be approved for vertical or horizontal installation as required by the location shown and shall be installed using steel sleeves, angles, and other materials and practices required to provide an installation in accordance with the damper manufacturer's UL approved instructions.

2.04 Dampers by Ruskin, Air Balance, Arrow, American Warming and Ventilating, or Vent Products of the same type and meeting specified requirements, may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 Install dampers as recommended by manufacturer.

3.02 Inspect areas to receive dampers. Notify the A/E of conditions that would adversely affect the installation or subsequent utilization of the dampers. Do not proceed with installation until unsatisfactory conditions are corrected.

3.03 Install dampers at locations indicated on the drawings and in accordance with manufacturer's UL approved installation instructions.

3.04 Install dampers square and free from racking with blades running horizontally.

3.05 Do not compress or stretch damper frame into duct or opening.

3.06 Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jackshaft.

3.07 Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.08 All dampers and damper operators shall be checked and adjusted for proper operation and travel.

3.09 All dampers shall be labeled per Ohio Building Code requirements.

3.10 Install dampers as recommended by manufacturer.

3.11 Provide access doors in the ductwork at all automatic control and fire dampers.

END OF SECTION

SECTION 23 36 16

MEDIUM VELOCITY VAV BOXES

PART 1 GENERAL

1.01 REFERENCE

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Divisions 01 Specifications Sections, apply to this Section.
B. Section 23 01 05, Paragraph 1.05 - OHIO ENERGY CODE.
C. Section 23 31 13.13 - LOW PRESSURE DUCTWORK.
D. Section 23 31 13.16 - HIGH PRESSURE DUCTWORK.
E. Section 25 00 00 - TEMPERATURE CONTROLS

1.02 SCOPE

A. Furnish and install a DDC variable volume, "pressure independent" medium velocity air terminal units with electronic operators for air volume control, access door, attenuator section and inlet valves. Size, capacity and noise level as shown on the drawings.

B. Boxes shall have a direct digital controller and electronic actuator furnished and field installed by the Temperature Control Contractor.

1.03 SUBMITTALS

A. Provide dimensional drawings and product data on each VAV box.

B. Provide air flows and pressure drops for each VAV box at the specified operation point.

C. Provide sound power readings for the eight octave bands, decibels, and sones.

D. Provide manufacturer's certification that VAV boxes are licensed to bear ARI seal for sound and air performance.

E. Installation, Operation, and Maintenance Manual (IOM): Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, receiving, handling, storage, safety information and cleaning. Provide a troubleshooting guide, parts list, warranty and electrical wiring diagrams.

1.04 QUALITY ASSURANCE

A. Performance ratings: Conform to ARI standard 880.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.

B. Storage: Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer’s instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual. Inlet and outlet duct connections along with piping connections shall be provided with temporary caps or covers to prevent entry of dirt and moisture.

C. Handling: Handle and lift fans in accordance with the manufacturer’s instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.

1.06 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the date of occupancy.

PART 2 PRODUCTS

2.01 Variable volume medium velocity control box shall be Titus Type DESV.

2.02 Unit shall have factory catalogued performance ratings which conform to CFM, static pressure, discharge and radiated sound power and attenuation designated.

A. Cabinet shall be constructed of not lighter than 22 gauge, zinc-coated steel. (Without factory-applied enamel paint finish.) All terminal units must have an approved non-porouos sealed lining system. Liner and insulation must meet requirements of UL 181 and NFPA 90A. All seams and cut edges must be sealed to prevent erosion while all discharge edges of the liner must be secured with metal brackets. Insulation shall be 4.0 lb/ft3 density. Lining shall be Fiber-Free Lining System by Titus or equivalent. Liners made by Mylar, Tedlar, Silane or woven fiberglass cloth are not acceptable.

B. Refer to schedule on Drawings for minimum airflows.

C. Performance of units shall be based on tests conducted in accordance with ADC Standard 1061Rs and ASHRAE Standard 36B.

D. Electronic operator shall be furnished and field mounted on boxes by The Contractor.

E. Leakage of valves in fully closed position shall not exceed 2% of rated capacity at 4" w.g.

F. Automatic damper operators shall be factory installed and thoroughly tested for proper performance.

G. Minimum inlet SP requirement shall not exceed 0.50".

2.03 The Control Contractor shall field mount and wire the DDC controllers and actuators for the VAV box.

2.04 Units shall be UL listed with a flame spread rating not to exceed 25 and a smoke development rating not in excess of 50.

2.05 Box shall be factory adjusted to deliver the specified air quantities within 5%. Each box shall be labeled with the capacity as adjusted and furnished with a calibration chart. Pressure taps shall be provided to measure pressure drop across unit to confirm CFM.

2.06 Box shall be end outlet.

2.07 Box shall deliver the air quantities shown on the Drawings at sound levels not to exceed the manufacturer's published sound levels for the units indicated on the Drawings.

2.08 Box shall be furnished with a minimum 2-row reheat coil with aluminum fins and copper tubes. Provide access door in VAV box upstream of coil.

2.09 All boxes shall be furnished with an attenuator section.

2.10 All boxes shall be furnished with a discharge air sensor. Each sensor shall be provided and installed by the Temperature Control Contractor.

2.11 Variable Air volume boxes by Kreuger, or Price, meeting all specified requirements, may be furnished at the Contractor’s option.

PART 3 EXECUTION

3.01 Provide flexible connection at inlet to the box. Box shall be installed with at least two duct diameters of rigid straight duct attached directly to box inlets.

3.02 Support the units from the building structure with solid steel hanger rods or sheet metal strap hangers from corner points of unit, minimum 4, such that unit is self-supporting. Units shall not be supported from the duct system or piping system or ceiling suspension system.

3.03 The air control terminal box locations must be coordinated with all elements that shall be in or above the ceiling. This includes but is not limited to HVAC piping, plumbing piping, conduit, wiring, junction boxes, pull boxes, lighting fixtures, sprinkler heads, cable tray, speakers, smoke detectors air devices, etc. In no case shall the HVAC Contractor mount an air control terminal above a lighting fixture, speaker, diffuser or any other

device mounted on the ceiling without written permission from the University. Provide ceiling access panels where the ceiling system does not afford ready access.

3.04 Provide a manual air vent at the coil.

3.05 Operating sequence of boxes shall be as described under Section 25 00 00 – TEMPERATURE CONTROLS.

3.06 Low voltage power and communications wiring shall be by the Temperature Control Contractor.

END OF SECTION

SECTION 23 36 17

MEDIUM VELOCITY DUAL DUCT BOXES

PART 1 GENERAL

1.01 REFERENCE

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Divisions 01 Specifications Sections, apply to this Section.
B. Section 23 01 05, Paragraph 1.05 - OHIO ENERGY CODE.
C. Section 23 31 13.13 - LOW PRESSURE DUCTWORK.
D. Section 23 31 13.16 - HIGH PRESSURE DUCTWORK.
E. Section 25 00 00 - TEMPERATURE CONTROLS

1.02 SCOPE

A. Furnish and install hot and cold dual duct, variable air volume, "pressure independent" medium velocity air terminal units with electronic operators and relays for both temperature and air volume control, inlet valves, variable constant volume device and attenuator section (if required to meet sound levels). Sizes, capacities and noise levels as scheduled on the Drawings.

B. Box shall be provided with Honeywell DDC controllers and electronic actuators furnished by the Temperature Control Contractor.

PART 2 PRODUCTS

2.01 Dual duct variable volume medium velocity control boxes shall be Titus Type DEDV.

2.02 Unit shall have factory catalogued performance ratings which conform to CFM, static pressure, discharge and radiated sound power and attenuation designated.

A. Cabinet shall be constructed of not lighter than 22 gauge, zinc-coated steel. (Without factory-applied enamel paint finish.) All terminal units must have an approved non-porous sealed lining system. Liner and insulation must meet requirements of UL 181 and NFPA 90A. Liner must meet bacteriological standards of ASTM C665. All seams and cut edges must be sealed from the airstream with metal brackets. Use of adhesive backed tape is unacceptable. Insulation shall be 4 lb/ft3 density with an R-Value of 3.5. Lining shall be Micro-Loc Lining System by Titus or equivalent.

B. Refer to schedule on Drawings for minimum airflows.

C. Performance of units shall be based on tests conducted in accordance with ADC Standard 1061Rs and ASHRAE Standard 36B.

D. DDC Controller and Electronic operator shall be furnished by Temperature Control Contractor and factory mounted on boxes by the box manufacturer. Mounting of the operator shall be at the expense of the box manufacturer, not the Temperature Control Contractor. See Temperature Control Section.

E. Leakage of valves in fully closed position shall not exceed 2% of rated capacity at 4" w.g.

F. Automatic damper operators shall be factory installed and thoroughly tested for proper performance.

G. Minimum inlet SP requirement shall not exceed 0.50".

2.03 The Temperature Control Contractor shall field install box actuator to the box.

2.04 Units shall be UL listed with a flame spread rating not to exceed 25 and a smoke development rating not in excess of 50.

2.05 Box shall be factory adjusted to deliver the specified air quantities within 5%. Each box shall be labeled with the capacity as adjusted and furnished with a calibration chart. Pressure taps shall be provided to measure pressure drop across unit to confirm CFM.

2.06 Box shall be end outlet.

2.07 Box shall deliver the air quantities shown on the Drawings at sound levels not to exceed the manufacturer's published sound levels for the units indicated on the Drawings.

2.08 All boxes shall be furnished with an attenuator section. Attenuator section shall also be furnished with the Micro-Loc lining system.

2.10 Variable Air volume boxes by Price or Krueger meeting all specified requirements, may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 Provide flexible connection at inlet to the box. Box shall be installed with at least two duct diameters of rigid straight duct attached directly to box inlets.

3.02 Provide additional steel as required to support box.

3.03 Operating sequence of boxes shall be as described under Section 25 00 00 – Temperature Controls.

END OF SECTION 23 36 17

SECTION 23 37 00

REGISTERS, GRILLES AND DIFFUSERS

PART 1 GENERAL

1.01 REFERENCE

A. Section 23 31 13.13 - LOW PRESSURE DUCTWORK

1.02 SCOPE

A. Furnish and install registers, grilles, diffusers and appurtenances.

PART 2 PRODUCTS

2.01 SQUARE CEILING SUPPLY AIR DIFFUSERS

A. Adjustable air pattern steel square ceiling diffusers with round neck. Air pattern to be adjustable from full horizontal to full vertical.

1. Titus TMSA with Border Type 3 frame to fit into lay-in ceiling grid.

2.02 RETURN AND EXHAUST AIR GRILLES

A. Grilles with curved horizontal face bars, fixed at 45 degrees.

1. Titus 350RL, steel, surface mounted.
2. Titus 350RL, steel, lay-in.

2.03 LINEAR CEILING SUPPLY AIR DIFFUSERS

A. Extruded aluminum straight line diffusers with concealed keyways and alignment clips. Number of slots, direction of throw, size and capacities as shown on the Drawings. Install manual dampers in branch ducts to linear diffusers. Units shall have integral volume and pattern control. Air pattern to be adjustable from full horizontal to full vertical. Pattern controllers must be capable of shut-off for each slot.

1. Titus ML, Adjustable throw.

2.04 Registers, grilles and diffusers by Anemostat, Price or Krueger of the same type, size and meeting other specified requirements may be furnished at the Contractor's option.

PART 3 EXECUTION

3.01 All steel grilles and registers shall be furnished with factory prime coat of paint. Outlets in ceilings shall be furnished with factory white finish unless otherwise noted.

3.02 Diffusers in ceilings shall have flush appearance and shall initially be set by Mechanical Contractor for horizontal air pattern distribution.

3.03 Manufacturer's drawings shall include the "K" factor for use with an Alnor velometer for each size and type of register, grille and diffuser furnished.

3.04 Furnish frames and trim compatible with existing ceilings.

3.05 All diffusers shall be installed with equalizing grid.

3.06 Provide additional support hangers for grilles and registers mounted in lay-in ceiling tiles.

END OF SECTION

SECTION 25 00 00

TEMPERATURE CONTROLS

PART 1 GENERAL

1.01 REFERENCES

A. Section 23 01 05, Paragraph 1.4 - OHIO ENERGY CODE
B. Section 23 05 13 - ELECTRICAL WORK
C Section 23 36 17 - MEDIUM VELOCITY DUAL DUCT BOXES
D. Section 23 37 00 - REGISTERS, GRILLES AND DIFFUSERS

1.02 SCOPE

A. Furnish and install a complete Direct Digital Control (DDC) Temperature Control System basis for design is Siemens Building Technologies, to automatically control the operation of the entire Heating, Ventilating and Air Conditioning System. Failure to mention any specific item or device does not relieve the Contractor of the responsibility for installing such device or item in order to comply with the intent of the Drawings or this Specification. The temperature control system shall be fully integrated into the existing Campus System such that complete control, monitoring, programming, etc. can be performed from the existing campus operator workstations at the Cole Services Building and Mosler Hall.

1. The existing Miami University automation system consists of an APOGEE System 600 server and

2. multiple client workstations that perform a variety of specific monitoring, programming, and alarm notification functions. New APOGEE System 600 panels shall be provided where necessary to accomplish the operating sequences described in this Section. Existing APOGEE System 600 panels currently located in the third floor Mechanical Room of Williams Hall shall be reused if possible. All new systems associated with this project shall directly interface with the existing systems in a seamless manner to support the following functionality:

a) Monitor/Command all physical and virtual points.

b) System network and hardware diagnostics.

c) Programming - all editing functions.

d) Dynamic and historical trending - automatic data collection.

e) Automatic database back-up/reload.

f) Time-clock synchronization

g) Alarm routing

h) Time of day scheduling

C. Building Automation System (BAS) installer shall provide:

1. A fully integrated building automation system (BAS) as manufactured by Siemens Building Technologies, UL listed, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, including color graphic workstations.

2. Complete temperature control system to be DDC as specified herein.

3. All wiring, conduit, panels, for all DDC temperature controls.

4. All final electrical connections to the new DDC Controller. Pick up power immediately inside of panel.

5. BAS installer shall be responsible for all electrical work associated with the BAS control system and as called for on the Drawings.

a) Perform all wiring in accordance with all local and national codes.

b) Install all line voltage wiring, concealed or exposed, in accordance with Division 16.

c) BAS Contractor shall provide 120 volt, 20 amp circuits and circuit breakers from the existing normal power panel for direct digital control systems.

d) Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers.

e) All 120V and low voltage electrical control wiring throughout the building whether exposed or concealed shall be run in conduit in accordance with Division 16.

f) All 24V power shall be by the BAS installer and the The contractor.

6. BAS installer shall furnish and install all control damper and control valve actuators, including plenum and/or duct reinforcements where required.

7. BAS installer shall furnish and field install all VAV box controllers and actuators.

8. BAS Graphics for all new and modified HVAC equipment installed under this contract.

D. The contractor provides:

1. All wells and openings for water monitoring devices, differential pressure switches and alarms furnished by BAS installer.

2. Installation of control valves.

3. Installation of openings for air flow monitoring devices, for differential pressure switches furnished by BAS installer.

E. Electrical Contractor provides:

1. Power circuit to junction box within 5 feet of equipment for stand-alone control panels indicated on the Drawings; installed and connected by BAS Contractor.

2. 120 volt, 20 amp breaker for each DDC Controller.

F. BAS Installer shall provide programming modifications necessary to fine tune sequences during commissioning of systems at no additional cost to the University.

1.03 GENERAL PRODUCT DESCRIPTION:

A. The building automation system (BAS) shall integrate multiple building functions including equipment supervision and control, alarm management, energy management and historical data collection.

B. The building automation system shall consist of the following:

1. Stand-alone DDC Controller

C. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers and operator devices.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

E. DDC Controller shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central processing device. DDC Controller shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

1.04 QUALITY ASSURANCE

A. Materials and equipment shall be the catalogued products of the BAS manufacturer and shall be the manufacturer's latest standard design that complies with the specification requirements.

B. Install system using competent workmen who are fully trained in the installation of building automation system equipment.

C. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system. This shall include assisting the chemical treatment supplier in the proper operation and calibration of all components associated with the condenser water chemical treatment system.

D. Supplier shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

E. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

F. BAS shall comply with UL 916 PAZX ,UL 864 UUKL, and be so listed at the time of bid.

G. Design and build all system components to be fault-tolerant.

1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3 Hertz variation in line frequency.

2. Static, transient and short-circuit protection on all inputs and outputs.

3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.

4. Network-connected devices to be A.C. coupled or equivalent so that any single device failure will not disrupt or halt network communication.

5. All real time clocks and data file RAM to be battery-backed for a minimum 72 hours and include local and system low battery indication.

6. All programs shall retain their memory for a minimum of 7 days upon loss of power.

1.05 SUBMITTALS - REVIEW

A. Manufacturer's Product Data:

1. All equipment components

B. Shop Drawings:

1. System wiring diagrams with sequence of operation for each system as specified.

2. Submit manufacturer's product information on all hardware items along with descriptive literature for all software programs to show compliance with specifications.

3. System configuration diagram showing all panel types and locations as well as communications network and workstations.

1.06 SUBMITTALS - INFORMATIONAL

A. Where installation procedures, or any part thereof, are required to be in accord with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the A/E prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received.

1.07 SYSTEM CHECK-OUT

A. Provide necessary personnel as required to assist the University and A/E in providing complete system operational testing.

PART 2 PRODUCTS

2.01 NETWORKING COMMUNICATIONS

A. The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of two levels, a high performance peer-to-peer network and DDC Controller specific local area networks. The new DDC controller for this project shall connect to the existing campus network.

B. Access to system data shall not be restricted by the hardware configuration of the building automation system. The hardware configuration of the BAS network shall be totally transparent to the user when accessing data or developing control programs.

C. Peer-to-Peer Network Level:

1. Operator workstations and DDC Controllers shall directly reside on a network such that communications may be executed directly between DDC Controllers, directly between existing workstations and between DDC Controllers and existing workstations on a peer-to-peer basis.

2. All operator devices either network resident or connected via dial-up

modems shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. Access to data shall be based upon logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the network data.

3. Network design shall include the following provisions:

a. Provide high-speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices. System performance shall insure that an alarm occurring at any DDC Controller is displayed at existing workstation and/or alarm printer within 5 seconds.

b. Support of any combination of DDC Controllers and operator workstations directly connected to the peer-to-peer network. A minimum of 30 devices shall be supported on a single network.

c. Message and alarm buffering to prevent information from being lost.

d. Error detection, correction and retransmission to guarantee data integrity.

e. Synchronization of real-time clocks, to include automatic daylight savings time updating between all DDC Controllers shall be provided.

D. DDC Controller Local Area Network (LAN):

1. This level communication shall support a family of application specific controllers and shall communicate bi-directionally with the peer-to-peer network through DDC Controllers for transmission of global data.

2.02 DDC CONTROLLER

A. Stand-alone Controller shall be microprocessor-based with a minimum word size of 16 bits. They shall also be multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point list.

B. The DDC Controller shall have sufficient memory, to support its own operating system and databases, including:

1. Control processes

2. Energy management applications

3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.

4. Historical/trend data for points specified

5. Maintenance support applications

6. Custom processes

7. Operator I/O

8. Dial-up communications

9. Manual override monitoring

C. Each DDC Controller shall support:

1. Monitoring of the following types of inputs, without the addition of equipment outside the DDC Controller cabinet:

a. Analog inputs

1) 4-20 mA
2) 0-10 Vdc
3) Thermistors
4) 1000 ohm RTDs
5) Conductivity Sensor (0-6000 micromho/cm)

b. Digital inputs

1) Dry contact closure
2) Pulse Accumulator
3) Voltage Sensing

2. Direct control of pneumatic and electronic actuators and control devices. Each DDC Controller shall be capable of providing the following control outputs:

a. Digital outputs (contact closure)

1) Contact closure (motor starters, sizes 1-4)

b. Analog outputs

1) 0-20 psi
2) 4-20 mA
3) 0-10 Vdc

D. Each DDC Controller shall have a minimum of 10 per cent spare capacity for

future point connection. The I/O points in the panel shall be modular plug-in type. No spare point will be furnished, but the panel shall have the spare capability mentioned above. The type of future points shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall the panel be capable of less than two spares of each implemented I/O type. Provide all processors, power supplies, communication controllers and point modules to patch implemented types so that the implementation of a point only requires the addition of the appropriate point, wiring, software and the end device (sensor, actuator, etc.).

1. Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.

E. DDC Controllers shall provide at least two RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

F. The operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points. These override switches shall be operable whether the panel processor is operational or not.

1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or auxiliary control panel to prevent unauthorized overrides.

2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.

G. DDC Controllers shall provide local LED status indication for each digital output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

H. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

I. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.

J. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all

volatile memory for a minimum of 7 days.

1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

2.03 DDC CONTROLLER RESIDENT SOFTWARE FEATURES

A. General:

1. All necessary software to form a complete operating system as described in this specification shall be provided.

2. The software programs specified in this Section shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer for execution.

B. Control Software Description:

1. The DDC Controllers shall have the ability to perform the following pre-tested control algorithms:

a. Two-position control

b. Proportional control

c. Proportional plus integral control

d. Proportional, integral, plus derivative control

2. Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

3. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

4. Upon the resumption of normal power, each DDC Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.

C. DDC Controllers shall have the ability to perform all the following energy management routines:

1. Time-of-day scheduling
2 Calendar-based scheduling

3. Holiday scheduling
4. Temporary schedule overrides
5. Start-Stop Time Optimization
6. Automatic Daylight Savings Time Switchover
7. Night setback control
8. Enthalpy switchover (economizer)
9. Peak demand limiting
10. Temperature-compensated duty cycling
11. Fan speed/CFM control
12. Heating/cooling interlock
13. Cold deck reset
14. Hot deck reset
15. Hot water reset
16. Chilled water reset
17. Condenser water reset
18. Chiller sequencing

    a. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operations.

D. DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. It shall be possible to use any of the following in a custom process:

    a. Any system measured point data or status
    b. Any calculated data
    c. Any results from other processes
    d. User-defined constants
    e. Arithmetic functions (+, -, *, /,square root, exp, etc.)
    f. Boolean logic operators (and/or, exclusive or, etc.)
    g. On-delay/off-delay/one-shot timers

2. Custom processes may be triggered based on any combination of the following:

    a. Time interval
    b. Time-of-day
    c. Date
    d. Other processes
    e. Time programming
    f. Events (e.g., point alarms)

3. A single process shall be able to incorporate measured or calculated data from any and all other DDC Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC Controllers on the network.

4. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.

5. The custom control programming feature shall be documented via English language descriptors.

E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

3. Alarm reports and messages will be directed to a University-defined list of operator devices or PCs.

4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a minimum 80 character alarm message to more fully describe the alarm condition or direct operator response.

   a. Each DDC Controller shall be capable of storing a library of at least 50 alarm messages. Each message may be assignable to any number of points in the Controller.

5. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.

1. DDC Controllers shall store point history data for selected analog and digital inputs and outputs:

a. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of l minute to 7 days shall be provided. Each DDC Controller shall have a dedicated RAM-based buffer for trend data.

2. Trend data shall be stored at the DDC Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All trend data shall be available for use in 3rd party personal computer applications.

G. DDC Controllers shall automatically accumulate and store run-time hours for digital input and output points as specified in the point I/O summary.

1. The totalization routine shall have a sampling resolution of one minute or less.

2. The user shall have the ability to define a warning limit for run-time totalization. Unique, user-specified messages shall be generated when the limit is reached.

H. DDC Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for user-selected analog and digital pulse input type points as specified in the point I/O summary.

1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g., KWH, gallons, BTU, tons, etc.).

2. The totalization routine shall have a sampling resolution of one minute or less.

3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

I. DDC Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for points as specified in the point I/O summary.

1. The event totalization feature shall be able to store the records associated with a minimum of 9,999.9 events before reset.

2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

J. Color Graphics Software

The vendor shall, as part of the project, provide all necessary hardware and software required to integrate color graphic representatives of HVAC systems into the existing campus graphics software. All graphics for this project shall be consistent with existing Miami University graphics. Provide color graphics for the following systems/equipment as a minimum:

1. New VAV Boxes
2. Finned Radiation

2.04 PRODUCTS

A. Valves (Throttling Plugs): General Design - All valves shall be equipped with throttling plugs and removable composition discs. All valves are to be sized by the control manufacturer and he shall submit pressure drop calculation and guarantee sufficient size to meet the requirements of the equipment being served. Valve operators shall be of such design so as to provide adequate operating power for valve positioning at full pump head. Valve operators shall be electronic type. All valves are to be equipped with U cup silicone packing. Pressure drop through valves shall not exceed 10 feet for modulating control.

B. Three-Way Valves: Three-way valves are to be of the three port mixing type designed expressly for mixing of two inlets and providing a common outlet. The use of reverse piped diverting valves will not be acceptable. The control manufacturer will be responsible to the The contractor relative to notification as to correct method of piping of all three-way valves.

C. Temperature Sensors: Each temperature sensor shall match the requirements of the associated temperature controller. Each sensor shall be designed for the appropriate application (i.e., duct, immersion, etc.) and be provided with all necessary installation accessories. Ranges shall be selected to the middle of the control range.

PART 3 EXECUTION

3.01 WIRING AND CONDUIT

A. All control wiring incidental to the Building Automation System shall be by the Building Automation Manufacturer except as follows:

1. Line voltage thermostats shall be turned over to the Electrical Contractor for installation and wiring.

2. Wiring shown on the Electrical Contract Drawings shall be wired by the Electrical Contractor.

B. All temperature control panels shall be completely prewired by the Temperature Control Manufacturer to terminal strips within the control cabinet. Provide 20 amp toggle switch to disconnect power at each panel. All internal interlock wiring within the control panel shall be complete to the terminal strips.

C. All wiring, including low voltage, shall be installed in conduit. All wiring, conduit and installation shall be in accordance with the latest edition of the National Electrical Code and the requirements of Division 16 Electrical Specification, except low voltage wiring may be of the type and size recommended by the Building Automation Manufacturer.

D. All conduit and conduit installation, including conduit utilized for plastic pneumatic tubing, shall be in accordance with the requirements of Division 16, Electrical Specification.

3.02 BUILDING AUTOMATION SYSTEM DIAGRAMS

A. Complete Building Automation System diagrams including motor control schematics, wiring diagrams and a written description of the system operation shall be provided by the Building Automation System Installer. Diagrams shall include face elevations of the temperature control panels.

B. Prepare, as a part of Building Automation System shop drawings, complete terminal-to-terminal wiring diagrams. These will show terminal designations on control items and equipment. Wiring diagrams to be compatible with Electrical Drawings.

C. The Control diagrams, along with product literature on all system components shall be submitted as "Shop Drawings" for review by the A/E prior to starting work. Submit two sets of drawings for "preliminary" review before making a formal submittal.

D. Control diagrams, laminated in plastic or in full size heavy plastic binders with mounting rings, shall be hung adjacent to each control panel showing all schematic diagrams and descriptions related to the systems served by that panel.

E. Furnish four (4) complete sets of Operating and Maintenance Instructions for Temperature Controls, including control diagrams, to the contractor for inclusion in the "Operating and Maintenance Manuals". Record control drawings must show set points and spring ranges.

3.03 CALIBRATION

A. Inasmuch as controllers are factory calibrated and controlled devices have nominal operating ranges, different from actual field conditions, all controllers shall be calibrated and set for the actual field conditions. A listing of actual spring ranges on controlled devices such as for valves, etc., shall be submitted to the University's Operating Engineer in the Operating and Maintenance Manual, for future recalibration/maintenance.

3.04 SUPERVISION

A. All temperature controls shall be installed, and calibrated under the supervision

of a qualified representative of the Building Automation System Manufacturer. The Building Automation System Manufacturer shall certify in writing the qualification of the installing company.

3.05 SEQUENCES

A. Dual Duct Mixing Box Control (DDC Controls):

1) Units are hot and cold dual duct variable air volume, high velocity air terminal units which shall be factory set for limiting cold air quantity and hot air quantity. Hot air maximum quantity shall be 50% of design full capacity. Each box shall have a separate thermostat unless otherwise noted.

2) Damper operators shall be shipped to the mixing box manufacturer for factory installation.

3) In response to control from a room sensor and box TEC, as cooling demand decreases, cold air quantity decreases down to the preset minimum, at which point, warm air will gradually be introduced to mix with the cold air while the cold air quantity is being reduced. As heating demand (less cooling) increases, the hot air quantity is increased until, when fully open at 50% of full design air flow the cold air is shut off. When control air is removed from the mixing box controls, the hot duct will be open and the cold duct will be closed.

4) ASC and actuator for each box shall be furnished by the BAS Contractor and shipped to the box manufacturer for installation.

5) Box controller shall provide supply air volume in CFM and space temperature at the central control console through the BAS panels

6) Temperature sensors for terminal box control shall have no temperature setpoint adjustment capability. All space temperature adjustment shall be made by operation's station. The contractor shall be responsible for meeting with the University's Facility Manager to determine the appropriate temperature adjustment range.

6) The dual duct box shall have an occupied and unoccupied sequence of operation as described herein. Each dual duct box shall be indexed between the occupied and unoccupied cycle in conjunction with the existing air handling unit supplying the terminal box.

7) During the occupied sequence of operation, the dual duct box controller and actuator shall modulate the box damper to the box minimum airflow position (30%) as the room temperature decreases. On a requirement for heat to maintain space temperature setpoint, the controller shall modulate the hot deck valve through the valve electric actuator.

8) Dual duct boxes serving offices shall be controlled by the room vacancy sensors to go to minimum whenever the room is vacant for more than 30 minutes (adjustable). Vacancy sensor provided by the Electrical Contractor.

9) Dual duct Boxes serving multiple offices or spaces shall have averaging sensors for control of each space.

10) 4. Heating, Cooling and Dehumidification During the Associated Air Handling Unit Unoccupied Cycle:

Heating Cycle: The DDC system shall monitor the terminal box temperature sensors and cycle the air handling unit supplying the terminal box through the air handling unit controller to maintain a minimum space temperature. When the air handling unit is operating in the unoccupied heating cycle, the terminal box controller shall modulate the primary air damper to maintain 75% of the maximum volume of airflow as scheduled on the Drawings and the reheat coil control valve shall be modulated.

Cooling Cycle: The DDC system shall monitor the terminal box temperature sensors and cycle the air handling unit supplying the terminal box through the air handling unit controller to maintain a maximum space temperature. When the air handling unit is operating in the unoccupied cooling cycle, the terminal box controller shall modulate the primary air damper to maintain 75% of the maximum volume of airflow as scheduled on the drawings and the reheat coil control valve shall be closed.

10. Heating During the Associated Air Handling Unit Morning Warm-Up Cycle:

The DDC system shall initiate the air handling unit to a timed morning warm-up cycle prior to the start of the scheduled occupied cycle. When the air handling unit is operating in the warm-up cycle, the terminal box controller shall modulate the primary air damper to maintain 75% of the maximum volume of airflow as scheduled on the Drawings and the reheat coil control valve shall be modulated. When the DDC system indexes the air handling unit from the warm-up cycle to the occupied cycle, the terminal box shall also be indexed to occupied cycle control.

11. The terminal box hot deck shall fail to last position on a loss of power to the controller.

12. Each terminal box shall have a separate space temperature sensor unless otherwise shown on the drawings.

13. Terminal boxes serving more than one space shall average the inputs from all sensors and use the average value to control the box. In areas with occupancy sensors, when it is determined the space is not occupied,

the inputs from the space sensor of the unoccupied zones shall not be used.

14. The contractor shall connect to 120V junction boxes as shown on the drawings and provided by the Electrical Contractor and provide transformers as required for box power. All wiring and transformers from the junction boxes to the terminal boxes shall be by the contractor.

15. Box controller shall provide supply air volume in CFM, supply air temperature, space temperature, and space temperature setpoint at the operator's terminal.

16. Dual duct box shall be interlocked with the vacancy sensor provided by the Electrical Contractor for occupancy control. Wiring between the vacancy sensor and the DDC Controller shall be by the contractor. The BAS shall index the VAV box to unoccupied mode when the room is unoccupied.

3.06 ON-SITE TESTING

A. Provide University-approved operation and acceptance testing of the complete system. The University will witness all tests.

B. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the installer. Provide a detailed cross-check of each sensor within the system by making a comparison between the reading at the sensor and a standard traceable to the National Bureau of Standards. Provide a cross-check of each control point within the system by making a comparison between the control command and the field-controlled device. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Submit the results of functional and diagnostic tests and calibrations to the Engineer for final system acceptance.

3.07 SERVICE AND GUARANTEE

A. General Requirements: Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after completion of successful performance test. Provide necessary material required for the work. Minimize impacts on facility operations when performing scheduled adjustments and non-scheduled work.

B. Systems Modifications: Provide any recommendations for system modification in writing to Owner. Do not make any system modifications, including operating parameters and control settings, without prior approval of Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

C. Software: Provide all software updates and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and shall be incorporated into the operations and maintenance manuals, and software documentation.

3.08 TRAINING

A. The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach.

B. Provide 2 hours of training for University's operating personnel. Training shall include:

1. Explanation of drawings, operations and maintenance manuals
2. DDC Controller operation/function
3. Operator control functions including graphic generation and field panel programming
4. Explanation of adjustment, calibration and replacement procedures

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to Division 22, Division 23, more than one section of Division 26, Division 27, Division 28, Division 33, and Division 34. It expands and supplements the requirements specified in sections of Division 01.

B. Codes and Standards: All equipment, material and installations shall comply with applicable codes, Miami University Design Standards, and installation practices. Comply with the requirements of the applicable local building code, the applicable NEC, all local rules and regulations including those of the fire authorities. Comply with all applicable NFPA standards. All material and equipment shall be listed by the Underwriters Laboratories (UL) standard that is applicable for the specific purpose of the material and equipment. The National Electrical Code, National Electrical Manufacturer's Association (NEMA) Standards, and applicable ANSI and IEEE standards shall apply to the pertinent materials, equipment, and installation practices. Testing shall be in accordance with the applicable International Electrical Testing Association (NETA) standards.

C. Permits and Fees: Obtain all permits and inspections required by all laws and regulations or public authority having such jurisdiction. File drawings necessary to obtain permits. Miami University will pay for all permits. Coordinate payment with the University's Project Manager.

D. Coordinate installation, equipment and manufacturers, within all Specifications Sections, with Miami University Design Standards manual.

1.2 INSPECTIONS

A. Obtain all inspections required by all laws, ordinances, rules, regulations or public authority having jurisdiction and obtain certificates of such inspections and submit same to the Engineer. Pay all fees, charges and other expenses in connection therein.

B. Before any electrical work is covered, the Engineer will inspect the electrical work completed at that time.

C. Final Inspection - When the Contractor determines all work is completed and working properly per the Contract Documents, the contractor shall request a "Final" inspection by the Engineer in writing. If more than one re-inspection is required after this final inspection, the Contractor shall bear all additional costs, including compensation for

the Engineer additional services made necessary thereby. A final inspection will not be made until Operating and Maintenance Manuals and Test Reports are submitted and approved and all prior "Observation report" punch lists are completed, signed and returned to the Engineer.

D. All work shall be inspected by the local authority having jurisdiction and upon completion of the work, the Electrical Contractor shall furnish to the State Architect, a certificate of inspection and approval from said Department before final payment on the Contract will be allowed. Fee for inspections shall be a part of this Contract.

1.3 OBSERVATION REPORTS

A. During the course of construction, the Engineer will prepare "Observation Reports" with a list of items found to be in need of correction. All items listed shall be corrected by the Contractor. A space is provided on the form for the Contractor to note the completion of each item. All prior "Observation Report" items must be completed, the lists signed and returned to the Engineer prior to making the final inspection. After the final list is issued, the same procedure will apply

1.4 TESTS

A. Refer to section 26 08 00, Commissioning.

B. When the Engineer makes final inspection of all electrical work he will order tests performed as deemed necessary. These tests may include operation of lights and equipment, continuity of conduit system, grounding resistances and insulation resistances and checking out the operation of the various systems. This Contractor shall provide such assistance as required (including manpower and tools) to start and stop the various systems, etc. and simulate control sequences. The Contractor (not the Engineer) is responsible to turn on the systems and demonstrate they are operating properly.

C. Submit data taken during such test to Engineer. Pay all professional engineering fees involved in required testing of equipment.

D. All signaling systems, such as fire alarm shall be checked out and tested by a qualified field representative of equipment vendor. A report shall be submitted to Engineer by vendor representative indicating results of such final check out and test. Final payment will not be approved until such report is submitted.

E. If the Engineer determines that any work requires special inspection, testing, or approval which Part 3 - Execution does not include, he will, upon written authorization from the University, instruct the Contractor to order such special inspection, testing or approval. The Contractor shall give timely notice so the Engineer may observe the inspections, tests or approvals. If such special inspection or testing reveals a failure of the work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Engineer additional services made necessary by such failure; otherwise the University shall bear such costs, and an appropriate Change Order shall be issued.

F. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.

G. The Contractor shall promptly correct all work found unacceptable by the Engineer whether observed before or after substantial completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such unacceptable work, including compensation for the Engineer additional services made necessary thereby.

1.5 SEISMIC REQUIREMENTS

A. Conform to requirements in Section 20 08 00 "Seismic Protection," including required submittals described under Section 20 08 00.

1.6 ELECTRICAL SUBMITTALS

A. General: Submittals are not requested for all products covered in the specifications. Submit only the data requested under the submittals portion of each specification section. Un-requested submittals will not be processed or reviewed. FAX or photo copies are not allowed as submittals for operating and maintenance manuals. Submittals for operating and maintenance manuals must be on original manufacturer printed stock. Non-requirement of submittals, when so noted, is not to be construed as an allowance for substitutions and does not relieve the contractor from full compliance with the plans and specifications. Any deviation from specified items is considered a substitution. If the contractor desires to use other than specified items, then a formal request for substitution must be submitted prior to bid date, in accordance with the methods and times indicated in these specifications.

B. Before submitting a shop drawing or any related material to the Engineer, Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of the Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting it.

C. Definitions:
   1. Product Data: Pre-printed manufacturer's data.
   2. Shop Drawings: Drawings made specifically for the manufacture of a particular piece of equipment to be used on this project.
   3. Operation and Maintenance Data: Information containing instructions on the proper operation, maintenance and repair of the equipment, complete with written text, diagrams, photos, exploded views and parts lists.
   4. Record Documents: Information indicating the actual installed conditions of the project on Mylar, electronic media, photographs or typed paper. Submit type, quantities and on media specified where indicated to be submitted.

1.7 DRAWINGS AND SPECIFICATIONS

A. The architectural, structural, mechanical, and electrical drawings and specifications shall be considered as mutually explanatory and complementary. Any electrical work called for by one and not by the other shall be performed as though required by all. All

sections and subsections of the Electrical work shall be governed by and subject to the general and supplementary conditions. Any discrepancies in or between the drawings and specifications, or between the drawings and actual field conditions shall be reported to the Engineer/Architect in sufficient time to issue an addendum for clarification.

B. The electrical drawings are diagrammatic, and some circuit runs have been distorted to avoid confusion of lines. However, the drawings indicate the general layout of the complete electrical system. Field verification of scale dimensions on plans is directed since actual locations, distance, and levels will be governed by actual field conditions.

1.8 PRODUCT OPTIONS AND SUBSTITUTIONS

A. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.

B. Provide products which are compatible within systems and other connected items.

C. Substitutions: Products other than those specified must be submitted as a substitution, at least 15 days prior to bid due date, along with a letter explaining the reason for the substitution. A sample of the proposed substitution shall be submitted to the engineer for the engineer's evaluation when requested by the engineer. This sample shall be supplied at no cost to the engineer, and will be returned to the contractor, at the contractor's expense, at the end of the evaluation period. Substitutions will only be evaluated and considered by the engineer when the engineer's time for such evaluation is paid for by the contractor requesting the substitution. Delivery time problems due to the contractor's failure to order the originally specified items in a timely manner will not be considered as an acceptable reason for substitution.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling. Protect stored equipment and materials from damage.

B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.10 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 01 Section "Contract Closeout." In addition to the requirements specified in Division 01, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices.
5. Mark Specifications to indicate approved substitutions, Change Orders, actual equipment and materials used.

1.11 OPERATION AND MAINTENANCE DATA

A. Refer to the Division 01 Section: "Contract Closeout" or "Operation and Maintenance Data" for procedures and requirements for preparation and submittal of maintenance manuals.

B. In addition to the information required by Division 01 for Maintenance Data, include the following information:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions, regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.12 WARRANTIES

A. Refer to the Division 01 Section: "Warranties" for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 26, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

D. This Contractor is responsible for all defects, repairs and replacements in materials and workmanship, for a period of one (1) year after final payment is approved by the Engineer.

E. Product guarantees greater than one (1) year shall be passed along to the Owner for full benefit of the manufacturer's warranty.

1.13 CLEANING

A. Refer to the Division 01 Section: “Contract Closeout” or “Final Cleaning” for general requirements for final cleaning.

1.14 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Coordinate equipment rough-in requirements with Divisions 02 through 23.

1.15 ELECTRICAL INSTALLATIONS

A. Coordinate electrical equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases, slots, and openings in other building components to allow for electrical installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

G. Install systems, materials, and equipment to conform to project requirements and approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.

H. Systems, materials, and equipment, which will be exposed in finished areas shall be installed level and plumb, parallel and perpendicular to other building systems and components.

I. Install electrical services and overhead equipment to provide the maximum headroom possible, where mounting heights are not detailed or dimensioned.

J. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. Maintain code clearances in front of and about all electrical equipment. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

K. Install electrical conduits and cabling in crawl space (interstitial space) as indicated on drawings and for lighting, fire alarm, mechanical equipment, and power circuits located in parking garage. Rough-in conduits for low voltage systems such as CCTV shall also be allowed in crawl space. All conduit and cabling routing shall be coordinated with all other trades.

L. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.

M. Include in the work all labor, materials, equipment, services, apparatus, drawings (in addition to the Contract Documents) as required to complete the intended work.

N. Only new, clean and perfect equipment, apparatus, materials and supplies of latest design and manufacture shall be incorporated in the work in order to assure an electrical system of high quality.

O. The work required to be done by the contractor, the utility companies and the owner, in order to obtain utility services such as telephone and electric, is delineated in these specifications and on the drawings. Unless otherwise noted, construction or connection charges (except for temporary power) by those companies shall be paid by the Owner.

1.16 CONNECTIONS TO EQUIPMENT AND APPLIANCES

A. In many instances the drawings show an outlet box and power supply for specific equipment, be it Owner or contractor furnished. It is to be understood, unless otherwise noted, that the work includes a connection from the box to the equipment or appliance. Verify circuit conductor quantities and sizes and overcurrent device number of poles and rating as well as any special grounding requirements, for all owner furnished equipment and adjust the required work accordingly.

1.17 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 01 Section "Cutting and Patching." In addition to the requirements specified in Division 01, the following requirements apply:
   1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
      a. Uncover Work to provide for installation of ill-timed Work.
      b. Remove and replace defective Work.
      c. Remove and replace Work not conforming to requirements of the Contract Documents.
      d. Remove samples of installed Work as specified for testing.
      e. Install equipment and materials in existing structures.
      f. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to,

removal of electrical items indicated to be removed and items made obsolete by the new Work.

2. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1.18 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer for the installation and application of sealers and access panels and access doors.

B. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

C. Provide UL Label on each fire-rated access door.

1.19 SEQUENCE AND SCHEDULING

A. Coordinate the shut-off and disconnection of electrical and communication services with the Owner and the utility companies.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B. Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, welded.

E. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout, recommended for interior and exterior applications.

F. Fasteners: Zinc-coated, type, grade, and class as required.

2.2 MISCELLANEOUS LUMBER

A. All lumber shall be fire treated.

B. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

C. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated but not less than 15/32 inches.

2.3 Concrete Bases:

1. Concrete: Portland cement mix, 3000 psi.
2. Cement: ASTM C 150, Type I.
   a. Fine Aggregate: ASTM C 33, sand.
   b. Coarse Aggregate: ASTM C 33, crushed gravel.
3. Fabric Reinforcement: ASTM A 185, welded-wire fabric, plain.
4. Reinforcement Bars: ASTM A 615, Grade 60, deformed.
5. Provide concrete bases where shown and outlined on drawings

B. Fire-stopping materials:

1. Products: Subject to compliance with project and Underwriters Laboratories requirements, provide materials by one of the following:
   a. 3M, unless otherwise required by the UL System to be used.

2.4 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

C. For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.

D. For gypsum wallboard or plaster: Perforated flanges with wallboard bead.

E. For full-bed plaster applications: Galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

F. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.

G. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

H. Locking Devices: Flush, screwdriver-operated cam locks.

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

1. Bar-Co., Inc.
2. J.L. Industries.
3. Karp Associates, Inc.
4. Milcor Div. Inryco, Inc.
5. Nystrom, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Install equipment and materials in accordance with manufacturer instructions and the requirements in Section 20 08 00 "Seismic Protection."

3.2 CONCRETE BASES

A. Provide concrete bases for all floor-mounted electrical equipment, except that stand alone dry type transformers with integral floor channels may be placed without equipment bases when located in finished areas and electrical closets.

B. Form concrete equipment bases using nominal 2 inch by 4 inch framing lumber (use larger framing if larger pads, such as for engine-generators are required) with form release compounds. Locate as indicated and construct 4 inches larger in both directions than supported unit. Except where otherwise indicated, pour bases 4-inches higher than surrounding slab. Anchor or key to floor slab in accordance with Section 200800 "Seismic Protection." Chamfer top edges and corners.

C. Install reinforcing bars, and place anchor bolts and sleeves using manufacturer's installation template.

D. Place concrete and allow to cure before installation of equipment.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.4 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.5 APPLICATION OF SEALERS

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

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

C. Apply rated firestopping sealants at all penetrations of fire and smoke walls; at all penetrations of floors and at other locations as noted on the drawings or where required by code. Consider walls that are common to different abutting buildings, to different additions to buildings, and to fire and smoke separations within buildings as requiring fire stopping sealant. Refer to architectural drawings. When in doubt, consult with Engineer or Architect.
   1. Submit the following approval before ordering materials for fire stopping:
      a. Fire stopping detail, including Underwriters Laboratories System Number, as listed in Volume 2 of the UL Fire Resistance Directory, for each different intended project application, such as cable tray penetration, conduit penetration, penetration of one-hour gypsum penetration, penetration of two hour concrete slab, etc.
      b. Fire stopping material manufacturer. This manufacturer must be listed in the applicable UL System Number detail.
      c. Submittals for approval by the engineer are not required for other items in this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the contractor from full compliance with the plans and specifications.

3.6 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the CM from full compliance with the plans and specifications.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with provisions of the following code:
   1. NFPA 70 "National Electrical Code:"
      a. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.
   2. UL Compliance: Provide components which are listed and labeled by Underwriters Laboratories under the following standards.
      a. UL Std. 83 Thermoplastic-Insulated Wires and Cables
      b. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
   3. NEMA and ICEA Compliance: Provide components which comply with the following standards:
      a. WC-5: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
      b. WC-7: Cross Linked Thermosetting
      c. Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
   4. IEEE Compliance: Provide components which comply with the following standard.
      a. Std. 82: Test procedures for Impulse Voltage Tests on Insulated Conductors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Insulated tap connector:
   1. Blackburn Series IPC
   2. Buchanon B-Tap

B. Spring Wire Connectors for AWG sizes Number 14 to Number 10 in dry locations:
   1. 3M Scotchlok Y, R, G, and B
   2. Ideal Wingnut
   3. Thomas & Betts Type PT

C. Threaded on Wire Connectors for AWG sizes Number 8 and larger:
   1. Raychem TCS (indoor)
   2. Raychem WCSM (exterior)

D. Spring Wire Connectors for AWG sizes Number 14 to Number 10 in wet and damp locations:
   1. King Technology "One-Step" Model King-4, 5, 6, 9 Silicone-Filled Safety Connectors

E. Below Grade Wiring Connectors:
   1. 3M In-Line Cold Shrink Splice.
   2. King Technology "One-Step" Model King-4, 5, 6, 9 Silicone-Filled Safety Connectors.

F. For connections of cables to buswork: Use two hole mechanical lugs if space allows, otherwise use one-hole lugs. Lugs to be Burndy universal terminal series KA, K2A or K3A as required or approved equal.
   1. Electrical Tape: Use 3M Super #88 electrical tape. 3M #33, #33+ or other tapes are not acceptable.

2.2 WIRES AND CABLES

A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.

B. Single Conductors for General Power and Lighting Circuits:
   1. Stranding: Provide solid conductors for lighting circuits and non-vibrating power utilization equipment utilizing Number 10 AWG and smaller and stranded conductors for Number 8 AWG and larger. Provide stranded conductors, regardless of size, for connections to vibrating equipment such as motors and transformers.
   2. Conductors of AWG Number 10 and smaller for lighting circuits and non-vibrating power utilization equipment may be stranded if used with devices, lugs and connectors specifically applicable for stranded conductors. Stranded conductors are not to be used with screw head binding, such as with side wired devices. Proper back-wired or pressure devices UL listed for stranded conductor termination must be used where stranded conductors are selected.
   3. Use stranded conductors for control circuits.

4. Conductor Material: Copper for all wires and cables.
5. Insulation: Provide XHHW or THHN or THWN insulation for all conductors. Provide XHHW or THWN for all conductors installed outdoors or underground
6. Color Coding for phase identification in accordance with Part 3 below.

C. Wiring for other systems such as fire alarm, paging, communications, etc., shall be as specified in those sections of these specifications.

PART 3 - EXECUTION

3.1 WIRING METHOD

A. Use the following wiring methods as indicated:
1. Wire: Install all wire in raceway, except in the following cases:
a. Low voltage conductors to systems such as communications and alarms in attic or crawl space cable tray.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical cables, wires, and connectors in compliance with NEC.

B. Coordinate cable installation with other Work.

C. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant where necessary.

D. Use pulling means including, fish tape, cable, rope, and basket weave wire and cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable. Do not exceed maximum tensile strength of conductor or grip. Do not exceed maximum sidewall pressure limitations of cables.

E. Conceal all cable in finished spaces.

F. Keep conductor splices to minimum.

G. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.

H. Use splice and tap connectors which are compatible with conductor material.

I. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than Number 10 AWG cabled in individual circuits. Make terminations so there is no more than 1/8 inch of exposed bare conductor at the terminal.

J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

K. Verify that interior of building has been protected from weather.

L. Verify that mechanical work likely to damage wire and cable has been completed.

M. Install products in accordance with manufacturer's instructions.

N. Use conductor not smaller than Number 12 AWG for power and lighting circuits.

O. Single conductors used for control circuits shall not be smaller than Number 14 AWG.

P. Feeder conductors shall be continuous and shall not contain splices.

Q. Neatly train wiring inside boxes, equipment, and panelboards. Observe NEC 310- 15 (b)(2)(a) adjustment factors.

R. Clean conductor surfaces before installing lugs and connectors.

S. Make splices, taps, and terminations to carry full ampacity of conductors.
   1. Install splices and taps which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced.
   2. Use splice and tap connectors which are compatible with conductor material.

T. Above grade:
   1. Use pre-molded insulated tap connectors for copper conductor splices and taps, Number 8 AWG and larger. Insulate with UL listed insulating cover supplied by same manufacturer as connector.
   2. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, Number 10 AWG and smaller.
   3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor, or three layers of tape, whichever is greater.

U. Below grade:
   1. Use specified insulated connectors suitable and approved for below grade wiring connectors. Ensure that conductors do not apply tension to splice.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Identify each conductor with its circuit Number or other designation indicated on Drawings.

3.5 FIELD QUALITY CONTROL

A. Inspect wire for physical damage and proper connection.

B. Measure tightness of bolted connections with properly scaled and calibrated torque tool and compare torque measurements with manufacturer's recommended values.

C. Before energizing, verify continuity and isolation of each branch circuit conductor.

D. Conductor Color Coding:
   1. Color code secondary service, feeder, and branch circuit conductors, as follows:

208Y/120 Volts	Phase	480Y/277 Volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green with yellow stripe

   2. Permanently post this identification table at all branch circuit panelboards.

E. Conductor Color Coding Methods: Use conductors with color factory-applied the entire length of the conductors except that the following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than Number 6 AWG.

F. For phase conductors:
   1. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 4 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1/2 or 3/4 inch-wide 3M Scotch #35 tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
   2. In lieu of pressure-sensitive tape, colored non-conductive cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

G. For neutral conductor:
   1. Same as for phase conductors except that three continuous white strips, factory applied, may be used. Cable ties not allowed.
   2. Neutral wires serving AFCI protected circuits requiring a dedicated neutral shall be white in color and include a permanent stripe or tracer with a color matching phase used.

H. For ground conductor:
   1. Same as for phase conductors except that cable ties are not allowed.

I. Prior to energizing, test wires and cables for electrical continuity and for short circuits.

J. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1.3 SUBMITTALS

A. Submittals for approval by the Engineer of products to be used are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the CM from full compliance with the plans and specifications.

B. Submit the following to the Engineer:
   1. Report of field tests and observations of the type indicated under Part 3 - Execution.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled for the specific purposes by Underwriter's Laboratories.

B. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code" (NEC).

C. UL Standard: Comply with UL 467, "Grounding and Bonding Equipment."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Erico Products, Inc.
   2. Ideal Industries, Inc.
   3. O-Z/Gedney Co.

2.2 GROUNDING AND BONDING PRODUCTS

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

B. Conductor Materials: Copper.

2.3 WIRE AND CABLE CONDUCTORS

A. General: Comply with Division 26 Section "Low-Voltage Electrical Power and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

B. Equipment Grounding Conductor: Copper, green insulated.

C. Grounding Electrode Conductor: Copper, stranded cable.

D. Bare Copper Conductors: Conform to the following:
   1. Solid Conductors: ASTM B-3.
   2. Assembly of Stranded Conductors: ASTM B-8.
   3. Tinned Conductors: ASTM B-33.

2.4 MISCELLANEOUS CONDUCTORS

A. Ground Bus: Bare annealed copper bars of rectangular cross section.

B. Braided Bonding Jumpers: Copper tape, consisting of braided No. 30 gage bare copper wire, terminated with copper ferrules.

C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.5 CONNECTOR PRODUCTS

A. General: Listed and labeled as grounding connectors for the materials used.
   1. Pressure Connectors: High-conductivity-plated units.
   2. Bolted Clamps: Heavy-duty units listed for the application.
   3. Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

2.6 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
   1. Size: 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATION

A. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.

B. Install separate insulated equipment grounding conductors with circuit conductors for all feeders and branch circuits.

C. Nonmetallic Raceways: Install an insulated equipment ground conductor in nonmetallic raceways containing power conductors.

D. Air Duct Equipment Circuits: Install an insulated equipment-grounding conductor to duct-mounted electrical devices operating at 120-V and above including air cleaners and heaters. Bond the conductor to each such unit and to the air duct.

E. Water Heater, Heat Tracing, and Anti-Frost Heater Circuits: Install separate insulated equipment ground conductor to each electric water heater, heat tracing, and surface anti-frost heating cable. Bond this conductor to heater units, piping, and connected equipment and components.

F. Underground Conductors: Bare, stranded copper except as otherwise indicated.

G. Signal and Communications: For telephone, alarm, and communication systems, provide a green insulated copper conductor in raceway from the grounding electrode system to each terminal cabinet or central equipment location. Size of the conductor shall be minimum #4 copper or as shown on drawings, whichever is larger.

H. Separately derived systems required by NEC to be grounded shall be grounded in accordance with the NEC.

I. Bond electrical system grounding, telephone, CATV, other communications systems, water piping, gas piping, and other piping systems together.

3.2 INSTALLATION

A. Ground Rods: Locate a minimum of three ground rods at two-rod lengths from each other and at least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade. Connect bare-cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated. Make these connections without damaging the copper coating or exposing the steel. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated.

B. Metallic Water Service Pipe: Provide insulated copper ground conductors, sized as indicated, in conduit from the building main service equipment, or the ground bus, to main metallic water service entrances to the building. Connect ground conductors to the main metallic water service pipes by means of ground clamps. Where a dielectric main water fitting is installed, connect the ground conductor to the street side of the

fitting. Install a grounding jumper around dielectric fittings. When the grounding electrode conductor is routed in metal conduit, bond the conduit to the conductor at each end.

C. Braided-Type Bonding Jumpers: Install to connect ground clamps on water meter piping to bypass water meters electrically. Use elsewhere for flexible bonding and grounding connections.

D. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

E. Bond interior metal piping systems and metal air ducts to equipment ground conductors of pumps, fans, electric heaters, and air cleaners serving individual systems.

3.3 CONNECTIONS

A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis.

B. Make connections with clean bare metal at points of contact.

C. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps.

D. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.

E. Coat and seal connections involving dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Exothermic Welded Connections: Use for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and plate electrodes. Comply with manufacturers written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

G. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus or lug in the housing. Bond conduits at both entrances and exits with grounding bushings and bare grounding conductors.

H. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

I. Compression-Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

J. Cable tray and ladder rack shall be bonded at all joints in the cable tray/ladder rack, to communications conduits, sleeves and the telecommunications grounding bus bar with #6 AWG bonding jumper.

3.4 FIELD QUALITY CONTROL

A. Tests: The maximum acceptable impedance to ground at the service entrance is 5 ohms. Subject the completed grounding system to a resistance test at each location where a ground resistance test is specified, and at service disconnect enclosure ground terminal, and at ground test wells. Measure ground resistance without the soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Notify the Engineer of the scheduled testing time at least 48 hours in advance of the scheduled test time. Perform tests by the fall of potential method in accordance with Section 9.03 of IEEE 81, "Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System."

B. Report: Prepare test reports of the ground resistance at each test location. Buried ground systems shall be tested before pavement is installed in order to allow for possible changes to the grounding system. Include observations of weather and other phenomena that might affect test results. Submit results of testing to the Engineer.

C. Deficiencies: When directed by the Engineer, modify the grounding system to reduce resistance values. Where measures are directed that exceed those indicated in the provisions of the Contract, covering changes will apply.

3.5 CLEANING AND ADJUSTING

A. Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work to their original condition. Include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Maintain disturbed surfaces and restore. Restore disturbed paving as indicated.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Refer to other Division 26 sections for additional specific support requirements that may be applicable to specific items.

1.3 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the CM from full compliance with the plans and specifications.

1.4 QUALITY ASSURANCE

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

B. Electrical components shall be listed and labeled for the specific intended purpose by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Slotted Metal Angle and U-Channel Systems:
      a. Allied Tube & Conduit
      b. American Electric
      c. B-Line Systems, Inc.
      d. Cinch Clamp Co., Inc.
      e. GS Metals Corp.
      f. Haydon Corp.
      g. Kin-Line, Inc.
      h. Unistrut Diversified Products

2. Conduit Sealing Bushings:
    a. Bridgeport Fittings, Inc.
    b. Killark Electric Mfg. Co.
    c. O-Z/Gedney
    d. Raco, Inc.
    e. Red Seal Electric Corp.
    f. Spring City Electrical Mfg. Co.
    g. Thomas & Betts Corp.

2.2 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.

2.3 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:
    1. Expansion Anchors: Carbon steel wedge or sleeve type.
    2. Toggle Bolts: All steel springhead type.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, between one and one half and two and one half inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

2.4 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:
    1. Interior Dry Locations: Fabricate from Schedule 40 galvanized steel pipe or Schedule 40 PVC plastic pipe.

2. Exterior or Interior Wet or Damp Locations: Fabricate from Schedule 40 PVC plastic pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:

D. Conform to manufacturer's recommendations for selection and installation of supports.

E. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.

F. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

G. Support parallel runs of horizontal raceways together on trapeze-type hangers.

H. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1 inch and smaller raceways serving branch circuits, telephone and data above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

I. Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.

J. Support exposed and concealed raceway within 3 feet of boxes, access fittings, device boxes, cabinets or other raceway terminations.

K. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

L. Vertical Conductor Supports: Install simultaneously with installation of conductors.

M. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

N. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. Provide insulated bushings at each end of sleeve. For sleeves through fire rated-wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

O. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

P. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, motor control centers, disconnect switches, and control components in accordance with the following:
   1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
   2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
   3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

TABLE I: SPACING FOR RACEWAY SUPPORTS

			Maximum Spacing of Supports (Feet)		
Raceway Size (Inches)	No. of Conduits in Run	Location	RMC & IMC*	EMT	RNC
1) HORIZONTAL RUNS					
1/2, 3/4	1 or 2	Flat ceiling or wall.	5	5	3
1/2, 3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7	7	--
1/2, ¾, 1	3 or more	Any location.	7	7	--
1 & larger	1 or 2	Flat ceiling or wall.	6	6	--
1 & larger	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	10	10	--
1 & larger	3 or more	Any location.	10	10	--
Any	--	Concealed.	10	10	--
2) VERTICAL RUNS					
1/2, 3/4	--	Exposed.	7	7	--
1, 1-1/4	--	Exposed.	8	8	--
1-1/2 and larger	--	Exposed.	10	10	--
Up to 2	--	Shaftway.	14	10	--
2-1/2	--	Shaftway.	16	10	--
3 & larger	--	Shaftway.	20	10	--
Any	--	Concealed.	10	10	--

*Maximum spacings for IMC above apply to straight runs only. Otherwise the maximums for EMT apply.

Abbreviations:
- EMT Electrical metallic tubing
- IMC Intermediate metallic conduit
- RMC Rigid metallic conduit
- RNC Rigid nonmetallic conduit

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES

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 SEISMIC REQUIREMENTS

A. Conform to requirements in Section 200800 "Seismic Protection."

1.3 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Raceways include the following:
1. Rigid metal conduit
2. Intermediate metal conduit
3. Rigid non-metallic conduit and duct
4. Electrical metallic tubing (EMT)
5. Flexible metal conduit
6. Liquidtight flexible conduit
7. Wireway
8. Surface raceways
9. Boxes, enclosures, and cabinets include the following:
    a. Device boxes
    b. Floor boxes
    c. Outlet boxes
    d. Pull and junction boxes
    e. Cabinets and hinged cover enclosures
    f. Conduit bodies

1.4 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the contractor from full compliance with the plans and specifications.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled by Underwriter's Laboratories for the specific purpose and comply with the 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.
   4. ANSI/NFPA 70 - National Electrical Code.
   5. NECA 1 "Standard practice of Good Workmanship in Electrical Construction (ANSI)."
   6. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   7. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
   8. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
   9. NEMA TC 6 - PVC and ABS Plastic Utilities Duct for Underground Installation.

C. Comply with NECA "Standard of Installation."

D. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. General: Provide conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.

B. Minimum Size: 3/4 inch, switch legs may be ½ inch minimum, and fixture heat whips may be 1/2 inch minimum.

2.2 METAL CONDUIT

A. Rigid Steel Conduit: Conduit to be seamless, hot dipped galvanized rigid steel. Threads to be cut and ends chamfered prior to galvanizing. Galvanizing to provide zinc coating fused to inside and outside walls of conduit. Provide an enamel lubricating coating on the inside of the conduit. Conduit to conform to ANSI C80.1 and listed and labeled under UL 6.

B. Rigid Aluminum Conduit: Conduit to be seamless, 6063 alloy, T-1 temper. Conduit to conform to ANSI C80.5 and listed and labeled under UL6.

C. Intermediate Metal Conduit: Conduit to be seamless, hot dipped galvanized rigid steel. Threads to be cut and ends chamfered prior to galvanizing. Galvanizing to provide zinc coating fused to outside walls of conduit. Provide an enamel lubricating coating on the inside of the conduit. Conduit to be listed and labeled under UL 1242.

D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit. Couplings for rigid steel conduit and IMC to be single piece threaded, cadmium plated malleable

iron. Conduit bodies may be aluminum. Couplings for rigid aluminum conduit to be of aluminum construction, 6063 alloy. Hubs for box connection to be two-piece with outer internally threaded hub to receive conduit and inner locking ring with bonding screw. Expansion fittings shall allow for a minimum of four inches of movement and shall be similar to O-Z Gedney AX series, complete with bonding jumpers and hardware.

E. Raintight Sealing Hubs: Two piece type with outer internally-threaded hub to receive conduit, inner locking ring with bonding screw, insulated throat, and V-shaped ring or O-ring .
   1. Manufacturers: Thomas & Betts H series or Bridgeport.

2.3 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Description: Interlocked steel or aluminum construction.

B. Flexible Metal Steel Conduit: Conduit to be constructed of spirally wrapped, convoluted hot dip galvanized steel strip. Zinc coating to cover both sides and all edges of steel strip. Convolutions to be interlocked to prevent separation when conduit is bent at radius equal to 4-1/2 times conduit O.D. Conduit to be listed and labeled under UL 1 - 1985.

C. Flexible Metal Aluminum Conduit: Conduit to be constructed of spirally wrapped, convoluted aluminum strip. Convolutions to be interlocked to prevent separation when conduit is bent at radius equal to 4-1/2 times conduit O.D. Conduit to be listed and labeled under UL 1 - 1985.
   1. Fittings: ANSI/NEMA FB 1 -1988.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT and FITTINGS

A. Liquidtight flexible metal conduit and fittings shall meet the same construction specifications as flexible metal conduit above and shall have an outer PVC jacket.

B. Liquidtight Flexible Metal Steel Conduit: Conduit to be listed and labeled under UL 360 - 1986.

C. Liquidtight Flexible Metal Aluminum Conduit: Conduit to be listed and labeled.

D. Liquidtight flexible conduit connectors to consist of body, cone (ferrule), sealing gland, and nut. Fitting to be UL 514B - 1987 listed for grounding. Body to be cadmium plated malleable iron and have male and female thread for attachment to box or conduit as required.

2.5 ELECTRICAL METALLIC TUBING (EMT) and FITTINGS

A. Description: Conduit to be seamless, hot dipped or electro-galvanized steel tubing. Galvanizing to provide zinc coating fused to outside walls of conduit. Provide an enamel lubricating coating on the inside of the conduit. Conduit to conform to ANSI C80.3 - 1983 and listed and labeled under UL 797 - 1983.

B. Provide steel set-screw type connectors and couplings for interior EMT fittings. Connectors and fittings to be cadmium plated, zinc plated steel, or malleable iron

fittings and include insulated throats. Die cast fittings, components, and indenter type couplings and connectors are not allowed.

C. Expansion fittings for use with EMT shall allow for a minimum of four inches of movement and shall be similar to O-Z Gedney TX series, complete with bonding jumpers and hardware.

2.6 CONDUIT BUSHINGS

A. Bushings for terminating conduits smaller than 1-1/4 inches are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation. Install insulated type bushings for terminating conduits 1-1/4 inches and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing. Bushings to have screw type grounding terminal.

2.7 RIGID NONMETALLIC CONDUIT AND DUCT

A. Description:
1. Rigid Non-Metallic Conduit: Conduit to be PVC, Schedule 40 or Schedule 80 as indicated, conforming to ANSI, NEMA specifications and be listed and labeled under UL 651. May be used in or under concrete slabs on grade and in exterior when concrete encased {3 in. minimum cover),

B. Fittings and Conduit Bodies:
1. Rigid non-metallic conduit connectors and couplings to be manufactured per NEMA TC-3 and UL 651 listed.

2.8 NONMETALLIC CONDUIT FITTINGS

A. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit, tubing type and material. Expansion fittings shall allow for six inch movement, and shall be similar to Carlon E945 series.

2.9 ELECTRICAL NONMETALLIC TUBING (ENT) and FITTINGS

A. Description: Tubing to be pliable corrugated PVC raceway of circular cross section, suitable for use in accordance with NEC Article 331. ENT to comply with NEMA TC 13 and listed under UL 1653.

B. Connectors and couplings shall be either snap-on type manufactured specifically for ENT or solvent-welded rigid nonmetallic PVC fittings. All connectors shall be concrete-tight without use of an external covering.

2.10 WIREWAYS

A. Material: Galvanized sheet steel sized as indicated or required, whichever is greater.
1. Wireway up to 6 inch by 6 inch cross section shall be minimum 16 gauge.
2. Wireway larger than 6 inch by 6 inch cross section shall be minimum 14 gauge.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion fittings, seismic connections, adapters, hold-down straps, end caps, and other fittings to match and mate with wireway as required for complete system.

C. Select features where not otherwise indicated, as required to complete wiring system and to comply with NEC.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.11 SURFACE RACEWAY

A. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceway.

B. Surface Metal Raceway: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating suitable for painting.

C. Reference standard: Wiremold 2400 series

2.12 OUTLET AND DEVICE BOXES

A. Outlet Boxes shall be constructed in accordance with National Electrical Code Article 370. Outlet boxes shall be sized for the volume required by the National Electrical Code, but in no case shall they be less than 1-1/2 inches deep.
   1. Indoor: Galvanized steel, knockouts as required.
   2. Exterior boxes or exposed interior wet or damp locations: Cast, deep type, corrosion proof fasteners, watertight, gasketed, threaded hubs.
   3. For suspended or surface-mounted fixtures:
      a. Outlet boxes shall be 4 inch octagonal or 4 inch square, in accordance with devices used. Furnish outlet boxes with fixture studs where required. Provide 4 inch octagonal and square outlet boxes for all exposed conduit work with fixture extension pan or deep fixture canopy to enclose the outlet box.
   4. For recessed fixtures:
      a. 4 inch octagonal or square. Minimum 1-1/2 inches deep and complete with blank cover.
   5. Provide corrosion-resistant steel knockout closures for unused openings.

B. Sheet Metal Boxes: NEMA OS 1. Boxes for receptacle, telephone and data outlets shall be 4-11/16 inches square by 2-1/8 inches deep and shall be provided with extension rings.

C. Sheet metal boxes for lighting fixtures shall be 4 inch octagonal or square according to fixture hardware requirements.. Boxes shall be at least 1-1/2 inches deep.

D. Cast Metal Boxes: NEMA FB 1, type FD, cast feralloy box with gasketed cover.

2.13 FLOOR BOXES

A. Floor Box: Cast metal, fully adjustable, rectangular.

2.14 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1. Flush-mounted boxes shall have an overlapping cover.

B. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

C. Surface-mounted boxes: Screw-on or hinged cover.

D. Covers shall be the same material as the box. Cover shall be on the largest access side of the box, unless otherwise indicated.

E. Boxes located outdoors above ground shall be raintight and gasketed cast aluminum.

F. Boxes located in the ground or in wet or damp locations shall be cast malleable iron having cadmium finish, unless otherwise indicated.

2.15 CABINETS AND ENCLOSURES

A. Hinged Cover Enclosures: Per NEMA 250, steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.

B. Cabinets: Type 1, per NEMA 250, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

2.16 CONDUIT BODIES

A. Cast metal of type, shape and size to fit location and conduit.

B. Constructed with threaded conduit ends, removable cover, corrosion-resistant screws.

2.17 UNDERGROUND WALL PENETRATION SEALS

A. New Walls: Seal assembly shall consist of a matched sleeve and seal assembly. Sleeve shall be model WS steel sleeve and seal shall consist of interconnected rubber links, which shall create a water-tight and gas-tight seal. Sleeves and seals shall be PSI-Thunderline “Link-Seal” model C.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of

the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Install equipment and materials in accordance with requirements in Section 200800 "Seismic Protection."

3.2 WIRING METHODS FOR 600 VOLTS AND LESS

A. Outdoor and Interior Wet and Damp Locations:
1. Underground Installations or under slab on grade: Use Schedule 40 PVC conduit a minimum of 3" below slab. Use rigid steel conduit for stub ups from slab and from below grade
2. Above Grade and Interior Wet and Damp Locations: Use rigid steel conduit. Provide spacers to maintain a minimum of 1/4 inch gap between the conduit and masonry and other surfaces detrimental to aluminum conduit.
3. Connections to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible Liquidtight flexible metal conduit.
4. Boxes and Enclosures: NEMA Type 3R or Type 4, unless noted otherwise on the drawings.

B. Dry Interior Locations:
1. Concealed in Walls and Ceilings: Use electrical metallic tubing unless noted otherwise on drawings.
2. Exposed: Unless otherwise indicated on the drawings, the following shall apply:
   a. Use rigid metal or intermediate metal conduit within 6 feet 0 inches of the floor in areas subject to physical damage such as mechanical areas, loading dock areas, generator rooms and storerooms. Electrical metallic tubing may be used above 6 feet 0 inches from the floor and where not subject to physical damage. Rooms dedicated solely to electrical equipment do not require rigid metal or intermediate metal conduit, unless required elsewhere in the documents or by code, such as for medium voltage circuits.
3. Connections to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquid-tight flexible metal conduit. Use Liquidtight flexible metal conduit where subject to oil drips or spray and all other areas which are not completely free of spray, vapor and liquids.
   a. Boxes and Enclosures: NEMA Type 1, unless noted otherwise on the drawings.
4. Concealed in Interstitial space (crawl space): Use nonmetallic conduit unless noted otherwise on drawings.

3.3 INSTALLATION

A. Do not reduce the indicated sizes of raceways.

B. Do not install any raceway in concrete slabs. Under slab conduits to be a minimum of 3" below slab.

C. Raceway routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system. Verify field measurements and routing and termination locations of raceway prior to rough-in. Raceways are not to cross pipe shafts, or ventilating duct openings, nor are they to pass through HVAC ducts. Support riser raceway at each floor level with clamp hangers. Maintain adequate clearance between raceway and piping.

D. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

E. Avoid moisture traps; provide junction box with drain fitting at low points in raceway system.

F. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender when field fabricated elbows are required for bends in metal conduit larger than 2 inch size.

G. Expansion:
   1. Provide suitable fittings to accommodate expansion and contraction where raceway crosses seismic and expansion joints. Install expansion fittings in the full open position if installed during a period of lowest expected temperature, and in the fully closed position if installed during a period of highest expected temperature. Install at proportionate intermediate position for intermediate temperatures.

H. In addition to the foregoing, provide expansion fittings according to the following table, for exposed linear runs or runs in hung ceiling cavities where such runs do not contain junction boxes, pull boxes, nor bends totaling more than 30 degrees:

Raceway Material	Indoor, conditioned areas	Outdoors and non-conditioned areas
Steel	One expansion fitting in runs longer than 80 feet, additional expansion fittings every 400 feet	One expansion fitting in runs longer than 40 feet, additional expansion fittings every 200 feet

I. Seismic:
   1. Whenever Specification Section “Seismic Protection” is included in these specifications, the following is also required for those life safety, emergency, fire alarms, etc., conduits that are defined therein. Details on the drawings, when shown, are intended to clarify or supplement these requirements:
      a. All expansion joints shall be considered seismic joints that can cause movement in any direction during a seismic event. Conventional expansion fittings are not adequate for this condition.
      b. For exposed conduit runs or runs above hung ceilings, provide a length of flexible metal conduit across the joint that will allow 2 inches of conduit movement in any direction. Length of the flexible section shall not exceed 6 feet.
      c. For conduit runs in the slab except slab on grade: On each side of the joint, turn the conduit down into a junction box on the underside of the slab or in the hung ceiling below. Provide a piece of exposed flexible metal

conduit connecting the boxes. Length of the flexible conduit shall not exceed 6 feet.

d. For slabs on grade: Do not install any conduit through the joint in this slab. Routing underground beneath the joint is permitted only for conduit routed from a point in the building to appoint beyond the perimeter of the building.

J. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

K. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

L. Install raceways level and square and at proper elevations. Provide adequate headroom. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

M. Complete raceway installation before starting conductor installation.

N. Use temporary closures to prevent foreign matter from entering raceway.

O. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

P. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

Q. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.

R. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

S. Run parallel or banked raceways together, on common supports where practical and make bends from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.

T. Raceways passing through exterior below-grade slabs:

1. New walls: Install sleeve unit before wall is poured and install rubber link sealing unit between wall sleeve and raceway after concrete has cured and raceway is run. Ensure that bolt heads remain accessible on inside of building wall.

U. Terminate rigid and IMC conduits in threaded hubs. Screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Use raintight sealing hubs with neoprene O-ring between exterior of enclosure and exterior half of hub where exposed to weather or other wet locations.

V. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less

than 12 inches of slack at each end of the pull wire. Test conduits required to be installed, but left empty, with ball mandrel. Clear any conduit which rejects ball mandrel.

W. Telephone, data, and cable TV System Raceways 2-Inch Trade Size and Smaller: In addition to the above requirements, install in maximum lengths of 150 feet and with a maximum of three 90 degree bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements. Raceways for telephone, data, and cable TV systems may be employed using NEC ENT tubing.

X. Do not use ENT tubing for any other work and systems except where allowed in the above paragraph.

Y. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings where conduits enter or leave hazardous locations, where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces, and other places indicated on the drawings or required by the NEC.

Z. Stub-Up Connections: Use type of conduit described for stub ups from slab. Extend conduit through concrete floor for connection to freestanding equipment to a distance 6 inches above the floor and transition to Liquidtight flexible conduit. Provide grounding bushing at equipment end of Liquidtight flexible conduit. Connect equipment grounding conductor run with the serving branch circuit to this grounding bushing, the box, and the equipment ground connection point for the piece of equipment served.

AA. Install conduit and provide sealant to preserve smoke partition using materials and methods under the provisions of Section 07 92 00 “Joint Sealants.”
1. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

BB. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use Liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

CC. Surface Metal Raceway: Install a separate green ground conductor in raceway from the junction box supplying the raceway to receptacle or fixture ground terminals. Install surface metal raceway with all necessary offsets, fittings, bends and boxes to comprise a complete system.
1. Select each surface metal raceway outlet box to which a lighting fixture is attached to be of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface metal raceway is used to supply a fluorescent lighting fixture having central stem suspension with a backplate and a canopy (with or without extension ring), the backplate and canopy will serve as the outlet box and no separate outlet box need be provided.

3. Provide surface metal raceway outlet box, in addition to the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end stem suspension.
4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed (provide a backplate slightly smaller than the fixture canopy), no additional surface mounted outlet box need be installed.

DD. Set floor boxes level and adjust to floor surface.

EE. Install hinged cover enclosures and cabinets plumb. Support at each corner.

FF. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

GG. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

3.4 BOXES AND CABINETS

A. Provide boxes as shown and for splices, taps, wire pulling, equipment and fixture connections and where required by applicable codes and installation practices.

B. Electrical boxes are shown on drawings in approximate locations unless dimensioned. The Engineer or Architect shall be allowed to adjust the location of boxes up to 10 feet in any direction without additional cost to the project. This is intended for boxes for receptacles and switches and other wiring devices.

C. Locate boxes to maintain headroom and present a neat appearance. Locate to allow proper access. Provide access doors for boxes located above inaccessible ceilings.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Support all boxes rigidly and independently of conduit except where specifically allowed by the National Electrical Code. Use supports suitable for the purpose.

F. Set floor boxes level and adjust to floor surface.

G. Outlet Boxes:
1. Flush-mount outlet boxes in finished areas. Outlets in mechanical rooms, electrical rooms, and the above removable ceilings may be surface-mounted.
2. Do not install boxes back-to-back in same wall. Provide at least 16 inch separation or greater where required by the building code. In hollow fire walls, maintain minimum 24 inch horizontal separation between outlets on opposite sides. Refer to detail 3, sheet E-8.01.
   a. Masonry walls:

1) Adjust position of outlets in finished masonry walls to suit masonry course lines where possible. Do not, however, violate maximum heights defined by accessibility codes such as ADA.
   a) Coordinate cutting in of walls to achieve neat openings for boxes. Locate boxes in walls so that only the corner need be cut from masonry units where possible.
2) Use multiple gang boxes where more than one device is mounted together. Provide barriers to separate different voltage systems.
3) Ensure that thermal insulation will be in place behind outlet boxes before installing them in insulated walls. Do not damage insulation.
4) For outlets mounted above counters, benches, or backsplashes, coordinate location and mounting heights with architectural details. Install with bottom of box minimum 2 inches above backsplash.
5) Adjust outlet mounting height and horizontal location to agree with required location for equipment served as may be shown on installation instructions or shop drawing for the equipment.
6) Position outlets to locate luminaries as shown on reflected ceiling drawings. For recessed boxes in finished areas, secure to interior wall and partition studs; allow for surface finish thickness.
7) Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

b. Pull and Junction Boxes:
1) Locate above accessible ceilings or in unfinished areas.
2) Support independent of conduit.
3) Locate pull or junction boxes to limit conduit runs to no more than 150 linear feet of four (4) 90 degree bends between pulling points. For telephone/ data limit bends to no more than three (3) 90 degree bends to pulling points.

H. Provide covers for all boxes.

I. Special care shall be taken to set all flush boxes square and true with the building finish. The edge of the cover shall meet the building finish or be no greater than 1/8 inch back from the finish surface. All wall outlets shall be rigidly secured to the stud system, using adjustable supports where necessary, to prevent all box movement.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to Engineer or Architect to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.

B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

C. Repair damage to PVC or paint finishes with matching touch-up coating recommended by the manufacturer.

3.6 CLEANING

A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

3.7 MARKING AND IDENTIFICATION

A. Mark and identify conduits in accordance with Section 26 05 53 “Identification for Electrical Systems.”

3.8 RECORD DOCUMENTS

A. Accurately record actual routing of all feeder and sub-feeder conduits regardless of size and branch circuits conduits larger than 2 inches.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:
   1. Buried electrical line warnings
   2. Identification labeling for raceways, cables, and conductors
   3. Operational instruction signs
   4. Warning and caution signs
   5. Equipment labels and signs

B. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.03 SUBMITTALS

A. Do not submit product data or shop drawings. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the CM from full compliance with the plans and specifications.

1.04 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Electromark - Wolcott, New York
   2. Ideal Industries, Inc.
   3. 3M
   4. Panduit Corp.
   5. Seton Name Plate Co.
   6. Thomas & Betts
   7. W. H. Brady, Co. - Signmark Division - Milwaukee, Wisconsin

2.02 ELECTRICAL IDENTIFICATION PRODUCTS

A. Indoor Pictogram Signs for Equipment and Doors to Electrical Equipment Rooms: Self adhesive, polyester, minimum 7 by 17 inch size.

B. Underground Line Marking Tape: Permanent, bright-colored, continuous-printed, plastic, tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend shall be indicative of general type of underground line below, such as "CAUTION - BURIED ELECTRIC LINE BELOW," "CAUTION - BURIED TELEPHONE LINE BELOW," etc. Tape shall have integral metallic facing or metallic core to allow locating buried tape with electronic detection equipment. Provide marking tape similar to Thomas & Betts NAF series.

C. Wire and Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable and conductor markers with preprinted numbers and letter.

D. Plasticized Card Stock Tags: Vinyl cloth with preprinted and field-printed legends to suit the application. Orange background, except as otherwise indicated, with eyelet for fastener.

E. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in black letters on white face and punched for mechanical fasteners.

F. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 10-32 stainless steel machine screws with nuts and flat and lock washers.

G. Cable Ties: Fungus-inert, self-extinguishing, nylon one-piece, self-locking cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a minimum temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color-coding.

H. Identification Cable Ties: Same as "Cable Ties" above, except with integral tab of suitable size for marking requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as required by code.

B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

C. Apply identification to areas as follows:
   1. Clean surface of dust, loose material, and oily films before painting.
   2. Prime surfaces: For galvanized metal, use single- component acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use

heavy-duty acrylic resin block filler. For concrete surfaces, use clear alkali-resistant alkyd binder-type sealer.
3. Apply one intermediate and one finish coat of orange silicone alkyd enamel.
4. Apply primer and finish materials in accordance with manufacturer's instructions.

D. Identify Raceways of Certain Systems with Color Banding: Band exposed or accessible raceways of the following systems for identification. Bands shall be pretensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors, and at 40-foot maximum intervals in straight runs. Apply the following colors:
1. Fire Alarm System: Red
2. Telecommunications: Blue

E. Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Legibly mark box covers with identity of contained circuits with contrasting color permanent marker.

F. Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground line marking tape located directly above each respective line at 6 to 8 inches below finished grade.

G. Conductor Color Coding for Conductors Rated 600 Volts and Less: See Specification Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

H. Tag or label conductors as follows:
1. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

I. Apply warning, caution, and instruction signs and stencils as follows:
1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with Owner approved legend where instructions or explanations are needed for system or equipment operation. Install fiberglass signs or outdoor items.

J. Install identification as follows:
1. Apply equipment identification nameplates of engraved plastic-laminate on each major unit of electrical equipment, including central or master unit of each electrical system. This includes communication, signal and alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), black lettering in white field. Text shall match terminology and numbering of the Contract Documents and shop drawings. All nameplates shall be mounted with rivets or

screws. Apply labels for each unit of the following categories of electrical equipment.

a. Fire alarm master station or control panel
b. Transformers
c. Electrical switchgear and switchboards
d. Motor starters, VFDs
e. Pushbutton stations
f. Contactors
g. Panelboards, electrical cabinets, and enclosures
h. Access doors and panels for concealed electrical items

K. Apply labels of engraved plastic laminate for disconnect switches, circuit breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm and signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items served by each individual switch and circuit breaker.

L. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

M. Nameplate Data: Provide permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

N. Service Disconnects: Provide permanent engraved sign with 2 inch high black lettering on white background clearly describing the location of all other service disconnecting means (retail services for buildings 1A and 1B) when the building is served by more than one source of electrical power. Locate signs at each power source's disconnect means.

O. Outdoor Electrical Equipment: Provide outdoor Pictogram type sign per above specifications, with the words "DANGER - HIGH VOLTAGE Hazardous Voltage. Will shock burn, or cause death. KEEP OUT." NEMA Mr. Ouch symbol shall be included. Install at all entrances to outdoor areas and every 20 feet along area fences, with at least one sign per side of fencing. Install on doors to equipment.

P. Fusible Switches: Install fuse manufacturer supplied labels inside the door of the fusible switch indicating the proper type and fuse required for replacement.

END OF SECTION

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

A. Submittals for approval by the engineer are required for this section. Provide catalog cuts and descriptive literature. Provide schedule with bill of material indicating the following for each panel: bus material, ampere and voltage ratings, overcurrent device sizes, poles and type, including spares. Indicate spaces. Indicate all short circuit ratings.

B. Provide two copies each of Product Data and Operation and Maintenance Data covering panelboards and panel board components to owner at completion of project.

1.3 SUMMARY

A. This Section includes:
   1. Lighting and Appliance Panelboards
   2. Power Distribution Panelboards

1.4 QUALITY ASSURANCE

A. Comply with the following standards.
   1. NEMA PB, "Panelboards"
   2. NEMA PB1.1 "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less"
   3. NEMA AB 1 "Molded Case Circuit Breaker and Molded Case Switches"
   4. UL 50 "Boxes and Cabinets"
   5. UL 67 "Electric Panelboards"
   6. UL 489 "Molded Case Circuit Breakers and Circuit Breaker Enclosures"
   7. Federal Specification W-C-375B/GEN "Molded Case Circuit Breakers"
   8. Federal Specification W-P-115C “Type I Class 1”

B. Warranty: Panelboard and components shall be warranted to be free from manufacturing defects for a period of one year after project acceptance by owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. GE Electrical Distribution & Control.
2. Square D; Schneider Electric.
3. Eaton; Cutler-Hammer

B. Manufacturers other than the above are not allowed.

2.2 PANELBOARDS

A. Ratings
1. 208/120 volt, 3 phase, 4 wire.
2. Continuous current as indicated on the drawings.
3. Unless a higher value is indicated in the panelboard schedules on the drawings, the minimum short circuit rating of the panelboard and each individual circuit breaker shall be 22,000 amperes symmetrical for 208Y/120V panelboards. Series rated panelboards will not be allowed. All panelboards shall be fully rated.

B. Enclosures and Trim
1. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements.
2. Dead front cabinets, flush or surface mounted as indicted.
3. Code gauge, galvanized steel tubs with minimum 4” clear gutters all sides. Minimum tub width 20” and depth 5”.
4. Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
5. Fronts shall be hinged 1-piece with door. Mounting shall be flush or surface as indicated on the drawings.
6. Locking type reinforced doors with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs. Doors over 48” high shall have 3 point latch and vault locks. All locks shall be master keyed cylinder to match the University’s standard “Best” key change
7. A clear plastic directory cardholder shall be mounted on the inside of door.
8. Permanent individual breaker pole numbers affixed adjacent to each breaker in a uniform position consisting of a stamped metallic or painted numeral.
9. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting spaces.

C. Interiors
1. All bussing shall be tin plated copper and run full for entire panel. Bus bar plating shall run the entire length of the bus bar.
2. Provide one continuous bus bar per phase. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67.
3. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
4. A neutral bar and ground bar assembly shall be provided and shall be mounted at opposite ends of cabinet from the mains. The assembly shall have the adequate number of terminals, of sufficient size and type of anti-turn solderless lugs. This assembly shall be factory bonded to a panel cabinet, and shall have conductor terminal screwdriver slots facing the front of the panel.

5. Terminals for feeder conductors to the panel board mains neutral and branch circuit breaker wiring shall be suitable for the type of conductor specified.

D. Main Circuit Breaker
1. Main circuit breakers shall have an overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
2. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select the desired trip level of all poles.
3. Breaker handle and faceplate shall indicate rated ampacity.
4. Circuit breaker escutcheon shall have ON/OFF markings.
5. Lugs shall be UL Listed to accept solid or stranded copper conductors. Lug body shall be bolted in place.

E. Branch Circuit Breakers
1. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the drawings.
2. Molded case branch circuit breakers shall have bolt-on type bus connectors.
3. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
4. The breaker handle shall reside in a position between ON and OFF for trip indication.
5. The exposed faceplates of all branch circuit breakers shall be flush with one another.
6. Lugs shall be UL Listed to accept solid or stranded copper conductors.
7. Ratings of breakers for lighting and general purposes receptacles shall be 20 ampere. Other sizes as required for loads.
8. Circuit breakers for 20 ampere branch circuits shall be HACR and SWD rated.
9. Breakers that feed heating, air conditioning and refrigeration equipment shall be listed as "HACR" type.
10. AFCI Circuit Breakers: 20 ampere, single-pole, configured for parallel and series-type arc fault protection per the NEC and in compliance with UL1699.
11. Ground Fault Circuit Interrupter Circuit Breakers: Unless noted otherwise, GFCI circuit breakers are to be UL Class A, intended for operation on circuits of 240 volts or less and tripping at no more than 6 mA of ground fault current.

2.3 IDENTIFICATION

A. Panelboard Nameplates: Engraved laminated plastic or metal nameplate for each panelboard shall be mounted with rivets or screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install panelboards and accessory items in accordance with NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less" and manufacturers' written installation instructions.

B. Mount top of wall mounted cabinets 6’-0” above floor, except as indicated. Align top edges of panelboard covers where multiple panelboards are installed in the same general area.

C. Coordinate location of recessed panels to be accessible and to avoid interference with other equipment and trades.

D. The position of breakers in each panel shall be arranged in the field for sequence phasing by this Contractor to best suit wiring condition and balancing of phases.

E. Fill in, type written, the directory of each branch circuit panel board using final building room numbers, not architectural drawing room numbers. Panels updated for renovations shall follow the same procedure. Correct/update actual, present building room numbers where circuits for existing rooms are involved in a renovation project.

F. Mounting: Plumb and rigid without distortion of box. Mount flush panels uniformly flush with wall finish.

G. Install filler plates in unused spaces.

H. Stub six (6) ¾” empty conduits from flush/recessed panels into accessible ceiling space or space designated to be ceiling space in future. Ream and bush ends.

I. Wiring in Panel Gutters: Train conductors neatly in groups, bundle, and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs in accordance with Division 26 Section "Identification for Electrical Systems."

B. Panelboards connected to normal power shall be provided with an engraved nameplate with black field and white lettering.

C. Panelboards connected to emergency power shall be provided with an engraved nameplate with red field and white letters.

D. Nameplates shall be formatted as follows.

L&PP-1-4-N
208/120V, 3 Phase, 4 Wire
Fed from Main Distribution Panel

3.3 GROUNDING

A. Connections: Make equipment grounding connections for panelboards as indicated.

B. Provide ground continuity to main electrical ground bus indicated.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 CLEANING

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

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes various types of receptacles, connectors, switches, and finish plates.

1.03 SUBMITTALS

A. Submittals for approval by the Engineer are not required for this section. Unrequested submittals will not be processed or reviewed. Non-requirement of submittals is not to be construed as an allowance for substitutions and does not relieve the CM from full compliance with the plans and specifications.
   1. Sample: Submit sample of receptacle plate or switch plate.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70 - "National Electrical Code" for devices and installation.

B. Comply with UL 498 - “Attachment Plugs and Receptacles.”

C. Comply with UL 943 - “Ground-Fault Circuit-Interrupters.”

D. Listing and Labeling: Provide products which are listed and labeled by Underwriter's Laboratories for their applications and installation conditions and for the environments in which installed.

1.05 COORDINATION

A. Wiring Devices for Owner-Furnished Equipment: Match devices to plug connectors for Owner-furnished equipment.

B. Cord and Plug Sets: Match cord and plug sets to equipment requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Wiring Devices:
    a. Leviton
    b. Hubbell Inc.
    c. Pass & Seymour/Legrand
2. Not Used:
3. Vacancy Sensors:
    a. Watt-Stopper
    b. Sensor Switch
    c. Leviton
    d. Lutron
    e. Hubbell
4. Poke-Through, Floor Service Outlets, and Telephone/Power Poles:
    a. Hubbell, Inc.
    b. Wiremold Co.
    c. Thomas & Betts
5. Device Enclosures for Outdoor and Other Wet and Damp Locations:
    a. Pass & Seymour
    b. Leviton, Inc.
    c. Hubbell

2.2 WIRING DEVICES

A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices" and NEMA Standard WD6 “Wiring Device Dimensional Requirements.”

B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.

C. Color:
1. Normal Power - Ivory except as otherwise indicated or required.
2. Standby Power - Gray except as otherwise indicated or required.
3. Life Safety Power - Red except as otherwise indicated or required.

D. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide UL labeling of devices to verify these compliances. Provide straight blade receptacles per table on the following page.

E. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498, UL 1449, IEEE 587 and Federal Spec W-C 596.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
    a. Cooper.
    b. Hubbell.
    c. Leviton.
    d. Pass & Seymour; (reference standard: TR5362).

STRAIGHT BLADE DUPLEX RECEPTACLES						
APPLICATION	SPECIFICATION	ARROW HART	BRYANT	HUBBELL	LEVITON	PASS & SEYMOUR
Specification Grade	UL 498, Fed Spec. WC 596	*	*	HBL5362	*	*
Heavy Duty GFI	UL 943, UL 498, Fed. Spec. WC 596G	*	*	GF20	*	*

Duplex, straight blade devices, 120 volt, 20 amperes. All shall comply with Federal Specification W-C-596, NEMA configuration 5-20R.
*See reference standard.

F. Locking or special type to be of NEMA configuration called out for the specific application on the drawings.
   1. Type “A” to be a NEMA type 6-20R
   2. Type “B” to be a NEMA type L6-30R
   3. Type “C” to be a NEMA type 6-15R
   4. Type “D” to be a 60 amp pin and sleeve connector/receptacle (Mass Spectrometer)
   5. Type “E” to be a European type (Relocated from Culler Hall by the CM)
   6. Type “F” to be a NEMA type 5-30R
   7. Type “R” to be disconnected and relocated from Culler Hall

G. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.
   1. Cord: Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor shall have green insulation. Minimum ampacity of cord shall be equipment rating plus 25 percent minimum.
   2. Plug: Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.

H. Snap Switches: Quiet-type A.C. switches, Underwriter's Laboratories listed and labeled as complying with UL Standard 20 "General Use Snap Switches, 20A, 277v.

I. Cover Plates for Interior Wiring Devices: Single and combination types that mate and match with corresponding wiring devices. Features include the following:
   1. Color/material: Stainless steel with brushed nickel satin finish

J. Device Enclosures for Outdoor and Other Wet and Damp Locations: Enclosure shall be suitable for wet locations while in use in accordance with Article 410-57 (b) and listed and labeled for the specific use by Underwriter's Laboratories. Enclosure shall be clearly and visibly marked by the factory with the wording "Suitable For Wet Locations While In Use." Enclosure shall be non-metallic with hinged clear cover and integral key operated cover lock. Cover to have two exit holes for up to 3/8 inch diameter cords with holes located at bottom of cover. Provide cover with device opening matched to type of wiring device used - e.g., duplex receptacle, GFCI receptacle, and toggle switch.

K. At CM's option, receptacles having plug tail connectors consisting of a female at the receptacle and a matching male on the pigtail are acceptable provided that the ratings listings and other portions of this specification apply. The receptacle shall have no exposed parts or wiring when the mating connector is installed.

2.3 VACANCY SENSORS

A. General:
1. All vacancy sensors shall be UL listed and shall meet the energy code requirements of the area in which they are to be installed. All vacancy sensors shall be manufactured by the same single manufacturer.
2. Install all vacancy sensors in accord with manufacturer's recommendations.
3. The CM and manufacturer shall select units with the required contact voltage and current ratings as required for the lighting load the sensor is to control, taking into account the nature of the load, i.e., incandescent, inductive, etc.
4. In addition, select sensors to cover the physical area in which they are to be installed. This might mean using large area units or multiple units in a given space. When necessary, provide interconnecting wiring between units, relays and manufacturer's control units where required. These accessories are not shown or specified but shall be provided where the physical conditions of the room or the electrical requirements of the load so necessitate.
5. Make all adjustments for each vacancy sensor for light level, sensitivity and time delay in coordination with and to suit the needs and requirements of the Owner. Tilt and adjust adjustable units for maximum coverage.
6. For all units but especially for non-standard room shapes, such as in the case of long narrow rooms or hallways, select units with the appropriate field of view, standard or long range lenses, wide angle lenses, linear coverage, etc., all as required to suit the application.
7. Coordinate the exact locations and mounting heights of adjustable wall units with the conditions on the wall, with other devices and equipment on the wall and with manufacturer's recommendations. For ceiling mounted units, coordinate with other ceiling mounted equipment and with reflected ceiling plans.
8. Models numbers listed below are shown for basis of design. Equal manufacturer's shall be Hubbell and Leviton.

B. Not Used.

C. Not Used.

D. Not Used.

E. Digital Timer (Janitor, storage closets and other similar areas:
1. Programmable digital timer with on-off switch, LCD display, adjustable time out settings (0 to 12 hours), adjustable time scroll on/off settings, flash and beeper warning indications of impending time out. Rated for 120/277 volts, 800 or 1200 watts as required. Suitable for mounting in a standard outlet box. Ivory housing and stainless steel coverplate. Watt Stopper TS-400. Provide 3-way digital timers where shown on plans. Provide wiring per manufacturer's instructions.

F. Sensor (Interior corridors):

1. Ceiling mounted, suitable for mounting to a standard outlet box, employing dual ultrasonic and passive infrared technology, 360 degree coverage, suitable for 24-volt operation, suitable for use with electronic ballasts and LED drivers, possessing immunity to EMI and RFI, adjustments for light level, time delay and sensitivity. Provide ivory units. Manufacturer to select angle coverage, range, number of sensing sides and other necessary parameters to suit the conditions and size of the space. Watt-Stopper DT-300 Series Ceiling Occupancy. Provide power packs as required. Provide auxiliary relay for control signal “ON” initiation to the Building Automation System (BAS) relay. Provide a separate “hot” conductor to the corridor occupancy sensors, bypassing the BAS relay, to maintain power to occupancy sensor(s) when the BAS relay is “open” (i.e. when the lighting is “off”).

EXECUTION

3.01 INSTALLATION

G. Install devices and assemblies plumb and secure.

H. Install wall plates when painting is complete.

I. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

J. Protect devices and assemblies during painting.

K. Adjust locations at which floor service outlets and telephone and power service poles are installed to suit the indicated arrangement of partitions and furnishings.

L. Unless noted otherwise, occupancy sensors in bathrooms to be set for 30 minute delay and all other occupancy sensors to be set for to be set for 20 minute delay.

3.02 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."
   1. Switches: Where 3 or more switches are ganged, and elsewhere where indicated, identify each switch with approved legend engraved on wall plate.
   2. Receptacles: Identify the panelboard and circuit number from which served. Mark on inside face of coverplate.

3.03 FIELD QUALITY CONTROL

A. Testing: Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 6 times.

B. Test ground-fault circuit interrupter operation according to manufacturer recommendations.

C. Replace damaged or defective components.

3.03 CLEANING

A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

SECTION 26 51 00

LIGHTING FIXTURES

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. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:
1. Division 26 Section "Wiring Devices" for occupancy sensors.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. LED: Light Emitting Diode

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
    1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    2. Wiring Diagrams: For power, signal, and control wiring.

C. Installation instructions.

D. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

E. Field quality-control reports.

F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
    1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

G. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

E. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.
   1. Obtain Architect's approval of fixtures for mockups before starting installations.
   2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
   2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for LED Luminaires: Manufacturer's standard form in which manufacturer of LED luminaire agrees to repair or replace components of LED driver that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for LED Luminaires: 5 years from date of Substantial Completion.

1.8 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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least two of each type.
   2. Plastic Diffusers and Lenses: One for every 50 of each type and rating installed. Furnish at least one of each type.
   3. Generator Transfer Device (GTD): One for every 20 GTD’s provided.
   4. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
   5. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements indicated on the lighting fixture schedule sheets E-2.60 and E.2.61.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:
   1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
      a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
      b. UV stabilized.
   2. Glass: Annealed crystal glass unless otherwise indicated.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp and ballast characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter code (T-4, T-5, T-8, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
      c. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
      d. ANSI ballast type (M98, M57, etc.) for HID luminaires.
      e. CCT and CRI for all luminaires.

H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:
   1. Comply with UL 935 and with ANSI C82.11.
   2. Designed for type and quantity of lamps served.
   3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
   4. Sound Rating: Class A
   5. Total Harmonic Distortion Rating: Less than 10 percent.
   6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
   7. Operating Frequency: 42 kHz or higher.
   8. Lamp Current Crest Factor: 1.7 or less.
   9. BF: 0.88 or higher unless otherwise noted on lighting fixture schedules
   10. Power Factor: 0.95 or higher.
   11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Electronic Programmed Rapid-Start Ballasts for T5, T8 Lamps: Comply with ANSI C82.11 and the following:
   1. Automatic lamp starting after lamp replacement.

C. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
   1. Lamp end-of-life detection and shutdown circuit.
   2. Automatic lamp starting after lamp replacement.
   3. Sound Rating: Class A.
   4. Total Harmonic Distortion Rating: Less than 20 percent.
   5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
   6. Operating Frequency: 20 kHz or higher.
   7. Lamp Current Crest Factor: 1.7 or less.
   8. BF: 0.95 or higher unless otherwise indicated.
   9. Power Factor: 0.95 or higher. except fixtures in apartment units may use low-power-factor electronic ballasts
   10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

2.5 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
   2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
   3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
      a. Battery: Sealed, maintenance-free, nickel-cadmium type.
      b. Charger: Fully automatic, solid-state type with sealed transfer relay.
      c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
      d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
      f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
      g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 FLUORESCENT LAMPS

A. Flourescent Lighting Alternate Only: T8 rapid-start lamps, rated 25 W maximum, nominal length of 48 inches 2800 initial lumens (minimum), CRI 82 (minimum), color temperature 4100 K, and average rated life 20,000 hours unless otherwise indicated.

B. Flourescent Lighting Alternate Only: T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches 1300 initial lumens (minimum), CRI 82 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.

C. Flourescent Lighting Alternate Only: T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated

D. Flourescent Lighting Alternate Only: T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100K, and average rated life of 20,000 hours unless otherwise indicated.

E. Flourescent Lighting Alternate Only: Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 41K, average rated life of 10,000 hours at three hours operation per start unless otherwise indicated.
   1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
   2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
   3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
   4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).

5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.7 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:
1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Associate, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
1. Install ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

D. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION

SECTION 27 10 00

COMMUNICATIONS EQUIPMENT AND CABLING

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. This Section includes the following types of control and signal transmission media.
   1. Optical fiber cable
   2. Coaxial cable
   3. Twisted-pair cable
   4. Connectors, terminations and couplers

1.3 SUBMITTALS

A. General: Submittals for approval by the Cabling Contractor are required for all cabling and equipment covered by this section.

B. Cabling Contractor shall submit with their bid the following information:
   1. A record of RCDD on staff.
   2. A Manufacturer Certification for the system solution bid, issued directly in the bidder's company name, valid for the time frame in which the installation will be completed.

C. Submit the following to the Engineer and Miami University IT Services according to Conditions of Contract and Division 01 Specification Sections.
   1. To be submitted after installation of cabling and equipment:
      a. Field test reports indicating and interpreting test results.

D. Miami University IT Services requires the following Job Site Inspections and Reviews with the Cabling Contractor.
   1. Pre−Cabling Pathways inspection
   2. TR Room Layout & Cabling Routing Review
   3. Cable Label Review (Cabling Contractor to provide label sample)
   4. Cabling Rough−In Inspection
   5. Final Review and TR Turnover

E. After Miami University IT Services has Network Electronics installed, tested and operational the Cabling Contractor shall install & label the Wireless Access Points (WAPs) provided by the Owner, and provide a drawing marked up with WAP locations and MAC addresses.

F. Submit the following to the Owner as soon as the installation of the cabling and equipment is complete:
   1. Provide as-built drawing electronically in AutoCad format as well as two copies of record drawings of completed project showing cable runs and location numbers assigned to rooms.
   2. Transfer to Miami University IT Services the manufacturer’s warranties in addition to the general system warranty.

1.4 QUALITY ASSURANCE

A. Only installers trained and certified by the proposed manufacturer shall be allowed to install products. The Cabling Contractor shall be Panduit, General and Corning Certified Warranty providers with full 25-year warranty provided at project completion. Reference appendix C for approved Cabling Contractors.

B. Cabling Contractor shall schedule and conduct a coordination meeting with Miami University IT Services to confirm and coordinate scope of work requirements prior to commencement of work. Project meetings shall be scheduled through the Project General Construction Manager.

C. Miami University reserves the right to reject any unregistered or uncertified installers performing work for which they are not registered/certified. The Cabling Contractor shall be responsible for any loss of work, delays in schedules, or extra cost as a result of the use of unregistered/uncertified workers. Additional effort on the part of the Cabling Contractor to maintain the installation schedule as a result of the above mentioned loss time shall be the Cabling Contractor's responsibility and at the Cabling Contractor's additional expense.

D. Standards are based on NFPA 70 (NEC), National Electrical Safety Code (NESC), Institute of Electronic and Electrical Engineers IEEE, ANSI/TIA/EIA Telecommunication Standards, and BICSI methodologies. The requirements within those documents are not superseded unless specifically stated. As required, NEC and NESC code requirements cannot be superseded by this document at any time. ANSI/TIA/EIA standards and BICSI methodologies may be superseded, as specified, or may be made stricter by this document. The absence of a specific reference to an element of these codes, standards, and methodologies does not relieve all parties of compliance with them.

E. All new materials, equipment, and installation practices shall comply with accepted standards of workmanship as recognized by:
   1. Building Industry Consulting Service International (BICSI)
      a. Telecommunications Distribution Methods Manual (TDMM) most recent, edition.
      b. Information Transport Systems Installation Manual most recent edition.
      c. Miami University Outside Plant Design Manual (CO−OSP) most recent, edition.

F. Modifications made to the existing copper OSP cabling and fiber optic entrance shall be performed by the Cabling Contractor providing the warranty on the cables.

1.5 WARRANTY

A. The Cabling Contractor shall be Panduit, General and Corning Certified Warranty providers with full 25-year warranty provided at project completion. Reference appendix C for approved Cabling Contractors.

B. Post-System Warranty Maintenance Service:
   1. Miami University shall reserve the right to elect or cancel at any time any maintenance service to be provided by the Cabling Contractor.
   2. Warranty of On-Site Response: Regardless of the cause of the problem, the Cabling Contractor shall ensure that parts, equipment, and materials are available to remedy the problems and its personnel are ready to begin work (such action being deemed a "response")
   3. Warranty of Security: Cabling Contractor shall warrant that its personnel, including all subcontractors, shall at all times comply with all Miami University security regulations of which contractor has been informed by Miami University. Cabling Contractor also warrants that it has obtained all necessary licenses and permits required by federal, state and local government.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Reference brands and part numbers listed herein are basis of design. Voluntary alternates shall meet or exceed specifications for the items listed. Acceptance of products, other than those listed as approved shall be at the sole discretion of Miami University IT Services.

B. All approved brands and part numbers shall be listed in Appendix B at the end of this document.

2.2 GROUNDING AND BONDING

A. Bus Bars for Communications (BICSI Pattern)
1. Approved Manufacturers: Panduit Corporation
2. Approved P/N's for PBB (Primary Bonding Busbar), SBB (Secondary Bonding Busbar) and RBB (Rack Bonding Busbar) may be found in Appendix B.

B. H−TAPs kits for Communications
1. Approved Manufacturers: Panduit Corporation
2. Approved P/N's for H−TAPs may be found in Appendix B.

C. RBCs (Rack Bonding Conductors) for Communications
1. Approved Manufacturers: Panduit Corporation
2. Approved P/N's for RBCs may be found in Appendix B.

D. UBCs (Unit Bonding Conductors) for Communications
1. Approved Manufacturers: Panduit Corporation
2. Approved P/N's for UBCs may be found in Appendix B.

E. ESD (Electro−Static Discharge) for Communications
1. Approved Manufacturers: Panduit Corporation
2. Approved P/N's for UBCs may be found in Appendix B.

2.3 HANGERS AND SUPPORTS

A. Approved Manufacturers: Panduit Corporation
1. J−Mod and J−Pro Cable Support System.

2.4 IDENTIFICATION

A. Approved Manufacturers: Panduit Corporation

B. All labeling conventions and products shall be in compliance with ANSI/TIA/EIA−606−B, Administration Standard for Commercial Telecommunications Infrastructure.

2.5 FIRESTOPPING DEVICES

A. Approved Manufacturers: STI, E−Z Path Series

B. The approved pathway through wall penetrations, up to 8 inches thick, is the E−Z Path (sleeve system) by STI. The Contractor shall identify penetration points for horizontal cabling, but must obtain pre−approval from the electrical engineer prior to installation.

C. For cable tray penetrations through rated walls, intumescent firestop pillows shall be installed. E−Z Path Series SSB Firestop Pillows or the equivalent.

D. For floor penetrations thicker than 8 inches, the use of metallic conduit shall be approved. Metallic conduit sleeves shall be 4 inches minimum. The electrical engineer shall preapprove the size, quantity, and locations of the pathways. Refer to Division 26.

2.6 COMMUNICATIONS ENTRANCE PROTECTION

A. Approved Manufacturers: Porta Systems

B. Building Entrance Terminals
   1. Multi-pair indoor protector packs shall be constructed of metal housing with fire resistant plastic connecting block containing mountings for twenty-five (25) gas tube protector modules.
   2. Panels shall comprise a 66-block form factor for side-by-side and top-to-bottom installation and shall be mounted on a 66-block bracket. Both input and output terminations shall be 66-style.

2.7 COMMUNICATION RACKS AND FRAMES

A. Approved Manufacturers: Panduit Corporation, CPI

B. Approved P/N's for Racks and Frames may be found in Appendix B.

2.8 COMMUNICATION TERMINATION BLOCKS AND PATCH PANELS

A. Termination Blocks for copper horizontal "analog" station
   1. Approved Manufacturers: Emerson Network Power
   2. Approved P/N's for Termination Blocks may be found in Appendix B.

B. Patch panels for copper horizontal "data/voice/video" station cabling (at main communications room(s) and telecommunications room(s):
   1. Approved Manufacturers: Panduit Corporation
   2. Approved P/N's for Patch Panels may be found in Appendix B.

2.9 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

A. Cable Management
   1. Vertical Cable Management for Racks/Frames
      a. Approved Manufacturers: CPI
      b. Approved P/N's for Vertical Cable Management may be found in Appendix B.
   2. Horizontal Cable Management for Racks/Frames.
      a. Approved Manufacturers: Panduit Corporation
      b. Approved P/N's for Horizontal Cable Management may be found in Appendix B.

B. Ladder Rack and Accessories
   1. Approved Manufacturers: CPI, Homaco
   2. Approved P/N's for Ladder Rack and Accessories may be found in Appendix B.

2.10 COMMUNICATIONS COPPER BACKBONE CABLING

A. Copper Backbone Cabling − Intra−building
   1. Approved Manufacturers: General Cable, Commscope, Superior Essex
   2. Approved P/N's for Copper Backbone Cabling − Intra−building may be found in Appendix B.

B. Copper Backbone Cabling − Inter−building (OSP)

1. Approved Manufacturers: General Cable, Commscope, Superior Essex
2. Approved P/N's for Copper Backbone Cabling − Inter−building (OSP) may be found in Appendix B.

C. Copper Backbone Splicing − Inter−building Only (OSP)
1. Approved Manufacturers: General Cable
2. Approved P/N's for Copper Backbone Cabling − Inter−building (OSP) may be found in Appendix B.

2.11 COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

A. Optical Fiber Backbone Cabling
1. Approved Manufacturers: Corning
2. Approved P/N's for Optical Fiber Backbone Cabling may be found in Appendix B.

B. Optical Fiber Connectors
1. Approved Manufacturers: Corning
2. Approved P/N's for Optical Fiber Connectors may be found in Appendix B.

C. Distribution Panels for Optical Fiber Backbone Cabling:
1. Approved Manufacturers: Corning
2. Corning Optical Fiber Distribution Panels shall be CCH series.
3. Approved P/N's for Distribution Panels for Optical Fiber Backbone Cabling may be found in Appendix B.

2.12 COMMUNICATIONS HORIZONTAL CABLING

A. Approved Manufacturers:
1. Category 6A: General Cable − Blue in color (#7132850, #7133850)
2. Category 6A: Panduit − Blue in color (PUR6A04BU-UG, PUP6A04BU-UG)
3. Category 6: General Cable − White in color (#7133901, #7131901)

2.13 COMMUNICATIONS FACEPLATES AND CONNECTORS

A. Faceplates
1. Approved Manufacturers: Panduit Corporation, Randl
2. Approved P/N's for Faceplates may be found in Appendix B.

B. Copper Connectors
1. Approved Manufacturers: Panduit Corporation
2. Approved P/N's for Copper Connectors may be found in Appendix B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine raceways and other elements to receive cable for compliance with installation tolerances and other adverse conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General
1. All communications pathways and cable supports shall be sized and installed to accommodate Category 6A cabling.

B. Grounding and Bonding
   1. Bus Bars
      a. All communications spaces including, but not limited to Main Communications Room (MCR) and Telecommunications Room (TR) shall require a Primary Bonding Busbar (PBB) or Secondary Bonding Busbar (SBB).
      b. The PBB/SBB shall be bonded to an appropriately sized Bonding Conductor for Telecommunications (BCT) bonding conductor as well as to the Telecommunication Bonding Backbone (TBB) using two-hole compression connectors.
      c. Location of the position of the PBB/SBB shall be determined by owner.
   2. Conductors
      a. Route conductors on short direct paths that have minimum resistive and inductive impedance as follows:
         1) Bonding conductors shall be routed with minimum bends or changes in direction.
         2) Minimum of 8−inch bend radius and/or 10x the diameter of the conductor is to be maintained.
         3) Bonding connections shall be made directly to the points being bonded.
         4) Bonding conductors shall be continuous and void of splices.
      b. Bus bars may be bonded to structural steel as a telecommunications bonding backbone. Impedance testing shall be required to confirm potential steel within entrance facilities and communications spaces as being properly grounded and available for use as a grounding conductor.
      c. Structural steel used as lightning down conductors shall not be used as a TBB.
      d. Furnish and install a conductor from any bus bar to metallic cold water pipes within the room.
      e. Sizing of TBB will be per Table 1 in Appendix A.
   3. Bonding
      a. Furnish and install bonding conductors from all telecommunications bus bars to any electrical service panels, structural steel, and cold water pipes within the MCR, TR(s), EF, and any other information transport systems distribution spaces.
      b. Self-tapping screws, or any other type of screw, shall not be used to form bonds or attach grounding hardware. All specified bonds shall be irreversible compression connectors.
      c. Test all grounding conductors for resistance:
         1) 1) < 0.1 ohm
      d. Test all grounding conductors for current:
         1) AC: </= 1 A
         2) 2) DC: </= 500ma
      e. Bonding shall be per Figure 1 in Appendix A.

C. Hangers and Supports
   1. Communications cabling shall be contained within a combination of open spaces, enclosed conduits, raceways, and cable pathways and physical layouts. These pathways are designed to provide the capacity to properly install high performance communications cabling for present and future applications.
   2. Cables shall be neatly routed and bundled above the suspended ceiling structure in bundles limited to a quantity of cables as per manufacturer specifications and installation practices for Category 6A or F/UTP as applicable to the media being installed. High performance sling−type supports shall be used for adds/moves/changes or low cable count pathways.
   3. High performance J−Hook supports shall also be used.
   4. Suspended ceiling support wires shall not be used for cabling support. Cables shall not be laid directly on ceiling tiles or rails. Cables placed in hangers in the ceiling area shall be routed high and away from all other electrical and mechanical systems so as to avoid

contact with light fixtures, ventilation ducts, sprinkler system or plumbing piping, motors or any other electrical devices.

5. The maximum separation between support points for all cabling shall be five (5) feet.
6. All cable pathway support elements shall be certified by the manufacturer for a high performance twisted pair installation, when applicable. In all cases, support products shall be approved for the support of Category 6A or higher cables, including optical fiber.

D. Cable Routing, Separation, and Distance

1. Whenever possible, primary cable routing paths shall follow the logical structure of the building. When a wall must be breached, provide sleeved openings. Cabling shall enter and exit these areas at 90° angles. Route all cables and cable raceways parallel to or perpendicular to building structure. No diagonal runs shall be permitted, unless noted otherwise.
2. To reduce or eliminate the field effect of EMI on data signaling, cable runs shall be kept a minimum distance from EMI sources.
   a. Minimum separation distance from possible sources of EMI:
      1) 5 inches (125mm) from power lines of 2 KVA or less.
      2) 12 inches (305mm) from lighting fixtures.
   b. Minimum separation distance from possible sources of EMI exceeding 5KVA:

Condition	Min. Separation Distance
Unshielded power lines or electrical equipment in proximity to open or non-metal pathways.	24 in. (610 mm)
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	12 in. (300 mm)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway.	6 in. (150 mm)
Electrical motors and transformers.	47 in. (1200 mm)

3. Communications cabling shall not be run in parallel with any high voltage electrical wiring.
4. Communications cables shall maintain a minimum separation of 2−inches (50mm) from bonding conductors.
5. The maximum length of horizontal communications cables shall be limited to 90 meters from the Telecommunications Outlet (TO) to the MCR or TR point of termination.
6. Cable routing from the ladder tray onto the distribution frame shall be neatly organized and supported by cable support brackets, clips, loops, radius drops, spools, etc., as required to minimize tension and stress on the connector block terminations.

E. Conduit Chase Pipes

1. Furnish and install 4 inch EMT conduit "Chase Pipes" within MCR, TR, EF, and other information transport system spaces where communications cabling must pass through suspended ceiling tiles enroute to point of cabling termination.
2. Chase Pipes shall be securely mounted to the wall above ladder tray segments using slotted Unistrut and 4−inch pipe clamps. Reamed and bush pipes at both ends prior to cabling rough−in.

F. Communications Entrance Protection

1. All OSP cables entering any building shall be properly protected and bonded to ground at both ends of the circuit.

2. Building Entrance Terminal shall be located on the leftmost section of plywood backboards and organized in columns, unless otherwise directed by the Owner. Existing station and riser cabling shall be located to the right of the feed and riser columns. Feed and station blocks shall not be mixed within a single column.
3. Ground all panels using solid 6AWG green insulated conductors direct to the SBB or PBB.
4. Configuration, where multiple BETs are implemented, shall be such that interconnecting grounding conductors are routed as straight as possible and directly attached to the SBB or PBB.
5. Contractors shall not inter−connect BETs with horseshoe−shaped conductors.
6. Bond protectors to cable bonding clamps.

G. Communication Racks and Frames
1. Open Frame Equipment Racks - Single Upright, 2-Post.
   a. Racks shall be mounted to allow a minimum of 36 inches access space in both front and rear. Racks shall be bolted to the floor. The tops of the racks shall be securely braced to rigid ladder tray and bracketed to the wall. All hardware shall be provided for protection within seismic zones, where applicable.
   b. The sides of a rack or group of racks situated against a wall shall abut and extend from the wall. Clearance for the access "walk around" end shall be 36 inches at minimum.
   c. All racks shall be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below. (Use CPI #40604−003 for concrete slab floors or #40607−001 wood floors. Raised floor support kits are also available.)
   d. All Racks shall be individually (home−run) bonded to the SBB or PBB using appropriate hardware.
   e. Ladder rack shall be attached 6 inches from the top of the rack to deliver cables to the rack using appropriate radius control "waterfall" kits. Use appropriate hardware from the ladder rack manufacturer to attach ladder rack.
   f. Vertical Cable Management shall be attached to the sides of the rack to deliver cables to the rack. Use appropriate hardware from the cable management manufacturer to attach ladder rack.
2. Labeling
   a. General: Mechanically printed, adhesive labels shall be used in all cases except for 66 blocks. Labels shall have a white background with black lettering. Brady ID Pro label tape (or equal) is required for the riser and station jacket labels. Brother P−Touch (or equal) labels are required for all other labels.
   b. Rack Labels: Each rack shall contain a label bearing the building and TR designation, followed by a dash and letter designation, indicating which rack it is in sequence. Example: for racks located within in TR PSY206, the first rack will be labeled 'PSY206− A', the second 'PSY206−B', etc. Rack labels will be placed on the front, upper left hand corner of each rack, viewed when facing the rack.

H. Communication Termination Blocks and Patch Panels
1. Labeling − Labeling samples must be submitted and accepted by owner.
   a. Mechanically printed, adhesive labels shall be used in all cases except for 66 blocks. Labels shall have a white background with black lettering.
   b. 66 Blocks: 66 block labels are to be legibly handwritten, using a fine point black Sharpie, or other indelible/permanent marker. For riser blocks, the number of the riser count shall be placed at the first white/blue position, followed by every fifth pair number afterward. For station blocks, the numbers in the outlet ID shall be used, placed at the white position of the white/blue pair. Example: 203−1−T1 shall be labeled '203−1'. In cases where there is a T3, etc. this shall be written on the blue position of the white/blue pair, under the outlet ID numbers.

c. Patch Panels: Each installed patch panel shall have a mechanically printed label attached in the upper left−hand corner of the panel, containing the TR number, the letter of the rack in which it is installed, and the letter identifying the panel, separated by dashes. Example: The first panel in the second rack of TR ROB206 would be labeled 'ROB206B−A'.

d. Patch Panel Ports: Each patch panel port shall have a mechanically printed label attached below the port to indicate the far end connection information. The label will contain the outlet number, the location number, and the jack number, separated by dots.

e. Fiber Optic Hardware: Each fiber−optic cabinet will contain a label in the upper left−hand corner of the door, with FT followed by the two−digit number of the panel. The first cabinet will be labeled 'FT01', the fifth Cabinet 'FT05', etc. The cabinet's interior label strip will be as follows. For each column, a label containing the originating TR and cabinet label (FTxx) separated by a slash, followed by the destination TR and cabinet label (FTxx) followed by the strand (element) count for each coupler panel position. Example: Cable CAB125T/ROB204−1 is terminated into coupler panel positions A−G in FT01 and at CAB125T and FT02 at ROB204. Column 'A' on the fiber cabinet pullout strip will contain this label, installed vertically down the column: 'CAB125T FT01 / ROB204 FT02 1−12'.

I. Communications Cable Management and Ladder Rack

1. Vertical Cable Management

a. Vertical Cable Management sections, 84 inches, shall be bolted−in between all Open Frame Racks.

b. Vertical Cable Managers shall be attached to the side of the Rack/Frame using the manufacturer's installation instructions and included hardware. No holes shall be drilled in Racks/Frames in order to install mismatched managers.

c. When a single Vertical Cable Manager is used in between two Racks/Frames, attach the Vertical Cable Manager to both Racks/Frames.

d. When more than one (1) Vertical Cable Manager is used on a Rack/Frame or group of Racks/Frames, use the same make, style and size of Vertical Cable Manager on the Rack/Frame or in between Racks/Frames.

e. The color of the Racks/Frames and Vertical Cable Managers shall match.

2. Horizontal Cable Management: All Managers shall be securely mounted in the rack with a minimum of four (4) rack screws located in the four corners of each panel.

3. Ladder Rack

a. Ladder Rack shall be installed with side stringers facing down so that the ladder forms an inverted U−shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.

b. Ladder Rack shall be supported every 5 feet on center with 5/8−inch diameter threaded rod, or applicable support brackets or racks. Exposed portion of threaded rod shall be protected with tubular cover throughout the portion of the rod exposed to cabling within the maximum fill area.

c. Ladder Rack shall be supported every 5 feet or less in accordance with TIA−569−B. Ladder Rack shall be supported within 2 feet of every splice and within 2 feet on both/all sides of every intersection. Support Ladder Rack within 2 feet on both sides of every change in elevation. Support Ladder Rack every 2 feet when attached vertically to a wall.

d. Heavy−duty splices are required for Ladder Racks exceeding 18 inches in width. Heavy− duty splices are required for any splice formed in the vertical orientation including changes in elevation formed using vertical−to−horizontal 90˚ turns or horizontal−to−vertical 90˚ turns. Use heavy−duty splices to secure all overhead turns to the overhead horizontal pathway(s).

e. When the pathway is overhead, Ladder Rack shall be installed with a minimum clearance of 12 inches above the Ladder Rack. Leave a minimum of 12 inches in between Ladder Rack and ceiling/building truss structure. Leave a minimum of 3

inches in between Ladder Rack and the tops of equipment racks and/or cabinets. Multiple tiers of Ladder Rack shall be installed with a minimum clearance of 12 inches in between each tier of Ladder Rack. When located above an acoustical drop ceiling, leave a minimum of 3 inch clearance between the top of the drop ceiling tiles and the bottom of the Ladder Rack.

f. Use a radius drop to guide cables wherever cable exits overhead Ladder Rack to access a rack, cabinet or wall−mounted rack, cabinet or termination field. Furnish and install a moveable cross member also to attach and align the radius drop in between the welded cross members of a Ladder Rack.

g. Whenever possible, maintain a 2 feet separation between Ladder Rack used for communications cables and pathways for other utilities or building services.

J. Communications Copper Backbone Cabling

1. Intra-building

a. The Contractor shall use common vertical sleeve(s) for routing of all copper intra−building backbone/riser cables. Cables shall be supported vertically within the MCR and TR spaces using wall mounted ladder rack and Erico/Caddy CableCat Vertical Backbone Cable Support.

b. Place cables without exceeding cable manufacturer's recommended pulling tensions.

1) Pull cables simultaneously if more than one is being pulled in the same raceway.

2) Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.

3) Use pulling means, including fish tape, cable, rope, and basket weave or cable grips, that will not damage cabling or raceways.

c. The Contractor shall secure all copper intra−building backbone cables to the MCR walls to prevent movement of the cable. D−rings shall be acceptable for this purpose. The Contractor shall secure the cables to the Ladder rack to prevent movement of the cable. The Contractor shall use the horizontal Ladder Rack to route the cable to the MCR termination blocks.

d. Within the MCR, the Contractor shall furnish a ten (10) foot service loop suspended from the Ladder Rack above the MC frame.

e. All cabling shall be continuous and without splices, except to attach to BETs.

f. Bond and ground all cable shields and drain wires at each end.

g. Category 3 Riser Cables shall be terminated on 66 blocks separate from those used for Station Cable and shall be mounted on plywood backboard.

1) Riser cable shall be routed from the overheard ladder rack around the perimeter of the plywood using metal D−Rings.

2) All cabling shall approach the point of termination from the bottom, entering in the bottom of the block.

3) All cables shall be neatly organized and dressed (combed) using plastic tie wraps with metal reinforced locking tabs.

4) Cable management hardware shall be furnished and installed by the contractor to ensure that the installation is neatly organized and readily identifiable.

5) Riser and Station cabling may be routed using the same metal D−Rings.

2. Inter−building

a. OSP (Outside Plant) multi−pair copper backbone cables from other buildings shall break for termination and protection within an SE (Service Entrance) within 50 ft. of the point at which cabling exits rigid entrance conduit. Cabling shall then be converted to UL® tested and listed CMR or CMP ISP as required for the environment into which it is to be placed and routed directly to the MC located in the MCR.

b. OSP Copper Backbone Cabling shall be RUS/REA PE89 design in conformance with ANSI ICEA 7CFR−1755.890, foam skin filled core, multi−pair 24AWG, at

minimum. Transition cabling from the SE splice to the termination panel shall be AR Series Riser cable (ARMM).

c. All OSP cables entering any building shall be properly protected and bonded to ground at both ends of the circuit.

d. Contractor shall furnish and install BET (Building Entrance Terminals) with primary protection modules.

e. The Contractor shall use common conduits and sleeve(s) for routing of all copper inter− building cables. Cables shall be supported vertically within the MCR and TR spaces using wall mounted ladder rack and Erico/Caddy CableCat Vertical Backbone Cable Support.

f. Place cables without exceeding cable manufacturer's recommended pulling tensions.
   1) Pull cables simultaneously if more than one is being pulled in the same raceway.
   2) Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
   3) Use pulling means, including fish tape, cable, rope, and basket weave or cable grips, that will not damage cabling or raceways.

g. The Contractor shall secure all copper inter−building cables to the MCR walls to prevent movement of the cable. D−rings shall be acceptable for this purpose.

h. The Contractor shall secure the cables to the Ladder rack to prevent movement of the cable.

i. The Contractor shall use the horizontal Ladder Rack to route the cable to the MC termination blocks.

j. Within the MCR, the Contractor shall furnish a ten (10) foot service loop suspended from the Ladder Rack above the MC frame.

k. All cabling shall be continuous and without splices, except to attach to BETs.

l. Bond and ground all cable shields and drain wires at each end.

m. Cabling shall be arranged on the termination blocks in sequential numerical order by cable pair.

n. Copper Backbone Cabling shall be terminated on 66−style termination blocks at the MC.

3. Testing

   a. New cable pairs shall be end−to−end tested as follows:
      1) DC loop resistance
      2) Wire map
      3) Continuity to remote end
      4) Shorts between two or more conductors
      5) Crossed pairs
      6) Reversed pairs
      7) Split pairs

   b. All balanced twisted−pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated in the manuals provided with the field test unit.
      1) The calibration certificate shall be provided for review prior to the start of testing.
      2) Testers shall require a 66−style adapter.

   c. Autotest settings, provided in the field tester for testing the installed cabling, shall be set to the manufacturer default parameters for the type and characteristics of the cable to be tested.

   d. Tests shall be performed with connectors and termination completed and in−place.

   e. Any cable or component not satisfactorily passing the tests as described or failing to meet quality installation standards as described in this specification, shall be repaired and/or replaced at the Contractor's expense.

   f. The Contractor shall prepare complete cable test reports for all installed cables for review and approval of the University prior to acceptance of the cabling system.

g. A copy of the final completed and reviewed cable test reports shall be enclosed in clear vinyl protective covers and posted in the wiring closet for use and reference by the University.

4. Labeling
   a. Labeling shall be furnished and installed by the Cabling Contractor according to the following details.
      1) Cabling Contractor shall make early contact with Miami University IT Services (through the General Construction Project Manager) to obtain the three−letter identifier and any other special requirements for each project. Example labels are available upon request.
      2) A sample of the labeling shall be submitted to the University for approval prior to installation.
   b. Mechanically printed, adhesive labels shall be used in all cases except for 66 blocks. Labels shall have a white background with black lettering.
   c. All OSP Fiber and Copper Jacket Labels shall be labeled using a mechanically printed label, designed for use on cable sheathing, at each end.
      1) Labels shall contain the three−letter identifier and room number for the start and end destination TRs, followed by the sequence number and strand (element) or pair count.
      2) Cable jacket labels will be installed between 6 inches and 10 inches from the terminated cable end.
      3) All cable labels shall be mechanically printed, wrap−around self−laminating type.
   d. All Riser Cable Jacket (both copper and fiber) cables shall be labeled using a mechanically printed label, designed for use on cable sheathing, at each end.
      1) Labels shall contain the three−letter identifier and room number for the start and end destination TRs, followed by the sequence number and strand (element) or pair count.
      2) All cable labels shall be mechanically printed, wrap−around self−laminating type.

K. Communications Optical Fiber Backbone Cabling
   1. The Contractor shall use common vertical sleeve(s) for routing of all optical inter−building backbone/riser cables.
   2. Cables shall be supported vertically within the MCR spaces using wall mounted ladder rack and 4 to 6 inch metal D−Rings or Erico/Caddy CableCat Vertical Backbone Cable Support.
   3. All optical fiber cabling shall be installed within conduit.
   4. Place cables without exceeding cable manufacturer's recommended pulling tensions.
      a. Pull cables simultaneously if more than one is being pulled in the same raceway.
      b. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
      c. Use pulling means, including fish tape, cable, rope, and basket weave or cable grips, that will not damage cabling or raceways.
   5. The Contractor shall secure all optical intra−building backbone cables to the MCR walls to prevent movement of the cable. D−rings shall be acceptable for this purpose.
      a. The Contractor shall secure the cables to the Ladder rack to prevent movement of the cable.
      b. The Contractor shall use the horizontal Ladder Rack above each of the Open Frame Rack(s).
   6. Contractor shall include a minimum of fifty (50) foot single service loop, secured to the TR backboard prior completing the run to the optical fiber distribution panel within the floor mounted equipment rack.
   7. All Intra−building cabling shall be continuous and without splices of any kind.
   8. All MCR−to−TR fiber cabling shall be in an armored jacket when not in conduit.

9. Bond and ground all interlocking armor, where applicable, at each end of the cable to telecommunications grounding system.
10. Cabling shall be arranged on the distribution panels in sequential numerical order by individual element according to optical fiber color code.
11. Optical Fiber Backbone Cabling shall be terminated as follows:
    a. Optical Fiber Distribution Panels shall be rack mount Corning CCH variety.
    b. Each panel shall include a full complement of blank adapter panels, labels, cable storage accessories, and optical fiber cable routing accessory kit.
    c. The last 6 duplex singlemode fibers shall be "LC−APC" style duplex adapters and shall be color coded according to the optical fiber type for which they are applied. 8.3/125µm single mode shall be green.
12. Prior to shipment, both cable ends shall be sealed with a waterproof cap to prevent moisture from entering the cable.
13. The cable reel shall be shipped with OTDR results for each fiber. OTDR results shall show attenuation and bandwidth. The results shall be documented in such a manner that the information can be retained for future use.
14. Certification Testing
    a. Panduit CPI or Corning EWP is required to pre−form any and all fiber work. Full Corning Warranty is required on all fiber cables.
    b. Full testing shall be performed on each cabling segment (connector to connector). Perform the following tests and inspections and prepare full reports to be submitted immediately upon completion of each phase of construction as well as for inclusion in O&M Manuals.
    c. The Cabling Contractor, installer, tester, and warranty issuer shall be employed by the same firm.
15. Labeling
    a. Labeling shall be furnished and installed by the contractor according to the following details.
        1) Contractor shall make early contact with University IT Services (through the Project Manager) to obtain the three−letter identifier and any other special requirements for each project. Example labels are available upon request.
        2) A sample of the labeling shall be submitted to the University for approval prior to installation.
    b. Mechanically printed, adhesive labels shall be used in all cases except for 66 blocks. Labels shall have a white background with black lettering.
        1) Brady ID Pro (or equal) label tape is required for the riser and station jacket labels.
        2) Brother P−Touch (or equal) labels are required for all other labels.
    c. All OSP Fiber and Copper Jacket Labels shall be labeled using a mechanically printed label, designed for use on cable sheathing, at each end.
        1) Labels shall contain the three−letter identifier and room number for the start and end destination TRs, followed by the sequence number and strand (element) or pair count.
        2) Cable jacket labels will be installed between 6 inches and 10 inches from the terminated cable end.
        3) All cable labels shall be mechanically printed, wrap−around self−laminating type.
    d. All Riser Cable Jacket (both copper and fiber) cables shall be labeled using a mechanically printed label, designed for use on cable sheathing, at each end.
        1) Labels shall contain the three−letter identifier and room number for the start and end destination TRs, followed by the sequence number and strand (element) or pair count.
        2) All cable labels shall be mechanically printed, wrap−around self−laminating type.

L. Communications Horizontal Cabling

1. Horizontal copper cabling runs shall be placed in one continuous end−to−end length between the (Main) Telecommunications Room(s) and the WAO without splices of any kind.
2. Contractor shall be responsible for determining the route and quantity of J−Hooks and other independent cable supports within the overhead ceiling space wherein cable tray or other support systems.
    a. Attaching or otherwise draping cables to ceiling wire grid, pipes by other trades, lighting fixtures, etc. shall not be permitted.
    b. J−Hooks and other independent cable supports shall be located on 48" to 60" centers to adequately support and distribute the cable weight.
    c. Where J−Hooks and independent cable supports are used, runs shall follow walls and building supporting structures; diagonal runs shall not be acceptable.
3. Outdoor Cabling and any terminations outside mechanically controlled temperature environments shall use corrosion resistant connectors wherever possible.
4. In certain special cases, Voice Station Cables shall be terminated on 66 blocks separate from those used for Riser cable and shall be mounted on plywood backboard. Each column of Station blocks shall be mounted with a vertical spacing of 4", measured from the centerline of each column.
    a. Half D−Rings shall be furnished and installed for cross−connect management with a quantity of two (2) at the top of each column.
    b. The Station cables shall be routed from the overhead ladder rack to a designated corner of the TR. From there, they will be routed to comprise a long service loop of cable upon the ladder rack of the TR. The length of this service loop shall be sufficient to re−terminate all cables within new rack mounted Patch Panels as needed in the future. After the service loop, all cabling shall be routed through metal D−Rings and approach the point of termination from the bottom, entering in the bottom of the block.
    c. All cables shall be neatly organized and dressed (combed) using Velcro strap material (instead of tie wraps).
    d. Cable management hardware shall be furnished and installed by the contractor to ensure that the installation is neatly organized and readily identifiable.
5. Data/Voice/Video Station Cables shall be terminated on rack mounted patch panels within the designated TR according to EIA/TIA T568B wire map.
    a. Unused spaces on patch panels shall be left vacant.
    b. All cables for data service shall be neatly organized and dressed following industry−standard practices and in conformance with installation standards of BICSI ITS Installation Methods Manual specifications.
    c. Each patch panel start with the lowest outlet location number and increase in sequence from left to right, top to bottom.
    d. Panels shall be arranged so that the first outlet on each floor begins on a new panel where possible.
    e. The Station cables shall be routed from the overhead ladder rack to a designated corner of the TR. From there, they will be routed to comprise a long service loop of cable upon the ladder rack of the TR. The length of this service loop shall be sufficient to pull back and re−terminate cables, as needed in the future, on wall mounted 66 blocks in the event cables must be hard−wired for life−safety, or other reasons, as required by the University.
    f. All cables shall be neatly organized and dressed (combed) using Velcro strap material (instead of tie wraps).
    g. Cable management hardware shall be furnished and installed by the contractor to ensure that the installation is neatly organized and readily identifiable.
6. Certification Testing
    a. Tests shall be performed with connectors and termination completed and in−place. All new cable pairs shall be 100% tested and passed by the criteria as established herein:

b. Test equipment shall be equipped with the most current software upgrades to meet applicable testing standards.
    1) Calibration of the testing instruments shall be current as per the manufacturer's requirements.
    2) Test cords, adapters, and connectors shall be maintained in good order.
    3) Test instruments must be identified on the applicable summary test forms as to make, model, software generic, and calibration date.
c. Full testing shall be performed on each permanent link (Patch Panel to Patch Panel and Patch Panel to Work Area Outlet) by trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof.
    1) The test of each link shall include all of the parameters as detailed below. In order to pass, the test measurements must all meet or exceed the limit value determined in the TIA/EIA Standard.
    2) Perform and record the tests and prepare full reports for inclusion in O&M Manuals.
d. The Contractor shall produce summary test reports to be accepted by the University at the completion of each project phase.
    1) Test reports shall be completely and legibly filled out, dated, and signed by the person performing the tests.
    2) The completed forms shall be submitted to the Engineer for review and acceptance for authorization to proceed into the next installation phase.

7. Labeling
    a. Labeling shall be furnished and installed by the contractor according to the following details.
        1) Contractor shall make early contact with University IT Services (through the Project Manager) to obtain the three−letter identifier and any other special requirements for each project. Example labels are available upon request.
        2) A sample of the labeling shall be submitted to the University for approval prior to installation.
    b. Mechanically printed, adhesive labels shall be used in all cases except for 66 blocks. Labels shall have a white background with black lettering.
        1) Provide Brother P−Touch labels for all faceplate labels.
    c. All Station Cable Jacket cables will be labeled using a mechanically printed label, designed for use on cable sheathing, at each end.
        1) Labels will contain the outlet number, location number, and jack number on one line, separated by dashes.
        2) The telecommunications room designation in which the cable is terminated shall be contained on a second line.
        3) Cable jacket labels will be installed between 6 inches and 10 inches from the terminated cable end.
    d. All cable labels shall be mechanically printed, wrap−around self−laminating type.

M. Communications Faceplates and Connectors
1. Outlet configurations shall be:
    a. “D−WALL” − Randl 5 square outlet box with Single−gang mud ring containing a biscuit jack for wall phone application.
    b. “D, 2D, 3D, or 4D” − Randl 5 square outlet box with Single−gang mud ring and faceplate for data, voice, and video applications.
    c. “4D, 5D, 6D, 7D or 8D” − Randl 5 square outlet box with Double−gang mud ring and faceplate for data, voice, and video applications.
    d. “D−WAP” − Biscuit−jack with data for wireless above drop−ceiling with 10 foot cable coil.
    e. “DOS−WAP” − Biscuit−jack with data for outside wireless terminated into a Randl 5 square outlet box (refer to drawing for details)

f. “D-S” – Randl 5 square outlet box with single-gang mud ring. Cover plate is not required. One category 6 data cable with 8P8C modular male connector. Connect to a wireless access point. Cable shall be provided with a 12”-18” “pig-tail”. One category 6 data cable shall be provided as a spare. Contractor shall install University furnished wire access point.

g. “C” – Biscuit-jack with one RJ-45 modular jack above accessible ceiling with 10 foot cable coil; or biscuit-jack with one RJ-45 modular jack in a Randl 5 square outlet box with single-gang mud ring, in dry-wall ceiling or wall, for camera installation.

2. Certification Testing
   a. Testing shall be performed only after faceplates and outlets have been fixed in final position. Under no circumstances shall testing shall be performed while outlets are hanging loose, prior to being permanently "settled" into their backbox or surface box.
   b. Full testing shall be performed per “Data/Voice/Video Station Cables” testing above.
3. Labeling
   a. Labeling shall be furnished and installed by the contractor according to the following details.
      1) Contractor shall make early contact with University IT Services (through the Project Manager) to obtain the three−letter identifier and any other special requirements for each project. Example labels are available upon request.
      2) A sample of the labeling shall be submitted to the University for approval prior to installation.
   b. Mechanically printed, adhesive labels shall be used in all cases except for 66 blocks. Labels shall have a white background with black lettering.

3.3 LABELING

A. University Approved Labeling Format
   1. All labeling shall be submitted to the University for approval prior to installation.
   2. Labeling shall be furnished and applied to all components of Division 27 in conformance with the following numbering formats:
      a. A Three−digit identifier will be provided by The University for each project. The following examples, utilize the three−digit identifier and for Anderson Hall
      b. TR (Telecommunications Room) Patch Panel: (intuitively AND004−AA−1 thru 48, AND004− A−B−1 thru 24 and AND004−A−B−1 thru 48 and so on.) 104.1.1 would be D1 (Data 1) on Outlet 104−1, 104.1.2, 104.1.3, 104.1.4, etc,
      c. Outlet: AND104−1, AND004 (include D1, D2, D3 & D4 at each jack)

3.4 FINAL CLEANING

A. Contractor shall thoroughly clean all assemblies within all MCR and TR spaces before they are turned over to University IT Services for operation. Cleaning shall include, but not be limited to, all ladder tray, racks and wire managers (inside and out), copper and optical fiber panels (inside and out). Should the MCR or TR be completed prior to the balance of the floor space that it serves, racks, cabinets, and wall frames shall be covered with plastic sheeting to repel dust and other contaminants to which they will be subjected.

APPENDIX A

TBB/TEBC linear length m	TBB/TEBC size (AWG)
Less that 4 (13)	6
4 − 6 (14 − 20)	4
6 − 8 (21 − 26)	3
8 − 10 (27 − 33)	2
10 − 13 (34 − 41)	1
13 − 16 (42 − 52)	1/0
16 − 20 (53 − 66)	2/0
20 − 26 (67 − 84)	3/0
26 − 32 (85 − 105)	4/0
33 − 38 (106 − 125)	250 kcmil
38 − 46 (126 − 150)	300 kcmil
46 − 53 (151 − 175)	350 kcmil
53 − 76 (176 − 250)	500 kcmil
76 − 91 (251 − 300)	600 kcmil
Greater than 91 (301)	750 kcmil

Table 1

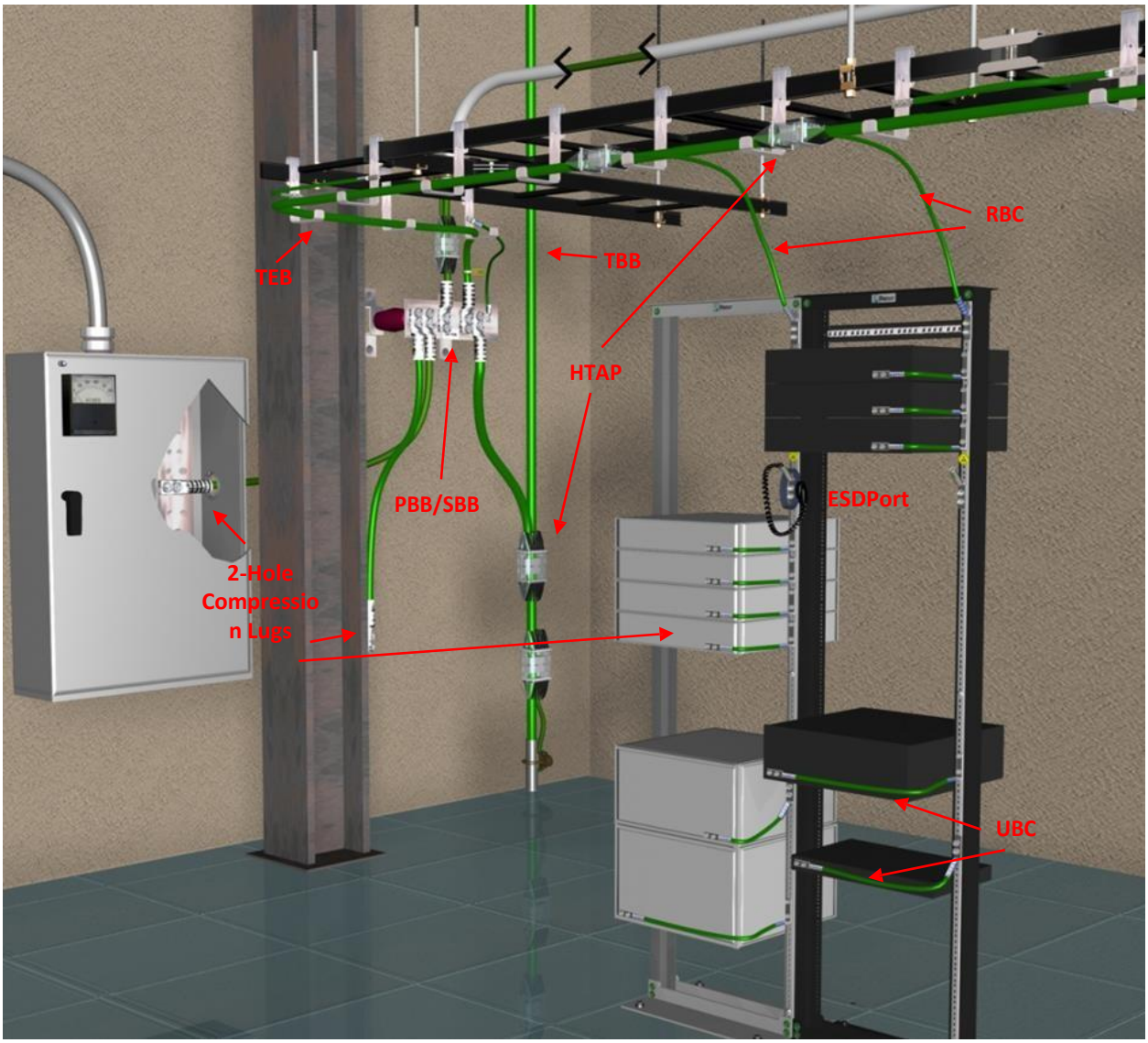

Figure 1 (grounding reference only)

APPENDIX B

Category	Manufacturer	Part Number	Description
Grounding/ Bonding	Panduit	GB4B1028TPI-1	1/4" X 4" X 24" Telecommunications Grounding Busbars for MCR.
	Panduit	GB4B0624TPI-1	1/4" x 4" x 20" Grounding Busbars for TR.
	Harger	GBI14424TMGMBKT	1/4" x 4" x 24" Grounding Busbars for MCR.
	Harger	GBI14420TMGMBKT	1/4" x 4" x 20" Grounding Busbars for TR.
	Panduit	HTWC2-2-1	Kit contains HTCT2-2-1 HTAP and CLRCVR2-1 clear cover, terminates code #2– #6 AWG STR/SOL Run and Tap 1 or flex #2 – #8 AWG Run and Tap 1, code or flex #8 – #14 AWG Tap 2 and Tap 3.
	Panduit	HTWC250-2-1	Kit contains HTCT250-2-1 HTAP and CLRCVR3-1 clear cover, terminates code 250 kcmil – #2 AWG Run or flex 4/0 – #2 AWG Run, code #2 – #6 AWG STR/SOL or flex #2 – #8 AWG Tap 1, code or flex #8 – #14 AWG Tap 2.
	Panduit	RGS134-1Y	Grounding strip; 78.65" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
	Panduit	RGRB19U	Grounding busbar; 19" (483mm) length; tin-plated; twenty holes arranged for flexibility in mounting with twenty #12-24 x 1/2" hex head screws installed; mounting hole sets have 5/8" (15.9mm) spacing; provided with two each #12-24 x 1/2", M6 x 12mm thread-forming screws, and two #12flat washers for mounting.
	Panduit	RGCBNJ660P22	#6 AWG (16mm²) jumper; 60" (1.52m) length; 45° bent lug on grounding strip side; provided with .16 oz. (5cc) of antioxidant, two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws and a copper compression HTAP* for connecting to the MCBN.
	Panduit	RGEJ624PFY	#6 AWG (16mm²) jumper; bent lug on grounding strip side to straight lug on equipment; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws.

	Panduit	RGESD2-1	Two-hole ESD port with 5/8" hole spacing, provided with an ESD protection sticker, .16 oz. (5cc) of antioxidant, and two each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
	Panduit	RGESDWS	Adjustable fabric ESD wrist strap with 6' coil cord, banana plug, 1 megohm resistor and 4mm snap.
	Panduit	RGTBSG-C	Green thread-forming bonding screw, #12-24 x 1/2", 100pk
	Panduit	RGTS	Thread-forming grounding screw, #12-24 x 1/2".
	Panduit	RGW-100-1Y	100 paint piercing bonding washers for 3/8" (M8) stud size; .875" (22.2mm) O.D.; provided with .16 oz. (5cc) of antioxidant.
	Panduit	ACG24K	#6 AWG (16mm²) jumper for armored cable diameter up to 0.84" (21.3mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover.
	Panduit	ACG24K-500	#6 AWG (16mm²) jumper for armored cable diameter 0.85" (21.3mm) to 1.03" (26.2mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover.
	Panduit	LCC-W Series	Two-hole compression connectors; long barrel, windowed
	Panduit	CGJ620UC	Front to back rail grounding jumper kit; two #6 AWG (16mm²) jumpers; factory terminated on both ends with 90° reverse bent lugs; Length 20" (.5M); for thru-hole rails.
	Arlington	EMT400	Insulated Bushings
	Open Sourced		Grounding Conductor, Stranded 6AWG w/ Green Insulation
Hangers/ Supports	Panduit	J-Pro Series	4" or 2" J- Hooks and accessories only
Identification	Brother	P-Touch	1/4" Black-on-White Label Tape for Patch Panel
	Brother	P-Touch	3/8" Black-on-White Label Tape for Faceplates
	Brady	311-292	ID Pro Label Tape for Cable Jacket
Firestopping Devices			

Communication Entrance Protection	Porta Systems	581 P225 GT	25-Pair Primary Protection Module w/ 66 Clip In/Out
Communication Racks /Frames	Panduit	R2P	Standard 19" EIA Aluminum 45RU 2-Post rack with hardware kit and paint piercing bonding kit, numbered up.
	CPI	48353-715	Open Frame Equipment Rack 7' x 19", Single Upright Two-Post
Communication Termination Blocks/Patch Panels	Emerson Network Power	R66M150X	50-Pair 66 Style Punch Down Block
	Emerson Network Power	R891	Stand-Off Bracket for 66 Style Block
	Panduit	CPP48FMWBLY	48-port flush mount patch panel supplied with rear mounted faceplates.
	Panduit	SRB19BLY	Strain relief bar extends 2" off the rack; supports, manages, and provides proper bend radius protection.
Communication Cable Management/ Ladder Rack	CPI	11729-X03	Double-Sided Vertical Cable Manager
	Panduit	CMPHH2	2RU Horizontal D-ring cable manager, D-rings on front only, 3" x 3" ring size.
	Panduit	SRB19MDBL	Strain relief multi-depth bar extends 7" off the rack, supports, manages, and provides proper bend radius protection. Ideal for use with Category 6A copper cabling installations.
	Panduit	CMSRC2	Bend Manager
	CPI	12100-712	Waterfall, 11”, black
	CPI	12100-718	Waterfall, 17”, black
	Homaco/ Ortronics-Legrand	TRC10-12	Ladder Rack, 12 inches Wide
	Homaco/ Ortronics-Legrand	TRC6-12	Ladder Rack, 12 inches Wide
	Homaco/ Ortronics-Legrand	P820147H	Corner Clamp
	Homaco/ Ortronics-Legrand	P128240H	Wall Angle Assembly
	Homaco/ Ortronics-Legrand	P139340H	Shelf Bracket
	Homaco/ Ortronics-Legrand	P4033472H	Straight Clamp Assembly
	Legrand/ Cablofil	09-2E72-0012-12	PW Ladder Tray 5" x 12" Mill Galv. Steel

	Legrand/ Cablofil	09-2E72-0012-18	PW Ladder Tray 5" x 18" Mill Galv. Steel
	Legrand/ Cablofil	50-5164-0006-12-02-J	Peaked Flanged PW Tray Cover 12" x 72"
	Legrand/ Cablofil	G-0215-13	Single Strut Bracket
	CPI	10250-706	Ladder Rack, 6 inches Wide
	CPI	10250-712	Ladder Rack, 12 inches Wide
	CPI	10250-X18	Ladder Rack, 18 inches Wide
	CPI	12100-712	Cable Runway Radius Drop, 12 inch
	CPI	12100-X18	Cable Runway Radius Drop, 18 inch
	CPI	10595-712	3" Channel Mounting Plate, 12 inch
	CPI	10595-X18	3" Channel Mounting Plate, 18 inch
	CPI	11421-712	Wall Mounting Angle, 12 inch
	CPI	1141-X18	Wall Mounting Angle, 18 inch
	CPI	10608-001	Vertical Wall Bracket
	CPI	11309-001	Cable Runway Foot
	CPI	11301-011	Butt Splice Kit
	CPI	11302-701	Junction Splice Kit
	CPI	11746-712	Triangular Support Bracket, 12 inch
	CPI	11746-X18	Triangular Support Bracket, 18 inch
	CPI	12594-X01???	Runway Enclosure Junction Kit ???
	CPI	12595-X01 ???	Runway Enclosure Junction Kit???
	CPI	10506-706	Runway Elevation Kit
	CPI	10595-712	Rack/Runway Mounting Plate
	CPI	11959-X15	Corner Bracket 15" W
	CPI	10596-706	Cable Runway Retaining Post
	CPI	13392-712	Cable Runway Pathway Divider
	CPI	10642-001	Protective End Cap
	CPI	10757-001	Protective End Cap
Communications Copper Backbone Cabling	Erico/Caddy	CAT600WM	Vertical Backbone Cable Support
	General Cable, CommScope, Superior-Essex	Cat 3 Riser – 25 pr 2133033 (or 2133033.99 BULK)	Intrabuilding Category 3 Multi-pair Cabling
	General Cable, CommScope, Superior-Essex	Cat 3 Plenum – 25 pr 2131505 (or 2131505.99 BULK)	Intrabuilding Category 3 Multi-pair Plenum Cabling
	General Cable, CommScope, Superior-Essex	Anixter E-002524DFC through E-090024DFC	Interbuilding OSP Cat3 Cabling
Communications Optical Fiber Backbone Cabling	Preformed		Armadillo Re-Enterable Closure
	3M		710 Series Splicing Components
	Grainger	3W517	OSP Pull Rope
	Corning	036EUC-T4100D20	Altos Loose Tube Gel-Free, Armored, 36-element Single Mode
	Corning	012EUC-T4100D20	Altos Loose Tube Gel-Free, Armored, 12-element Single Mode
	Corning	FAN-BT25-12	Fanout Kit, 12-element Units

	Corning	036H8F-61131-29	FREEDM ONE Unitized Tight Buffer Cable, I/O, 36F, Singlemode, CMR
	Corning	012E81-33131-24	MIC Tight Buffer Cable, 12F, Singlemode, CMR
	Corning	012E81-33131-A1	MIC Tight Buffer Cable, 12F, Singlemode, armored
	Corning	012T81-33180-24	MIC Tight Buffer Cable, 12F, 50um, OM3, CMR
	Corning	012T81-33190-A1	MIC Tight Buffer Cable, 12F, 50um, OM4, armored
	Corning	SX300/SMF28e	900µm Tight Buffered Fanout Cable, 12-element Multimode + 12-element Single Mode, OFNR
	Corning	SX300/SMF28e	900µm Tight Buffered Fanout Cable, 12-element Multimode + 12-element Single Mode, OFNP
	Corning	CCH-04U	RACK-MT ENCLOSURE 19" 2U EMPTY - ACCEPTS 4 PANELS, CASSETTES OR MODULES
	Corning	CCH-02U	RACK-MT ENCLOSURE 19" 4U EMPTY - ACCEPTS 12 PANELS, CASSETTES OR MODULES
	Corning	CCH-BLNK	BLANK PANEL
	Corning	CCH-CS24-A9-P00RE	24 strand s/m OS2 LC/LC CCH Pigtailed Splice Casssette, 24 F, LC UPC duplex, Single-mode (OS2), single fiber (250 µm)
	Corning	CCH-CS12-B3-P00RE	12 strand s/m OS2 APC/LC CCH Pigtailed Splice Casssette, 12 F, LC APC duplex, Single-mode (OS2), single fiber (250 µm)
	Corning	CCH-CS24-E4-P00TE	24 strand m/m OMC LC/LC CCH Pigtailed Splice Casssette, 24 F, LC UPC duplex, 50 µm multimode (OM3), single fiber (250 µm)
	Corning	CCH-CS12-E4-P00TE	12 strand m/m OMC LC/LC CCH Pigtailed Splice Casssette, 12 F, LC UPC duplex, 50 µm multimode (OM3), single fiber (250 µm)
	Corning	CCH-CS12-A8-P00KE	12 strand m/m OMC LC/LC CCH-CS12-91-P00KJ is the only OM1 cassette I see and it has SC duplex connectors
	Corning	CCH-CP12-A9	Optical Connector Panel w/ (6) Duplex LC, 8-8.3/125 Single Mode Ceramic
	Corning	CCH-CP12-E4	Optical Connector Panel w/ (6) Duplex LC, 50/125 Multimode Ceramic
Communication Horizontal Cabling	General Cable	7133901	Category 6 CMR, white
	General Cable	7131901	Category 6 CMP, white
	General	7141849	Copper cable, category 6A UTP .0250 OD, plenum (CMP), 4-pair, conductors are 23 AWG with FEP insulation, twisted in pairs, separated by an integrated pair divider, surrounded by a patent-pending Mosaic tape and protected by a flame-retardant PVC jacket, blue.

	General	7133849	Copper cable, category 6A UTP, RISER (CMR), 4-pair, conductors are 23 AWG with FEP insulation, twisted in pairs, separated by an integrated pair divider, surrounded by a patent-pending Mosaic tape and protected by a flame-retardant PVC jacket, blue.
	Panduit	PUP6AV04BU-G	Category 6A, Advanced MaTriX, 4-pair, 23 AWG, U/UTP .0250 OD. Copper cable, plenum (CMP) rated, blue, 1000ft
	Panduit	PUP6AM04BU-CG	Category 6A, Advanced MaTriX, 4-pair, 23 AWG, U/UTP Copper cable, Riser (CMR) rated, blue, 1000ft

Communication Faceplates/ Connectors	Panduit	CBEIWY	Single gang faceplate frame accepts up to two 1/2-size module inserts or three 1/3-size module inserts. Supplied with labels and label cover/screw covers, Off White.
	Panduit	CBEIW-2GY	Double gang faceplate frame which accepts up to four 1/2-size module inserts or six 1/3-size module inserts. Supplied with labels and label cover/screw covers, Off White.
	Panduit	CHSRE2IW-X	Two module space, 1/2-size, 30° sloped recessed insert accepts two Mini- Com® Modules, Off White.
	Panduit	CFFP4BL	Faceplate snaps into industry standard knockouts found on modular furniture. Accepts up to four Mini-Com® Modules. Black.
	Panduit	CBX1EI-A	Mini-Com® 1-port low profile surface mount box accepts a single Mini-Com® Module. Dimensions: 0.90"H x 1.03"W x 1.89"L (22.8mm x 26.3mm x 48.1mm), Electric Ivory.
	Panduit	CBXQ2EI-A	Surface mount box accepts one or two Mini-Com Modules; includes built-in removable blank to add a second module. Dimensions: 1.06”H x 1.95”W x 3.65”L (26.92mm x 49.53mm x 92.71 mm)
	Panduit	CJ688TGBL	Mini-Com TX-6 Unshielded Module: Category 6 performance: 8 position, 8 wire universal module. Termination cap is color coded for T568A and B wiring schemes. Color: Black, terminates 4-pair 24/22 AWG 100 ohm unshielded twisted pair cable
	Panduit	SP688-C	8-position, 8-wire modular plug, for use with 24 AWG, category 6, UTP copper cable
	Panduit	SP6X88-C	8-position, 8-wire modular plug, for use with 24 AWG, category 6A, UTP copper cable
	Panduit	CHB2IW-X	1/2-size blank insert. Reserves space for future upgrades, Off White.
	Panduit	CF1064EIY	Module frame mounts behind standard 106 NEMA faceplates, accepts four Mini-Com® Modules, Electric Ivory.
	Panduit	CJLRCAPBU-X	Cat 6A left/right 45 degree wire cap
	Randl Inc.	T-55017	5 SQUARE® Telecommunications Outlet Box
	Panduit	CHI2MWI-X	Adapter for use with Wiremold CM- ARA
	Panduit	CUFMB24BL	24-Port Consolidation Point Enclosure/Panel
	Panduit	CUFB48BL	48-Port Consolidation Point Enclosure/Panel
	Wiremold	CM-ARA	Carrier for 5500 Wiremold Applications

	Panduit	CJH688TGWH	Category 6, RJ45, 8-position, 8-wire spring shuttered universal jack module, white.
	Panduit	CJE688TGWH	Category 6, RJ45, 8-position, 8-wire universal, corrosive resistant UTP jack module, white.
	Panduit	CJ6X88TGBU	Category 6A, RJ45, 8-position, 8-wire universal jack module, blue.
	Panduit	CJH6X88TGBU	Category 6A, RJ45, 8-position, 8-wire spring shuttered universal jack module, blue.
	Panduit	MPI588T	8-position, 8-wire, UTP modular plug with bulkhead, for use with 24 AWG, Category 5e, shielded copper cable.
	Panduit	CMFSREIY	Module supplied with 75 ohm self-terminating F-type coupler, electric ivory.
	Panduit	TG70EI8	TG-70 raceway base & cover, 8 foot length. (also available in 10 foot length)
	Panduit	LD10EI6-A	One-piece latching surface raceway with pre-applied adhesive backed tape, 6 foot length, electric ivory (also available in 8' and 10' lengths)
	CommScope	2227V	RG6 Quad Shield Coax, White CMP
	CommScope	5740R	RG6 Quad Shield Coax, Black CMR
	CommScope	5940R	RG11 Quad Shield Coax, Non-Plenum
	ICM Corporation	RG-6WR	F-Connector for Coaxial Cable (2227V)
	ICM Corporation	RG-6NR	F-Connector for Coaxial Cable (5740R)
	Belden/ ICM Corporation	716SNS1P11HQ	F-Connector for RG11Q Coaxial Cable (5940R)
Talk-A-Phone Boxes	Anixter	MS-600	Recessed Back Box for VOIP-500NCK-MUO-001 locations Res. Hall entry and hallways
	Anixter	ETP-SM-1	Surface Mount Box with Brushed Stainless Steel Finish for VOIP-500NCK-MUO-001 locations Res. Hall entry and hallways

APPENDIX C

Contractor Business Partners	City	Stat	Key Contact	Email

		e		
CTS Telecom	Cincinnati (Blue Ash)	OH	John Jones - Program Manager	jjones@ctseleomm.com
Jacobs Telephone – Cincinnati	Cincinnati (Tri-County)	OH	Aaron Brown – Branch Manager	abrownindy@jacobstelephone.com
PCS (CBTS)	Cincinnati (Blue Ash)	OH	Jeff Hollingsworth – President	jeff@pcswiring.com
Team Fishel – Cincinnati	Cincinnati (Tri-County)	OH	Bob DiNuoscio – Cincinnati Branch Manager	rwdinuoscio@teamfishel.com
Protocol	Cincinnati (Milford)	OH	Roger Hanna – President	roger@protocol.cc
Black Box	Cincinnati (Tri-County)	OH	Scott Calbeck – Operations Manager	scott.calbeck@blackbox.com
Apachi Networks	Cincinnati (Tri-County)	OH	Tim Anderson – President	tanderson@apachi-networks.com
RCS Robinson	Oxford	OH	Tim Robinson – Owner	rcs.tim@fuse.net

END OF SECTION

SECTION 27 4000

AUDIO/VIDEO SYSTEMS

This bid package requests a total package price for the build up and installation of audio-visual presentation systems. The systems will use state-of-the-art electronic equipment to allow the presenter(s) to make multimedia presentations in these classrooms. The systems are built based on the University's Standard Classroom design. The system will use audio and video derived from sources such as a resident classroom computer, bluray player, digital document camera, and other external devices (such as a laptop, computer, tablets, and phones).

1. Vendor will be responsible for the following:

1.1. Attend all weekly project meetings once this becomes appropriate, and coordinate the installation of A/V with all other trades. The vender is responsible and liable for any changes to electrical, ceiling, or wall changed in order to finish the install due to the lack of coordination.

1.2. Providing a completely operational ("turn-key") system that fulfills all the functions specified under System Specifications and the conceptual drawings included with this bid package. The equipment list and drawings are "NOT" intended to be used for final design/build. The vender is responsible to complete and include any additional hardware and engineering that is required to provide a complete and functional system.

1.3. Submitting proposed system design schematic, along with layouts and labels for connection panels, equipment rack layouts, and all equipment makes and models for approval prior to implementation. Vendor shall submit these documents at least ten (10) working days before approval is required, and remain available during this period to make such changes as may be required by the University. The intent is for the vendor and the University to establish a clear agreement as to the details of the system.

1.4. Providing and installing all equipment, cabling, connectors, plugs and jacks, programming, mounting, and security hardware, custom interface panels and plates, power cords, and outlet strips, and other items as required to meet this objective, regardless of whether or not named specifically herein. All such components shall be such design and qualities as are appropriately and satisfactorily used in commercial, industrial, and higher education institutions. All equipment with front panel options shall be provided with local or front panel controls if available.

1.5. Any custom programming. All custom programming along with source code shall be turned over to the University. All code becomes property of Miami University.

1.6. Site supervision by a single designated coordinator over the course of installation, who shall be the vendor's primary contact with the University and available by phone during working hours.

1.7. Compliance with good practices and standards for the installation and wiring of audio-visual systems, as exemplified in ICIA Installation School.

1.8. Shipping arrangements and costs for, and receipt, custody, and security of, all equipment and material until system acceptance has been completed.

1.9. The connection of the system to the power and communications cables or outlets provided in the room by the University. This may include telephone, data, alarm, CATV, and auxiliary wiring.

1.10. Attaching the projector mount to the ceiling structure as required. Coordinate with the electrician for final placement of the electrical outlet in the ceiling and the location of the 1 ¼" conduit penetration.
1.11. Any additional blocking required for securing and mounting displays, speakers or any other A/V equipment to a wall. The vender may contract with the general contractor to have this provided for them if so desired. This must be coordinated during the weekly project meetings.
1.12. Labeling of each panel-mounted connector with familiar terms for use on the front side, and unique designation as used on the as-built system drawing on its backside. Labels must be either engraved into the panel, or engraved in plastic stick on labels. Tape labels or label machine labels are not acceptable.
1.13. The adjustment, performance checks, and documentation of all functions.
1.14. Documentation: A separate binder for each system type, labeled with building and room number, and containing: As-built system schematics with unique designations for each cable, matching the labels provided on the cables and connection panels.
1.15. Operating manuals for each item of equipment.
1.16. List of equipment settings required for proper operation (such as equalization, gain, and delay in sound amplification system).
1.17. An inventory list of name, make, model and serial number, MAC address, and Jack ID's for each item of equipment in the room.
1.18. A signed statement of warranty bearing the coverage dates (see system warranty section).
1.19. Two copies of a CD-ROM containing all of the above material. As-built drawings shall be provided in PDF format in addition to AutoCad, Visio, or other standard program used in their creation. Software programs and any passwords that may be necessary to access, edit, or load control code into devices shall be provided along with the source and complied code. Where adjustments are made through software programs, the adjusted settings and software necessary to load them shall be included. The only exception to this requirement shall be for materials which a manufacturer does not make available in electronic format.
1.20. Training on the operation and maintenance of the system to designated University support staff.

2. System Specifications

2.1. Functionality (reference attached drawings: AV System Design; Additional Wiring Diagram; Touch Screen Layout, Plate Layouts, Teacher Station pictures).
2.2. Provide sufficient brightness, image clarity and size, and sound level and clarity, to enable students with mild hearing or visual loss to perceive program material accurately.

3. Preferred Products & Specifications

3.1. The following list names acceptable models of equipment, which at this date are preferred by the Miami University Electronic Classroom Planning Services for consistency and ease of support. Substitutions for discontinued items must be of the same manufacturer and be the current replacement for that model.

Item	Manufacturer	Model
Data Projector	Epson	710Ui

Document Camera	Lumens	DC-193
Control System	Crestron	Control Processors and Touch Screens
Instructor Workstation	Case Crafters	MU-Series Custom Cabinet
Matrix Switcher	Extron	Switchers, Matrix Switcher

3.2. The vendor is expected to be pro-active in advising Miami University Electronic Classroom Planning Services of improvements in relevant AV technology and pricing in a timely manner, and to provide demonstration samples for testing and evaluation in actual use.
3.3. Equipment shall be of current design and consist of standard products from established manufacturers, carrying valid manufacturer's standard USA warranties.
3.4. All items must be new. Latest versions of a product type are generally preferred. Used, including demonstrator equipment is unacceptable.
3.5. The smart controls shall be designed to provide optimum usability for all controllable equipment. They shall imitate the design and functionality of the touch-screen type user interface for the University's existing systems with such improvements as may be required by this document or specified during the final design approval process prior to the implementation.

4. The University will provide:

4.1. All standard conduits or other clear cable paths for signal cables (conduit will be provided in walls, but may be stubbed at the ceiling on non-plenum areas.)
4.2. AC power to instructor workstation and projector location.
4.3. Projector Stem in proper location for mounting the projector.
4.4. Resident Classroom computer and monitor
4.5. Room lighting.
4.6. A person designated as primary point of contact for the project; however, the vendor may be required to interface directly with other trades and University Staff to coordinate work and resolve problems.

5. Schedule Requirements and System Acceptance

5.1. Vendors must adhere to timetables for installation and completion of electronic classroom systems. Timetables will be mutually agreed upon as part of the award for this project. Failure to achieve system acceptance by the deadline specified may result in assessment of liquidated damages as set forth in the Contract Documents. Vendor will perform and document systematic comprehensive testing that will be performed before final acceptance of installed systems. The purposes of these tests are to demonstrate that systems meet all performance, installation, and training specifications as set forth in the Contract Documents to the satisfaction of the Miami University representatives.
5.2. System acceptance will be granted when the vendor has demonstrated and documented compliance with all requirements of this contract, unless the University issues a specific waiver in writing.

System Warranty

6.1. The vendor shall include a statement of warranty on the entire system, which shall begin on the date of system acceptance and end no earlier than one year later. These dates shall be recorded as the start of the system warranty at the completion of system acceptance.
6.2. The vendor shall provide all equipment, material, labor, software and travel at no charge to the University during the warranty period for any and all failures of any kind, except as may result from University abuses. Any changes in programming that may be required as a result of vendor's substitution of equipment in fulfillment of the warranty will be the obligation of the vendor.

7. Attachments

8. Omitted

9. Service Offering

The University usually has existing on-site systems support teams that provide an initial rapid response to inoperative installed systems. Their purpose is to solve minor problems on site (such as open circuit breakers burned out bulbs), and to swap out equipment when necessary. They do not generally repair electronic equipment.
Service requirements regarding your products/product lines and labor are as follows:

9.1. Service guarantee that someone will respond by phone with 2 hours from the time of initial contact. Must be able to provide an on site technician for emergency repairs within 24 hours from the time of initial troubleshooting call. The determination of an emergency call or not will be the responsibility of the University representative.
9.2. Technician and user training provided to University personnel
9.3. Warranties: advise of all standard warranty coverage and of any improvements you propose to extend to the standards. Include service level guarantees.
9.4. Tools: vendors and any subcontractors shall furnish at their own cost all tools and expendable supplies necessary to complete work and shall be responsible for their security.

10. Omitted

11. Vendor Credentials

11.1. The vendor must be able to demonstrate an established, successful track record of past performance in providing products and services closely related to the requirements and scale specified in technical specifications and other Contract Documents. In addition to the information contained in the RBI additional information is required, as set forth below, to demonstrate your company's background and experience in supplying and maintaining audio-visual systems to colleges and universities.

12. Staff Experience

12.1. Supply resumes or background and the level of experience of all individuals who will be involved with this project. Include a description of the individual's current responsibilities for this project including, but not limited to, the following positions:
  12.1.1. Sales representative/account manager.
  12.1.2. Corporate executive who has the authority to negotiate for and bind the company contractually when the bid is awarded.
  12.1.3. Marketing personnel/project managers who would be assigned to this project.
  12.1.4. Implementation Project Manager who would be assigned to this project.
  12.1.5. System designer must have ICIA CTS certification (name and certification must be supplied).
  12.1.6. System programmer must have Crestron Programming certification.
  12.1.7. Lead system installer must have ICIA CTS certification.

12.2. Such special qualifications as may be required to install, align, or service the provided equipment in order to maintain manufacturer's warranties.

12.3. Alternative qualifications will be considered if submitted with bid, but the acceptability of the skill sets as being capable of performing the technical services required for this project will be determined solely by the University.

12.4. Other requirement: Location and response time for service calls as set forth in 12.5.

12.5. Vendor must have qualified personnel who can and will respond on site within four hours of a call for urgent service. Vendors located more than two hundred road miles from the University's campus are deemed unable to meet this requirement and thus ineligible for award.

12.6. Qualified means that personnel have the requisite training, experience, and support to be able to determine on the first visit what item of equipment or wiring is responsible for a malfunction, and to remove, adjust, install, or substitute other similar equipment or wiring to restore service.

13. Request for References

Reference: Responsible Bidder Information Sheet provide in this package.

By providing this information you are granting the University the right to contact any and all references listed to make inquiries as to the type, nature, length, and quality of products and services rendered by your firm. Furthermore, the University reserves the right to factor that information into our bid evaluation process.

14. Method of Evaluation

In determining whether the apparent low bidder is deemed a "responsible" bidder within the meaning of ORC Chapter 153 and the Contract Documents, the information submitted pursuant to sections 11, 12 and 13 above will be carefully examined to assure that the Bidder possesses the requisite level of expertise to perform the highly technical Work required for this project, with such criteria to include, without limitation, the firm's qualifications, past experience with similar projects, and proximity to the University.

15. University Mark(s) Promotions Notice:

The contractor covenants and agrees that unless the University Director of Licensing first gives prior written consent, the contractor shall not (1) use the words “Miami University” (whether alone or in combination with other words), (2) display or otherwise use the name, emblem or logo (or any similar name, emblem, or logo) of any department, or other component constituent or affiliate of the University or (3) otherwise refer to the University or any department, or other component or affiliate of the University, whether in or on any sign advertisement (including any newspaper, television, or radio advertisement), commercial announcement, circular, flier, or other publication or employee uniform.

16. <u>Equipment Specifications:</u>

The conveyance for the Data/Voice, A/V, and electric will be provided in each classroom by the University. It will be the responsibility of the A/V contractor to provide the appropriate cover plates for each of the types. Most of the cover plates have been specified on the equipment list and included drawings. The conveyance and electric will be provided by the University. Any additional conveyance required by the A/V contractor will be the responsibility of the A/V contractor. It will be the responsibility of the A/V contractor to mount the projector to the provided pipe stem with the appropriate mounting hardware. It will be the responsibility of the A/V contractor to pull and terminate all cables required to provide a fully functioning system. Exposed cables above the ceiling must be approved by the University. All cables need to be plenum and securely attached above the ceiling with wire loops or appropriate hangers. All other cables must be in cable tray or conduit.

END OF SECTION

SECTION 28 31 11

ADDRESSABLE FIRE ALARM SYSTEM

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. This Section includes fire alarm systems, including manual stations, automatic detectors, signal equipment, controls, and devices.

B. The fire alarm specifications and drawings define the intent of the fire alarm system to be provided. Provide delegated design and submittal for complete fire alarm system, signed and sealed by the NICET certified fire alarm designer in compliance with all governing laws, rules and regulations. Nothing in the specifications or drawings shall be deemed as authority to violate any governing code.

C. Provide new fire alarm devices in the area of work as indicated in construction document. Integrate new fire alarm devices to existing fire alarm system.

1.3 SYSTEM DESCRIPTION

A. General: Complete, non-coded, addressable, fire detection and alarm system with manual and automatic alarm initiation, addressable smoke detectors, automatic alarm verification for alarms initiated by certain smoke detector zones as indicated, and Transient Voltage Surge Suppression (TVSS) for all 120 VAC power circuits at each fire alarm equipment connected to 120 VAC power, and TVSS at each end of all low voltage circuits which run between and among buildings.

B. System Capacity: 632 intelligent addressable detectors and 632 addressable modules and expandable through addition of LCM and LDM loop cards.

C. Signal Transmission: Multiplex signal transmission dedicated to fire alarm service only.

D. Alarm Indication: By synchronized sounding of voice alarm messages and tone signals on loudspeakers and synchronized flashing of strobes. Horn tone signals shall be synchronized, utilizing the ANSI S3.41 emergency evacuation signal consisting of a three-pulse on-off-on repeating signal.

E. System connections for alarm-initiation and alarm-indicating circuits: Class B wiring.

F. Functional Description: The following are required system functions and operating features:

1. Priority of Signals: Accomplish automatic response functions by the first zone initiated. Alarm functions resulting from initiation by the first zone shall not be altered by subsequent alarms. Alarm signals shall have the highest priority; supervisory and trouble signals have second and third-level priority, respectively. Signals of a higher-level priority shall take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.
2. Non-interfering: Zone, power, wire, and supervise the system so a signal on one device does not prevent the receipt of signals from any other device. All zones shall be capable of being reset manually from the FACP after the initiating device or devices are restored to normal at the initiating device.
3. Programming: All FACP programming and operational features shall be stored in non-volatile memory. Systems that require the use of batteries or battery backup for the program storage are not acceptable. Provide programming of custom messages for each alarm initiation device, and each trouble and supervisory device. Custom messages are to be reviewed and approved by Owner.
4. Signal Initiation: The manual or automatic operation of an alarm, supervisory or trouble condition shall cause the FACP to transmit an appropriate signal including:
    a. General alarm.
    b. Fire suppression system operation alarm.
    c. Smoke detector alarm.
    d. Valve tamper supervisory.
    e. Door release.
    f. Elevator recall.
    g. Elevator shutdown.
    h. System trouble.
    i. Fan shutdown.
    j. Smoke damper control.

G. Transmission to Remote Central Station: Automatically send alarm, supervisory, and trouble signals to Miami University Police Department (MUPD) via Keltron system.

H. Silencing at FACP: Provide capability for acknowledgment of alarm, supervisory, trouble, and other specified signals at the FACP and the capability to silence the local audible signal and provide a visual silenced indicator. Subsequent zone alarms shall cause the audible signal to sound again until silenced in turn by switch operation. Restoration to normal of alarm, supervisory, and trouble conditions shall extinguish the associated visual indicator and cause the audible signal to sound again until the restoration is acknowledged by switch operation.

I. Loss of primary power at the FACP shall sound a trouble signal at the FACP and the annunciator. A visual indicator shall illuminate at both locations when the system is operating on an alternate power supply.

J. Annunciation: Manual and automatic operation of alarm, trouble and supervisory signals shall be annunciated in plain English text utilizing a LCD display at the FACP and at the annunciator, indicating the location and type device. Transmit all alarm and supervisory signals to the remote central station and send the appropriate information to the system printer.

K. General Alarm: A system general alarm includes:
   1. Indicating the general alarm condition and identifying the device that is the source of the alarm at the FACP and the annunciators.
   2. Initiating audible and visible alarm signals throughout the building.
   3. Initiating automatic recall operation of elevators. This shall occur only from smoke detectors located in the elevator lobbies, the machine room and the hoistway. Actuation of the elevator lobby smoke detector at the designated level (main egress floor) shall signal the machine room with a dedicated signal. Actuation of a lobby smoke detector at any other floor elevator lobby shall send a separate signal to the elevator machine room. Actuation of a hoistway, pit or machine room smoke detector shall send a third dedicated signal to the machine room. Actuation of any heat or smoke detector at the top of the hoistway or in the pit or in the machine room shall send a fourth signal to the elevator machine room for elevator cab flashing signal. Heat detectors, when provided, shall not initiate this function.
      a. Elevator lobby, hoistway, and machine room smoke detectors shall be monitored by an alarm verification zone. If not allowed by the fire or elevator authority, then a minimum of two cross zoned detectors must be used for this purpose in each lobby, shaft and machine room (include a second smoke detector within the space to accomplish this requirements if alarm verification is rejected by the AHJ).

   4. Operation of a heat detector in the elevator hoistway, pit, or machine room shall cause the power to the related elevators to shut-down via the control methodology and time delays (if any) required by the AHJ. Operation of any of these detectors shall signal the fire suppression system and activate the appropriate response. Coordinate elevator shut-down requirements with elevator contractor.
   5. Closing fire and smoke doors normally held open by electrically operated door holders.
   6. Stopping supply and return fans when their duct detectors are actuated.
   7. Closing smoke dampers.

L. A general alarm shall be initiated by the following conditions:
   1. Manual pull station alarm operation.
   2. Water-flow alarm switch operation.
   3. Initiation of smoke detectors which do not require alarm verification.
   4. Priority 1 alarm condition.

M. Initiation of smoke detectors which require alarm verification shall cause the following:
   1. Audible and visible indication of an alarm verification signal at the FACP.
   2. Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
   3. General alarm initiation if the alarm is verified.
   4. FACP indication cancellation and system reset if the alarm is not verified.

N. Sprinkler valve tamper switch operation shall initiate the following:
   1. A supervisory audible and visible valve tamper signal indication at FACP and annunciators.

O. Closing of smoke dampers upon shut-down of air handling unit.

P. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP shall allow the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. The same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. The system printer shall record sensitivity adjustments and sensitivity adjustment schedule changes. Prior to the start of detector sensitivity adjustment, the manufacturer and contractor shall meet with Miami University to coordinate smoke detector sensitivity level.

Q. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. Printouts shall be by zone, device, and type of signal (alarm, supervisory, or trouble). Printout shall include date and time of the occurrence, and shall differentiate alarm signals from all other printed indications. System reset shall also be printed and include the same information concerning device, location, date, and time. It shall be possible to initiate the printout of a list of existing alarm, supervisory, and trouble conditions in the system.
   1. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire-detection system alarm-initiating device and its indication at the FACP shall be ten seconds.
   2. Independent System Monitoring: Supervise each independent smoke detection system, duct detector, and elevator smoke detection system for both normal operation and trouble.
   3. Circuit Supervision: Indicate circuit faults by means of both a zone and a trouble signal at the FACP. Provide a distinctive indicating audible tone and a visual indication.

1.4 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
   1. Product data for system components: Include dimensioned plans and elevations showing minimum clearances and installed features and devices. Include list of materials and Underwriter's Laboratories listing data.
   2. Wiring diagrams from manufacturer differentiating between factory- and field-installed wiring: Include diagrams for equipment and for system with all terminals and interconnections identified, including power connections and interface to fire safety control functions. Indicate components for both field and factory wiring. Include conductor type and sizes.
   3. Battery and voltage drop calculations.
   4. System operation description covering this specific Project including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
   5. Operating instructions for mounting at the FACP.
   6. Operation and maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1: Include data for each type product, including all features and operating sequences, both automatic and manual. Provide riser diagram of system showing locations and addresses of fire alarm devices. Include recommendations for spare parts to be stocked at the site. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.

7. Warranty: Two years from the point of formal acceptance of the system by the University. Provide two full person days, minimum 16 hours, of on-site support for the system during warranty.

B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of annotated Contract Drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, submit them for review. Make resubmissions if required to make clarifications or revisions to obtain approval.

C. Record of field tests of system.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A factory-authorized Installer is to perform the Work of this Section.

B. Compliance with Local Requirements: Comply with all applicable building codes, local ordinances, and regulations, and the requirements of the authority having jurisdiction.

C. Comply with NFPA 72 National Fire Alarm Code.

D. FM Compliance: Provide fire alarm systems and components that are FM-approved.

E. Single-Source Responsibility: Obtain fire alarm components from a single source that assumes responsibility for compatibility for system components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products as manufactured by Simplex, 4100U series.

2.2 MANUAL PULL STATIONS

A. Description: Addressable, double-action type, fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color. Stations requiring the breaking of a glass panel are not acceptable. Stations requiring the breaking of a concealed glass rod may be provided.

B. Station Reset: Key or wrench-operated, double-pole, double-throw, switch-rated for the voltage and current at which it operates. Stations have screw terminals for connections.

2.3 SMOKE DETECTORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
1. Factory Nameplate: Serial number and type identification.

2. Operating Voltage: 24-V D.C. nominal.
3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4. Plug-In Arrangement: Detector and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring.
5. Visual Indicator: Connected to indicate detector has operated.
6. Addressability: Detectors shall include a communication transmitter and receiver having a unique identification and capability for status reporting to the FACP.
7. Remote Controllability: Individually monitor detectors at the FACP for calibration, sensitivity, and alarm condition, and individually adjust for sensitivity from the FACP.

B. Photoelectric Smoke Detectors: Include the following features and characteristics:
1. Detector Sensitivity: Between 2.5- and 3.5-percent-per-foot smoke obscuration when tested according to UL 268.
2. Sensor: An infrared detector light source with matching silicon cell receiver.

C. Duct Smoke Detector: Photoelectric-type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied.

2.4 ALARM-INDICATING DEVICES

A. General: Equip alarm-indicating devices for mounting as indicated. Provide terminal blocks for system connections.

B. Addressable Interface Units: Arrange to monitor one system components that is not otherwise equipped for multiplex communication. The unit shall transmit identification and status to the FACP using a communication transmitter and receiver with unique identification and capability for status reporting to the FACP. Units that support more than one system component are not acceptable.

C. Visual Alarm Devices: Electronic, xenon flashtube type, designed for operation from 20 to 24 volts DC. Power connections shall be by means of a terminal block. Device shall comply with ADA requirements and be listed to UL 1971 and marked as such. Flash rate shall not exceed two per second. Light output shall be rated at a minimum intensity of 15/75 candelas per UL 1971 over the entire design voltage range, or as indicated on the drawings, whichever is greater. A designation of 75, in lieu of 15/75, indicates a UL 1971 rating of 75 candelas, which is different than the UL 1971 dual-rated 15/75 candelas. Mount lenses on an aluminum or Noryl faceplate. The word "FIRE" is to be marked in minimum 1-inch-high letters on the lens. Units shall have synchronization capability for uniform flashing of visual alarm units.
1. Color: White

D. Combination audio-visual devices shall consist of factory-combined audible and visual alarm units in a single mounting assembly. Each audible and visual component shall meet the same requirements indicated for separate fire alarm speakers and visual alarm devices indicated above and below.

2.5 LOUDSPEAKERS

A. Voice/Tone Speakers: Comply with UL 1480, "Speakers for Fire Protective Signaling." Use 25-volt system.

B. Speakers: Unit to have a frequency response of 400 to 4000 Hz; equipped with a multiple tap, varnish-impregnated, sealed, matching transformer. Match transformer tap range and speaker power rating to the acoustical environment of the speaker location. Provide speakers with ¼, ½, 1 and 2 watt tap settings providing 81, 84, 87 and 90 dB respectively at 10 feet. Set at ¼ watt except where higher taps are required for required dB audibility level and except where noted to have higher settings. Provide a white perforated grilled faceplate. Mount entire assembly in a steel back box, flush mounted unless otherwise indicated. Size amplifier(s) for actual wattage used plus a minimum of 50% spare capacity.
   1. Re-Entrant Units: To be used outdoors or where noted, with adjustable mounting bracket, weatherproof enclosure, 5 watts with built-in amplifier and 1.25, 2.5 and 5 watt taps, proving 110, 113 and 116 dB respectively at 4 feet on axis, 300 to 10,000 Hz frequency response, 110 degree dispersion, similar to Wheelock SA-H5-B, or approved equal.
   2. Color: White

2.6 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall mounting and are complete with matching door plate. Electromagnet operates from a 24 volt ac circuit provided from the fire alarm system, and shall require no more than 3 watts to develop 25 lbs. holding force.

B. Material and Finish: Stainless steel.

2.7 FIRE ALARM CONTROL PANEL (FACP)

A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."

B. Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of panels as well as field wiring. Identify each enclosure by an engraved, red-laminated, phenolic resin nameplate. Lettering on the enclosure nameplate shall not be less than 1 inch high. Identify individual components and modules within the cabinets with permanent labels. Where multiple cabinets are required, the cabinets shall be the same size, type, and keyed alike.

C. Systems: Alarm and supervisory systems are to be separate and independent in the FACP. The alarm-initiating zone boards in the FACP consist of plug-in cards. Construction requiring removal of field wiring for module replacement is not acceptable.

D. Power Supplies: Power supplies for 24 volt DC shall be filtered and regulated. Power supplies and fusing shall be sized to operate properly under normal and peak device currents.

E. Control Modules: Types and capacities required to perform all functions of the fire alarm systems. Local, visible, and audible signals notify of alarm, supervisory, and trouble conditions. Each type of audible alarm has a distinctly different sound.

F. Digital Alarm Communicator / Transmitter (DACT) shall be provided for transmission of alarm, trouble and supervisory signals to University Police Department. DACT shall be UL listed and compatible with the central station service to be used.

G. Resetting: Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory or trouble condition still exists.

H. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at FACP and addressable system components, including annunciation, supervision, and control. A display with a minimum of 80 characters displays alarm, supervisory, and component status messages and indicates control commands to be entered into the system for control of smoke detector sensitivity and other parameters. Arrange keypad for use in entering and executing control commands.

I. Voice Alarm: An emergency communication system, integral with the FACP, shall include central voice alarm system components complete with microphones, pre-amplifiers, amplifiers, audio source unit, and tone generators. Features include:
   1. Amplifiers: comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Size for actual wattage used plus 50% spare. Select for 25 volt system.
   2. Two alarm channels shall permit simultaneous transmission of different announcements to different zones or floors automatically or by use of the central control microphone.
   3. All announcements shall be made over dedicated, supervised communication lines.

J. Instructions: Printed or typewritten instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a location observable from the FACP. Include interpretation and appropriate response for displays and signals, and briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.8 ANNUNCIATOR

A. Provide flush steel cabinet with keyed lockable door. Keyed alike to match FACP enclosure keys.

B. Power from the fire alarm control panel.

C. Provide power available light, alarm light, supervisory light and trouble light and test switch.

D. All alarm, supervisory and trouble conditions shall annunciate at the remote annunciator.

E. Provide an LCD display with language for each condition to match the control panel.

F. Locate as shown on the Drawings. Coordinate final location with City of Oxford Fire Marshal.

G. Provide microphone for manual anouncements.

2.9 EMERGENCY POWER SUPPLY

A. General: Components include valve-regulated, recombinant lead acid battery, charger, and an automatic transfer switch. Battery nominal life expectancy is 10 years minimum.

B. Battery capacity adequate to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. At the end of this period, the battery has sufficient capacity to operate the system, including alarm-indicating devices in either alarm or supervisory mode for a period of 15-minutes. For Voice Alarm communications service, the secondary power supply shall be capable of operating the system for a period of 15-minutes at maximum load.

C. Magnetic door holders are not to be served by emergency power. Magnetic door holders are released when normal power fails.

D. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger recharges them fully within four hours. Charger output is supervised as part of system power supply supervision.

E. Unit shall automatically transfer the load to the battery without loss of signals or status indications when normal power fails.

2.10 TAGS

A. Tags For Identifying Tested Components: Comply with NFPA 72H.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system according to NFPA Standards referenced in Parts 1 and 2 of this Section.

B. Fire Alarm Power Supply Disconnect: Provide lock on circuit breaker devices that are UL listed for use with the specific circuit breaker. Clearly mark the corresponding circuits on the panel board directory as "FIRE ALARM CONTROL CIRCUIT."

3.2 EQUIPMENT INSTALLATION

A. Protection from construction debris. Do not install detector heads, pull stations, fire alarm annunciators and signaling appliances before all dust producing construction in the area has ceased. Protective bags may be installed over said equipment if it is not possible to delay the equipment installation as herein stated. Remove protective bags after system is tested and accepted.

B. Install all devices including smoke and heat detectors, manual stations, control or monitor modules, notification appliances, etc., on a metal back box whether conduit is specified to be used or not.

C. Manual Pull Stations: Mount semi-flush in recessed back boxes with operating handles at ADA required mounting height.

D. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.

E. Smoke Detectors: Install ceiling mounted smoke detectors where shown on the drawings but not less than 4 inches from a sidewall to the near edge. Where wall mounted, install smoke detectors at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers.

F. Install a smoke detector at the fire alarm panel location locations whether or not these are shown on the drawings.

G. All detectors are to be accessible. Particular attention is to be paid to locating duct mounted smoke detectors.

H. Heat detectors at the top of elevator shafts and in pits shall be located within 2 feet of each sprinkler head and shall have a 135 degree F rating maximum.

I. Audible Alarm-Indicating Devices: Install at mounting heights indicated on drawings. Install bells and horns on flush-mounted back boxes with the device operating mechanism concealed behind a grille or as indicated. Combine audible and visual alarms at the same location into a single unit.

J. Visual Alarm-Indicating Devices: Install at mounting heights indicated on drawings.

K. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

L. Fire Alarm Control Panel (FACP): Surface mount with top of cabinet(s) not more than 6 feet above the finished floor.

M. Annunciator: Arrange as indicated, with the top of the panel no more than 6 feet above the finished floor.

N. System Programming: Provide programming of system and devices in accordance with this specific installation and programming of custom messages for each alarm initiating device and trouble condition. Custom messages are to be as indicated by owner.

3.3 WIRING INSTALLATION

A. Wiring Method: Where wiring is installed in accessible locations (above accessible ceilings), open plenum rated cabling may be used in the ceiling cavity . Cables shall be properly supported with dedicated J-hooks or bridal rings supporting fire alarm cabling only. Should bridal rings be used, each ring must include a cable saddle. Exposed cables will not be accepted. In spaces without ceilings, the fire alarm cabling shall be installed in conduit leading to an accessible ceiling cavity. Cable supports and cabling above the ceiling shall be placed to allow access for maintenance, but shall be placed to be protected from damage during maintenance of other systems. Where wiring will not be accessible it shall be installed in EMT conduit. Where wiring cannot be concealed in renovated spaces it shall be installed in surface metal raceway (review proposed surface raceway routing with the project architect and University's Project Manager prior to rough-in). Junction boxes shall be painted red.

B. Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where any circuit tap is made.

D. System Wiring: For the low-voltage portion of the fire alarm system, install minimum No. 16 AWG copper conductors for initiation devices and minimum #14 AWG copper conductors for notification , power supply and miscellaneous applications. Low voltage portion of wiring may be installed without conduit within crawl space or in the attic. Take voltage drop into account and increase size of wires where required. For line-voltage wiring, install No. 12 AWG size with insulation rated 75 deg C minimum.

E. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuits wiring and a different color code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visual alarm-indicating devices. Paint fire alarm system junction boxes and covers red. Provide the FACP with a legend of each unique wire color used identifying its service as noted above.

F. Wiring to telephone system: Provide necessary wiring from the FACP to the building telephone system and tag the telephone wiring as "Fire Alarm Communications" at all exposed locations and punch downs.

3.4 GROUNDING

A. Ground all equipment enclosures and conductor and cable shields.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results. Pre-acceptance testing of the entire fire alarm system must be completed in the presence of the University Fire Marshal and University Project Manager prior to the Contractor requesting final inspection by the State Fire Marshal's Office. There are no exceptions to this requirement.

C. Report of Pretesting: After pretesting is complete, provide a letter on Contractor's letterhead certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72. Minimum required tests are as follows:
   1. Verify the absence of unwanted voltages between circuit conductors and ground.
   2. Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1-megohm for evaluation.
   3. Test all conductors for short circuits utilizing an insulation-testing device.
   4. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.
   5. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
   6. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
   7. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
   8. Test the system for all specified functions according to the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones,

and annunciator indications. Observe all voice audio for routing, clarity, and quality, freedom from noise and distortion, and proper volume level.

9. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

3.6 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Vacuum clean dust and debris from inside and outside of all fire alarm control panels, fire alarm junction boxes and all fire alarm equipment not protected from dust and debris during construction.

3.7 DEMONSTRATION

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
   1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 16 hours' training. All instruction sessions shall be audio/video taped in a digital format by the system supplier. Provide two (2) record copies on DVD media to the University within two weeks.
   2. Schedule training with the Owner at least seven days in advance.

3.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed, that are packaged with protective covering for storage, and that are identified with labels clearly describing contents.
   1. Glass Rods for Manual Stations: Furnish 12 rods per building.
   2. Ceiling Speakers: Furnish 12 complete assemblies per building.
   3. Wall Mounted A/V Units: Furnish 4 complete assemblies per building.
   4. Smoke Detectors: Furnish 4 detectors per building.
   5. Detector Bases: Furnish 4 bases per building.

END OF SECTION