

**MIAMI UNIVERSITY
OXFORD, OHIO 45056**

**PHYSICAL FACILITIES DIVISION
FACILITIES CONTRACTING
STANDARD CONDITIONS OF CONTRACT FOR CONSTRUCTION**

**GARDEN COMMONS - INTERIOR RENOVATION
NOURISH**

**PROJECT MANUAL
TECHNICAL SPECIFICATIONS**

January 29, 2025

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SECTION 01 1000

SUMMARY

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, that applies to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents
 - 2. Type of the Contract
 - 3. Use of premises
 - 4. Owner's occupancy requirements
 - 5. Work restrictions
 - 6. Specification formats and conventions

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: **Miami University**
Garden Commons – Interior Renovation
Nourish

- 1. Project Location: Miami University
95 N. Patterson Road
Oxford, Ohio 45056

- B. Owner: Miami University
 - 1. Owner's Representative:
Andrew Burwinkel
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- C. Associate: App Architecture, Inc.
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- D. **This project will be governed by a Single Prime General Contractor agreement.**

1.04 TYPE OF CONTRACT

- A. Project will be constructed under a **single prime contract**. See Division 01 Section "Summary of Contract" for a description of work included in the contract. Contracts for this Project include the following:
 - 1. General Construction

- B. University Separate Contractors: The University intends to contract directly with separate Contractors, and/or to use its own forces, to perform certain work related to the Work of this Contract.
 - 1. The University will hire a separate contractor to provide and install kitchen equipment. Sheet A1.4 EQUIPMENT PLAN provides a schedule of equipment and information on who is providing and installing the equipment. MEP drawings provide contractor's information on required scope of work for these divisions.
 - 2. The University will hire a separate contractor to perform: provide and install branding signage and room signage. Locations of signage are identified on the construction documents and provided for reference and coordination.
- C. The provisions of the Bidding Requirements, Contract Forms, Contract Conditions, and Division 01 – General Requirements apply to the Contractors and its subcontractors working at the job site unless specifically specified otherwise.

1.05 PROJECT SCHEDULE

- A. Project will consist of Work as described in the Construction Documents and the Specifications herein:

2/11/2025	Pre-Bid Meeting
2/26/2025	Bid Opening
3/19/2025 - 8/1/2025	Construction
3/19/2025 - 4/2/2025	Submit Submittals
4/7/2025 – 4/12/2025	Mobilization
8/1/2025	Substantial Completion
8/1/2025 – 8/6/2025	Project Turnover

1.06 SUMMARY OF WORK

- A. Project consists of the Interior Renovation of 1,300 SF of existing serving, kitchen and back of house support space. New construction is inclusive of general trades work, fire protection, plumbing, mechanical and electrical. The area of the building is unchanged and the occupancy is unchanged by the project. The main dining hall will remain operational during the construction phase.
 - 1. Architectural new work and renovation of existing partitions, ceilings, floors, doors, door frames, and door hardware.
 - 2. Finish revisions and upgrades.
 - 3. Finish casework and carpentry removals, modifications, and new work.
 - 4. Engineering Work inclusive of Mechanical, Electrical, Plumbing, Fire Protection and Data/IT removals, modifications and new installations.
- B. The Contract Documents dated January 29, 2025, were prepared for the project by App Architecture, Inc., 615 Woodside Drive, Englewood, Ohio 45322 and Prater Engineering, Inc. 6130 Wilcox Road, Dublin, OH 43016.

1.07 USE OF PREMISES

- A. General Contractor shall have building access for construction operations within areas of scope of work. **The General Contractor is responsible for protecting all existing walls, ceilings, floors, finishes, and equipment to remain in adjacent areas, and steps, exterior drive, walkways and all areas used and accessed during construction operations.**
- B. Use of Site: Use of premises should be confined as necessary to areas within the Contract limits indicated, with non-work areas being used for the transportation of materials as needed. Reduce disturbance to portions of the Project site beyond areas in which the Work is indicated. See Sheet G0.2. Construction Staging.
 - 1. Confine constructions primarily to operations in areas indicated in the Drawings and as required by the project scope.
 - 2. Owner Occupancy: Miami University personnel and others will require ongoing access to the building with public use during limited times as noted below.

3. Driveways, Walks and Entrances: Keep driveways, parking lots, loading areas, walkways and entrances serving premises clear and available to Miami University, Miami University's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways, walkways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Repair damage caused by construction operations. Protect building during construction period.
- D. Parking:
 - a. Expense for parking shall be required by contractors and subcontractors following guidelines and regulations set forth by Miami University's Parking Services.
 - b. Contractors and Subcontractors shall be eligible for parking access issued by Parking Services at the Campus Avenue Building. Parking passes must be obtained prior to the start of work and parking must be maintained within allowable areas.
- E. No storage or office trailers are allowed on Miami University's Main Campus unless indicated otherwise by the University's Project Manager. Miami will permit parking of the trailers at a designated offsite location as coordinated with Miami's Project Manager.

1.08 OWNER'S OCCUPANCY REQUIREMENTS

- A. Partial-Owner Occupancy: Miami University will require access to the premises during entire construction period. Cooperate with Miami University during construction operations to minimize conflicts and facilitate Miami University's usage. Perform the Work so as not to interfere with Miami University's operations. Maintain existing exits, unless otherwise indicated.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Miami University's Project Manager.
 2. Provide not less than seventy-two (72) hour notice to University's Project Manager of activities that will affect the University's operations.

1.09 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated. **To achieve required Milestones and Project Substantial Completion and Final Completion deadlines, work hours can include evenings, night and weekend work in coordination with Miami University's Project Manager.**
 1. Weekend Hours: As arranged a minimum seventy-two (72) hours beforehand with Miami University's Project Manager.
 2. Hours for Utility Shutdowns: As arranged a minimum seventy-two (72) hours beforehand with Miami University's Project Manager.
 3. Hours for noisy activity: as arranged a minimum seventy-two (72) hours beforehand with Miami University's Project Manager.
- B. Existing Utility Interruptions: Do not interrupt utilities serving occupied facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Miami University's Project Manager not less than seventy-two (72) hours in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Miami University's Project Manager's written permission.

1.10 SECURITY

- A. All Contractors and their subcontractors working at the site shall be responsible for the

protection and security of their own equipment and tools.

- B. Security Requirements:
 - 1. To ensure that all visitors to the job site are authorized by the project superintendent, signs will be posted stating that all visitors must check in at the construction office.
 - 2. All personnel on the job site must wear hard hats. All hard hats shall be labeled with employers names to identify all employees. All visitors, unless they have a hard hat with appropriate identification will be issued a visitor hard hat (labeled as such).
 - 3. Superintendent will also include any visitors.

1.11 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections according to CSI/CSC's "MasterFormat" numbering system.
 - 1. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents that is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires.
 - 2. Requirements expressed in the imperative language are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

1.12 STATE OF OHIO COMPLIANCES & INSPECTIONS

- A. Review and approval by State of Ohio Department of Commerce Department of Industrial Compliance. A CPA number shall apply to project.
- B. Permit fees for building permit issued by the State of Ohio Department of Industrial Compliance are the responsibility of Miami University. All others fees shall be the responsibility of the General Contractor and Subcontractors.
- C. All inspections during construction shall be the responsibility of the General Contractor for their associated work efforts.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 01 1400
WORK RESTRICTIONS

PART 1 - GENERAL

1.01 WORK RESTRICTIONS

- A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated. See Sheet G0.2.
- B. The General Contractor shall provide to Miami University's Project Manager's office and cellular telephone numbers for project managers, field supervisors and key foreman before the first application for payment is submitted.
- C. Storage of materials, when outside and approved by Miami University's Project Manager, shall be in orderly piles or storage boxes. No material shall be stored on grass or in areas that are to remain undisturbed. No storage or office trailers are allowed on Miami University's Main Campus area. Miami will permit parking of these trailers at a designated offsite location as coordinated with Miami's Project Manager.
- D. The Contractor and Subcontractors shall execute the work in a manner that will not adversely disrupt the University's operations. This includes, but is not limited to all areas outside of the limits of construction, all buildings, and all utility services.
- E. All Contractor's personnel including Subcontractors that desire to park on Campus while working on Campus shall only park in designated University areas as defined by required parking pass procurement. The University reserves the right to change the designated Contractor and Subcontractor's personnel parking area and lot by providing forty eight (48) hours written notice to the Contractor. The Contractor is responsible for shuttling their personnel and Subcontractors to and from designated Contractor parking lots. Any Contractor and/or Subcontractor employee who does not adhere to the requirements of this section, or who are parking anywhere else on Campus are subject to ticketing, fines, towing and permanent expulsion from working on the current capital improvement project without any further notice. Each Contractor is solely responsible for communicating the parking requirements to all of their employees and subcontractors while on Campus, and issuing the temporary parking permits provided by the University.
- F. Expense for parking shall be required by Contractor and Subcontractors following guidelines and regulations set forth by Miami University's Parking Services. Contractor and Subcontractors shall be eligible for parking access issued by Parking Services at the Campus Avenue Building. Parking passes must be obtained prior to the start of work and parking must be maintained within allowable areas.
- G. Contractors' and Subcontractors' vehicles including delivery vehicles are not permitted to block or obstruct any active sidewalk, cross walk or roadway on Campus. The driver of all delivery trucks shall remain with their vehicle at all times. Delivery trucks are not permitted to idle near public areas or in the vicinity of air intakes of the surrounding buildings. Delivery trucks shall only park within the limits of construction.
- H. The only signs that the Contractor is permitted to post are warning, emergency egress and traffic route signs.
- I. Occupancy of the building will continue through the construction period with coordination of efforts required with Miami University's Project Manager.

1.02 HOURS OF OPERATION

- A. Normal working hours on Campus shall be 7:00 A.M. until 5:00 P.M. Monday through Friday. If any contractor desires to work beyond working the normal working hours, they shall request permission on a daily basis from the Miami's Project Manager. **To achieve required**

Milestones and Project Completion Deadlines, work hours can include evenings, nights and weekend work in coordination with Miami University.

- B. Dumpsters must be located in coordination with Miami's Project Manager. Dumpster wheels and/or supports to be set on plywood at all times to protect substrate. General Contractor is responsible for any and all damages to pavement/substrate areas.

1.03 UTILITIES

- A. Utility outages must be scheduled not less than seventy-two (72) working hours in advance of proposed utility interruptions by filing a written request with the University's Project Manager. The information contained within the Contractor's request must be sufficient for the University to process the request. Contractor's and Subcontractors' personnel are prohibited from operating any breaker on the University's utility systems with the only exception being to save a life or prevent serious injury.
- B. Contractors and Subcontractors are to fully cooperate with the University during all utility outages and shut downs. Recognizing that the utility systems serve other facilities, the Contractors and/or Subcontractors shall plan tying into existing utility services during times when the systems are not functional or in low demand.
- C. The storage of flammable liquids, and other hazardous materials, such-as flammable thinners, gasoline, oil, inside any occupied building or adjacent to mean of egress, or near air intakes for any building is prohibited.
- D. Each Contractor is to maintain their own staging area.
- E. Contractor's and Subcontractors' employees are prohibited from entering into any occupied building on Campus, or riding a University shuttle bus unless specifically escorted by a representative of the University as coordinated through Miami's Project Manager.

PART 2 - PRODUCTS

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 2300

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 will be reviewed and accepted or rejected at the University's option. Accepted alternates will be identified in the final contractual agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of the alternate.

1.03 SCHEDULE OF ALTERNATES - ADDITIONS

- A. **ALTERNATE #01: Epoxy Flooring - Corridor 120A**
 - 1. Add to scope of work flooring in Room Corridor #120A. Work is inclusive of removal of existing sheet flooring and integral base, preparation of subfloor for new finishes and installation of epoxy flooring an integral epoxy cove base.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 3100
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 PROJECT MANAGEMENT

- A. The General Contractor and each Subcontractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.
- B. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
 - 1. General project coordination procedures.
 - 2. Coordination Drawings.
 - 3. Administrative and supervisory personnel.
 - 4. Cleaning and protection.
- C. Related Sections include the following:
 - 1. Division 01 Section "Summary" for a description of the division of Work and responsibility for coordination activities not in this Section.
 - 2. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
 - 3. Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 4. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.

1.02 COORDINATION

- A. Coordination: The General Contractor shall coordinate all construction operations and those of the Subcontractors and entities to ensure efficient and orderly installation of each part of the Work. Each Subcontractor shall coordinate their operations with operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other Subcontractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.
- B. Coordination is required with Miami University regarding new equipment provided by Miami University to be installed by the Contractor and also coordinate regarding equipment to be provided and installed by Miami University.
- C. The General Contractor shall coordinate through Miami University's Project Manager regarding projects that may occur within the project work area to reduce interferences to each project.
- D. Prepare memoranda for the distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Miami University and separate Subcontractors if coordination of their Work is required.

- E. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of Subcontractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Project closeout activities.
 - 7. Startup and adjustment of systems.
 - 8. Project closeout activities and documentation.
- F. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Miami University property.

1.03 PROJECT SCHEDULE

- A. As indicated in Section 01 1000 Summary.
- B. All project schedules should reflect the above noted contractual obligation dates.

1.04 SUBMITTALS

- A. Key Personnel Names: Within five (5) days of starting construction operations, submit to both the Design Associate and Miami's Project Manager a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, email addresses, and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
 - 1. Post copies of list in temporary field office, and by each temporary telephone. Keep list current at all times.

1.05 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project Superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
 - 1. Include special personnel required for coordination of operations with other contractors.

1.06 PROJECT MEETINGS

- A. **SCHEDULED PROJECT MEETING:** General Contractor to manage scheduled meetings at Project site, unless otherwise indicated as noted below.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Miami's Project Manager and Design Associate of scheduled meeting dates and times.
 - 2. Agenda: General Contractor to prepare and present meeting agenda with specific efforts delineated including those of the Subcontractors.
 - 3. Minutes: General Contractor to record significant discussions and agreements achieved. Document construction progress and assigned items and deadlines to be completed by members in attendance. General Contractor will electronically distribute the meeting minutes to attendees and everyone concerned.
 - 4. General Contractor to have video call available at all project meetings.
- B. **PRE-CONSTRUCTION MEETING:** General Contractor to prepare and lead a Pre-construction Meeting before starting construction, at a time scheduled in coordination with Miami's Project Manager, Design Associate, and others, but no later than five (5) days after execution of the

Agreement. The meeting will be held at the Project site or another convenient location as approved by Miami University's Manager. The meeting will be conducted to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Miami University and Design Associate; Contractor and its superintendent, General Contractor and Subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Designation of key personnel, duties, and contact verifications
 - b. Use of the premises and existing building
 - c. Work restrictions
 - d. Progress cleaning
 - e. Working hours
 - f. Owner's occupancy requirements including other projects in same building
 - g. Responsibility for temporary facilities and controls
 - h. Construction waste management and recycling
 - i. Parking availability
 - j. Office, work, and storage areas
 - k. Equipment deliveries and priorities
 - l. Equipment coordination
 - m. Construction schedule
 - n. Submittal procedures
 - o. Critical work sequencing and long-lead items
 - p. Procedures for requests for interpretations (RFIs)
 - q. Procedures for processing field decisions resultant in Construction Change Directives (CCDs), Bulletins and /or and Change Orders (COs)
 - r. Procedures for inspections
 - s. Procedures for processing Applications for Payment.
 - t. Preparation of Record Documents
 - u. First aid
 - v. Security
3. Minutes: Record and distribute meeting minutes.

C. PROGRESS AND COORDINATION MEETINGS:

1. The General Contractor will conduct progress meetings at weekly intervals or at intervals approved by Miami's Project Manager. Dates of meetings will be coordinated with preparation of payment requests.
 - a. Attendees: In addition to representatives of Miami University and Design Associate, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule:
 1. Review progress since the last meeting
 2. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule.
 3. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so.
 4. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 5. Review schedule for next period.

- b. Review present and future needs of each entity present, including the following:
 - 1. Sequence of operations
 - 2. Status of submittals
 - 3. Deliveries
 - 4. Off-site fabrication
 - 5. Access
 - 6. Site utilization
 - 7. Temporary facilities and controls
 - 8. Work hours
 - 9. Hazards and risks
 - 10. Progress cleaning
 - 11. Quality and work standards
 - 12. Status of correction of deficient items
 - 13. Requests for interpretations (RFIs).
 - 14. Status of proposal requests
 - 15. Status of equipment orders, deliveries, inspections and installations
- c. Pending changes
 - 1. Status of CCDs and Change Orders (COs)
 - 2. Pending claims and disputes
 - 3. Documentation of information for payment requests
- 3. Minutes will be recorded and distributed to all attendees.
- 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Contractor's Construction Schedules will be revised after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.07 CLEANING & PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Contract Completion.
 - 1. Keep all work areas broom-clean daily and maintain essential paths of pedestrian traffic free of debris, materials, etc. Erect barricades and dustproof partitions as needed.
- B. Protection: Protect finished surfaces or openings through construction in-place used as passageways for moving materials and equipment. Provide protective coverings over finished floor surfaces in areas exposed to traffic or other construction activities, to ensure clean and undamaged condition at time of Contract Completion.
 - 1. Repair or replace damage to finished Work at no cost to University.
 - 2. No additional Contract Time will be granted by the University as a result of required repairs or replacement of damaged work.
- C. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 3200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Preliminary Construction Schedule
 2. Contractor's Construction Schedule
 3. Field condition reports
- B. Related Sections include the following:
1. Division 01 Section "Summary" for preparing a combined Contractor's Construction Schedule
 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes
 3. Division 01 Section "Submittal Procedures" for submitting schedules and reports
 4. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections
- C. The approved Construction Progress Schedule will be used to plan and execute the work, to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis for all progress payments.
- D. Contractors shall cooperate and coordinate with each other, and with the A/E and the Owner, to provide all scheduling requirements in their respective schedules in accordance with the Contract Documents.
- E. Failure to maintain the Construction Progress Schedule in an approved status may result in the Contracting Authority withholding a monetary penalty against the responsible Contractor(s) until the schedule is approved.

1.03. DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project.
1. Activities included in a construction schedule consume time and resources.
 2. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 3. Predecessor Activity: An activity that precedes another activity in the network.
 4. Successor Activity: An activity that follows another activity in the network.
- B. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- Event: The starting or ending point of an activity.
- Float: The measure of leeway in starting and completing an activity.
1. Float time is not for the exclusive use or benefit of either Miami University or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

- C. Major Area: A story of construction, a separate building, or a similar significant construction element.
- D. Milestone: A key or critical point in time for reference or measurement.

1.04 PROJECT SCHEDULE

- A. As noted in Section 01 1000 Summary.
- B. All project schedules should reflect the contractual obligation dates.
- C. The General Contractor will prepare a Construction Progress Schedule for all work included within the scope of Work.
 - 1. The General Contractor will schedule and conduct a Schedule Kick-Off Meeting. Subcontractors are required to attend.
 - a. The General Contractor will prepare and furnish to all Subcontractors defining the Responsibilities, Milestones, etc. for the Construction Progress Schedule, as outlined in this section. The general Contractor shall submit subsequent schedule requirements to achieve continuity in merging scheduling input.
 - b. The General Contractor will prepare and distribute a schedule of proposed construction sequence to the Subcontractors.
 - 2. The General Contractor will prepare and furnish a detailed electronic schedule to the Subcontractors, the Design Associate and Miami University's Project Manager.
 - a. Subcontractors shall utilize the detailed schedule framework to prepare their Construction Progress Schedule for their specific scope of work.

1.05 SUBMITTALS

- A. Submittals shall be submitted to the Design Associate with copies to be retained for later inclusion as part of project closeout submittal manual.
- B. Preliminary Construction Schedule: Submit one (1) electronic copy to both Miami University's Project Manager and the Design Associate.
- C. Contractor's Construction Schedule: Submit one (1) electronic copy to both Miami University's Project Manager and the Design Associate.
- D. Field Condition Reports: Submit one (1) electronic copy to both Miami University's Project Manager and the Design Associate.

1.06 QUALITY ASSURANCE

- A. Construction Schedule: Conduct schedule review at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the Contractor's Construction Schedule, Including, but not limited to, the following:
 - 1. Discuss constraints, including work stages, area separations, interim milestones, and work by others within building.
 - 2. Review time required for review of submittals and re-submittals.
 - 3. Review requirements for inspections.
 - 4. Review equipment delivery and installation periods.
 - 5. Review time required for completion and startup procedures.
 - 6. Review and finalize list of construction activities to be included in schedule.
 - 7. Review submittal requirements and procedures.
 - 8. Review procedures for updating schedule.

1.07 COORDINATION

- A. The General Contractor shall coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of all Subcontractors.
- B. The General Contractor shall coordinate the Construction Schedule with the Schedule of Values, Submittals Schedule, progress reports, payment requests, and other required

schedules and reports:

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE - GENERAL

- A. Time Frame: Extend schedule from date established for the Notice-to-Proceed to date of Substantial Completion and then to Final Construction Completion and to date of close out documents Final Completion.
- B. Activities
 1. Activity Duration: Define activities so no activity is longer than fourteen (14) days, unless specifically allowed by Miami University.
 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than fourteen (14) days, as separate activities in schedule. Procurement cycle activities include, but are not limited to submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and re-submittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Associate's administrative procedures necessary for certification of Substantial Completion.
 5. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 6. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 7. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Use of premises restrictions.
 8. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Submittals
 - b. Deliveries
 - c. Installation
 - d. Inspections
 - e. Adjusting
 - f. Startup and placement into final use and operation
 9. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, Miami University Occupancy Requirements and Final Completion.

2.02 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 1. List of employees, subcontractors, and others at Project site
 2. Material deliveries
 3. Accidents
 4. Meetings and significant decisions
 5. Unusual events (refer to special reports)
 6. Stoppages, delays, shortages, and losses

7. Emergency procedures
 8. Orders and requests of authorities having jurisdiction
 9. Change Orders received and implemented
 10. Construction Change Directives received and implemented
 11. Services connected and disconnected
 12. Partial Completions and occupancies
 13. Substantial Completions authorized
- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule three (3) days before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses indicate Actual Completion percentage for each activity.
 4. The Critical Path Method (CPM) will be used to generate the schedule.
- B. Distribution: Distribute copies of approved schedule to Design Associate, Miami's Project Manager, Subcontractors, and other parties with a need-to-know schedule responsibility.
1. Post copies in temporary field office.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their, assigned portion of the Work and are no longer involved in performance of construction activities.

3.02 TWO-WEEK LOOK AHEAD SCHEDULE SUBMISSION

- A. The General Contractor shall provide a two-week Look Ahead Schedule for review at the Progress Meeting that occurs closest to the 15th of each month. The Look Ahead Schedule will be based on the most recent monthly update and will show only those activities that are scheduled to begin or are in progress during the week before and for two weeks after the 15th of the current month. The two-week Look Ahead Schedule reports will contain the following information for each activity and will be required from the Contractor throughout the duration of the project unless directed otherwise by the Design Associate.
1. Activity I.D.
 2. Activity Description
 3. Original Duration
 4. Remaining Duration
 5. Early Start Date
 6. Early Finish Date
 7. Percent Complete
 8. Total Float

END OF SECTION

SECTION 01 3233
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Periodic construction photographs.

1.03 SUBMITTALS

- A. Digital Images: Submit a complete set of digital image electronic files as a Project Record Document as part of final construction closeout. Identify electronic media with date photographs were
- B. Maintain accessible copy of all digital images at job site during construction.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in high-quality JPEG format with a maximum compression ratio of 1/2.7, produced by a digital camera with minimum sensor size containing 8 million effective pixels, and at an image resolution of not less than 3200 x 2400 pixels.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in filename for each image.
 - 2. Field Office Images: Maintain one set of images in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Design Associate.
- C. Periodic Construction Photographs: Take digital photographs of construction progress weekly, timing each week to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

END OF SECTION

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SECTION 01 3300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
 - 2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
 - 3. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
 - 4. Division 01 Section "Closeout Procedures" for submitting warranties.
 - 5. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 6. Divisions 02 through 26 Sections for specific requirements for submittals in those Sections.

1.03 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Design Associate's responsive action.
- B. Informational Submittals: Written information that does not require Design Associate's responsive action. Submittals may be rejected for not complying with requirements.

1.04 SUBMITTAL PROCEDURES

- A. General: Upon request electronic copies of CAD Drawings of the Contract Drawings will be provided by Design Associate for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Design Associate reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress" for list of construction schedule submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Design Associate's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
 - 1. Initial Review: Allow five (5) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Design Associate will advise Contractor when a submittal being processed must be delayed for coordination:
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner

- as initial submittal.
3. Re-submittal Review: Allow two (2) days for review of each re-submittal.
 4. Concurrent Consultant Review: When transmitted simultaneously to Design Associate and to Associate's consultants, allow two (2) days for review of each submittal. Submittal will be returned to Design Associate before being returned to the General Contractor.
- E. **Identification:** Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 4 inches by 4 inches (200 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Associate.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name
 - b. Date
 - c. Name and address of Design Associate
 - d. Name and address of Contractor
 - e. Name and address of Subcontractor
 - f. Name and address of Supplier
 - g. Name of manufacturer
 - h. Submittal number or other unique identifier, including revision identifier.
 1. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
 - i. Number and title of appropriate Specification Section
 - j. Drawing number and detail references, as appropriate
 - k. Location(s) where product is to be installed, as appropriate
 - l. Other necessary identification
 - m. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- F. **Additional Copies:** Unless additional copies are required for final submittal, and unless Design Associate observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Submit electronic copy of submittal to concurrent reviewer in addition to specified copy to Design Associate.
 2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
- G. **Transmittal:** Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Design Associate will return submittals, without review, received from sources other than the General Contractor.
1. **Transmittal Form:** Provide locations on form for the following information:
 - a. Project name
 - b. Date
 - c. Destination (To:)
 - d. Source (From:)
 - e. Names of subcontractor, manufacturer, and supplier
 - f. Category and type of submittal
 - g. Submittal purpose and description
 - h. Specification Section number and title
 - i. Drawing number and detail references, as appropriate
 - j. Transmittal number
 - k. Submittal and transmittal distribution record
 - l. Remarks
 - m. Signature of transmitter
 2. On an attached separate sheet, prepared on the General Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Design Associate on previous submittals, and deviations from requirements in the Contract

Documents, including minor variations and limitations. Include same label information as related submittal.

- H. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked "NO EXCEPTION" or "REVIEWED AND NOTED"
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms. Use for Construction: Use only final submittals with mark indicating "NO EXCEPTION" or "REVIEWED AND NOTED" taken by Associate.

1.05 CONTRACTOR'S USE OF DESIGN ASSOCIATE'S CAD FILES

- A. General: At the General Contractor's request, copies of Design Associate's CAD files will be provided to the General Contractor for their use in connection with Project, subject to the following conditions:
 - 1. Acceptance and signing of the Design Associate's CAD Disclaimer prior to the release of any electronic files.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable:
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations
 - b. Manufacturer's product specifications
 - c. Manufacturer's installation instructions.
 - d. Standard color charts
 - e. Compliance with specified referenced standards
 - f. Testing by recognized testing agency. Application of testing agency labels and seals. Notation of coordination requirements.
 - 4. Submit Product Data before or concurrent with Samples.
 - 5. Number of Copies: Submit one (1) electronic copy of Product Data, unless otherwise indicated. Markup and retain one (1) returned copy for the Design Associate as a Project Record Document.
 - 6. Electronic submittals may be submitted to Design Associate with receipt documentation required from associate confirming delivery of information.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions
 - b. Identification of products
 - c. Fabrication and installation drawings
 - d. Roughing-in and setting diagrams
 - e. Shopwork manufacturing instructions
 - f. Templates and patterns
 - g. Schedules

- h. Design calculations
 - i. Compliance with specified standards
 - j. Notation of coordination requirements
 - l. Notation of dimensions established by field measurement
 - m. Relationship to adjoining construction clearly indicated
2. Number of Copies: Submit one (1) electronic copy of each submittal, unless copies are required for operation and maintenance manuals.
 3. Coordinate with Design Associate regarding electronic submissions.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of sample
 - b. Product name and name of manufacturer
 - c. Sample source
 - d. Number and title of appropriate Specification Section
 3. Disposition: Maintain sets of approved samples at Project site, available for quality control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit three (3) full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Design Associate will return submittal with options selected.
 5. Samples for Verification: Submit full-size units or samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three (3) sets of samples. Design Associate will retain one (1) sample set; remainder will be returned.
 - 1) Submit a single sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.
- E. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- F. Schedule of Values: Comply with requirements specified in Miami University's Contract requirements. Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, email addresses, and telephone number of entity performing subcontract or supplying products.

2. Number of Copies: Submit one (1) electronic copy of subcontractor list to Miami's Project Manager and one (1) electronic copy to the Associate, unless otherwise indicated.
 - a. Mark up and retain one returned copy as a Project Record Document.

2.02 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 1. Number of Copies: Submit one (1) electronic copy of each submittal, unless otherwise indicated. Associate will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified Division 01 Section "Construction Progress Documentation."
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- K. Schedule of Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- L. Maintenance Data: Prepare written instructions and procedures for normal maintenance of products.
- M. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page-numbers.
- N. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates
 2. Required substrate tolerances
 3. Sequence of installation or erection
 4. Required installation tolerances
 5. Required adjustments
 6. Recommendations for cleaning and protection
- O. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles; if any, and term of the coverage. Coordinate with Miami's Project Manager and contracting service regarding these submittals.
- P. Material Safety Data Sheets (MSDSs): Submit information directly to Miami's Project Manager; do not submit to Design Associate.
1. Design Associate will not review submittals that include MSDSs and will return them for re-submittal.

PART 3 - EXECUTION

3.01 GENERAL CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Design Associate.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of the General Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 DESIGN ASSOCIATE'S ACTION

- A. General: Associate will not review submittals that do not bear the General Contractor's approval stamp and will return them without action
- B. Action Submittals: Design Associate will review each submittal, make marks to indicate corrections or modifications required, and return it. Associate will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
1. REVIEWED
 2. REVIEWED AND NOTED
 3. RESUBMIT
- C. Informational Submittals: Design Associate will review each submittal and will not return it, or will return it if it does not comply with requirements. Design Associate will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required inspections.
 - 2. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by inspecting activities.
 - 3. Divisions 02 through 26 Sections for specific inspection requirements.
- C. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and control services required by University, Design Associate, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 DEFINITIONS

- A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality Control Services: Inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Design Associate.
- C. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- E. Installer/Applicator/Erector: General Contractor or another entity engaged by the General Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
- F. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Design Associate for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements refer uncertainties to Design Associate for a decision before proceeding.

1.05 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection by a recognized authority
- B. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue
 - 2. Project title and number
 - 3. Dates and locations of inspections
 - 4. Names of individuals making inspections
 - 5. Description of the Work and inspection method
 - 6. Identification of product and Specification Section
 - 7. Complete inspection data
 - 8. Comments or professional opinion on whether inspected Work complies with the Contract Document requirements
 - 9. Name and signature of inspector
 - 10. Recommendations on retesting and re-inspecting
- C. Permits, Licenses, and Certificates: For Miami University's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work. Submit as part of final Project Manual.

1.06 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation- of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.07 QUALITY CONTROL

- A. Inspections not explicitly assigned to Miami University are the General Contractor's responsibility. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of the General Contractor by authorities having jurisdiction, whether specified or not.
 - 1. Inspection requested by the General Contractor and not required by the Contract Documents are Contractor's responsibility.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- C. Re-inspecting: Regardless of whether original inspections were the General Contractor's responsibility, provide quality-control services, including re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Associated Services: Cooperate with agencies performing inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate inspections.
- E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 INSPECTION LOG

- A. Prepare a record of inspections. Include the following:
 - 1. Date inspection was conducted.
 - 2. Description of the Work inspected.
 - 3. Date inspection results were transmitted to Design Associate.
 - 4. Identification of special inspector conducting inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Design Associate's reference during normal working hours.

3.02 REPAIR AND PROTECTION

- A. General: On completion of inspecting and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are the General Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

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SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
 - 2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
 - 3. Division 01 Section "Execution Requirements" for progress cleaning requirements.
 - 4. Divisions 02 through 26 Sections for ventilation, and humidity requirements for products in those Sections.

1.03 USE CHARGES

- A. General: Cost or use charges for temporary Contractor facilities shall be included In the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to Miami University, Design Associate, and authorities having jurisdiction.
- B. Electric Power Service: Electric power from Miami University's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.04 SUBMITTALS

- A. Site Plan: Show staging areas and parking areas for construction personnel. Coordinate with Miami's Project Manager regarding acceptable parking, storage and staging areas.

1.05 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.06 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 TEMPORARY FACILITIES

- A. Storage: Provide storage area to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.02 EQUIPMENT

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

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

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

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Connect to existing service:
 - 1. Arrange with Miami's Project Manager for time when service can be interrupted, if necessary, to make connections for services.
- B. Water Service: Use of Miami's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Miami University. At Substantial Completion, restore these facilities to condition existing before initial use.
 - 1. Toilets: Use of existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Miami University. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- D. Electric Power Service & Lighting: Use of Miami University's existing electric power service and lighting will be permitted, as long as equipment is maintained in a condition acceptable to Miami University.
- E. The General Contractor shall be responsible for temporary project lighting during the period of time after the existing fixtures have been removed and prior to the installation and use of the new light fixtures.

3.03 SUPPORT FACILITIES INSTALLATION

- A. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- B. Parking: Use designated areas of Miami University's existing parking areas for construction personnel.
 - 1. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted: Provide temporary, directional signs for construction personnel and visitors
 - 2. Maintain and touchup signs so they are legible at all times.
- C. Waste Disposal Facilities: Each Contractor is responsible for waste removal of waste related to their own work. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution Requirements" for progress cleaning requirements.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air or water contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Division 01 Section "Summary."

- B. Site Control: Maintain security by limiting number of access cards, keys and/or key cards and restricting distribution to authorized personnel.
- C. Security: Install safety barriers at ongoing areas of construction. Prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

3.05 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a twenty four (24) hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility.
- E. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor.
 - 2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01, Section "Closeout Procedures."

END OF SECTION

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SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
 - 2. Divisions 02 through 26 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.03 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published-product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.04 SUBMITTALS

- A. Substitution Requests: Submit one (1) electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution requests should be submitted to Design Associate for review and approval.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Miami University and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and

- e. installation procedures.
 - f. Samples, where applicable or requested.
 - g. If list of similar installations for completed projects with, project names and addresses and names and addresses of architects and owners.
 - h. Written material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - j. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum,
 - l. General Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - m. The General Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results:
3. Design Associate's Action: If necessary, Design Associate will request additional information or documentation for evaluation within two (2) calendar days of receipt of a request for substitution. Design Associate will notify Contractor of acceptance or rejection of proposed substitution within two (2) calendar days of receipt of request, or two (2) calendar days of receipt of additional information or documentation, whichever is later.
 - a. Use product specified if Design Associate cannot make a decision on use of a proposed substitution within time allocated.
- B. Comparable Product Requests: Submit one (1) electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Design Associate's Action: If necessary, Design Associate will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Design Associate will notify General Contractor of approval or rejection of proposed comparable product request within two (2) calendar days of receipt of request, or two (2) calendar days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
- C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Compatibility of Options: if the General Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
1. General Contractor and Subcontractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Associate will determine which products shall be used.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage,

deterioration, and loss, including theft. Comply with manufacturer's written instructions.

- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units: Store materials in a manner that will not endanger Project structure.
 - 2. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
 - 3. Protect stored products from damage and liquids from freezing.
 - 4. Provide a secure location and enclosure at Project site for storage of materials and equipment by Miami University's construction forces. Coordinate location with Miami University's Project Manager.

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve the General Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Miami University.
 - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Miami University.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 - 3. Refer to Divisions 02 through 26 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 – PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents that are undamaged and, unless otherwise indicated, that are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete Installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Miami University reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Associate will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Associate's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications and/or Drawings name a single product and manufacturer, provide the named product that complies with requirements.
 2. Manufacturer/Source: Where Specifications and/or Drawings name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 3. Products: Where Specifications and/or Drawings include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 4. Manufacturers: Where Specifications and/or Drawings include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 5. Available Products: Where Specifications and/or Drawings include a list of names of both- products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
 6. Available Manufacturers: Where Specifications and/or Drawings include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
 7. Product Options: Where Specifications and/or Drawings indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
 8. Basis-of-Design Product: Where Specifications and/or Drawings name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics, that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
 9. Visual Matching Specification: Where Specifications and/or Drawings require matching an established Sample or "built-in" existing item, select a product that complies with requirements and matches existing conditions Associate's sample. Associate's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
 10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, and textures" or a similar phrase; select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Design Associate will select color, pattern, density; or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Design Associate will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium

items.

2.02 PRODUCT SUBSTITUTIONS

- A. Timing: Design Associate will consider requests for substitution if received within five (5) calendar days after the Notice-to-Proceed. Requests received after that time may be considered or rejected at discretion of Design Associate.
- B. Conditions: Design Associate will consider the General Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Design Associate will return requests without action, except to record noncompliance with these requirements:
 - 1. Requested substitution offers Miami University a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Miami University must assume. Miami University's additional responsibilities may include compensation to Associate for redesign and evaluation services, increased cost of other construction by Miami University, and similar considerations.
 - 2. Requested substitution does not require extensive revisions to the Contract Documents.
 - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. Substitution request is fully documented and properly submitted.
 - 5. Requested substitution will not adversely affect the General Contractor's Construction Schedule.
 - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. Requested substitution is compatible with other portions of the Work.
 - 8. Requested substitution has been coordinated with other portions of the Work.
 - 9. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.03 COMPARABLE PRODUCTS

- A. Conditions: Design Associate will consider the General Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Design Associate will return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 – EXECUTION (Not Used)

END OF SECTION

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SECTION 01 7000
EXECUTION REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following: General installation of products, progress cleaning, starting and adjusting, protection of installed construction, correction of the Work.
- B. Related Sections include the following: Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities: Division 01 Section "Submittal Procedures" for submitting surveys and Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
- C. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Miami University accepted deviations from indicated lines and levels, and final cleaning.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of electrical and plumbing systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance . Record observations.
 - 1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Examine roughing-in for electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 3. Examine walls for suitable conditions where products and systems are to be installed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
 - 5. In coordination with Miami University's Project Manager, inspect all Miami University supplied equipment and materials prior to proceeding with installations.

3.02 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown

diagrammatically on Drawings.

- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Associate. Include a detailed description of problem encountered, together with recommendations for changing Documents.
- D. Verify that specified finish materials noted on the drawings that are to match existing condition materials remain in production and are readily available.

3.03 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Design Associate.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including inserts, anchor bolts, and items with integral anchors, that are to be embedded in masonry or other materials. Deliver such items to Project site in time for installation.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.
- I. Install Owner provided equipment and conduct operations testing in coordination with Miami University's Project Manager.

3.04 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Containerize unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for

proper execution of the Work.

1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
 3. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- D. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- F. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- G. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- H. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.05 STARTING AND ADJUSTING

- A. Start equipment and operating components in coordination with Miami University's project manager to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.06 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure Installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.07 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching"
 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

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SECTION 01 7310
CUTTING AND PATCHING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. The Contractor is responsible for all cutting, fitting and patching, including removal and replacement of existing materials outside his normal trade operations, required to:
 - 1. Uncover portions of the Work to provide for installation of his work.
 - 2. Remove and replace defective work or work not conforming to requirements of the Contract Documents.
 - 3. Remove samples of installed work as specified for testing.
 - 4. Provide routine penetrations of non-structural surfaces for installation of piping, conduit and similar items.
- C. Related Sections include the following:
 - 1. Division 01 Section "Selective Demolition" for demolition of selected portions of the building.
 - 2. Divisions 02 through 26 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.03 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to match existing visual and subsurface conditions.

1.04 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio. Particular attention to be given to new window cut-ins.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or those results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - 1. Primary operational systems and equipment;
 - 2. Control systems;
 - 3. Communication systems;
 - 4. Electrical wiring systems;
 - 5. Fire alarm piping, systems and equipment.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or results in increased maintenance or decreased operational life or safety. Miscellaneous elements include, but are not limited to the following:
 - 1. Equipment supports;
 - 2. Piping, ductwork, and equipment;
 - 3. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Design Associate's opinion, reduce the

building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.05 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials upon pre-approval of selected product and finish characteristics by Design Associate.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.
 - 3. Prime contractors to coordinate extent of removals prior to starting work.
 - 4. **Specific attention is required related to penetrating the raised floor system, its temporary support and restructuring against the penetrating wall system. Contractor to meet with Design Associate and Miami University's Project Manager to verify existing condition and approved reconfiguration condition.**

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.03 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching: Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch finish surface construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

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SECTION 01 7320
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for use of premises and Owner-occupancy requirements.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental protection measures for selective demolition operations.
 - 3. Division 01 Section "Cutting and Patching" for cutting and patching procedures.
 - 4. Division 03 0130 Resurfacing Concrete
 - 5. Division 06 2000 Finish Carpentry
 - 6. Division 08 Aluminum Storefront
 - 7. Division 09 Flooring
 - 8. Division 09 5100 Acoustical Ceilings
 - 9. Related Engineering Specification Section.

1.03 DEFINITIONS

- A. Remove: Detach and/or designated items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Miami University.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

- A. Items of interest or value to Miami University will be encountered during selective demolition will remain Miami University's property and are indicated on the construction documents. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Miami University.
 - 1. Coordinate with Miami University's Project Manager, who will establish special procedures for removal, salvage and delivery of removed material to designated locations.

1.05 PROCESSES COORDINATION

- A. Detail sequence of selective demolition and removal work within the Project Schedule, with starting and ending dates for each activity. Ensure Miami University's on-site operations are uninterrupted.
- B. Interruption of utility services: indicate how long utility services will be interrupted.
- C. Coordinate shutoff, capping, and continuation of utility services.
- D. Locate proposed dust and noise control temporary partitions and means of egress, including for other occupants affected by selective demolition operations. Note that any erected partitions require materials that are non-combustible or made of fire retardant materials.
- E. Coordinate Miami's continuing occupancy of portions of existing building.

- F. Coordinate Miami University's partial occupancy of completed Work.
- G. Provide means of protection for items to remain and items in path of waste removal from building.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Pre-construction Meeting: Conduct a Pre-construction Meeting at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods, procedures, and coordination related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished and extent of the construction.
 - 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 4. Review areas where existing construction is to remain and requires protection.

1.07 PROJECT CONDITIONS

- A. Miami University will occupy portions of the building immediately adjacent to selective demolition areas. Conduct selective demolition so Miami University's operations will not be disrupted.
 - 1. Comply with requirements specified in Division 01 Section "Summary."
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Miami University as far as practical.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Miami University's Project Manager. Miami University will remove hazardous materials under a separate contract if applicable.
- D. Storage or sale of removed items or materials on-site is not permitted. Storage on-site is permitted for removed and relocated materials in coordination with Miami University regarding their locations.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.08 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped where required by construction activities.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of

- selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Contact Miami University's Project Manager for clarifications.
- E. Survey of Existing Conditions:
 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
- F. Perform surveys as the Work progresses to detect possible hazards that may result from selective demolition activities.

3.02 UTILITY SERVICES

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
- B. Service/System Requirements: Locate, identify, disconnect, and seal off indicated utility services serving areas to be selectively demolished.
 1. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 2. Where entire wall areas are to be removed, existing services may be removed with partial removal of the wall.
- C. See Engineering Drawings and Specifications.

3.03 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary fire and smoke resistant barricades and other protection required to prevent injury to people and damage to adjacent facilities to remain where required.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 3. Cover and protect equipment that has not been removed.
 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

3.04 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction and equipment only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically, from higher to lower levels or in coordination with Miami University's Project Manager
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping,

- to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 5. Dispose of demolished items and materials promptly.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Miami's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION

SECTION 01 7700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to the following:
1. Inspection procedures
 2. Warranties
 3. Final cleaning
 4. Project Closeout
- B. Related Sections include the following:
1. Division 01 Section "Execution Requirements" for progress cleaning of Project site.
 2. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 3. Divisions 02 through 26 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting site progress verification for determining date of Substantial Completion, complete the following. List items below that are incomplete in request:
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 3. Obtain and submit releases permitting Miami University unrestricted use of the Work and access to services and utilities. Include occupancy permits, and similar releases.
 4. Prepare and submit Project Record Documents, operation and maintenance manuals.
 5. Deliver tools, spare parts, extra materials, and similar items to location designated by Miami University. Label with manufacturer's name and model number where applicable.
 6. Terminate and remove temporary facilities from Project site, construction tools, and similar elements.
 7. Submit changeover information related to Miami University's use, operation, and maintenance.
 8. Complete final cleaning requirements, including touchup painting.
 9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Site Observation: Submit an email or written request for site observation to occur to verify Substantial Completion. On receipt of request, Design Associate will either proceed with the site development evaluation or notify Contractor of unfulfilled requirements. Design Associate will prepare the Certificate of Substantial Completion after the site review and will notify Contractor of items, either on Contractor's list or additional items identified by Design Associate, that must be completed or corrected before final certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion and subsequent submission of the Certificate of Contract Completion.

1.04 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit one (1) electronic copy of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by the General Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. Project name
 - b. Date
 - c. Name of Design Associate
 - d. Name of General Contractor
 - e. Page number

1.05 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final site review for construction compliances determining the date of Final Completion, complete the following:
 - 1. Submit a final Application for Payment according to Miami University payment procedure.
 - 2. Submit certified copy of Design Associate's Substantial Completion inspection list of items to be completed or corrected (Punch List), endorsed and dated by Design Associate. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Submit evidence of final, continuing insurance coverage complying with Insurance requirements.
 - 4. Instruct Miami University's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Site Observation: Submit an email or written request for site construction compliance review for acceptance. On receipt of request, Design Associate will either proceed with the site review or notify Contractor of unfulfilled requirements. Design Associate will prepare a final Certificate for Payment after inspection or will notify the General Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
- C. Finalized Certificate of Warranty Commencement Certificate of Contract Completion and the Payment Release Affidavit.

1.06 WARRANTIES

- A. Submittal Time: Submit written warranties to Design Associate for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor and subcontractors.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site in areas disturbed by construction activities, including rubbish, waste material, litter, and other foreign substances.
 - b. Remove spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Remove floor protection materials.
 - e. Clean exposed interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including plenums and similar spaces.
 - g. Sweep floors clean in unoccupied spaces.
 - h. Clean transparent materials, including mirrors.
 - i. Remove labels that are not permanent.
 - j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - k. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - l. Replace parts subject to unusual operating conditions.
 - m. Leave Project-clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Miami's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

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SECTION 01 7810
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for coordinating Project Record Documents covering the Work of multiple contracts.
 - 2. Division 01 Section "Closeout Procedures" for general closeout procedures.
 - 3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 4. Divisions 02 through 26 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.03 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Record Drawings: Provide one (1) printed copy of drawings on bond paper and provide one (1) set of electronic as-built drawings in PDF format.
- B. Record Specifications: Comply with the following:
 - 1. Record specifications: Provide one electronic copy of specifications on CD, thumb drive, or other data storage device with modifications noted in red throughout the specification documents.
- C. Record Product Data: Submit one (1) copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.
- D. Record Management Data: Submit one (1) copy of the following:
 - 1. Safety Meeting Minutes
 - 2. Site Field Conditions Record
 - 3. RFIs
 - 4. Construction Change Directives (CCD)
 - 5. Bulletins
 - 6. Change Orders (CO)
 - 7. Addenda

PART 2 – PRODUCTS

2.01 RECORD DRAWINGS

- A. Maintain one (1) set of drawings of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Drawings to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
2. Mark record sets with colors to distinguish between changes for different categories of the Work at same location.
 3. Mark important additional information that was either shown schematically or omitted from original Drawings.
 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record CAD Drawings:
1. Format: Provide record drawings in format as noted above.
 2. Incorporate changes and additional information previously marked on Record Prints.
 3. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to the Design Associate for resolution.
- C. Newly Prepared Record Drawings: Prepare new drawings instead of preparing Record Drawings where Design Associate determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Design Associate for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
 2. Identification: As follows:
 - a. Project name
 - b. Date
 - c. Designation "PROJECT RECORD DRAWINGS"
 - d. Name of Design Associate
 - e. Name of Contractor

2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and Installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
- B. Miscellaneous Record Submittals
1. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 – EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one (1) copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Design Associate's reference during normal working hours.
1. Maintenance documentation directory.
 2. Emergency manuals.
 3. Maintenance manuals for the care and maintenance of products, materials, finishes, systems, and equipment.
- C. Related Sections include the following:
1. Division 01 Section "Summary of the Contract" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
 2. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 3. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
 4. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 5. Divisions 02 through 26 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

3.02 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

3.03 SUBMITTALS

- A. Final Submittal: Submit one (1) copy of manual in final Project Manual form.
1. Correct or modify Project Manual to comply with Design Associate's comments. Submit three (3) copies of corrected Project Manual prior to submission of final Contractor of Payment Request and issuance of Certificate of Project Completion.

3.04 COORDINATION

- A. Where maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.
- B. Provide information related to Owner supplied and installed equipment and materials as well as Owner supplied and Contractor installed equipment or materials.

3.05 MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 - 1. List of documents
 - 2. List of systems
 - 3. List of equipment
 - 4. Table of contents

- B. Tables of Contents: Include a table of contents for each emergency and maintenance manual.

3.06 PROJECT MANUAL - GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page
 - 2. Table of contents
 - 3. Manual contents

- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual
 - 2. Name and address of Project
 - 3. Name and address of Owner
 - 4. Date of submittal
 - 5. Name, address, and telephone number of the General Contractor
 - 6. Names, addresses, and telephone numbers of the Subcontractors
 - 7. Name and address of Associate
 - 8. Cross-reference to related systems in other operation and maintenance manuals.

- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 - 1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8 ½ by 11 inch (215-by-280-rnm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents.
 - 2. Dividers: Heavy paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual. .
 - 3. Supplementary Text: Prepared on 8 ½ by 11-inch (215-by-280-mm) white bond paper.
 - 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

3.07 PROJECT MANUAL - OPERATIONS

- A. Descriptions: Include the following:
 - 1. Product name and model number
 - 2. Manufacturer's name
 - 3. Equipment identification with serial number of each component including that supplied by

- Owner and installed by either the Owner or the Contractor.
- 4. Limiting conditions
- 5. Complete nomenclature and number of replacement parts

3.08 PRODUCT MANUAL - MAINTENANCE

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number;
 - 2. Manufacturer's name;
 - 3. Color, pattern, and texture;
 - 4. Material and chemical composition;
 - 5. Reordering information for specially manufactured products;
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Types of cleaning agents to be used and methods of cleaning
 - 2. List of cleaning agents and methods of cleaning detrimental to product
 - 3. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

3.09 PROJECT MANUAL PREPARATION

- A. Maintenance: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work and indicating maintenance of each system, subsystem, and piece of equipment not part of a system.
- B. Manufacturers' Data: Include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- C. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

END OF SECTION

SECTION 03 0130

RESURFACING AND REHABILITATION OF CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resurfacing of concrete floors.

1.02 RELATED SECTIONS

- A. Section 01 7310 - Cutting and Patching
- B. Section 01 7320 - Selective Demolition
- C. Section 09 6813 - Tile Carpeting

1.03 REFERENCES

- A. AASHTO M 148 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2001.
- B. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2003.

1.04 SUBMITTALS

- A. 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. Installation methods.
- B. See Section 01 3300 – Submittal Procedures for submittal procedures.

1.05 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.

1.06 PROJECT 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 MANUFACTURERS

- A. Basis of Design Manufacturer: Mapei Corporation; 1144 East Newport Center Drive, Deerfield Beach, FL 33442. ASD. Tel: (954) 246-8888 or (800) 42-MAPEI. Fax: (954) 246-8800. www.mapei.com
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 APPLICATIONS/SCOPE

- A. See drawings for extent of work where concrete block walls have been removed.
- B. Interior Floors:
 - 1. For Patching: Use Traffic Surface Repair Mortar, Interior Repair Mortar, or Interior Repair Mortar compatible with new floor covering manufacturer's product recommendations as required in floor areas types immediately noted above.
- C. Bonding new concrete to old concrete: Use epoxy adhesive.

2.03 INTERIOR MATERIALS

- A. Self-Leveling Thin Topping Underlayment: Pre-blended cementitious, for thicknesses from feather edge to 1/2 inch.
 - 1. Acceptable Product: Mapei Novo/Plan 5, fast setting; for over cured concrete.
 - 2. Primer: As recommended by topping manufacturer.
- B. Interior Repair Mortar: Pre-blended cementitious patching mortar for concrete.
 - 1. Acceptable Product: Mapei Planitop 22; two-component, fast-setting, polymer-modified, synthetic fiber reinforced; for vertical and horizontal surfaces, 1/8 inch to 1-5/8 inches per coat.
 - 2. Acceptable Product: Mapei Quickcem Top 101; one-component, fast-setting, non-shrinking, self-curing; for horizontal surfaces, feather edge to 1 inch per coat.
 - 3. Acceptable Product: Mapei Planitop 10; one-component, fast-setting; for floor surfaces, feather edge to 1/4 inch thick.
 - 4. Acceptable Product: Portland cement, sand, and Mapei Planicrete AC or SB mix; for minimum 3/8 inch thickness.
 - 5. Primer: As recommended by topping manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

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.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preservative treatment of wood.
- B. Fire-retardant-treated materials.
- C. Miscellaneous framing, sheathing, wood nailers and furring strips.
- D. Concealed wood blocking for support of accessories and wood trim.

1.02 RELATED REQUIREMENTS

- A. Section 06 2000 - Finish Carpentry
- B. Section 06 4023 - Interior Architectural Woodwork

1.03 REFERENCES

- A. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2003.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2004.
- C. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2003.
- D. AWPA C20 - Structural Lumber -- Fire Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.
- E. AWPA C27 - Plywood -- Fire-Retardant Treatment by Pressure Processes; American Wood-Preservers' Association; 2003.
- F. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2004.
- G. PS 1 - Construction and Industrial Plywood; National Institute of Standards and Technology (Department of Commerce); 1995.
- H. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 1999.
- I. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2002.
- J. WWPA G-5 - Western Lumber Grading Rules; Western Wood Products Association; 2005.

1.04 SUBMITTALS

- A. Product Data: Provide technical data on wood preservative and fire-resistant materials.

1.05 QUALITY ASSURANCE

- A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
- B. 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.

1.06 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).
- B. Grading Agency: Western Wood Products Association (WWPA).
- C. Sizes: Nominal sizes as indicated on drawings, Rough (unsurfaced).
- D. Moisture Content: S-dry or MC19.
- E. Miscellaneous Blocking, Furring, and Nailers:
 - 1. Lumber: S4S, No. 1 or Construction Grade.
 - 2. Boards: Standard or No. 3.

2.02 ACCESSORIES & FASTENERS

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M 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 panels.
 - 3. Nails, Brads, and Staples: ASTM F 1667.
 - 4. Power-Driven Fasteners: NES NER-272.
 - 5. Wood Screws: ASME B18.6.1.

2.03 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Preservative Treatment:
 - 1. Manufacturers:
 - a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
 - b. Chemical Specialties, Inc: www.treatedwood.com.
 - c. Osmose, Inc: www.osmose.com.
- C. Preservative Pressure Treatment of Lumber Above Grade: AWWA Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft retention.
 - 1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - 3. Treat lumber in contact with concrete.
 - 4. Treat lumber less than 18 inches above grade.
 - a. Treat lumber in other locations as indicated.
 - 5. Preservative Pressure Treatment of Plywood Above Grade: AWWA Use Category UC2 and UC3B, Commodity Specification F (Treatment C9) using waterborne preservative to 0.25 lb/cu ft retention.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 - b. Treat plywood in contact with concrete.
 - c. Treat plywood in other locations as indicated.

2.04 FIRE-RETARDANT-TREATED MATERIALS

- A. Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWWA C20 (lumber) and AWWA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

PART 3 EXECUTION

3.01 INSTALLATION

- 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. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- D. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- E. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated,
- F. Provide miscellaneous members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- G. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.
- H. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- I. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.
- J. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.
- K. Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide.

3.02 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.03 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

3.04 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.

3.05 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7419.
 - 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.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Miscellaneous interior finish carpentry work.
- B. Attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry
- B. Section 06 4023 - Interior Architectural Woodwork
- C. Section 07 9005 - Joint Sealers
- D. Section 08 1113 - Hollow Metal Doors & Frames: Applied door frame wood trim
- E. Section 09 9000 - Painting and Coating: Finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.
- B. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.
- D. WI (CCP) - Certified Compliance Program (CCP); current edition at www.woodworkinstitute.com/certification.

1.04 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures for submittal procedures.
- B. Submittal Document: Indicate materials, component profiles, fastening methods, and jointing details.
- C. Samples:
 - 1. Trim: Submit one (1) sample of any applicable trim elements utilized to match existing. Size to be a minimum of 6" inch in length illustrating trim design to match existing removed.

1.05 QUALITY ASSURANCE

- A. Quality Certification: Provide AWI Quality Certification Program inspection report and quality certification of completed work.
 - 1. Prior to delivery to the site provide shop drawings.
 - 2. Replace, repair, or rework all work for which is refused by Miami University Project Manager and/or Design Associate.

PART 2 - PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI Architectural Woodwork Standards for Premium Grade.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

2.02 WOOD PRODUCTS

- A. Sizes and Patterns of Wood Products Provide yard and board lumber sizes. Provide shaped lumber and millwork in the patterns indicated and in standard patterns of the association covering the species.
- B. Interior Standing & Running Trim for Transparent Finish

1. Grade: Custom.
2. Certified Wood: Interior trim for transparent finish shall be certified as "FSC Pure" or "FSC Mixed. Credit!" according to FSC STD-01 -001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
3. Wood Species: White Oak derived from certified sustainable sources.
4. Base, casing, trim, wainscoting and miscellaneous millwork as indicated on the Drawings.

2.03 ACCESSORIES

- A. Adhesive: Type recommended by installer to suit application in conjunction with attachment screws.
- B. Fasteners: Size and type to suit application.
- C. Screws: Of size and type to suit application; galvanized finish in concealed locations.

2.04 FABRICATION

- A. When advantageous to project shop assemble work for delivery to site,
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing.
- B. See Section 06 1000 Rough Carpentry for installation of recessed fire-resistant material wood blocking.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- D. Grade: Install wood trim to comply with same grade as existing trim and mouldings.
- E. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- F. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at mats.
- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
- H. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site finish woodwork areas impacted by installation.

3.04 TOLERANCES

- A. Maximum Variation from true position: 1/16 inch.

B. Maximum Offset from true alignment with abutting materials: 1/32 inch.

END OF SECTION

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SECTION 06 4023

INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Hardwood veneered plywood panels.
 - 2. Suspended decorative wood panels

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 2000 - Finish Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 09 9000 - Painting and Coating: Site finishing of cabinet exterior and interior.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 1999.
- B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2002.
- C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.
- D. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2003 (ANSI/BHMA A156.9).
- E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of blocking, including concealed blocking and reinforcement specified in other Sections.
 - 3. Coordinate with Miami University Project manager regarding locations and sizes of cutouts.
- C. Samples for Verification: Plastic laminates, 6 by 6 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to edge.
 - 1. Plastic laminate, 8 by 10 inches, for each type, color, pattern, and surface finish.
 - 2. Exposed cabinet hardware and accessories, one unit for each type and finish.
 - 3. Solid-surfacing materials, 6 inches square.
 - 4. Veneered panels; submit samples of each type and species of veneer.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three (3) years of documented experience.
- C. Fabricator/installer Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful

in-service performance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. During and after installation adjust work schedule to work with temperature and humidity conditions in building spaces at same levels planned for occupancy.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

PART 2 PRODUCTS

2.01 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.
- B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000.

2.02 PANEL MATERIALS

- A. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with moisture resistant adhesive under heat and pressure; sanded faces; thickness as indicated; use for concealed components.
- B. Hardwood Veneer Plywood Paneling: Provide hardwood plywood panels complying with HPVA HP-1 for
 - 1. Face Veneer Species: Match standing and running trim.
 - a. White Oak Rift Cut
 - 2. Veneer Matching: Book Match.

2.03 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. As specified on drawings.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative eliminates by one of the following:
 - a. Formica Corporation.
 - b. Lamin-Art, Inc.
 - c. Nevamar Corporation
 - d. Wilsonart International; Div. of Premark International, Inc.
 - 2. Type: Standard type or Veneer type made from material complying with requirements for Standard type, as indicated, unless Special Purpose type is indicated.
- C. Provide specific types as follows:
 - 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, color as selected, finish as selected.
 - 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, color as selected, finish as selected.
 - 3. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 SHELVES

- A. Plastic Laminate Shelves: Medium density fiberboard substrate covered with HPDL.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by AWI/AWMAC to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self-locking serrated tongue; of width to match component thickness, color as selected from manufacturer's standards.
 - 2. Use at all exposed shelf edges.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; chrome-plated.
- E. Concealed Joint Fasteners: Threaded steel. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- F. Grommets:
 - 1. 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 2. Product: Subject to compliance with requirements, provide "TG series" by Doug Mockett & Company, Inc.

2.07 SHOP TREATMENT OF WOOD MATERIALS

- A. Provide UL approved identification on fire retardant treated material.

2.08 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

2.09 SUSPENDED WOOD VENEER FLAT PANELS

- A. Existing Product Reference: Specification for previous construction product installation.
- B. Flat Veneer Panels:
 - 1. Flat Veneer Panels shall be manufactured by Rulon Company, St. Augustine, Florida, PH-1-800-227-8566. Panels shall be factory-fabricated to sizes established by approved Rulon shop drawings and confirmed by field dimensions. The Rulon Flat Veneer Panels will be made with a White Oak Rift Cut face veneer, applied to a 3/4" thick core material. Wood is a natural product that will undergo changes with variations in the environment. Therefore, all dimension tolerances shall be $\pm 1/8"$.
- C. Suspension System
 - 1. Ceiling panels shall be suspended from standard heavy duty 15/16" T-rail (supplied by contractor) using torsion springs, C-hangers, or direct screw attachment, according to project design.

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. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining work.
- D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure paneling supports using appropriate angles and anchorages.
- F. Paneling: Anchor securely and conceal anchors.
 - 1. Use smallest size anchors for installation.
 - 2. Countersink anchors and putty over holes to match surface finish.

3.03 ADJUSTING

- A. Adjust installed work.

3.04 CLEANING

- A. Clean paneling, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Batt insulation in interior wall construction.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.
- B. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.
- C. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004.
- D. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics.

1.04 DEFINITION

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.05 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on installation techniques.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.07 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Insulation:
 - 1. OWENS CORNING; www.owenscorning.com
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C 665; friction fit.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
 - 2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E 84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
 - 4. Formaldehyde Content: Zero.
 - 5. Thickness: 3 1/2 inch.
 - 6. Manufactured Product: PINK Next Gen Fiberglas Insulation.
 - 7. Manufacturers:
 - a. Owens Corning Corp: www.owenscorning.com.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESORIES

- A. insulation Flashing Tape: JM UltraFast® Flashing Tape, 3M All Weather Flashing Tape 8067, or equivalent.
- A. Wall Penetration Sealant: Tremco Spectrem 1, or equivalent.
- B. Insulation Fasteners: JM UltraFast CI Plates and JM Ultrafast CI Phillips screws, or equivalent.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Extend insulation in thickness indicated to envelop entire area to be insulated. Install in interior wall spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- E. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges to flanges of metal studs

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 9005

JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
 - 1. Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:
 - a. Perimeter joints between interior wall surfaces and frames of interior doors.

1.02 RELATED SECTIONS

- A. Section 06 2000 - Finish Carpentry
- B. Section 06 4023 - Interior Architectural Woodwork
- C. Section 09 9000 - Painting and Coatings

1.03 REFERENCES

- A. ASTM C 834 - Standard Specification for Latex Sealants; 2000.
- B. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2002.
- C. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2000.

1.04 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.05 PROJECT CONDITIONS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
- B. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.06 COORDINATION

- A. Coordinate the work with all sections referencing this section.

PART 2 - PRODUCTS

2.01 SEALANTS

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.
- B. Provide only products having lower volatile organic compound (VOC) content than

required by South Coast Air Quality Management District Rule No.1168.

- C. Type A - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
 - 1. Color: Standard colors matching finished surfaces as provided by Design Associate.
 - 2. Products:
 - a. Pecora, Inc.; AC-20+
 - b. Sonneborn Division of ChemRex, Inc.; Sonolac
 - c. Tremco; Tremflex 834
 - 3. Applications used for:
 - a. Joints between door frames and wall surfaces.
 - b. Other interior joints for which no other type of sealant is indicated.
- D. Type B - Acoustical Joint Sealant
 - 1. Performance Requirement:
 - a. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction.
 - 1. Sealant shall have a VOC content of 250 g/L or less.
 - 2. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber acoustical sealant complying with ASTM C 834 and the following:
 - a. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - 2. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- E. Preformed Tape Sealants
 - 1. Back-Bedding Mastic Tape Sealant: Preformed, butyl-based elastomeric tape sealant with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - a. AAMA 806.3 tape, for applications in which tape is subject to continuous pressure.
 - b. AAMA 807.3 tape, for applications in which tape is not subject to continuous pressure.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.

3.02 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

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 C 1193.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919

for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.

END OF SECTION

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SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel transom frames.
3. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
3. Division 08 Section "Door Hardware".
4. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
5. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Doors Under Specified Pressure Differences Across the Specimens.
11. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
12. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.

13. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
14. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
15. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
16. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
17. NFRC 102 – Procedure for Measuring the Steady State Thermal Transmittance of Fenestration Systems.
18. NFRC 400 – Procedure for Determining Fenestration Product Air Leakage.
19. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
20. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.

1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
 - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.37, R-Value 2.7, including insulated door, thermal-break frame and threshold.
 2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
 - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).
- D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
 - B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
 - C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.
- 1.7 COORDINATION
- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
 - B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Steelcraft (S).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 - 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 - 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.
2. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) – Thermal Break TQ Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) - CM Series.

b. Curries Company (CU) - M Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 2. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - 3. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
 - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
 - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
 - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
10. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

- 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
11. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
 12. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

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SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware.
 - 2. Cylinders for doors specified in other Sections.
 - 3. Electrified door hardware.

1.02 SUBMITTALS

- A. Coordination Document and product data:
 - 1. Indicate door location of door hardware products and hardware operation type for each new and relocated doors and confirm with Miami University.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three (3) years of documented experience.
- C. Hardware Supplier Qualifications: Company specializing in supplying institutional door hardware with five (5) years of documented experience.
- D. Supplier Qualifications: Person who is or employs a qualified DHI Architectural Hardware Consultant.
- E. Source Limitations: Obtain electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.
- F. Shop Drawings: Include details of electrified door hardware and wiring directions.

1.03 DELIVERY, STORAGE, AND PROTECTION

- A. Protect new hardware items and identify each hardware item according to door opening location.

1.04 COORDINATION

- A. Final Keying:
 - 1. Contractor to inventory existing doors to be relocated.
 - 2. Miami University to remove cores from existing relocated door latching/locking sets. Required on new door only if existing door and door hardware cannot be relocated.
 - 3. Miami University to key removed cores and reinstall in location as coordinated with Contractor. Required on new door only if existing door and door hardware cannot be relocated.
 - 4. New door locking hardware to be purchased and installed by contractor with removable Best cores to be shipped from manufacturer to Miami University Key Shop. Key shop to install cores. Required on new door only if existing door and door hardware cannot be relocated.
- B. Templates: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware.

1.05 MAINTENANCE PRODUCTS

- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within warranty period from date of Substantial Completion.
 - 1. Warranty Period for Manual Closers: ten (10) years.
 - 2. Warranty Period for Exit Devices: three (3) years.
 - 3. Warranty Period for Locks: seven (7) years.
 - 4. All other hardware one (1) year

PART 2 PRODUCTS

2.01 MANUFACTURERS & GENERAL INFORMATION

- A. Hinges: Heavy Duty, 5 Knuckle – Ball bearing type
 - 1. Manufacturers: Hager:
 - 2. Std. Wgt. Hinge TA2714 4 ½" x 4 ½".
 - 3. ECBB1100 Ball Bearing – Standard Weight.
 - 4. Steel with pin.
 - 5. General: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
 - 6. Non-removable Pins: Provide set screw in hinge barrel that prevents removal of pin while door is closed; for out-swinging exterior doors.
 - 7. Screws: Phillips flat-head screws; screw heads finished to match surface of hinges.
- B. Mortise Lock and Latch Sets:
 - 1. Key System: Best Access N/A – Univ. Std. (& pin per Miami University Standards.
 - 2. Schlage:
 - a. Locks: Schlage L Series mechanical mortise locks.
 - b. Schlage Handle: Model 07, ADA Accessible; Satin Chrome US26D; A Rose Escutcheon.
 - c. Types:
 - 1. Office with thumbturn: L9050.
 - 2. Office and inner entry lock: L9050.
 - d. Electric Hardware: Networked hardwired electronic lock.
 - 1. Inner Entry Lock: AD-300
 - a. Multi-technology reader (MT)
 - 3. Cylinders: Best 1E Mortise Cylinder; Core 7-7 pin w/ cylinder ring.
 - a. C265 Schlage L Mortise.
 - b. Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 4. Finish: US26D.
 - 5. Locks shall be ANSI A156.13, Grade 1 mortise locksets, manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
 - 6. Locks to have a standard 2-3/4" backset with a full 3/4" throw stainless steel mechanical anti- friction latch bolt. Deadbolt shall be a full 1" throw, constructed of stainless steel.
 - 7. Lever trim shall be cast or forged in the design specified, with 2-1/8" diameter roses. Levers to be thru-bolted to assure proper alignment. Trim shall be applied by threaded bushing "no ex- posed screws".
- C. Strikes: 1 ¼" x 4 7/8" x1 3/16 Curved Lip Strike.
 - 1. Manufacturer: Schlage.
 - 2. Type: L9000.
 - 3. Finish: US26D.
- D. Electric Strikes:
 - 1. Manufacturer: Von Duprin
 - 2. Flush mount Type: #6200.
 - 3. Surface mount Type: #6300.

- 3. Finish: US26D.
- F. Power Transfers/Supplies
 - 1. Manufacturers: Von Duprin.
- G. Door Silencers
 - 1. Manufacturer: Assay Abloy: www.rockwoodmfg.com.
 - 2. Rockwood 608: Basis of Design.
 - 3. Door hardware to be relocated to be reviewed by Contractor prior to construction.
 - 4. Neoprene or rubber; fabricated for drilled-in application to frame.
- H. Closers
 - 1. Manufacturer: LCN.
 - 2. Type: LCN 4041.
 - 3. Hinge: Pull side, Push Side.
 - 4. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and back check.
 - 5. All closers will not be seen on the public side or hallway side of the door. The appropriate drop plate or mounting plates will be used as conditions dictate.
- I. Concealed Overhead Closer
 - 1. Manufacturer: LCN.
 - 2. Type: LCN 2010, Single Arm
 - 3. Finish: 689
- J. Concealed Overhead Stops
 - 1. Manufacturer: Glynn Johnson
 - 2. Series 100; Model 104H
 - 3. Hold open.

2.02 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

- A. Provide products that comply with the following:
 - 1. Applicable provisions of Federal, State, and local codes.
 - 2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
 - 3. Applicable provisions of NFPA 101, Life Safety Code.
 - 4. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
- B. Finishes: All finishes are US26D or equivalent, unless noted otherwise.

2.03 KEYING

- A. Door Locks/Latches & Final Keying: (To occur in the event the existing door(s) cannot be relocated.)
 - 1. Miami University to remove cores from existing relocated door latching/locking sets.
 - 2. Miami University to key removed cores from existing relocated doors and reinstall in location as coordinated with Contractor.
 - 3. New door locking hardware to be purchased and installed by contractor with removable Best cores to be shipped from manufacturer to Miami University Key Shop. Key shop to install cores.

2.04 FABRICATION

- A. Base Metals: Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials if different from specified standard.
- B. Fasteners: Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated. Provide steel machine or wood screws or steel

through bolts for fire-rated applications.

- C. Spacers or Sex Bolts: For through bolting of hollow metal doors.
- D. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."
- E. Finishes: Comply with BHMA A156.18.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop/coordination drawings/documents.
- B. Doors and door hardware to be relocated to be reviewed by contractor prior to construction and coordinated as necessary in new opening.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Wood Door Preparation: Comply with DHI A115-W series.

3.03 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. One Year Adjustment: Approximately one year after date of Final Acceptance, Installer shall perform the following:
 - 1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
 - 2. Consult with and instruct personnel on recommended maintenance procedures.
 - 3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.04 PROTECTION OF FINISHED WORK

- A. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 2000 - Finish Carpentry: components with requirement for glass.
- B. Section 07 9005 - Joint Sealers: Sealant and back-up material.
- C. Section 08 1113 - Hollow Metal Doors and Frames: Glazed doors, sidelites & clerestory glazing.

1.03 REFERENCE STANDARDS

- A. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.
- B. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 1990.
- C. SIGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units; Sealed Insulating Glass Manufacturers Association; 2004.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Performance Requirements:
 - 1. Select type and thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures of 25 lb/sq ft positive and negative.
 - a. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
 - b. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
 - c. Thicknesses listed are minimum.
 - 2. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
 - a. For monolithic-glass lites heat treated to resist wind loads.
- B. Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.

1.05 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit two (2) samples 12 x 12 inch in size of glass units.
- E. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.
 - 1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency

acceptable to authorities having jurisdiction.

- F. Product test reports for each type of gasket indicated, evidencing compliance with requirements specified.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with SIGMA TM-3000 Glazing Guidelines for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience.
- C. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:
 - 1. Primary glass of each (ASTM C 1036) type and class indicated.
 - 2. Heat-treated glass of each (ASTM C 1048) condition indicated.
- D. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- E. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
 - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
 - 2. Where glazing units, including Kind FT glass are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.83 m²) in area, provide glazing products that comply with Category II materials, and for lites 9 sq. ft. (0.83 m²) or less in area, provide glazing
- F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Glazing Manual".
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units".

1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

- A. See Section 01 7700 - Closeout Procedure, for additional warranty requirements.
- B. General Warranty: Special warranties specified in this Article shall not deprive Miami University of other rights Miami University may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- C. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Miami University and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate.
 - 1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 FLAT GLASS MATERIALS

- A. Manufacturers:
 - 1. ACH Glass/Versalux: www.versaluxglass.com.
 - 2. AFG Industries, Inc: www.afgglass.com.
 - 3. Pilkington Building Products North America: www.pilkington.com.
 - 4. PPG Industries, Inc: www.ppg.com <<http://www.ppg.com>>.
- B. Clear Float Glass (Type S.1): Uncoated, Clear Monolithic Glass Products, Kind FT (fully tempered) where indicated or required by Code.
 - 1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 - 2. Comply with ASTM C 1048.
 - 3. Vision thickness application : ¼"
 - 4. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
 - 5. Statistical Heat Soak: Where required by manufacturer, provide heat-treated fully-tempered glass provided with statistical heat-soak to limit nickel-sulfide inclusion and subsequent break- age beyond specified maximums.
 - 6. Uncoated, Clear, Heat-Treated Float Glass (Glazing Type GLZ-2): ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); Class 1 (clear), Condition A (uncoated surfaces), kind as follows:
 - 1. Kind FT (fully tempered).
 - 2. Kind HS (heat strengthened).
- C. Safety Glass (Type S.2): Clear; fully tempered with horizontal tempering.
 - 1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select) and ASTM C 1048.
 - 2. Comply with 16 CFR 1201 test requirements for Category II.
 - 3. Comply with ANSI Z97.1.
 - 4. 6 mm minimum thick.
 - 5. Provide this type of glazing in the locations required by code.
 - a. Glazed lites in doors.
 - b. Glazed sidelights to doors.
 - c. Glazed transoms to doors.
- D. Back-Bedding Mastic Glazing Tape:
 - 1. Schnee-Morehead, Inc.
 - 2. Pecora Corporation.
 - 3. Tremco Inc.

2.02 FABRICATION OF GLASS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standards and requirements, to comply with system performance requirements.
 - 1. At butt glazing, clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor faces.
 - 2. Grind smooth and polish glass edges exposed to view in final glass installation.
 - 3. Produce glass edges complying with manufacturer's requirements for all insulated glazing units installed within sealant-glazed curtain wall systems.
 - a. Refer to Section 08 4113 Aluminum-Framed Entrances and Storefronts for requirements.

2.03 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C 864 Option I. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self-adhesive on one face.
- C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; size; black color.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions and ready to receive glazing.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

3.03 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
- B. Place setting blocks at 1/3 points with edge block no more than 6 inches from corners.
- C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- D. Place glazing tape on free perimeter of glazing in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.
- G. Comply with combined written instructions and recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- H. Glazing channel dimensions, as provided by manufacturers of grounds, shall provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- I. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- J. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- K. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- L. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:
 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch (3.2 mm) minimum bite of spacers on glass and use thickness equal to

sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- M. Provide edge blocking where required to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- N. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- O. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

3.04 TAPE GLAZING (INTERIOR GLAZING ONLY)

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.05 GASKET GLAZING (DRY)

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

3.06 CLEANING

- A. Examine glass surfaces adjacent to or below exterior surfaces at frequent intervals during construction, but not less than once a week, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- B. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- C. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- D. Wash glass on both exposed surfaces in each area of Project not more than four (4) days

before date scheduled for inspections that establish date of preliminary acceptance/Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.07 PROTECTION

- A. Protect interior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended in writing by glass manufacturer.
- C. Provide final protection and maintain conditions that ensure glass during construction is without damage at the time of preliminary acceptance/Substantial Completion.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Non-load bearing steel framing members for gypsum wallboard assemblies.
- B. Soffit framing
- C. Interior gypsum board.
- D. Gypsum board assemblies attached to steel framing
- E. Light gage metal blocking and reinforcing
- F. Joint treatment and accessories.

1.02 RELATED SECTIONS

- A. Section 07 9005 - Joint Sealers.
- B. Section 08 1113 - Hollow Metal Doors & Frames

1.03 REFERENCES

- A. AISI SG-971 - Specification for the Design of Cold-Formed Steel Structural Members; 1996, with 2000 Supplement.
- B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2003.
- C. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002.
- D. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; 2004.
- E. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2000.
- F. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2004.
- G. ASTM C 954 - 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; 2000.
- H. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2001.
- I. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 1999.
- J. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2003a.
- K. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association; 1996.

1.04 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
- B. Applicator Qualifications: Company specializing in performing gypsum board application and finishing, with minimum five (5) years of documented experience.
- C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- D. See Section 01 7700 - Closeout Procedures for additional warranty requirements.

PART 2 - PRODUCTS

2.01 METAL FRAMING MATERIALS

- A. Metal Framing Manufacturers:
 - 1. Clark Steel Framing Systems: www.clarksteel.com.
 - 2. Dietrich Metal Framing: www.dietrichindustries.com.
 - 3. National Gypsum Company. www.nationalgypsum.com.
 - 4. USG: www.usg.com.
- B. Metal Framing Connectors and Accessories:
 - 1. Same manufacturer as framing.
 - 2. The Steel Network Inc.: www.SteelNetwork.com.
- C. Non-Loadbearing Framing System Components: ASTM C 645 sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
 - 1. Studs: C shaped, min. 20 gauge
 - 2. Runners: U shaped, sized to match studs.
 - 3. Head Track: Slotted deflection track
 - a. 2 1/2" leg with 1-1/2" long slots with a total allowable vertical (deflection) movement of 1-1/2" (3/4"±)

2.02 GYPSUM BOARD MATERIALS

- A. Manufacturers:
 - 1. G-P Gypsum Corporation: www.gp.com/gypsum.
 - 2. National Gypsum Company: www.nationalgypsum.com.
 - 3. USG: www.usg.com.
 - 4. Certainteed: www.certainteed.com
- B. Gypsum Wallboard: ASTM C 1396/C 1396M. Sizes to minimize joints in place; ends square cut.
 - 1. Board for All Areas unless noted otherwise – Drywall panel
 - a. Application: Surfaces for all locations unless noted otherwise
 - c. Thickness: 5/8 inch, unless noted otherwise.
 - d. Edges: Tapered and featured.
 - e. Design Basis: Gypsum Board (Gold Bond® FIRESHIELD® Gypsum Board).
 - 2. Board for Wet Wall Areas - Moisture & Mold Resistant
 - a. Application: Surfaces for all locations at water fixture installation or specifically noted.
 - c. Thickness: 5/8 inch, unless noted otherwise.
 - d. Edges: Tapered and featured.
 - e. Design Basis: Mold and Moisture Resistant Gypsum Board (Gold Bond® BRAND XP® Gypsum Board).

2.03 ACCESSORIES

- A. Finishing Accessories: ASTM C 1047, galvanized steel or rolled zinc, unless otherwise indicated.
 - 1. Types: As detailed or required for finished appearance

2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, LC-bead, and J-bead at exposed panel edges.
 3. Architectural Z Shadow Bead Drywall Products - Trim Tex.
- B. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
1. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 2. Ready-mixed vinyl-based joint compound.
 3. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 4. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type or drying-type taping compound.
 - a. Do not use topping compound for bedding and first coat.
 5. Fill Coat: For second coat, use drying-type, sandable topping compound.
 6. Finish Coat: For third coat, use drying-type, sandable topping compound.
 7. Skim Coat: For final coat of Level 5 finish, use:
 - a. Setting-type, sandable topping compound.
or
 - b. High-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- C. Screws:
1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
 2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.
- D. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- E. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type or drying-type taping compound.
 - a. Do not use topping compound for bedding and first coat.
 3. Fill Coat: For second coat, use drying-type, sandable topping compound.
 4. Finish Coat: For third coat, use drying-type, sandable topping compound.
 5. Skim Coat: For final coat of Level 5 finish, use:
 - a. Setting-type, sandable topping compound.
- F. Sound Attenuation Blankets: See Section 07 2100 Thermal Insulation.
- G. Acoustical Sealant: See Section 07 9005 Joint Sealers.

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: Comply with ASTM C 754 and manufacturer's instructions.
- B. Studs: Space studs as indicated.
1. Extend partition framing to structure where indicated and to ceiling/soffit in other locations.

3.03 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Comply with applicable requirements of ASTM C 754 and with ASTM C 840.

- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with USG's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings. Where building structure abuts ceiling perimeter or penetrates ceiling. Where partition framing and wall furring abut structure, except at floor. Install deflection track top runner to attain lateral support and avoid axial loading.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.
- E. Install light gage steel supplementary framing, blocking, and reinforcing:
 1. To support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

3.04 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
 1. Where studs are installed directly against exterior walls, install foam gaskets between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
 1. Cut studs 1/2 inch short of full height to provide perimeter relief.
 2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
- D. Install steel studs and furring in sizes and at spacings indicated.
 1. Single-Layer Construction: Space studs 16 inches o.c., unless otherwise indicated.
 2. Cementitious Backer Unit Construction: Space studs 16 inches o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.
- F. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 1. Install 2 studs at each jamb, unless otherwise indicated.
 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- G. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Corner Beads: Install at external corners, using longest practical lengths.
- B. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.06 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- B. Finish all gypsum board in accordance with GA-214 Levels.
- C. 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 surfaces behind adhesive applied ceramic tile.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.08 FINISH LEVEL SCHEDULE

- A. Level 1: Above finished ceilings concealed from view and inner layers of double layer installation.
- B. Level 4: Walls and ceilings scheduled to receive flat or eggshell paint finish.
- C. Level 5: Walls receiving whiteboard paint.

END OF SECTION

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SECTION 09 5100
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Acoustical ceiling panels.
 - 2. Exposed grid suspension system.
 - 3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.
- B. Related Sections:
 - 1. Section 09 2116 - Gypsum Board Assemblies

1.02 REFERENCES

- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 - 4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - 7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 8. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.
 - 9. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for type of acoustical ceiling unit and suspension system required.
- B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
- C. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
- D. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the Associate's or Owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.04 QUALITY ASSURANCE

- A. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

- B. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
 - 1. Obtain both acoustical panels and suspension system from the same manufacturer.
- C. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
 - A. Flame Spread: 25 or less & Smoke Developed: 50 or less
- D. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers (if applicable).

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.06 PROJECT CONDITIONS

- A. Space Enclosure: Do not install interior ceilings until work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

1.07 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Acoustical Panels: Sagging and warping
 - 2. Grid System: Rusting and manufacturer's defects
- B. Warranty Period Standard:
 - 1. Acoustical panels: Ten (10) years from date of substantial completion.
 - 2. Grid: Ten (10) years from date of substantial completion.
- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.08 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 PRODUCTS

2.01 ACOUSTICAL CEILING UNITS

- A. Acoustical Panel Standard:

1. Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - a. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment:
 1. Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.
- C. Existing Acoustical Panels (To Be Matched): In areas where new work exists adjacent to existing work, match existing acoustical tiles and grid to existing.
- D. Acoustical Ceiling Panels:
 1. Match existing. See Sheet A4.1 Finish Schedule.
 2. Acoustical Products:
 - A. CLG-1: USG Halcyon ClimaPlus 2'x2'x1" (98225).
 - B. CLG-2 USG Halcyon ClimaPlus 2'x4'x1" (98245).
 - C. CLG-3 USG Halcyon ClimaPlus Logix 6"x48"x1" (98198).

2.02 SUSPENSION SYSTEMS

- A. Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized steel as per ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
 1. Structural Classification: ASTM C 635 Intermediate Duty.
 2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
 3. Acceptable Product: Exposed Tee as manufactured by USG Interiors, Inc.
- B. Suspension System:
 1. Match existing.
 2. Product:
 - a. USG ClimaPlus Performance/Donn Finline 9/16 DXFF suspension system.
- C. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- D. Wire for Hangers and Ties: Hilti X-CW 12 ga ceiling wire assembly complying with ASTM A641.
- E. Edge Moldings and Trim: Metal of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

3.03 INSTALLATION

- A. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.
- B. Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
 - 2. CISCA Recommendations for Acoustical Ceilings: Comply with CISCA "Recommendations for Direct-Hung Acoustical Tile and Lay-In Panel Ceilings."
- C. Suspend main beam from overhead construction with hanger wires spaced 4'-0" on center along the length of the main runner. Install hanger wires plumb and straight.
- D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.
- E. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.
- F. The General Contractor to coordinate responsibilities and work efforts related to the removal, adjustments, and reinstallation of grids and pads impacted by mechanical and electrical subcontract work efforts.

3.04 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 6500
RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Transition accessories.

1.02 REFERENCES

- A. ASTM F 1861 - Standard Specification for Resilient Wall Base; 2002.

1.03 SUBMITTALS

- A. See Section 01 3300 – Submittal Procedures 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. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.04 DELIVERY, STORAGE, AND PROTECTION

- A. Protect roll materials from damage by storing on end.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. 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.

1.06 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS - RESILIENT MOLDING ACCESSORIES

- A. Description: Carpet edge/reducer strip for glue-down applications; other conditions as indicated or as required.
- B. Manufacturers:
 - 1. Basis of Design: Johnsonite
 - 2. Flexco.
 - 3. Roppe Corporation
- C. Material: Rubber.
- D. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

2.02 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.

- B. Adhesives: Water-resistant type recommended

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are smooth and flat within tolerances specified in Section 09 2116, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

- A. Clean substrate.
- B. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.
 - 1. Miter transition strips at change in direction to form hairline joint.

3.04 CLEANING

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Apply protective floor polish to stair accessory surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to manufacturer.
 - 2. Cover stair accessory products with undyed, untreated building paper until Substantial Completion.
 - 3. Do not move heavy and sharp objects directly over stair accessories. Place plywood or hardboard panels over surfaces and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 09 6813

CARPET TILE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, loose laid with edges and control grid adhered.

1.02 REFERENCE STANDARDS

- A. ASTM D 2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2006.
- B. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2008b.
- C. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2008.
- D. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.
- E. CRI 104 - Standard for Installation of Commercial Textile Floorcovering Materials; Carpet and Rug Institute; 2002.
- F. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.
- G. CRI (GLP) - Green Label Plus Carpet Testing Program - Approved Products; Carpet and Rug Institute; Current Edition.
- H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2006.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate direction of carpet pile.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Samples: Submit two (2) carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three (3) years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet with minimum three (3) years experience.

1.05 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers
 - 1. Interface: Chenille Warp
<https://www.interface.com/CA/en-CA/detail/chenille-warp-reflections-1121005999G15S001>
 - 2. Color: Reflections 3681 (Product NO.: 1462902500)
 - 3. Layout: Brick

2.02 MATERIALS

- A. Carpet Tile: Tufted, manufactured in one color dye lot.
 - 1. Product: As indicated on Drawings Finish Schedule
 - 2. Construction: Tufted Tip-Sheared
 - 3. Yarn System: Post-Consumer Colored Yarn
 - 4. Yarn Manufacturer: Universal
 - 5. Dye method: Solution Dyed
 - 6. Soil/Stain: Protekt
 - 7. Tufted Yarn Weight: 17 oz/ydsq
 - 8. Machine Gauge: 1/12 inch
 - 9. Pile Height: 0.15 inches
 - 10. Pile Thickness: 0.094 inches
 - 11. Pile Density: 6.511 oz/yd(2)
 - 12. 19.69 inches x 19.69 inches
 - 13. Critical Radiant Flux: ASTM E 648 (passes)
 - 14. Smoke Density: ASTM E662 (passes)
 - 15. Static: (AATCC-134) <3.0 KV
 - 16. Lightfastness: (AATCC 16-E) >= 4.0 60 AFU's
 - 17. Flammability: Passes Methenamine Pill Test (DOC-FF1-70)
 - 18. Dimension Stability: AACHEN Din 54318 < 10%
 - 19. Traffic Classification: Severe
 - 20. Fiber Modification Ratio: 1.7 to 1.9
 - 21. Total Recycled Content: 64%
 - 22. Backing: Glassbac.

2.03 ACCESSORIES

- A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified.
 - 1. XL Brand Adhesive 2000 Plus.

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 sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- C. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain

instructions if test results are not within limits recommended by carpet tile manufacturer and adhesive materials manufacturer.

- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. 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 Carpet Installation Standard.
- C. Install carpet tile in accordance with manufacturer's instructions and CRI 104.
- D. Blend carpet from different cartons to ensure minimal variation in color match.
- E. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- F. Lay carpet tile in square pattern, with pile direction alternating to next unit, set aligned as indicated on shop drawings.
- G. Fully adhere carpet tile to substrate.
- H. Adhere carpet tile to substrate along centerline of rooms, at perimeter of rooms, where tiles are cut, and at 15 foot intervals throughout rooms. Lay remainder of tile dry over substrate.
- I. Trim carpet tile neatly at walls and around interruptions.
- J. 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

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SECTION 09 7813
METAL INTERIOR WALL PANELS

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes the following type of wall protection system:
 - 1. Wall Panels.

1.02 RELATED REQUIREMENTS

- A. Section

1.03 REFERENCES

- A. National codes (IBC, UBC, SBCCI, BOCA and Life Safety)
- B. American Society for Testing and Materials (ASTM)

1.04 SUBMITTALS

- A. Product data and detailed specification for component and installation accessory required, including installation method for type of substrate.
- B. Shop drawing showing location, extent and installation detail of wall covering product.
- C. Sample for verification purposes: Submit sample, as proposed for this work, for verification of color, texture, pattern and thickness:
- D. Sample of product specified.

1.05 QUALITY ASSURANCE

- A. Code compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA and Life Safety.
- B. Fire performance characteristics: Provide stainless steel components tested in accordance with ASTM E84 for Class A/1 fire characteristics.
- C. Single source responsibility.

1.06 DELIVERY, STORAGE & HANDLING

- A. Deliver material to the project site in unopened original factory packaging clearly labeled to show manufacturer.
- B. Material must be stored flat.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Interior surface protection product specified herein shall be manufactured by Construction Specialties, Inc. as Basis of Design.

2.02 MATERIALS

- A. Stainless Steel: Material to be 16 gauge type, 304 alloy with smooth #4 satin finish.

2.03 WALL COVERING

- A. Basis of Design: Stainless Steel Sheet.
 - 1. CS Acrovyn
 - 2. Nominal .0625" (1.59mm) thick stainless steel sheet
 - 3. Type 304 Stainless-steel alloy.
 - 4. Comply with ASTM Class A/1 fire characteristics.

2.04 FABRICATION

- A. General: Install wall protection product to comply with requirement indicated for design, dimensions, detail, finish and size.

2.05 FINISHES

- A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applications and designations of finishes.

2.06 ACCESSORIES

- A. Mounting: Stainless steel wall protection shall be furnished including appropriate adhesive or mechanical fastener.
- B. Fastener:
 - 1. #8 stainless steel star drive pan head sheet metal screw.
 - 2. Verify screw length with Design Associate prior to installation with reference to backing type.

PART 3 - EXECUTION

3.01 EXAMINATION

- 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. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
- B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install the work of this section in strict accordance with the manufacturer's recommendations using only approved hardware and locating all components firmly into position, level and plumb.

3.04 CLEANING

- A. General: Immediately upon completion of installation, clean wall protection products and accessories in accordance with manufacturer's recommended cleaning method.
- B. Remove surplus material, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 PROTECTION

- A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, sealants, and other coatings.

1.02 RELATED REQUIREMENTS

- A. Section 06 2000 – Finish Carpentry
- B. Section 09 2116 - Gypsum Board Assemblies
- C. Section 09 5100 – Acoustical Ceilings

1.03 SUMMARY

- A. Extent of painting work is shown on the Drawings and Schedules, and as specified herein.
 - 1. Paint new interior exposed items and surfaces throughout the project, unless otherwise indicated.
 - 2. Paint existing interior items and surfaces throughout the project, as indicated.
- B. This Section includes materials, labor, equipment and services necessary to, and applicable to, providing and applying paints, varnishes, coatings or other related materials specifically called for in this specification or on the Drawings.
- C. "Paint" as used herein means coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- D. Paint exposed surfaces whether or not colors are designated in "schedules", except where the natural finish of the material is specifically noted as a surface not be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.
 - 1. Paint surfaces behind movable equipment and furniture to be same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only, before final installation of equipment.
 - 2. Finish doors on tops, bottoms, side edges, and cut-outs the same as the faces, unless otherwise indicated.
 - 3. Paint back sides of access panels, and removable or hinged covers, to match exposed surfaces.
 - 4. Paint ceilings above lighting grilles and return air grilles.
 - 5. Paint interior surfaces of ducts, where visible through registers or grilles. Use flat, non-specular black paint.
- E. Paint Mechanical and Electrical Work: Do not paint mechanical and electrical items factory-prefinished with material intended as the final finish.
- F. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of the work.
- G. Provide incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.

1.04 PAINTING NOT INCLUDED

- A. Shop Priming: Unless otherwise specified, shop priming of structural steel, metal fabrications, hollow metal work, fabricated components such as architectural woodwork and shop-fabricated

or factory-built mechanical and electrical equipment or accessories is included under the various Sections.

- B. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory finishing or installer-finishing is specified for such items, including, but not necessarily limited, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment. Provide touch-up only as required.
- C. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, pipe spaces, duct shafts, and plenum spaces.
- D. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require finish painting, unless otherwise indicated.
- E. Labels: Do not paint over code-required labels, such as Underwriters' Laboratories, or any equipment identification, performance rating, name, or nomenclature plates.

1.04 DEFINITIONS

- A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.05 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2007.
- C. ASTM D 4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 1992 (Reapproved 2003).
- D. SSPC (PMI) – Good Painting Practice; SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.06 SUBMITTALS

- A. See Document 00 72 16 – General Requirements, Article 13 – Action Submittals for submittal procedures.
- B. See Section 01 3300 – Submittal Procedures for submittal procedures.
- C. Product Data: Provide data on all finishing products and special coatings, including VOC content.
- D. Samples: Submit two (2) paper chip samples, 6 x 6 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
- F. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum seven (7) years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum seven (7) years experience.

- C. Warranty: All components of each finish product/system shall be protected against failure and/or performance deficiencies by a product manufacturer's installation and materials warranty. Said warranties shall be specific to each system required and shall be non-prorated warranties which guarantee against material and labor defects for a minimum period of five (5) years.

1.08 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.

1.09 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. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
- B. Paints:
 - 1. Basis of Design: Porter PPG: www.ppgporterpaints.com
 - 2. Approved Standard: PPG Porter – PPG paints. No other manufacturer shall be approved.
 - 3. Coating Systems:
 - a. **New Gypsum Wallboard or Plaster:** 1 coat primer, 2 coat finish paint. Type of coating may vary due to project requirements. Miami University approved products: 17-921, 90-1210, 90-474, 9-500, 6-411, 6-500 and 9-300.
 - b. **Existing or Previously Painted Surfaces:** If color is to remain the same then 2 coats of finish paint. If color is to be changed, 1 coat primer and 2 coats finish paint is required. Miami University approved products: 17-921, 90-1210, 6-411, 6-500, 9-300, 90-474 and 9-500.
 - c. **New Exposed Metal Columns:** 1 coat primer, 2 coat finish paint. Type of coating may vary due to project requirements. Miami University approved products: 17-921, 90-1210, 90-474, 9-500, 6-411, 6-500, 9-300, 90-474 and 9-500.
 - d. **Exposed Metal Conduits or Piping:** Finish the same as adjoining wall or ceiling surface.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed.
 - 1. Provide paints and coatings 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.

2. 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.
 3. 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.
 4. Supply each coating material in quantity required to complete entire project's work from a single production run.
 5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content:
1. 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. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
 1. Opaque, Flat: 50 g/L, maximum.
 2. Opaque, Nonflat: 150 g/L, maximum.
 3. Opaque, High Gloss: 250 g/L, maximum.
 4. Primers, Sealers and Undercoaters: 200 g/L., maximum
 5. Floor Coatings: 100 g/L, maximum
 6. Shellacs, Clear: 730 g/l, maximum
 7. Shellacs, Pigmented: 550 g/L, maximum.
 - c. Architectural coatings VOC limits of 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.
- D. Flammability: Comply with International Building Code for surface burning characteristics.
- E. Colors: Custom color to match existing adjacent color
1. Test color match sample against adjacent walls, to be reviewed and approved by Miami University's Project Manager.

2.03 PAINT SYSTEMS

- A. Gypsum Wallboard: Semi-gloss alkyd enamel shall be used for gypsum wallboard surfaces.
1. New Wallboard: New wallboard shall receive one coat of primer and two (2) coats of finish.
 2. Existing Construction: Existing construction shall receive one (1) coat of primer and one coat of finish paint, except where old finish is removed to substrate.
 3. New Exposed Metal Structure: New exposed metal structure shall receive one coat of primer and two (2) coats of finish.

2.04 ACCESSORY MATERIALS

Miami University - Product Supplement Painting Standards

INTERIOR APPLICATION

Areas of use	Products
	PPG Porter Paints Painting Standard
<u>Primers (interior)</u>	
All surfaces, new or previously painted, (except metal and masonry).	PPG Porter Paints 17-921 Seal Grip (no product substitution will be accepted)
Metal surfaces, new or previously painted.	PPG Porter Paints Low VOC Multi-Purpose Primer 7-282 PPG Porter Paints Pitt-Tech Primer 90-712 (no product substitution will be accepted)
<u>Paint (interior)</u>	
Ceilings / Ceiling Tiles	PPG Porter Paints SpeedHide Eggshell 6-411 (no product substitution will be accepted)
Metal Surfaces/Walls	PPG Porter Paints Pitt Tech Satin 90-474 (no product substitution will be accepted)
Trim	PPG Porter Paints Pitt Tech Satin 90-474 (no product substitution will be accepted)
<u>Caulk (interior)</u>	
Window casings, Door Casings, Trim	Guarantee. Color: per finish PPG Porter Paints Top Gun 200 1414"

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin application of coatings until substrates have been properly prepared, including properly sanding and priming.
- 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 affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Design Associate 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 coating 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 coatings that exhibit surface defects.
- D. Remove 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. Seal voids between pipe penetrations and wall surfaces before painting as indicated on the drawings.
- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Sand metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finished coatings until completion of project.
- B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 10 2600
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Corner guards.
 2. End-wall guards.
 3. Abuse-resistant wall coverings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.
1. Include Samples of accent strips and accessories to verify color selection.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 2. Keep plastic materials out of direct sunlight.
 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS

- A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Inpro Corporation, 160BN or comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. Pawling Corporation
 - 2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; as follows:
 - a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
 - b. Height: As indicated on the drawings.
 - c. Color and Texture: As selected by Architect from manufacturer's full range.
 - 3. Continuous Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
 - 4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
 - 5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 END-WALL GUARDS

- A. Surface-Mounted, Plastic-Cover, End-Wall Guard: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over continuous retainer at each corner, with end of wall covered by semirigid, abuse-resistant wall covering; including mounting hardware.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Inpro Corporation, 160D or comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. Pawling Corporation

2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness; in dimensions and profiles indicated on Drawings.
 - a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
 - b. Height: As indicated on the drawings.
 - c. Color and Texture: As selected by Architect from manufacturer's full range.
3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.5 ABUSE-RESISTANT WALL COVERINGS

- A. Abuse-Resistant Sheet Wall Covering: Fabricated from semirigid, plastic sheet wall-covering material.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Inrpo Corporation, Rigid Palladium Sheet or comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. Pawling Corporation
 2. Size: As indicated.
 3. Sheet Thickness: 0.040 inch.
 4. Color and Texture: As selected by Architect from manufacturer's full range.
 5. Height: As indicated.
 6. Trim and Joint Moldings: Extruded rigid plastic that matches wall-covering color.
 7. Mounting: Adhesive.

2.6 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Polycarbonate Plastic Sheet: ASTM D6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D256, Test Method A.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: As recommended by protection product manufacturer.
 1. Adhesives shall have a VOC content of 70 g/L or less.

2.7 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.8 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.

3. Adjust end, and top caps as required to ensure tight seams.

D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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SECTION 10 4413
FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

- a. Portable fire extinguisher.**

B. Related Requirements:

- 1. Section 10 4416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.**

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

- 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.**

B. Shop Drawings: For fire-protection cabinets.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.**

2.2 PERFORMANCE REQUIREMENTS

1. ASTM International (ASTM):

- a. ASTM E814-11a (UL1479) standard testing method for fire tests of penetration fire stops.**

2.3 FIRE-PROTECTION CABINET

- A. Fire-Protection Cabinet Type: Suitable for fire extinguisher.**

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. JL Industries Inc. – Ambassador Series
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semi recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face with rolled back corners and wall return at outer edge (backbend).
 1. Rolled-Edge Trim: 2-1/2-inch backbend depth. (At 6 inch nominal wall thickness.)
 2. Rolled-Edge Trim: 4-inch backbend depth. (At 4 inch nominal wall thickness.)
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: 12 gauge steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Tempered glass.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 1. Provide projecting door pull and friction latch.
 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 2. Door Latch: Friction type, no lock.
 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
- K. Materials:
 1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.
 2. Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
 3. Rolled-Edge Trim: 2-1/2-inch or 4-inch backbend depth.
 4. Continuous Hinge: Same material and finish as trim, permitting door to open 180 degrees.

5. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to security fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with baked-enamel finish.
6. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in security fire-protection cabinet with the words "FIRE EXTINGUISHER."
7. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors.

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semi recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification:
 - 1. Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 4416
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 10 4413 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.

3. Handles and Levers: Manufacturer's standard.
 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix .
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

- A. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Location: Where indicated on the Drawings.
 - b. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.

END OF SECTION

SECTION 10 5113
METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Knocked-down corridor lockers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related

units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain metal lockers and accessories from single source from single locker manufacturer.

2.2 KNOCKED-DOWN CORRIDOR LOCKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hadrian Inc.; Zurn Industries, LLC
 - 2. Lyon LLC
 - 3. Republic Storage Systems, LLC
- B. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
 - 2. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch nominal-thickness steel sheet; welded to inner face of doors.
 - 3. Door Style: Vented panel as follows:
 - a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.
- C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 - 1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
 - 2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
 - 3. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
 - 1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
 - 1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high.

Provide no fewer than three hinges for each door more than 42 inches high.

- F. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant. Suitable for user provided padlocks.
 - 1. Multipoint Latching: Finger-lift latch control designed for use with User supplied padlocks; positive automatic latching.
 - a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact.
- G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- H. Hooks: Manufacturer's standard ball-pointed hooks, aluminum or steel; zinc plated.
- I. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.
 - 1. Closed Front and End Bases: Fabricated from 0.036-inch nominal-thickness steel sheet.
- J. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
- K. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.
- L. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- M. Configuration and sizes: As indicated on the Drawings.
- N. Finish: Baked enamel or powder coat.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 - 2. See drawings for locker configurations and sizes.
 - 3. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back;

and common intermediate uprights separating compartments.

- C. Equipment: Provide each locker with an identification plate and the following equipment:
 - 1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- D. Knocked-Down Construction: Fabricate metal lockers by assembling at Project site, using manufacturer's nuts, bolts, screws, or rivets.
- E. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.
- F. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

2.4 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
- B. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Equipment:

1. Attach hooks with at least two fasteners.
 2. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
1. Attach recess trim to recessed metal lockers with concealed clips.
 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

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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.
 - 4. NFPA pamphlet no. 13, INSTALLATION OF SPRINKLER SYSTEMS.
 - 5. NFPA pamphlet no. 14, INSTALLATION OF STANDPIPE AND HOSE SYSTEMS.
 - 6. NFPA pamphlet no. 70, NATIONAL ELECTRIC CODE.
 - 7. NFPA pamphlet no. 72, NATIONAL FIRE ALARM CODE.
 - 8. 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. Connection to new Fire Protection Water service at 12" within structure at location shown on plans.
 2. Installation of sprinkler/standpipe water meter/backflow prevention.
 3. Automatic Sprinkler Systems throughout the new structure per Ohio Building Code, Ohio Fire Code and NFPA -13.
 4. Installation of a wet standpipe system throughout the structure per Ohio Building Code, Ohio Fire Code and NFPA - 14
 5. Alarm valves; flow, pressure and tamper switches; and other alarm initiating devices.
 6. Layout Drawings, including all required design calculations and flow tests.
 7. Installation of all fire systems shall meet the requirements of the Owners Insurance Underwriter.
- F. Wiring:
 1. Unless indicated otherwise, all internal operation wiring incidental to the fire protection system shall be the responsibility of the Fire Protection Contractor, except wiring indicated by the Electrical Contract Documentation shall be by the Electrical Contractor. Electrical contract work includes external power input wiring to Fire Protection contract items, and wiring for flow alarms, supervisory switches, and any other alarm initiating or supervisory devices to and from the central fire alarm panel provided in the Electrical Contract.

2. All wiring (if any) in the Fire Protection contract, including low voltage, shall be installed in conduit. All wiring, conduit and installation shall be in accordance with the National Electrical and Fire Alarm Codes, and the requirements of Division 16, Electrical Specification.
 3. The Fire Protection Contractor shall coordinate with the Electrical Contractor as required for proper installation and operation of items wired by the Electrical Contractor. This includes providing the locations of all devices to be wired to the Electrical Contractor at the first opportunity, and coordinating the voltage and any other electrical requirements for all devices.
- G. The Fire Protection Contractor shall not submit or bid the sprinkler system as a gridded type system.
- H. 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.
- I. 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. The existing combined building domestic and Fire Protection water service shall be converted to a dedicated Fire Protection water service, including a new ASSE listed Dual Check Detector Assembly (backflow preventer with bypass meter) at the entry point to the existing structure. The existing building water meter assembly shall be returned to the municipal water authority.
- 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: The testing of the sprinkler installation shall conform to the applicable provisions of NFPA Pamphlet No. 13.

2. Underground Installation: The testing and flushing of the underground installation shall conform to the applicable provisions of NFPA Pamphlet No. 24.
 3. 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 of 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.
- C. Plastic 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. Ohio Pressure Piping Systems Code, State of Ohio.
 - 3. A.S.M.E. Pressure Piping Code - Section B31.1
 - 4. National Electrical Code, Bulletin No. 70, National Fire Protection Association.
 - 5. 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 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.

1.05 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 Fire Protection 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 Fire Protection 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 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.

1.06 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.

1.07 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.

1.08 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.

1.09 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 and Air Balance Reports 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 start and stop the various systems, open and close valves etc. and simulate summer, winter and other temperature control sequences. The Contractor (not the Engineer) is responsible to turn on the systems and demonstrate they are operating properly.

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 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.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 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.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

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. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. 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 waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

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 Firestopping" 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. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. 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 13 - ELECTRICAL WORK

PART 1 GENERAL

1.01 REFERENCE

- A. Section 23 01 05 - Paragraph 1.05 - OHIO ENERGY CODE
- B. Division 26 - ELECTRICAL

1.02 SCOPE

- A. This 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 - This Contractor:

- A. 120 volt wiring required for mechanical equipment when not shown or specified elsewhere.

1.04 WORK INCLUDED - Electrical Contractor.

- A. All power wiring.

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.

PART 2 PRODUCTS

2.01 Refer to Section 21 01 05 - Paragraph 1.05 for "Energy Code" requirements (Particularly power factor correction)

2.02 Refer to Division 16 - ELECTRICAL.

2.03 All single-phase motors provided by this Contractor to have built-in thermal overload protection.

2.04 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.

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.

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 1/4" 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 1/8" 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 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 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 20 - PAINTING

PART 1 GENERAL

1.01 REFERENCE

- A. Division 9 - FINISHES
- B. Section 21 05 53 - TAGGING AND CODING

1.02 SCOPE

- A. All steel supports shall be painted by this contractor per Division 9 requirements.
- B. Piping in exposed finished areas shall be painted by this contractor per Division 9 requirements. Mechanical room and shell space piping does not require paint.
- C. 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 meet requirements of Division 9 - Finishes

PART 3 EXECUTION

Not Applicable

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, 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 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. As specified in sections 21 13 13.
- 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 Provide pipe anchors and guides where and as indicated on the Drawings and elsewhere as required to properly control pipe. Method to suit job conditions.
- 3.04 Support piping at pumps and equipment from floor, ceiling, or walls, so that piping weight is not supported directly from pumps or equipment.
- 3.05 All beam clamps and supports for piping and ductwork shall be in place prior to the fireproofing of the structural steel.
- 3.06 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 OF HANGERS FOR STEEL PIPE

<u>Pipe Size</u>	<u>Rod</u>	<u>Spacing</u>
Thru 1"	3/8"	7'0"
1-1/4"	3/8"	9'0"
1-1/2"	3/8"	9'0"
2"	3/8"	10'0"
2-1/2"	1/2"	11'0"

3"	1/2"	12'0"
4"	5/8"	14'0"
6"	3/4"	17'0"
8"	7/8"	19'0"
10"	1"	22'0"
12"	1"	23'0"

3.07 Support plastic pipe at intervals not to exceed 4 feet, 6 feet on 4 inch and larger.

3.08 Support piping at pumps and equipment from floor, ceiling, or walls, so that piping weight is not supported directly from pumps or equipment.

END OF SECTION

SECTION 21 05 30 - INSTALLATION OF PIPING

PART 1 GENERAL

1.01 REFERENCE

- A. Section 21 05 19 - PIPING SPECIALTIES
- B. Section 21 05 29 - INSERTS, PIPE HANGERS AND SUPPORTS
- C. Section 21 05 93 - TESTS AND ADJUSTMENTS
- D. 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 50 - DEMOLITION

PART 1 GENERAL

1.01 SCOPE

- A. This Contractor shall be responsible for removal of and modifications to the existing fire protection installation including sprinkler heads, pumps, piping, alarms & other elements as herein noted and as shown on the Drawings. Unless indicated otherwise all elements removed and not reused in remodeling shall become the property of this Contractor and be promptly removed from the site.

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

- 3.01 Unless indicated otherwise this contractor shall be responsible for removing all structures & other elements as required for execution of work in his contract. This includes fixed structures (drywall, plaster, concrete, etc.) requiring cutting, removal, disposal & repair; & accessible structures (lay-in ceiling grids & tiles, etc.) requiring removal, storage & re-installation on completion of the fire protection installation. Care shall be taken with removal & storage of accessible structure components to ensure re-installation to original condition. Any elements damaged during removal, storage or re-installation must be replaced by this contractor at his expense.
- 3.02 All waste materials associated by the demolition process shall be removed & clean-up performed by this contractor in accordance with general conditions of construction.
- 3.03 All work in this contract to be done in such a manner as to maintain or minimize interruption of fire protection utility service to the portion of the structure remaining occupied, active & in-use during regular business hours while construction is underway. This includes scheduling & performing work after normal building operation hours when required as a condition of work.
- 3.04 Any fire protection systems shut-down, interruption, impairment or removal from service associated with work in this contract shall be scheduled & approved in advance with the owner's representative.

END OF SECTION

SECTION 21 05 51 - REMODELING

PART 1 GENERAL

1.01 SCOPE

- A. This Contract shall include revisions to all fire protection work in the remodeled portions of the building necessitated to properly integrate with & function within the finished remodeled structure. The remodeled areas shall be as indicated by the architectural and fire protection drawings
- B. This Contract shall include the removal & re-installation of existing fire protection equipment, and re-routing, re-installation & re-connection of associated piping. All de-activated fire protection equipment & piping not utilized in the remodeled structure shall be removed.

PART 2 PRODUCTS

Not applicable.

PART 3 EXECUTION

3.01 REMODELING

- A. In all of the remodeling work the fire protection work shall follow the intent of the Fire Protection Specification insofar as possible with regard to material and workmanship.
- B. Where existing structures (including soffits & fur-outs) are removed any exposed fire protection piping that is to remain active & in use on completion of the project shall be offset to the nearest available concealing structure (new or existing) and reconnected as necessary or required, using all new material for the offset. Note that this shall include piping of every description within the fire protection scope of work at both known and unknown locations.
- C. Unless indicated otherwise, all piping installed in the remodeling work in finished areas shall be installed as concealed work. This Contractor shall do all cutting & repair of structures as required.
- D. Existing fire protection equipment installations that are to remain upon project completion but which interfere with the remodeling work of this or any other project contractor shall be removed & re-installed by this contractor. Scheduling of equipment removal & re-installation shall be coordinated with any & all contractors affected & the Owner's Representative.

- 3.02 Unless indicated otherwise this contractor shall be responsible for repairing all structures & other elements as required for execution of work in his contract. This includes fixed structures (drywall, plaster, concrete, etc.) requiring cutting, removal, disposal & repair; & accessible structures (lay-in ceiling grids & tiles, etc.) requiring removal, storage & re-installation on completion of the fire

protection installation. Care shall be taken with removal & storage of accessible structure components to ensure re-installation to original condition. Any elements damaged during removal, storage or re-installation must be replaced by this contractor at his expense.

- 3.03 All waste materials associated with the remodeling process shall be removed & clean-up shall be performed by this contractor in accordance with general conditions of construction.
- 3.04 All work in this contract to be done in such a manner as to maintain or minimize interruption of fire protection utility service to the portion of the structure remaining occupied, active & in-use during regular business hours while construction is underway. This includes scheduling & performing work after normal building operation hours when required as a condition of work.
- 3.05 Any fire protection systems shut-down, interruption, impairment or removal from service associated with work in this contract shall be scheduled & approved in advance with the owner's representative.

END OF SECTION

SECTION 21 05 53 - TAGGING AND CODING

PART 1 GENERAL

1.01 SCOPE

- A. Provide brass tags on all valves. Tags shall state type of line in which the valve is installed (fire protection piping.) and number of valve. Furnish a schedule or schedules of all valves tagged with number, location and purpose of each valve and mount schedules under glass on Equipment Room wall, or elsewhere as required. Schedules shall be located near and convenient to the valves on the schedule.
- B. In the case of remodeling work when a valve identification system already exists, numbering shall start with the next number after the highest existing number.
- C. After exposed piping is complete, this Contractor shall apply 2" wide color bands on each side of a stenciled legend, lettered with the name of contents of piping. Flow direction arrows of the same colors are to be located adjacent to the Identification Legends. Spacing not over 20 ft. apart and at least once in each room. Do not use adhesive markers. Color per NFPA 13 standards.

PART 2 PRODUCTS

- 2.01 Valve tags shall be brass minimum 16 gauge.

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 21 05 54 - EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE

A. This Contractor shall label all 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. Equipment labels shall include the area served by equipment, horsepower, and flow.

2.02 After exposed piping and insulation is painted, this Contractor shall apply 2" wide color bands on each side of a stenciled legend, lettered with the name of contents of piping. Flow direction arrows of the same colors are to be located adjacent to the Identification Legends. Spacing not over 20 ft. apart and at least once in each room. Do not use adhesive markers. Color as follows:

Contents	Color	Designation
Fire Protection Water	Red	FL

PART 3 EXECUTION

3.01 Secure plates with screws. Do not attach to covers where covers can be easily mixed up.

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 as follows. At these pressures, the circulation shall be free and the piping free of leaks. Verify with the Owners Insurance Underwriter that the testing procedure listed is adequate for their standards.

System	Test Medium	Pressure Not Less Than	Time Not Less Than	Notes
Sprinkler system	Water	200 lbs	3 hrs	no drop

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 mechanical 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 mechanical/electrical 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 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:

Fire Protection Contract

Sprinkler Drawings
Fire Protection Equipment
Pipe, Hangers, and Fittings
Sprinkler Heads
Hydraulic Calculations
Tamper Switches
Flow Switches
Hose Valves
Floor Control Valve Assemblies

- C. The Assocaite 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. Assocaite'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. Manual wet-type, Class I standpipe systems.
 - 2. Wet-Pipe Sprinkler System.
- B. Related Sections include the following:
 - 1. Division 22 Section "Facility Water Distribution Piping" for piping outside the building.
 - 2. Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this Section.

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig.
- D. PE: Polyethylene plastic.
- E. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

- A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.
- B. Manual Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has small water supply to maintain water in standpipes. Piping is wet, but water must be pumped into standpipes to satisfy demand.
- C. 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.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.

- B. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.
 - 1. Minimum residual pressure at each hose-connection outlet is the following:
 - a. NPS 2-1/2 Hose Connections: 50 psig.
 - 2. Unless otherwise indicated, the following is maximum residual pressure at required flow at each hose-connection outlet:
 - a. NPS 2-1/2 Hose Connections: 175 psig.

- C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Laundries: Ordinary Hazard, Group 1.
 - e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - f. Office and Public Areas: Light Hazard.
 - g. Residential Living Areas: Light Hazard.
 - 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 2500-sq. ft. area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
 - 4. Maximum Protection Area per Sprinkler: Per UL listing.
 - 5. Maximum Protection Area per Sprinkler:
 - a. Office Spaces: 225 sq. ft.
 - b. Storage Areas: 130 sq. ft.
 - c. Mechanical Equipment Rooms: 130 sq. ft.
 - d. Electrical Equipment Rooms: 130 sq. ft.
 - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
 - 6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

1.6 SUBMITTALS

- A. Product Data: For the following:
 - 1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
 - 2. Pipe hangers and support.
 - 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 - 4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 - 5. Hose connections, including size, type, and finish.
 - 6. Alarm devices, including electrical data.

- B. Shop Drawings: Diagram power, signal, and control wiring.

- C. Fire-hydrant flow test and reports shall be performed and furnished by the University Fire Marshall. Arrangements and scheduling to be by the contractor, coordinated with the Construction Manager.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable. Submittal to Factory Mutual will be required of the contractor.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14 and Factory Mutual. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Welding certificates.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
 - 3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
 - 4. NFPA 230, "Fire Protection of Storage."

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers

required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

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.
- C. Alternate FP-1: Provide add alternate pricing to provide a complete building fire protection system consisting of steel piping and fittings as specified above.

2.3 Piping down-stream of the sprinkler zone control valve assemblies only may be plenum rated ASTM/fire protection service listed SDR 13.5 CPVC pipe with socket solvent weld pressure fittings rated for 175 psig working pressure. Provide listed adapter/transition fittings for integration of threaded fire protection components. All hangers and supports shall be spaced at 1/2 the Manufacturer recommended spacing to provide greater support and restrict sagging/settling of piping after installation. Installation shall be in full accordance with the Manufacturer's recommendations and NFPA 13.

2.4 FLEXIBLE CONNECTORS

- A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:
1. NPS 2 and Smaller: Threaded.
 2. NPS 2-1/2 and Larger: Flanged.
- B. Manufacturers:
1. Anamet Inc.
 2. Flex-Hose Co., Inc.
 3. Flexicraft Industries.
 4. Flex-Pression, Ltd.
 5. Flex-Weld, Inc.
 6. Hyspan Precision Products, Inc.
 7. Mercer Rubber Co.
 8. Metraflex, Inc.
 9. Proco Products, Inc.
 10. Unaflex Inc.
- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.5 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Outlet Specialty Fittings:
1. Manufacturers:
 - a. Anvil International, Inc.
 - b. Ductilic, Inc.
 - c. JDH Pacific, Inc.
 - d. National Fittings, Inc.
 - e. Shurjoint Piping Products, Inc.
 - f. Southwestern Pipe, Inc.
 - g. Star Pipe Products; Star Fittings Div.
 - h. Victaulic Co. of America.
 - i. Ward Manufacturing.

- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
 - 1. Manufacturers:
 - a. Fire-End and Croker Corp.
 - b. Viking Corp.
 - c. Victaulic Co. of America.
- C. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
 - 1. Manufacturers:
 - a. AGF Manufacturing Co.
 - b. G/J Innovations, Inc.
 - c. Triple R Specialty of Ajax, Inc.
- D. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
 - 1. Manufacturers:
 - a. CECA, LLC.
 - b. Merit.

2.6 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Valves shall have pressure rating if valves are components of high-pressure piping system.
- B. Gate Valves with Wall Indicator Posts:
 - 1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
 - 2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with operating wrench, extension rod, locking device, and cast-iron barrel.
 - 3. Manufacturers:
 - a. Hammond Valve.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
- C. Butterfly Valves: UL 1091.
 - 1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Hammond Valve.
 - 2) Kennedy Valve; a division of McWane, Inc.
 - 3) Watts Industries, Inc.; Water Products Div.
- D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
 - 1. Manufacturers:
 - a. Hammond Valve.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Watts Industries, Inc.; Water Products Div.

- E. Gate Valves: UL 262, OS&Y type.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Hammond Valve.
 - 2) Kennedy Valve; a division of McWane, Inc.
 - 3) Watts Industries, Inc.; Water Products Div.
 - 2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.
 - a. Manufacturers:
 - 1) Hammond Valve.
 - 2) Kennedy Valve; a division of McWane, Inc.
 - 3) Watts Industries, Inc.; Water Products Div.

- F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
 - 1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
 - 2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.
 - a. Manufacturers:
 - 1) Hammond Valve.
 - 2) Kennedy Valve; a division of McWane, Inc.
 - 3) Watts Industries, Inc.; Water Products Div.
 - 3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Hammond Valve.
 - 2) Kennedy Valve; a division of McWane, Inc.
 - 3) Watts Industries, Inc.; Water Products Div.

2.7 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

2.8 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.
 - 1. Manufacturers:
 - a. AFAC Inc.
 - b. Globe Fire Sprinkler Corporation.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Victaulic Co. of America.
 - e. Viking Corp.
 - 2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim

sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.

- a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
- b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

B. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers:
 - a. AFAC Inc.
 - b. Grinnell Fire Protection.

2.9 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. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:

1. Residential and Commercial types.
2. Pendent sprinklers.
3. Quick-response sprinklers.
4. Recessed sprinklers, including escutcheon.
5. Sidewall sprinklers.
6. Upright sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, and painted.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Ceiling Mounting: Chrome-plated steel, two piece, recessed.
3. Sidewall Mounting: Chrome-plated steel, one piece, flat.
4. Sidewall Mounting: Chrome-plated steel, two piece, recessed.

H. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

I. The use of flexible sprinkler heads is expressly prohibited.

2.10 HOSE CONNECTIONS

- A. Manufacturers:
 - 1. Elkhart Brass Mfg. Co., Inc.
 - 2. Fire-End and Croker Corp.
 - 3. Guardian Fire Equipment Incorporated.
 - 4. Potter-Roemer; Fire-Protection Div.
- B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle or gate pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 2-1/2 as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
 - 1. Valve Operation: Nonadjustable type.
 - 2. Finish: Rough chrome-plated.

2.11 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm: UL 464, with 6-inch- minimum- diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. System Sensor.
- C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 1. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. Grinnell Fire Protection.
 - c. ITT McDonnell & Miller.
 - d. Potter Electric Signal Company.
 - e. System Sensor.
 - f. Viking Corp.
 - g. Watts Industries, Inc.; Water Products Div.
- D. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
 - 1. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. Potter Electric Signal Company.
 - c. System Sensor.
 - d. Viking Corp.
- E. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 - 1. Manufacturers:

- a. McWane, Inc.; Kennedy Valve Div.
- b. Potter Electric Signal Company.
- c. System Sensor.

2.12 PRESSURE GAGES

- A. Manufacturers:
 1. AGF Manufacturing Co.
 2. AMETEK, Inc.; U.S. Gauge.
 3. Brecco Corporation.
 4. Dresser Equipment Group; Instrument Div.
 5. Marsh Bellofram.
 6. WIKA Instrument Corporation.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.
 1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
 2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

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 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

- A. Shop weld pipe joints where welded piping is indicated.
- B. Do not use welded joints for galvanized-steel pipe.
- C. 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.

- D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- E. Underground Service-Entrance Piping: Ductile-iron, grooved-end pipe and fittings; grooved-end-pipe couplings; and grooved joints. Include corrosion-protective encasement.

3.5 STANDPIPE SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Type Standpipe System, 175-psig Maximum Working Pressure:
 - 1. NPS 4 and Smaller: Threaded-end, black, standard-weight schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
 - 2. NPS 4 and Smaller: Grooved-end, black, standard-weight schedule 40 steel pipe with square-cut- or roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
 - 3. NPS 6: Threaded-end, black, standard-weight schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
 - 4. NPS 6: Grooved-end, black, standard-weight schedule 40 steel pipe with square-cut- or roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
 - 5. NPS 8: Threaded-end, black, standard-weight schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
 - 6. NPS 8: Grooved-end, black, standard-weight schedule 40 steel pipe with square-cut- or roll-grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.6 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.

- 3.7 Plenum rated ASTM/fire protection service listed SDR 13.5 CPVC pipe with socket solvent weld pressure fittings rated for 175 psig working pressure. Provide listed adapter/transition fittings for integration of threaded fire protection components.

3.8 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.

3.9 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.

3.10 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. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install drain valves on standpipes.
- K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- L. Install alarm devices in piping systems.

- M. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 - 1. Install standpipe system piping according to NFPA 14.
 - 2. Install sprinkler system piping according to NFPA 13.
- N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- O. Fill wet-standpipe system piping with water.
- P. Fill wet-pipe sprinkler system piping with water.

3.11 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

3.12 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: Recessed and concealed sprinklers, as indicated.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - c. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.13 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.14 HOSE-CONNECTION INSTALLATION

- A. Install hose connections adjacent to standpipes, unless otherwise indicated.

- B. Install NPS 2-1/2 hose-station valves.

3.15 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valve at each check valve for fire department connection.

3.16 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect water-supply piping to fire-suppression piping.
- D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- F. Electrical Connections: Power wiring is specified in Division 26.
- G. Connect alarm devices to fire alarm.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.17 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14.

3.18 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 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. Energize circuits to electrical equipment and devices.
 4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 5. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 6. Coordinate with fire alarm tests. Operate as required.

7. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.19 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.20 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

PLUMBING SPECIFICATIONS - INDEX

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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 of 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 00 - COMMON WORK RESULTS FOR PLUMBING

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. Transition fittings.
 3. Dielectric fittings.
 4. Mechanical sleeve seals.
 5. Sleeves.
 6. Escutcheons.
 7. Grout.
 8. Equipment installation requirements common to equipment sections.
 9. Painting and finishing.
 10. Concrete bases.
 11. 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 plastic materials:
 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 2. CPVC: Chlorinated polyvinyl chloride plastic.
 3. PE: Polyethylene plastic.
 4. PVC: Polyvinyl chloride plastic.
- G. 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. Transition fittings.
 2. Dielectric fittings.
 3. Mechanical sleeve seals.
 4. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 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.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing 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 plumbing 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 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 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.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:

- a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
- 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.
- 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
- 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.

- c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
- 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.

- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F .
 - 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. 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: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- C. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, 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 PLUMBING 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 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - b. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - e. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. 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. PVC Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.

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.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. 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.
- R. 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.
- S. 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 Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. 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 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic 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 Non-pressure Piping: Join according to ASTM D 2855.
- J. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of plumbing 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.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for plumbing 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, completely filling equipment bases.

- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 22 05 16 - SLEEVES AND COLLARS

PART 1 GENERAL

1.01 REFERENCE

- A. Section 22 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: black steel pipe, machine cut, large enough to allow 1/4" 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 1/8" 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 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 REQUIREMENTS

- 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 19 - METERS AND GAGES 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. Liquid-in-glass thermometers.
 - 2. Dial-type pressure gages.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Certificates: For each type of meter and gage, from manufacturer.
- C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Liquid-in-Glass Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Miljoco Corporation.
 - b. Palmer Wahl Instrumentation Group.
 - c. Trerice, H. O. Co.
 - d. Winters Instruments - U.S.
 - 2. Standard: ASME B40.200.
 - 3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
 - 4. Case Form: Adjustable angle unless otherwise indicated.
 - 5. Tube: Glass with magnifying lens and red organic liquid.
 - 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
 - 7. Window: Glass.
 - 8. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 - 9. Accuracy: Plus or minus 2 percent of scale range or one scale division.

2.2 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Miljoco Corporation.
 - b. Palmer Wahl Instrumentation Group.
 - c. Trerice, H. O. Co.
 - d. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Cast aluminum or drawn steel; 4-1/2-inch nominal diameter. 4-inch liquid filled at pumps location.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install thermometers in the following locations:
 1. Building water service entrance into building.
 2. Outlet of each backflow preventer.

3. Inlet and outlet of each water softener or treatment tanks.
4. Inlet and outlet of each water heater.
5. Inlets and outlets of each domestic water heat exchanger.
6. Outlet of hot water return pump.

- L. Install pressure gages in the following locations:
1. Building water service entrance into building.
 2. Inlet and outlet of each pressure-reducing valve.
 3. Inlet and outlet of each water softener or treatment tanks.
 4. Inlet and outlet of each water heater.
 5. Suction and discharge of each domestic water pump.
 6. Inlets and outlets of each domestic water heat exchanger.
 7. Inlet and outlet of each domestic hot-water storage tank.
 8. Outlet of hot water return pump.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers shall be the following:
1. Bimetallic-actuated type.
 2. Direct-mounted, metal-case, vapor-actuated type.
 3. Industrial-style, liquid-in-glass type.
 4. Direct-mounted, light-activated type.
 5. Inserts.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be the following:
1. Sealed, direct-mounted, metal case.
 2. Sealed, direct-mounted, plastic case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
1. Sealed, direct-mounted, metal case.
- C. Pressure gages at suction and discharge of each domestic water pump shall be the following:

1. Sealed, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 200 psi.

B. Scale Range for Domestic Water Piping: 0 to 160 psi.

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. 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: Non-rising 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. 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. Hand-lever: 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.
- 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: Stainless Steel.
 - i. Ball: Stainless Steel.
 - j. Port: Full.

2.3 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.

2.5 LUBRICATED PLUG VALVE

- A. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flowserve.
 - b. Homestead Valve; a division of Olson Technologies, Inc.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Milliken Valve Company.
 - e. Mueller Co.; Gas Products Div.
 - f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
 - 2. Body: Cast iron, complying with ASTM A 126, Class B.
 - 3. Plug: Bronze or nickel-plated cast iron.

4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig (862 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

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 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.

END OF SECTION

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: Pre-galvanized 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 in-turned 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, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, 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 non-insulated 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 non-insulated, stationary pipes NPS 1/2 to NPS 8.
 6. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
 7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
 8. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, 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-joint 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

SECTION 22 05 30 - INSTALLATION OF PIPING

PART 1 GENERAL

1.01 REFERENCE

- A. Section 22 05 19 - METERS AND GAUGES
- B. Section 22 05 23 - GENERAL DUTY VALVES
- C. Section 22 05 29 - INSERTS, PIPE HANGERS AND SUPPORTS
- D. Section 22 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 the Architect.
- 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 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.
- 3.20 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.
- 3.21 Where pipe drops occur in block walls, pipes to enter and leave walls at block joints. Coordinate with General Contractor.
- 3.22 Install galvanized sheet metal troughs with drains under pipes crossing electrical equipment. Seal to make water tight.
- 3.23 Do not run water or steam piping through electrical rooms.
- 3.24 Properly support all relief valve discharge piping and provide no more than one 90° ell.
- 3.25 Install galvanized steel pan under all water heaters on floors above the First Floor. Route drains properly.

END OF SECTION

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: Pre-coiled, 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.

- b. Hot Water: 2 inches round.
- 2. Valve-Tag Color:
 - a. Cold Water: Green.
 - b. Hot Water: Yellow.
 - c. Hot Water Return: Orange.
- 3. Letter Color:
 - a. Cold Water: White.
 - b. Hot 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

SECTION 22 05 63 - EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 REFERENCE

- A. Division 2 - SITE WORK

1.01 SCOPE

- A. This Contractor shall excavate and backfill all trenches and other excavations required for laying drains, sewers, services, manholes, catch basins, surface inlets, appurtenances and other excavations required for his work.
- B. All construction shall conform to the safety requirements as listed in the Federal Register Sections on Safety and Health Regulations for Construction.

PART 2 PRODUCTS

2.01 BACKFILL MATERIAL

- A. Earth Fill: Soil as approved by Architect and Soils Engineer, free of organic soil, sod, roots, wood, metal, rubbish, debris, lumps or excessive amounts of clay and rocks greater than 2" in diameter; capable of being compacted into dense and stable condition as specified.
- B. Granular Fill:
 - 1. Structural:
 - a. Coarse: Bank-run sand and gravel having uniform mixture of sand and gravel, capable of being compacted into dense and stable condition as specified, and free of organic soil, shale, lumps or excessive amounts of clay, and other foreign substances. NOTE: 100% of material must pass 2" sieve and have less than 25% passing #200 sieve as approved by Soils Engineer.
 - b. Fine: "6X" by American Aggregates; a finely graded crushed stone and stone by-product from approximately 3/8" to 10-20% passing the #200 sieve. Material to be of low solubility as approved by Soils Engineer.
 - 2. Slab Sub-Base: Provide under all interior concrete slabs on grade.
 - a. ODOT 703, Size #304 crushed or uncrushed stone.
 - b. Surface choke with sand or fines to prevent damage to vapor barrier.
 - 3. Drainage: ODOT 703, Size #467. Washed, uniformly graded mixture of uncrushed gravel, with 100% passing a 2-inch sieve, and not more than 5% passing a #4 sieve.

- C. Under Footings and Foundations: Concrete.
- D. Plastic Gas or Water Service Pipe. Soil free of large rocks, building materials, etc., that might cause damage to the plastic pipe. Backfill material must meet City of Oxford, Division of Water or City of Oxford Division of Sewers and Drains appropriately.

PART 3 EXECUTION

3.01 EXCAVATION

- A. Trench width shall be sufficient to permit proper installation of the pipe and bottom of trenches evenly graded to insure uniform bearing for pipe.
- B. Trenches shall be sheathed or braced and pumping or bailing performed as necessary to protect workmen and adjacent structures and to permit proper execution of the work.
- C. Bell and Spigot joint holes to be carefully excavated so that none of the load is supported by the bells or joints.
- D. Mechanical excavation shall be held to 4" above final pipe elevation. The remainder shall be shaped by manual excavation, so that pipe is fully supported on undisturbed soil.
- E. Excavations below required depths shall be refilled with sand or gravel firmly compacted. Rock encountered shall be excavated three inches (3") below the lowermost part of the pipe and the space so formed, refilled with sand and gravel well compacted. Refill shall be concrete under footings and foundations.
- F. All lines below slab-on-grade floors to be bedded in coarse sand or pea gravel, minimum 2" under pipe, 4" above.
- G. Whenever in the opinion of the Architect, Engineer, the soil at or below grade is unsuitable for supporting sewers, or other construction included under this Contract, such provisions for proper foundations shall be made, in addition to those shown or specified, as the Architect/Engineer may direct, equitable adjustment for same to be made in the Contract price.

3.02 TESTS AND INSPECTIONS

- A. All required tests and inspections are to be approved by the Architect/Engineer before any backfilling is done.

3.03 BACKFILLING

- A. Backfill to rough grade within area of grading work required under General Contract, and to finish grade elsewhere.
- B. Backfill shall be free of rubbish and boulders.
- C. Tamp in 6" layers to a point 24" above pipe, and 12" layers above this point. Thoroughly compact.

- D. No frozen backfill shall be used.
 - E. Under footings and foundations, concrete backfill to extend one foot each side of footing or foundation.
 - F. Locations:
 - 1. Under Building: Where additional excavation required or against footing sides where formed sides used; Granular, Fine Structural, to underside of slab sub-base.
 - 2. Under All Interior Slabs: Provide 4" layer of slab sub-base; smooth and compact to specified density and leave ready for installation of vapor barrier.
 - 3. Against Walls: Drainage fill.
 - 4. Under Pavements:
 - a. Drives and Roads: Granular, Course Structural.
 - b. Walks: Granular, Course or Fine Structural.
 - 5. Trenches: Granular, Fine Structural.
 - 6. Site: Earth-fill.
- 3.04 All pavements, curbs, walks and lawns damaged by this work shall be repaired by the General Contractor at this Contractor's expense to their original condition in kind.
- 3.05 Protect all utilities shown on Drawings or encountered in the construction work. Any damage to utilities shall be repaired by this Contractor to Owner's satisfaction, without cost to the Owner.
- 3.06 This Contractor shall remove any unusable or surplus excavated material from site.

END OF SECTION

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 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, he will, upon written authorization from the Owner, 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 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 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 Less Than	Notes
Water lines	water	125 lbs	6 hrs	no drop
Drainage systems	In accordance with applicable plumbing codes			

- 3.02 The Contractor, 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.
- 3.03 Before turning job over to Owner, inspect all valves and repack valves as necessary.
- 3.04 This Contractor 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

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 95 - FLUSHING AND STERILIZATION

PART 1 GENERAL

1.01 SCOPE

- A. Flush out all domestic water piping systems to remove all dirt and grease from pipes and equipment before systems are placed into operation. Clean strainers after each flushing until the strainer remains clean.
- B. After domestic water lines are all installed, sterilize lines, including outside services as prescribed by AWWA-C-651. Sterilization shall be done under the immediate on the job supervision of a water testing laboratory regularly engaged in the service and shall be done per their instructions. All fees for testing and test equipment shall be paid by this Contractor.
- C. Furnish a Certificate of Sterilization and disinfection indicating compliance with EPA regulations for drinking water, including the Safe Water Drinking Act (SWDA), the National Primary Drinking Water Regulations (NPDWR), and the National Secondary Drinking Water Regulations (NSDWR). Compliance to include confirmation that the maximum contaminant levels for all elements listed in the NPDWR and NSDWR are not exceeded. The certificate is to be signed by an authorized analyst in the employ of an EPA certified Potable Drinking Water Testing Laboratory. Completed certification shall be furnished to the owner's representative as a requirement for project closeout and final payment.

PART 2 PRODUCTS

- 2.01 Sterilization: Chlorinating material either liquid chlorine meeting AWWA Standard B301, sodium or calcium hypochlorite meeting AWWA Standard B300.

PART 3 EXECUTION

- 3.01 With all outlets closed, fill system to working pressure and close valve at supply main.
- 3.02 A cleaning solution containing not less than 50 parts per million of chlorine shall be introduced into the system.
- 3.03 Each outlet, hot and/or cold, shall be tested during fill to prove the presence of chlorine at that outlet and valves and faucets shall be opened and closed several times during the disinfecting time period.
- 3.04 Water piping systems shall remain filled for a period of 24 hours.
- 3.05 All outlets shall be opened wide and the main supply valves opened, flushing system with water until chlorine content is not greater than 0.2 parts per million or until approved by the Health Department. Flush drain valves.
- 3.06 After final flushing all aerators on plumbing brass shall be removed, cleaned and reinstalled.

3.07 Sterilization test may be performed at the same time the pressure test is placed on the system.

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 Contractor shall submit for review six (6) copies of manufacturers submittal data for specific plumbing equipment, fixtures & materials to the Owner's Representative for review within six weeks after the date of contract. This data shall include performance information, wiring diagrams, utility requirements & any other pertinent information necessary for appropriate evaluation. The Owner's Representative will review the Contractor's submittal data for compliance with project specifications & the ability of the associated elements to be furnished & installed as a properly functioning integral element of the overall plumbing installation. Before providing a submittal to the Architect the Contractor shall:
1. 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.
 2. Approve each submission & so stamp in advance of forwarding to the Owner's Representative.
- B. The Architect shall assume that no shop drawing or related submittal comprises a variation unless Contractor 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:
- Plumbing Contract
- Backflow Preventers
 - Pressure Reducing/Control Valves
 - Water Treatment Equipment
 - Point-of-Use Mixing Valves
 - Plumbing Fixtures
 - Interceptors (all types)
 - Drains, cleanouts, and drainage specialties
 - Piping and valves
 - Firestopping
 - Trap Primers
- C. The Architect 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 Architect 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. Architect'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 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. Drains receiving low temperature condensate drain discharge.
 6. 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. 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 development rating not to exceed 50. All exterior finishes shall have a minimum service temperature limit (FSTM 70) of minus 50 to 220 degrees F.
- B. Insulation thicknesses are based on insulation having thermal resistance in the range of 4.0 HR F ft²/Btu to 4.6 HR F ft²/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.
- C. Molded plastic fitting covers shall be U.L. listed, with a flame spread rating not to exceed 25, and a smoke development rating not to exceed 50.
- D. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule" articles for where insulating materials shall be applied.
- E. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- F. 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.

- G. 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 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).

2.3 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.

2.4 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.

2.5 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: Color-code jackets based on system.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

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.
- 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 Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water and drains receiving low temperature condensate drain discharge:
 - 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, Recirculated Domestic Hot Water, and Heat Recovery 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

SECTION 22 11 16 – FACILITY DOMESTIC WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.01 REFERENCE

- A. Section 22 05 23 - GENERAL DUTY VALVES
- B. Section 22 05 19 - METERS AND GAUGES
- 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
 - 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. Pipe and fittings shall be in accordance with Part 2.01 of Specification Section 22 11 16. Above ground piping and fittings may be plenum rated ASTM & NSF listed schedule 80 CPVC pipe with socket solvent weld pressure fittings as specified.
- B. 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.
 - 2. Plenum rated ASTM & NSF listed schedule 80 CPVC pipe with socket solvent weld pressure fittings.

- a. Hangers and supports for all CPVC tubing shall be spaced at ½ the Manufacturer recommended spacing to provide greater support and restrict sagging/settling of piping after installation.
- 3. Completed installation to be rated for 125 psig working pressure at maximum 140 degrees F water temperature.
- C. 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 wrought 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.
- D. 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 contractor'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 contractor'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 contractor'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 contractor's option.

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. 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.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- H. Install domestic water piping level without pitch and plumb.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping adjacent to equipment and specialties to allow service and maintenance.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- S. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- T. 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.
- U. 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," "Braze Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

- F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

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 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.

3.5 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. 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.
 - b. 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.

3.6 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.

3.7 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.

3.8 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.

3.9 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water piping, NPS 4 and smaller, shall be one of the following:

- a. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper brazed socket solder fittings and joints.

D. 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 wrought- copper solder-joint fittings; and soldered joints.

3.10 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

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. Balancing valves.
 - 2. Temperature-actuated water mixing valves.
 - 3. Water hammer arresters.
 - 4. 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 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITT Industries; Bell & Gossett Div.
 - b. Watts Industries, Inc.; Water Products Div.
 - 2. Type: Ball valve with two readout ports and memory setting indicator.
 - 3. Body: Bronze.
 - 4. Size: Same as connected piping, but not larger than NPS 2.
 - 5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

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 balancing valves in locations where they can easily be adjusted.
- C. 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.
- D. Install water hammer arresters in water piping according to PDI-WH 201.
- E. Install air vents at high points of water piping.
- F. 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 flow set points of balancing valves.
- B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 22 13 16 - SANITARY WASTE AND VENT 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. Section Includes:
 - Pipe, tube, and fittings.
 - Specialty pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

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.

PART 2 - PRODUCTS

3.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

3.2 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.

3.3 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.

3.4 PVC PIPE AND FITTINGS; not approved for installation within return air plenums.

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
- D. Solvent Cement: ASTM D 2564.

3.5 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

3.6 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, Non-pressure 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 4 - EXECUTION

4.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

4.2 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 smaller than NPS 3; 1 percent downward in direction of flow for piping NPS 3 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.

4.3 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.

4.4 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.

4.5 HANGER AND SUPPORT INSTALLATION; See specification section 22 05 29.

4.6 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.

4.7 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."

4.8 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.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. 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.
 - 2. 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.
 - 3. 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.
 - 4. 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.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

4.9 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.

4.10 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. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- C. Aboveground, vent 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. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 3. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.
- D. Above and below ground, soil, waste, and vent piping in/at Mechanical Rooms and Food Service/Kitchen areas 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 the following:
 - 1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

END OF SECTION

SECTION 22 13 19 - SANITARY WASTE AND STORM DRAIN 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.
 7. Roof drains (primary and overflow) and downspout nozzles.

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, ROOF DRAINS AND DOWNSPOUT NOZZLES.

- A. Cast-Iron Floor Drains, Roof Drains and Downspout nozzles:

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 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft. thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counter flashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES; See section 22 05 17.

2.5 MISCELLANEOUS SANITARY AND STORM 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.

B. Stack Flashing Fittings:

1. Description: Counter flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 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.
- 2.7 Equal polyethylene (PE) body interceptors as manufactured by Schier, Zurn, MiFab or Endura may be furnished at the contractor's option.

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 and roof drains at low points of surface areas to be drained. Set grates of floor 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. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- I. Assemble open drain fittings and install with top of hub 1 inch above floor.
- J. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- O. Install wood-blocking reinforcement for wall-mounting-type specialties.
- P. 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 caulking 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 22 16 13 - HOUSE LINES - GAS

PART 1 GENERAL

1.01 SCOPE

- A. Provide a low pressure (14" w.c. or less) house gas supply piping system to all items/elements indicated on plans, and any other points requiring same.
- B. Installation of all elements specified herein and shown on plans shall be in accordance with the requirements of the Gas provider, the referenced standards, and all review, inspection and approval authorities.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Maximum 14" w.c. (1/2 psig) working pressure Gas Pipe in Exposed Locations - Standard weight (schedule 40) ASTM listed black steel pipe. Fittings shall be threaded ANSI listed standard weight black malleable iron; to maximum 1 1/4" pipe size. Gas system piping in accordance with any of the following criteria shall be standard weight (schedule 40) ASTM listed black steel pipe and fittings with butt welded joints and connections:
 - 1. Piping in concealed Locations (includes above accessible ceilings, and within accessible structures/chases where not normally visible).
 - 2. All piping 1 1/2" size and larger.
 - 3. All piping with greater than 1/2 psig working pressure.
 - 4. All piping in air plenums, as confirmed from project HVAC documentation.
- B. Under-ground; ASTM listed SDR 11 plastic polyethylene (PE) piping which conforms to specification for thermoplastic gas pressure pipe, tubing and fittings. Joints & fittings to be heat fusion type. Furnish with #12 copper trace & overhead warning tape along entire length of underground installation. Plastic piping shall be flame retardant, and meet requirements of referenced codes and standards, the Gas provider, and all other review, inspection and approval authorities. Plastic piping shall be used for underground installation only. Joints to be kept to minimum quantity possible.
- C. Valves, fittings and any other elements not available with welded connections indicated to be installed in welded gas piping shall be furnished with listed/approved welding adapters or listed/approved class 125 flanges and gaskets.
- D. All piping in concealed locations (includes above accessible ceilings, and within accessible structures/chases where not normally visible) shall not have valves, unions, tubing fittings or running threads.
- E. Piping within last ten (10) feet of appliance may be screwed if approved by Code authorities for specific conditions.

PART 3 EXECUTION

- 3.01 Install a listed/approved tapered lubricated plug cock on incoming piping immediately inside building wall.
- 3.02 All gas piping shall be installed level. Inspect, test and purge all gas lines to outside as required by the Gas provider, referenced standards and the review/inspection/approval authorities..
- 3.03 Underground piping to have minimum of 24" cover to finish grade.
- 3.04 Piping penetrations at structure from building exterior to be sleeved and sealed weathertight.
- 3.05 Coordinate installation with structure, site conditions and work of other trades at and adjacent to gas service piping installation.
- 3.06 Maintain necessary clearance from structural support elements as required for installation of gas service piping outside of support/bearing zones.
- 3.07 Provide warning tape above underground gas service piping for entire length of run.
- 3.08 Install listed/approved pipe sleeves on gas piping at all structural penetrations.
- 3.09 All branch connections shall be made on the top or side of horizontal piping.
- 3.10 Before the gas service is turned on, the house lines shall be subjected to a 24-hour charted pressure test, unless another test is requested by the Gas provider. Pressures as indicated below. The test shall be performed by this Contractor and witnessed by the Gas provider. This Contractor to initially pressurize system. Test requirements (including required equipment and methods) to be confirmed with the Gas provider in advance. The Gas provider to rule on acceptability of the piping system after the test.
 - A. Systems 2 psig or less shall be tested with 5 psig air.
- 3.11 Pressure regulation valves (including those provided loose or installed with packaged equipment assemblies) installed within the building structure are to be individually vented to atmosphere in compliance with the Gas provider, referenced standards and the review/inspection/approval authorities.
- 3.12 All metallic piping installed at building exterior to be provided with field applied painted finish; (1) undercoat and (1) exterior coat with listed/approved weather-resistant epoxy paint.
- 3.13 When gas pressure regulators are installed within 3 feet horizontal distance from any building air intake and/or opening (including doors, operable windows, etc.), full size relief piping shall be extended from the regulator vent outlet connection to a point at least 3 linear feet in distance horizontal from all intakes and/or openings, or to a point at least 3 feet above the top of the highest intake and/or opening.

END OF SECTION

SECTION 22 99 00 - PLUMBING COMMISSIONING

PART 1 GENERAL

1.01 OWNER FURNISHED

- A. See Section 01 91 13 - General Requirements - Commissioning.

1.02 RELATED DOCUMENTS

- A. All drawings and general provisions of the contract, including all other Division 01 and general and supplementary conditions.
- B. Section 01 91 13 - General Requirements - Commissioning.

1.03 SUMMARY

- A. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the plumbing systems have been installed in the prescribed manner, and operate within the performance guidelines set in the Contract Documents. The Commissioning Authority shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The Commissioning Authority will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, subcontractors, manufacturers and equipment suppliers.

1.04 REFERENCES

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Divisions 01 Specifications Sections, apply to this Section.
- B. Section 01 91 13 - General Requirements - Commissioning.
- C. Section 22 05 93 - TESTS AND ADJUSTMENTS.
- D. Section 22 05 95 - FLUSHING AND STERILIZATION

1.05 SCOPE

- A. See Section 01 91 13 - General Requirements - Commissioning.

1.06 PLUMBING SYSTEMS/EQUIPMENT INCLUDED IN THE COMMISSIONING PROCESS:

- A. Domestic water backflow preventers
- B. Domestic water pressure regulators

- C. Domestic water heating installation and appurtenances
- D. Domestic hot water return/recirculation system
- E. Plumbing fixtures and appurtenances
- F. Domestic water mixing valves
- G. Trap primer installations and appurtenances
- H. Drain pump installations and appurtenances
- I. Interceptor installations and appurtenances
- J. Domestic water piping specialties
- K. Electric water coolers and appurtenances
- L. Domestic water secondary meters and appurtenances
- M. Domestic water flushing and sterilization procedures
- N. Identification of plumbing piping, valves and equipment

PART 2 PRODUCTS

2.01 COMMISSIONING PLAN DOCUMENT

- A. See Section 01 91 13 - General Requirements - Commissioning.

2.02 COMMISSIONING TEAM

- A. See Section 01 91 13 - General Requirements - Commissioning.

2.03 CONTRACT DOCUMENT

- A. See Section 01 91 13 - General Requirements - Commissioning.

2.04 COMMISSIONING MEETINGS

- A. See Section 01 91 13 - General Requirements - Commissioning.

2.05 MASTER FINDINGS LIST

- A. The Commissioning Authority (CxA) or installing contractor will complete Pre-Functional Testing. Commissioning Agent conducts Functional Testing with assistance of installing contractor.

- B. All findings from these inspections are documented and are posted to the master findings list and website within two business days.
- C. The Construction Manager will regularly distribute findings list to contractors and will hold contractor accountable to: 1.) correct any items and/or 2.) provide electronic responses for each finding.
- D. Responsible contractor will correct finding(s) and provide written confirmation that the finding(s) have/has been corrected. If finding was not corrected, contractor provides written explanation.
- E. Commissioning findings' status may be considered during the pay application approval process. Approval may be withheld due to unresolved findings and/or findings where written responses have not been provided.
- F. DB provides responses back to CxA. All responses are updated to the Master Findings List.
- G. Once written responses are provided for each finding, the CxA will re-inspect. The contractor will be back-charged at a rate not to exceed the CxA contract hourly rate for any finding(s) that was/were reported to have been resolved and that are found to be unresolved upon re-inspection.
- H. Status will be tracked for each finding and the Master Findings List will be updated accordingly.
- I. Once all findings have been resolved and the job is completed, a Final Report will be generated and a final commissioning meeting will be held.

2.06 PRE-FUNCTIONAL TESTING/MANUFACTURER'S CHECKLISTS

- A. The Commissioning Authority (CxA) or installing contractor will complete the Pre-Functional Testing forms for each piece of equipment prior to start-up.
- B. The equipment manufacturer's checklists must be completed by the installing contractor and reviewed by the Commissioning Authority before start-up can commence.

2.07 START-UP

- A. Start-up of major systems may be witnessed by the Commissioning Authority. The appropriate contractors and/or manufacturer's representative will be required on site to perform start-up. No system will be started until the appropriate Pre-Functional Testing forms have been completed. No system will be started until the Manufacturer's checklists have been completed. Start-up will be performed according to the Manufacturer's recommended procedures. The Commissioning Authority may visit the site to review completeness of installation in conjunction with progress meetings prior to starting equipment.
- B. Construction team members involved in installation, fabrication, manufacture, control, or design of equipment are required to be present at the time of start-up. A factory-

authorized technician will be on site to start equipment when required by the specifications. This will minimize delays in bringing equipment on line and expedite acceptable functional performance in accordance with the Miami University Project Requirements (MUPR) and the Basis of Design (BOD).

2.08 FUNCTIONAL TESTING

- A. The Commissioning Authority will perform or witness installing contractor or manufacturer's representative performing Functional Testing based on the Miami University Project Requirements (MUPR) and the Basis of Design (BOD). These tests will be completed for systems and subsystems.
- B. Each major system will be tested. A random sample of each subsystem will be tested. This may be coordinated and witnessed by the Commissioning Authority and the owner's maintenance staff. Witnessing the Functional Performance Tests (FPT's) will serve as a compliment to the O&M Training.
- C. Off-season mode testing will be implemented as necessary to assure conformance with the Miami University Project Requirements (MUPR) and the Basis of Design (BOD). Installing contractors will be expected to participate as required by the project specifications.

2.09 BUILDING TURN-OVER / OWNER ORIENTATION / USER TRAINING

- A. Owner training will be provided by the installing contractor, or manufacturer's representative, and may be witnessed by the Commissioning Authority. This training should include both classroom training and hands-on operational training. The owner may choose to videotape this training for future use. The Commissioning Authority may visit the site during the Turn-Over and Training period to assure that any on-going related problems are being addressed and corrected in a timely and efficient manner.
- B. The Commissioning Authority will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

2.10 WARRANTY REVIEW

- A. The Commissioning Authority will participate in a 10-month walk-through to observe the operation of the system. This will include a review meeting with the Facility Maintenance Department, a discussion of warranty issues, energy usage, maintenance practices, usage changes, and chronic problems, as well as other issues affecting the owner and the operation of the systems

PART 3 EXECUTION

3.01 RESPONSIBILITIES OF EQUIPMNET/SYSTEM INSTALLER

- A. The installing contractor in this division shall include in their quote the cost of participating in the commissioning process.

- B. Include requirements for submittal data (including partial load data), O&M data, and training in each purchase order or sub-contract.
- C. Assure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, and water treatment in commissioning activities.
- D. Assure participation of major equipment manufacturers in appropriate startup, training, and testing activities.
- E. Attend commissioning specific meetings scheduled by the Commissioning Authority or Design Builder.
- F. Assist and participate with the Commissioning Authority in system verification and performance testing, both Pre-Functional and Functional, to achieve design intent.
- G. Prepare preliminary schedule for system inspections, O & M manual submission, training sessions, pipe system testing, flushing and cleaning, equipment start-up, system verification, performance testing, and system completion for use by the Commissioning Authority. Update schedule as appropriate throughout the construction period.
- H. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of systems.
- I. Monitor and respond to the Master Findings List distributed by the Commissioning Authority in writing within five (5) business days in order to expedite corrective actions necessary to achieve design intent. Failure to respond in writing within five business days will result in contractor non-compliance and will warrant the provision of a seventy-two (72) hour notice to comply *and/or* back charge to the contractor for all necessary corrective work. Items that are reported to have been corrected but that are found not to have been corrected after a maximum of two re-inspections will result in a back charge to the responsible contractor for any subsequent reinspection that must be performed by the Commissioning Authority in order to verify that the corrective work has been completed.
- J. Notify the Commissioning Authority a minimum of two weeks in advance of scheduled system start-up.
- K. Update drawings to as-built condition and review with the Commissioning Authority throughout the construction process.
- L. Schedule vendor and subcontractor provided training sessions as required by project specifications.
- M. Confirm that all equipment in this contract indicated to provide BAS interface complies with the requirements of this contract and the BAS contract for proper interface and operation in accordance with the design intent of the BAS installation.
- N. Provide written notification to the DB and Commissioning Authority that the following work has been completed in accordance with the project specifications, and that the equipment, systems and Sub-systems are operating in accordance with design intent.

1. Equipment installation including water heaters, pumps, meters, backflow preventers, piping, valves, piping appurtenances, interceptors, etc.
 2. That all BAS outputs and interfaces have been provided and properly integrated with the BAS in accordance with design intent.
- O. Participate in the off-season mode testing as required to achieve design intent.
- P. Participate in operation and maintenance training as required by project specifications.
- Q. Provide a complete set of as-built drawings and operation and maintenance manuals for review. The Commissioning Authority shall review the as-built drawings and Operation and Maintenance manuals concurrently with the design team.
- R. In the event that any portion of the work to be completed by the contractor is subcontracted, ensure compliance with the commissioning process on the part of any individual(s) performing that work. To that end, ensure that each sub-contractor is provided a copy of this specification.

END OF SECTION

HVAC SPECIFICATIONS - INDEX

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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.
- 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.

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, 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
Low Pressure Ductwork
Packaged DX DOAS Makeup Air Units

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 1/4" 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 1/8" 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 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.

1.03 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 REQUIREMENTS

- 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 Managing 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 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 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 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 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 CONTRACTOR 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 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 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/Devoc.

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

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 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. 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.

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

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.

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:
 - Supply Air Ducts
 - 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 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).
- 3.02 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.
 - 3.03 Application shall be made on clean, dry surfaces with all joints butted firmly together.
 - 3.04 All supply air conditioning ducts to be continuous through walls, roofs and duct hangers.
 - 3.05 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.
 - 3.06 Install 20 gauge galvanized steel insulation protectors on all insulated exposed pipes passing through floor. Sleeves to be 12" above the floor.
 - 3.07 Hanger rods must be perpendicular before insulation is installed.
 - 3.08 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.
- C. Furnish, and install factory built double wall grease ductwork and appurtenances with sizes as shown on Drawings.

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.

2.02 Factory Built Double Wall Grease Ducts:

- A. Provide ductwork equal to Captiveaire Model DW-3Z. Ductwork shall be classified under UL2221 (Test of Fire Resistive Duct Enclosure Assemblies) as an alternate to 2-Hr. fire resistive shaft enclosures with a minimum zero clearance to combustibles (sizes 5" to 36" diameter).
- B. Inner duct section wall shall be constructed of .036" thick, 430 type stainless steel and be available in diameters 5" through 36"
- C. Outer Duct section wall shall be constructed of 430 stainless steel at a minimum of .024" thickness.
- D. Duct shall include 2 layers of Super Wool 607 Plus or Insulfrax Elite Blanket between the inner and outer wall insulation between the inner and outer wall.
- E. Duct sections shall be held together by the means of a formed V clamp. V clamps shall be of the hex-head type with flanged stops and tapered "lead in" threads.
- F. Duct joints shall be sealed with 3M Fire Barrier 2000+.
- G. Duct wall assembly shall be tested and listed at 3/4" or zero inch clearance, according to classifications

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.
- 3.05 Install factory-built double wall grease duct in accordance with manufacturer's instructions, drawings, written specifications, manufacturer's installation manual, and all applicable building codes

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 fasteners 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 233113.17 - NON-FIBROUS OUTDOOR DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermaduct, ducts and fittings by Thermaduct, LLC. 855-809-6903

1.2 SCOPE

- A. Furnish and install outdoor supply, return, outdoor air and exhaust ductwork as shown on the drawings.
- B. All ductwork located outdoors shall be non-fibrous, closed-cell type as specified below.

1.2 SUBMITTALS

- A. Product data: For each type of product indicated.
- B. Shop drawings: Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work including.
 1. Duct layout indicating sizes and pressure classes.
 2. Elevation of top of ducts.
 3. Dimensions of main duct runs from building grid lines.
 4. Fittings.
 5. Penetrations through fire-rated and other partitions.
- C. Coordination Drawings: Plans, drawn to scale, showing coordination general construction, building components, and other building services.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Thermaduct shall be installed by competent field mechanics who demonstrate competence in the HVAC industry and that have completed Thermaduct, LLC's online training course available at training.thermaduct.com. Installation practices must adhere to Thermaduct's Contractor Installation Manual that is current at the time of product installation.

1.4 SPECIFICATION COMPLIANCE

- A. Duct Leakage Class, follow SMACNA Leakage Class 3 or less.

- B. ThermaDuct shall incorporate a Kingspan KoolDuct fortified inner liner compliant to UL (C-UL) 181 Standard for Safety Listed, Class 1 system, with included testing and passing the following:
1. Test for Surface Burning Characteristics
 2. Flame Penetration Test
 3. Burning Test
 4. Mold Growth and Humidity Test
 5. Low Temperature Test and High Temperature Test
 6. Puncture Test
 7. Static Load Test
 8. Impact Test
 9. Pressure Test and Collapse (negative pressure) Test
 10. High Temperature and Humidity for 90 days
 11. Cone Calorimeter
 12. ASTM E2257 Standard Test Method for Room Fire Test of Wall and Ceiling Materials and Assemblies
 13. ASTM E 84 tested, Tunnel Test, Does not exceed 25 flame spread, 50 smoke developed.
 14. DW144, Class B
 15. NRTL product approval, (Subpart S of 29 CFR Part 1910, OSHA)
 16. ASTM C 423 noise reduction
 17. ASTM E 96/E 96M Procedure A for permeability
 18. ASTM C 1071 for erosion
 19. ASTM C 518: 2004, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 20. UL 723, Test for Surface Burning Characteristics of Building Materials
 21. NFPA Compliance:
 - a. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"
 - b. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems"
 - c. NFPA 255, "Standard Method of Test of Surface Burning Characteristics of Building Materials"

C. Thermaduct outer shell shall be a UV stable 1000 micron high impact resistant titanium infused vinyl with included testing as following:

1. UL-94 Flammability V-0
2. ASTM D-638 Tensile Strength of 6250 psi
3. ASTM D-790 Flexible Strength of 11,000 psi
4. ASTM D-4226 Drop Impact Resistance
5. ASTM D-4216 Cell Classification

1.5 PRODUCT DELIVERY AND STORAGE

- A. Prevent objectionable aesthetic damage to the outer surface of duct segments during transport and storage.
- B. Store duct segments under cover and protect from excessive moisture prior to installation.

PART 2 - PRODUCTS

2.1 THERMADUCT RECTANGULAR DUCT AND FITTINGS

A. Product:

1. Thermaduct by Thermaduct, LLC. 855-809-6903
2. Approved alternate product: Tuff Duct, manufactured by Hranec Mechanical contractors.

B. The panel shall be manufactured of CFC-free Kingspan Kooltherm closed cell rigid thermoset resin thermally bonded on both sides to a factory applied .001" (25 micron) aluminum foil facing reinforced with a fiberglass scrim. An added UV stable, IR reflective 1000-micron high impact resistant titanium infused vinyl is factory bonded using a full lamination process. The lamination process shall permanently bond the vinyl clad to the outer surfaces of the phenolic foam panel to provide a zero-permeability water tight barrier and to form a structurally insulated panel (SIP) in which to form duct segments. Processes that do not employ a full lamination process are not acceptable. Self-applied adhesives such as tapes, caulks or cladding that incorporate pressure sensitive or spray adhesives are not acceptable.

C. The thermal conductivity shall be no greater than 0.146 BTU • in/Hr • ft² • °F (.018W/m•°C), the thermal conductivity shall be no greater than 0.146BTU • in/Hr • ft² • °F (.018W/m•°C).

D. The density of the Kooltherm foam shall not be less than 3.5 pcf (56 Kg/m³) with a minimum compressive strength of 28 psi (.2 MPa).

E. The standard panel (31 mm) thickness panel with R-8.1 (1.5 RSI) shall be utilized unless indicated otherwise on the print.

1. Maximum Temperature: Continuous rating of 185 degrees F (70 deg C) inside ducts or ambient temperature surrounding ducts.

2. Maximum Thermal Conductivity: 0.146 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
3. Permeability: 0.00 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
4. Antimicrobial Agent: Additive for antimicrobial shall not be used but instead, raw product must pass UL bacteria growth testing.
5. Noise-Reduction Coefficient: 0.05 minimum when tested according to ASTM C 423, Mounting A.
6. Required Markings: All interior duct liner shall bear UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for internal closure materials.
7. All insulation materials shall be closed cell with a closed cell content of > 90%.
8. R-value:
 - a. 1 3/16 inch (31 mm) Thick Panel: 8.1 R
9. Design Pressure Class:
 - a. Return air ductwork: 2" w.g.
 - b. Medium pressure supply air ductwork: 4" w.g.

F. Closure Materials:

1. V-Groove Adhesive: Silicone (interior only).
2. UV stable 1000 micron high impact resistant titanium infused vinyl (exterior).
 - a. Factory manufactured seamless corners for zero perms.
 - b. Cohesive bonded over-lap at corner seam covers for zero perms.
 - c. Water resistant titanium infused welded vinyl seams.
 - d. Mold and mildew resistant.
3. Polymeric Sealing System:
 - a. Structural Membrane: Aluminum scrim with woven glass fiber with UV stable vinyl clad applied
 - b. Minimum Seam Cover Width: 2 7/8" inches (75 mm)
 - c. Sealant: Low VOC.

- d. Color: White (colors, matched by architect optional).
 - e. Water resistant.
 - f. Mold and mildew resistant.
4. Duct Connectors.
- a. Factory manufactured galvanized 4-bolt flange.
- G. Outdoor Cladding
- 1. Thermaduct outdoor Installations: Duct segments shall incorporate UV stable 1000 micron high impact resistant titanium infused vinyl which is introduced during the manufacturing process.
- H. Flange coverings
- 1. Flanges are field sealed airtight before flange covers are installed. Flange covering consists of the following:
 - a. Foam tape insulation with molded 39 mil covers.
 - b. Air gap (heating only application) with molded 39 mil covers.
- I. Reinforcement
- 1. Thermaduct shall be designed and built with adequate reinforcement to both; withstand air pressure forces from within the duct from blower pressure and shall be built to handle expected snow load for the location where the Thermaduct is being installed. Thermaduct will employ Airtruss™ reinforcement system when both specified static pressure and duct sizes dictate the need. This is a factory installed system and no field installation of the reinforcement system is required.
- J. Weight
- 1. Thermaduct shall provide low weight stresses on the building framing and support members. Assembled Thermaduct shall have a weight of 0.86 lbs. per square foot to maximum weight of 2.7 lbs. per square foot (depending on R-value and reinforcement requirement). Hangers and tie-downs are to be detailed in the Thermaduct Contractor Installation Manual for review prior to installation but not exceeding 13' for duct girth <84" and 8' for duct girth >85" between hangers and designed to carry the weight and wind load of the ductwork.

PART 2 - EXECUTION

3.1 SHOP FABRICATION

A. Certification:

- 1. Ducts shall be detailed and fully factory manufactured by an authorized Thermaduct, LLC

facility system. All fabrication labor will be certified “yellow label” building trade professionals, compliant to SMWIA and SMACNA labor guidelines (work preservation observed).

B. Fabrication:

1. Fabricated joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, and damage repairs according to manufacturer’s written and detailed instructions.
2. Fabricated 90-degree mitered elbows to include turning vanes.
3. Fabricated duct segments in accordance with manufacturer’s written details.
4. Duct Fittings shall include 6 inches of connecting material, as measured, from last bend line to the end of the duct. Connections on machine manufactured duct may be 4 inches.
5. Fabricated duct segments utilizing v-groove method of fabrication. Factory welded or cohesively bonded seams will apply to fully manufactured ductwork and fittings. Internal seams will be supplied with an unbroken layer of low VOC silicone or bonding (for paint shop applications). Each duct segment will be factory supplied with either aluminum grip pro-file or pre-insulated duct connectors in accordance with manufacturer’s detailed submittal guide. Applied duct reinforcement to protect against side deformation from both positive and negative pressure per manufacturer’s design guide based on specified ductwork size and system pressure.
6. Designed and fabricated duct segments and fittings will be in accordance with “SMACNA Phenolic Duct Construction Standards” latest edition.
7. Both positive and negative ductwork and fittings shall be constructed to incorporate a UL Listed as a Class 1 air duct to Standard for Safety UL 181 liner with an exterior clad for permanent protection against water intrusion.
8. Duct shall be constructed to exceed requirements for snow and wind loads.

3.2 DUCT INSTALLATION

- A. Duct segments shall be installed per the ThermaDuct Contractor Installation Manual by competent HVAC installers.
- B. Install ducts and fittings to comply with manufacturer’s installation instructions as follows:
 1. Install ducts with fewest possible joints.
 2. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
 3. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
 4. Protect duct interiors from the moisture, construction debris and dust, and other foreign

materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

5. Use prescribed duct support spacing as described in this specification and manufacturer's recommendations.

C. Air Leakage: Duct air leakage rates to be in compliance with "SMACNA HVAC Air Duct Leakage Test Manual" latest version per applicable leakage class based on pressure.

3.3 HANGER AND SUPPORT INSTALLATION

A. Contractor to ensure that the ductwork system is properly and adequately supported per the Thermaduct Contractor Installation Manual.

1. Ensure that the chosen method is compatible with the specific ductwork system requirements per Thermaduct installation detail drawings. Pre-installation should be provided prior to work commencement by installing contractor for approval.

2. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Supports on straight runs of ductwork shall be positioned at centers not exceeding 13 feet (3.96 m) for duct sections when fabricated in 13 foot (3.96 m) lengths with duct girth less than 84". Larger duct sizes and short segments with duct girth greater than 84" are to be supported at 8 foot centers or less, in accordance with the Thermaduct Contractor's Installation Manual provided prior to work commencement.

C. Ductwork shall be supported at changes of direction, at branch duct connections, tee fittings, parallel under turning vanes and all duct accessories such as dampers, etc.

D. The load of such accessories to the ductwork shall be neutralized by the accessory support.

3.4 FIELD QUALITY CONTROL

A. Inspection: Contractor shall provide Thermaduct, LLC fully completed post installation forms with jobsite photos for review; e-mailed to warranty@thermaduct.com.

1. Remove and replace duct system where initial post installation submission indicate that it does not comply with specified requirements.

B. Perform additional testing and inspecting, at the Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.5 DUCT SCHEDULE

A. Outdoor Ducts and Fittings:

1. Thermaduct Rectangular Ducts and Fittings:

a. Minimum Panel Thickness: 31 mm

b. Cladding: minimum 0.038 inch

END OF SECTION 233113.17

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 shall 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 1 1/2 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 1 1/2 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 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. Price PDS, Aluminum, lay-in.
 - 2. Price PDS, Aluminum, surface-mounted.

2.02 RETURN AND EXHAUST AIR GRILLES

- A. Grilles with curved horizontal face bars, fixed at 45 degrees.
 - 1. Price 630, aluminum, 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, Titus 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 23 7213 - DEDICATED OUTSIDE AIR UNITS

PART 1 GENERAL

1.1 REFERENCE

- A. Section 23 01 05 - Paragraph 1.05 - ENERGY CODE
- B. Section 23 05 13 - ELECTRICAL WORK
- C. Section 23 31 13.13 - LOW PRESSURE DUCTWORK
- D. Division 16 - ELECTRICAL

1.2 SCOPE

- A. Furnish and install Captive Aire Paragon packaged, roof mounted make-up air heating, air conditioning and energy recovery units with arrangement and capacity as shown on the drawings.
- B. The units shall be completely factory assembled, piped, wired, tested and shipped in one piece with a single point power connection. Outside air system, filters, switches, supply air fan system, modulating hot gas reheat, microprocessor operating controls and safety controls shall be furnished and factory installed. Units shall be specifically designed for outdoor application and include a weatherproof cabinet with insulated bottom panels.
- C. Units shall be provided with direct expansion cooling. Units shall be shipped fully charged with Refrigerant R-454B.
- D. Unit and refrigeration system shall comply with ASHRAE Standard 15, Safety Standard for Mechanical Refrigeration.
- E. Unit Energy Efficiency Ratio (EER) shall be equal to or greater than that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- F. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.
- G. Unit shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the dead-front cover in the main control panel. Electrical wiring diagrams shall be attached to the outside of control panels. Installation and maintenance bulletins shall be supplied with each unit.
- H. Packaged DOAS units by Greenheck can be furnished at the contractors option.

1.3 SUBMITTALS

- A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation, and Maintenance manual with startup requirements shall be provided.

- B. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.4 Delivery, Storage, and Handling

- A. Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

1.5 Warranty

- A. Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.
 - a. Warranty period for compressors shall be 5 years.
 - b. Warranty period for stainless steel heat exchangers shall be 25 years.
 - c. Warranty period for energy recovery wheel cassette shall be 5 years.

1.6 Extra Materials. Furnish extra materials that match products installed.

- A. Filters: One set of each type of filter specified.

PART 2 PRODUCTS

PART 2 - PRODUCTS

2.1 GENERAL

- A. Supply single zone one piece packaged units that are complete as per the following specification, deliver all capacities scheduled, and conform to design indicated herein. Alternate layouts or dimensional changes will not be accepted.

2.2 CABINET

- A. Size 1 unit(s) cabinets shall be constructed of minimum 24-gauge. Sizes 2, 3, or 4 cabinets shall be 20-gauge G-90 galvanized steel riveted together via structural pop-rivets. All metal shall be CNC bent for precise assembly.

1. Rigging Provisions: The unit shall have a structural base constructed of minimum 18-gauge in cabinet size 1 and 14-gauge in cabinet sizes 2, 3 & 4 G-90 galvanized steel, and include full sized fork pockets and lifting points on all four sides.
 2. Roof Construction: The lids shall be fabricated by forming a double-standing, self-locking seam that requires no additional support. Roof shall be pitched to allow for proper drainage.
 3. Exterior Wall Construction: All exterior walls shall consist of a double wall, G-90 galvanized steel construction. Cabinet size 1 shall be insulated with 1-inch thick, R4.3 fiber glass duct board insulation. Cabinet sizes 2, 3 & 4 shall be insulated with 2-inch thick, R13 closed cell foam.
 4. Service Access Doors: All door jambs shall be gasketed around their perimeter, and allow for doors to be mounted via removable, spring actuated, stainless steel hinges with stainless steel rivets, and self-compressing latches. Each compartment shall have removable access panels to allow for ease of service and maintainability. Electrical cabinet access doors shall have a door hold installed to prop doors open. All doors shall have stainless steel latches which are pad lockable. Electrical cabinet doors shall be outfitted with schematic/manual pouches formed into the door, along with wiring diagram attached to the interior of the door from the factory.
- B. Entire interior and exterior casing shall be constructed of minimum G90 galvanized steel. Unit shall have undergone a salt spray corrosion test as per ASTM B 117.
- C. Entire unit shall be Miami-Dade wind rated up to ± 150 psf per TAS 201, 202 & 203 on any units utilizing a 20" or shorter factory provided roof curb.

2.3 AIRFLOW CONFIGURATIONS

- A. Discharge: Unit shall be configurable for Down (vertical) discharge through the unit's base or Side (horizontal) discharge through the cabinet.
- B. Return: Unit shall also be configurable for No Return, Down (vertical) Return through the unit's base, or Side (horizontal) Return through the cabinet.
- C. Intake Airflow: Unit configuration shall be through use of a fresh/outdoor and return air damper.
1. Damper: Shall exceed AMCA Class 1A standard for low leakage. Damper assembly shall be a single assembly, and outfitted with an integral bird screen and louver/gutter system to divert any drainage through the base of the unit – intake air hood not required.
 2. Actuator: A single direct drive damper actuator shall be used with spring return to ensure that the outdoor air section closes when not powered.

2.4 SUPPLY AIR BLOWER AND MOTOR

- A. All supply fans shall be direct drive (belt-drive not acceptable) variable speed plenum fans.
- B. Blower Motor: Motor shall be a premium efficiency motor available as:
1. Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) motor driven by a Variable Frequency Drive.

2. Electronically Commutated Motor (ECM) modulated using a Pulse Width Modulating (PWM) signal.
- C. Fans to be selected at or near efficiency peak. (Submit fan curves).
- D. Blower and motor assembly shall be dynamically balanced. The entire blower and motor assembly shall be mounted on rubber vibration isolators. Wheels balanced as per AMCA 204-96, Balance Quality and Vibration Levels for fans.
- E. Unit equipped with total CFM monitoring to measure airflow across supply discharge.

2.5 REFRIGERATION SYSTEM

- A. Unit shall utilize a variable speed inverter duty scroll compressor with the following features:
 1. Modulation: Compressor shall be capable of compressor speed modulation from
 - 6%-100% on 50 Ton units
 - 7%-100% on 40 and 60 Ton units
 - 15%-100% on 5, 6, 7.5, 8, 10, & 12.5 Ton units/Size 3 30 Ton units
 - 17%-100% on 4 Ton units
 - 20%-100% on 3 Ton units
 - 25%-100% on 15, 20, 22, 25, and 30 Ton units.
 2. Refrigerant: Unit shall be factory charged with R454B refrigerant.
 3. Vibration Isolation: Compressor as well as blower assembly shall each be mounted on rubber vibration isolators to reduce transmission of vibration to the building structure.
 4. Internal Overload Protection: Compressor shall include internal thermal overload protection to protect against excessive motor temperatures.
 5. Crankcase Heater: Compressor shall include a crankcase heater to protect against liquid flood-back and elimination of oil foaming on startup. The crankcase heater must remain powered when the compressor is not in operation.
 6. Oil Management: Unit shall utilize both passive and active oil return management using Oil Level Sensor and scheduled oil boosts.
 7. Monitored Envelope: Unit shall monitor all critical refrigeration points to ensure compressor does not operate outside of safe operating envelope.
 8. Throttling Logic: Unit shall allow for high head pressure monitoring throttle mode for high ambient operation, and low suction pressure throttle mode for low capacity operation or any conditions resulting in low suction pressure.
 9. Pump-Down: Active pump-down mode with discharge line check valve to protect against liquid migration into compressor during idle times.
 10. Defrost mode in optional Heat Pump: When outdoor coils are deemed at risk of freezing, the unit shall simultaneously turn on auxiliary heat while running the heat pump in

“cooling” mode to help defrost outdoor coils as needed while still maintaining desired leaving air temperatures.

B. The unit shall be outfitted with the following:

1. Indoor Coil: Indoor coil shall be a high efficiency 4-10 row coil design with aluminum fins mechanically bonded to copper tubes. Coil is staggered to increase turbulence, reduce the coil bypass factor, and ultimately increase the time the air stays within the coil. Includes two probe sensors to read average coil face temperature.
2. Electronic Expansion Valve: Each refrigeration circuit will be outfitted with an electronic expansion valve metering device which can be throttled from 0-100% open to allow for precise superheat control.
3. Indoor Coil Drain Pan: The indoor coil shall be outfitted with a sloped stainless steel drain pan. This pan shall be insulated along the entire base to prevent condensation, and outfitted with a safety overflow switch which will automatically shut down cooling operation prior to water overflowing the drain pan in the event of a drain clog. The entire drain pan shall be 20 GA Stainless Steel construction and wrap beneath the entire coil with flashing on entering side of coil to ensure capture of all condensate. Drain pan discharge pipe shall also be stainless steel construction. Drain pan shall be pitched to exceed ASHRAE 62.1 standard.
4. Base of the condensing coil cabinet shall be pitched away from the unit as a safety to ensure all draining exits away from the curb.
5. Optional Hot Gas Reheat Coil: The unit shall include an optional copper tube and aluminum fin hot gas reheat coil mounted downstream of the indoor coil. This coil shall be controlled via fully modulating hot gas reheat valve to provide precise reheat temperature control. This coil shall include the addition of an evaporative coil leaving condition sensor to maintain a coil dew point. This also prevents operation of a dehumidification call when intake dew point conditions are found to be below space dew point conditions, preventing wasted energy.
6. Outdoor (Condenser) Coil: Outdoor coil shall be a high efficiency coil design with aluminum fins mechanically bonded to copper tubes. The coil shall be downward sloped to protect coil from hail damage. Optional hail guards may also be outfitted to the outdoor coil for added protection from hail bouncing off the unit's roof up the coil.
7. Outdoor Fans: The outdoor coil shall have a vertical discharge outfitted with quiet, efficient, fully modulating Electronically Commutated Motor (ECM) condensing fans. These fans shall modulate to maintain a temperature differential between outside air and the outdoor coil.

C. To help mitigate any long-term potential for leaks or hardware failures, the unit shall be outfitted with the following protection measures:

1. Suction line accumulator for added protection against liquid entering suction line of compressor.
2. Bi-flow, low pressure drop, filter drier.

3. Electronic Expansion Valve (EEV) for precise superheat control. EEV shall open partially allowing system pressure equalization prior to activation of the compressor.
4. On optional heat pump units, use of a single 3-way reheat valve to prevent obstructions due to valve failure.
5. Protective rubber sleeves installed on all distribution lines of indoor coil to prevent wear from rubbing.
6. All refrigeration ports shall be short-stub assembly and any access port with a transducer or switch is mounted vertically to mitigate risk of bent/cracked stub joints.
7. Refrigeration circuit shall be mechanically CNC pre-bent tubing wherever possible with minimal brazed joints to minimize points for potential refrigeration leaks.
8. Factory tested for leaks via high pressure nitrogen decay and helium tracer gas testing.
9. Suction line temperature sensor failure detection.
10. Preventative failure alerts through a manufacturer provided, cloud based, cellular remote monitoring system.
11. A2L refrigerant leak detectors are paired with custom logic to mitigate the risk of fire in the event of a detected leak.

2.6 HEATING SYSTEM

- A. The gas burner shall be an indirect-fired, push-through type, using natural gas or liquid propane gas. The inlet-supply pressure to the unit for natural gas must be 7" w.c. minimum. For liquid propane gas, the minimum must be 11" w.c.
- B. Burner shall be a tubular in-shot fired design capable of using natural or LP type gas. Each burner ignition shall be of the direct-spark design with remote flame sensing at inlet of the last firing tube of the gas manifold.
- C. Direct-sparking sequence shall last through the complete duration of the trial for ignition period for guaranteed light-off. Burner shall always be lit at maximum gas flow and combustion airflow for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal.
- D. All furnaces shall be controlled by an electronic Vernier-type fully modulating control system capable of achieving 81% combustion efficiency over the entire gas firing range of the unit.
- E. Each furnace shall have:
 1. A minimum turndown ratio of 6:1 for natural gas and 5:1 for LP gas while maintaining a constant 81% efficiency (90% for high efficiency furnace option). No cold air bypass of the heat exchanger.
 2. Each furnace heat exchanger shall be a bent-tube style design made entirely of stainless steel.
 3. Stainless steel Quick Seal Connection for gas connection.

4. Manifold and Input gas pressure gauges.
5. Factory piped condensate drain to exterior of cabinet.
6. A combustion flue to be installed on adjacent side as combustion intake with integrated high velocity wind cap.
7. A blocked vent safety airflow switch with high temperature silicone tubing operating off of absolute pressure measured inside of the power-vent blower housing.
8. A high temperature auto-recycling limit with a maximum non-adjustable set point.
9. A manual reset high temperature flame roll out switch with a non-adjustable set point.
10. Each furnace compartment shall have a removable post and panel that allows the furnace to be easily removed for service and maintainability.
11. A power-vent assembly for exhausting flue gases with a PSC or ECM type motor that is securely mounted and easily accessible/removable for service.
12. A 0-10" w.c. gas pressure gauge installed on the gas manifold.

F. Each electric heater shall have:

1. SCR electric inserts for side or down discharge supply.
2. Electric coils are controlled using SCR controls. SCR is a time proportioning type controller that modulates the heater and supplies the exact amount of power to match the heat demand with a 10:1 turndown per stage with full modulation between minimum turndown and max output.

2.7 FILTERS

- A. Provide filters as part of unit. All filters shall be furnished and installed to meet the performance requirements set forth in the schedule and as specified under another section of this work.
- B. All filters shall be installed on tracks for easy removal from the unit.
- C. Up to 3 layers of outdoor air filtration installed. Unit shall ship with a 2" washable metal mesh outdoor air filter. Mixed air shall have optional 2" MERV-8. Mixed air shall have optional MERV-13 filters. Mixed air shall have optional 4" MERV-15. Mixed air shall have optional 4" HEPA filter banks factory installed.
- D. Unit shall have an optional adjustable pressure differential sensor for the filter bank to alert in the event of a clogged filter.

2.8 ELECTRICAL

- A. All controls shall be pre-wired and housed in an insulated electrical cabinet within the unit to protect against risk of condensation.
- B. Units shall be provided with single point electrical connection or separate electrical heat connection.

- C. Unit shall be provided with a door safety switch that de-energizes the supply fan when the door is opened.
- D. Unit shall be provided with a factory mounted averaging supply air temperature sensor to allow for accurate discharge temperature readings within unit when a downstream sensor is not installed. Field mounted and wired discharge air sensors will not be accepted.
- E. Unit shall be provided with a factory mounted averaging intake air temperature sensor to allow for accurate intake temperature reading regardless of how the OA/RA dampers are positioned.
- F. The electrical cabinet shall be outfitted with the following:
 - 1. LED electrical cabinet service light with automatic activation upon door switch.
 - 2. Color wiring schematics, laminated to the interior wall of the cabinet doors.
 - 3. Factory mounted disconnect with unit bottom knockouts.
 - 4. A LED backlit, LCD Human-Machine Interface (HMI) shall be mounted within the unit's control cabinet to allow for all set points configuration and refrigeration system monitoring at the unit.
 - 5. Up to 4 additional space mounted HMIs available. Additional HMIs shall allow for full programming capabilities and are outfitted with integral temperature and humidity sensors. Additional HMIs shall be capable of being individually averaged for space temperature/humidity readings. All HMIs shall be wired using standard CAT5/6 cables.
 - 6. Optional 120V, 15A unit powered or unpowered convenience outlet.
- G. All sensors shall be wired back to the main control board that continuously monitors all critical components and makes decisions based on pre-determined logic to accurately control the following:
 - 1. PID logic to control heater modulation ensuring precise discharge/space temperature control.
 - 2. PID logic to control compressor speed to provide precise control over evaporative coil temperatures, leaving dew point, and discharge/space temperatures.
 - 3. PID logic for Outdoor fan modulation to maintain an optimal outdoor coil temperature.
 - 4. PID logic for Electronic Expansion Valve (EEV) position to maintain a precise superheat temperature
 - 5. PID logic for Modulating Reheat valve to limit supply air temperature and relative humidity based on space or discharge conditions.

2.9 CONTROLS

- A. Unit shall be outfitted with a control board to allow for full control of the entire unit.
- B. Provide air flow switch on the supply fan system to sense air flow with available set of contacts for connection to BMS for airflow alerts.

- C. All unit controls shall be compatible with BACnet and LonWorks based building management systems.
- D. All units shall be outfitted with CASLink cloud based monitoring, which monitors every point of operation. Provides configurable automated fault alert e-mails, and remote control capabilities.
- E. Integrated cellular module to provide remote connection to monitoring services to view both real time and historical unit operation. Data shall be stored a minimum of 3 years on the cloud. Data sample rate shall be a maximum of 60 seconds.
- F. Optional Blower Control - CO2 Min/Max Override Setpoint or CO2 Threshold Setpoint.
- G. Optional Damper Control - CO2 Min/Max Override Setpoint or CO2 Threshold Setpoint.
- H. Temperature Control System
 - 1. Low-Ambient Cooling: Unit is factory outfitted with logic allowing for low-ambient operation of the DX system
 - a. Standard low-ambient operation: Unit(s) with a DX system may operate down to 0°F outdoor temperatures purely through software utilizing the standard factory modulating components.
 - b. Extreme low-ambient operation: Unit(s) with a DX system may operate to extreme low-ambient conditions, down to -25°F outdoor temperatures, are factory fitted with a bypass solenoid.
 - 2. Discharge Temp Control (Heating)
Unit modulates the burner flame (current supply in the case of electric heating) to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls designed specifically for the Paragon unit(s).
 - 3. Discharge Temp Control (Cooling)
Unit modulates the compressor frequency to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using proprietary cooling PID controls designed specifically for the Paragon unit(s).
 - 4. Discharge Temp Control (Heat Pump)
Unit modulates the compressor frequency to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls designed specifically for the Paragon unit(s). Minimum and maximum discharge set points can be set to limit the temperature entering the space. When ambient temperatures drop below a user configurable minimum outdoor air temperature set point, or the unit is not able to maintain a user configurable minimum discharge temp for 5 minutes time, the heat pump will initiate its backup heat source. Initiation of backup heater operation shall ensure discharge temps are maintained prior to disabling heat pump to make sure discharge temps are never impacted during changeover. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.

5. Discharge Humidity Control (Dehumidification)
Unit modulates the compressor frequency to accurately maintain a desired evaporative coil dew point measured via a coil mounted temperature sensor between the evaporative and hot gas reheat coils. A fully modulating hot gas reheat valve shall utilize excess waste heat from the condensing section feeding the hot gas reheat coil with the precise amount of heat needed to accurately reheat the airstream in order to maintain a desired discharge temperature compensating for fluctuations in entering air temperature, air volume and % of OA using proprietary dehumidification PID controls designed specifically for Paragon unit(s).
6. Space Temp Control (Heating)
Unit modulates the burner flame (current supply in the case of electric heating) to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls designed specifically for the Paragon unit(s). Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
7. Space Temp Control (Cooling)
Unit modulates the compressor frequency to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using cooling (heating when in heat pump mode) PID controls designed specifically for the Paragon unit(s). Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
8. Space Temp Control (Heat Pump)
Unit modulates the compressor frequency to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls designed specifically for the Paragon unit(s). Minimum and maximum discharge set points can be set to limit the temperature entering the space. When ambient temperatures drop below a user configurable minimum outdoor air temperature set point, or the unit is not able to maintain a user configurable minimum discharge temp for 5 minutes time, the heat pump will initiate its backup heat source. Initiation of backup heater operation shall ensure discharge temps are maintained prior to disabling heat pump to make sure discharge temps are never impacted during changeover. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
9. Space Humidity Control (Dehumidification)
Unit modulates the compressor frequency to accurately maintain a desired evaporative coil dew point measured via a coil mounted temperature sensor between the evaporative and hot gas reheat coils. A fully modulating hot gas reheat valve shall utilize excess waste heat from the condensing section feed the hot gas reheat coil with the precise amount of heat needed to accurately reheat the airstream in order to maintain a desired space temperature compensating for fluctuations in entering air temperature, air volume and % of OA using proprietary dehumidification PID controls designed specifically for the Paragon unit(s).

10. Advanced Total Unit Economizer: The control system is outfitted standard, without need for any additional hardware, with an Advanced Total Unit Economizer which will take maximum advantage of as much energy available in the outdoor air conditions in order to run the compressor the minimum amount required at any given incoming air conditions. If the outdoor enthalpy (temperature and relative humidity) permits, the unit will be capable of completely modulating and shutting off compressor to provide “free” cooling and dehumidification as the outdoor air conditions allow.

I. Activation Controls:

1. Activate Based on Intake (Heating)
Unit will activate heating when the intake temperature drops below the desired set point.
2. Activate Based on Intake (Cooling)
Unit will activate cooling when the intake temperature rises above the desired set point.
3. Activate Based on Intake (Dehumidification)
Unit will activate dehumidification when the intake conditions rise above the desired intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
4. Activate Based on Space (Heating)
Unit will activate heating when the space temperature drops below the desired set point.
5. Activate Based on Space (Cooling)
Unit will activate cooling when the space temperature rises above the desired set point.
6. Activate Based on Space (Dehumidification)
Unit will activate dehumidification when the space set point rises above the desired space set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
7. Activate Based on Both (Heating)
Unit will activate heating when the space AND intake temperature drop below the desired set point.
8. Activate Based on Both (Cooling)
Unit will activate cooling when the space AND intake temperature rise above the desired set point.
9. Activate Based on Both (Dehumidification)
Unit will activate dehumidification when the space and intake set point rise above the desired space and intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
10. Activate Based on Either (Heating)
Unit will activate heating when the space OR intake temperature drops below the desired set point.
11. Activate Based on Either (Cooling)
Unit will activate cooling when the space OR intake temperature rises above the desired set point.

12. Activate Based on Either (Dehumidification)
Unit will activate dehumidification when the space or intake set point rises above the desired space or intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
13. Activate Based on Stat (Heating)
Unit will activate heating when the space thermostat sends a 24V signal to W and G on the main control board. Unit will modulate to maintain a constant discharge heat set point.
14. Activate Based on Stat (Cooling)
Unit will activate cooling when the space thermostat sends a 24V signal to Y and G on the main control board. Unit will modulate to maintain a constant discharge cool set point.

2.10 ROOF CURB

- A. Unit shall be factory assembled, and constructed of 18GA galvanized steel, with optional 16GA available.
- B. Curb shall be fully insulated with 1" acoustical and thermal insulation.
- C. Curb shall be factory outfitted with duct support hangers.

2.11 VARIABLE FREQUENCY DRIVES

- A. Provide Variable Frequency Drive for the compressor as part of the AC unit. VFD shall be furnished and installed to meet the performance set forth in the schedule and as specified under another section of this work.
 1. Accessories to be furnished and mounted by the drive manufacturer and contained in a single enclosure. (The use of more than one enclosure is not acceptable).
- B. Provide Variable Frequency Drive for speed control on all non-ECM direct drive supply fans.
- C. All VFDs shall provide the following inherent protections:
 1. Phase protection.
 2. Brownout protection.
 3. Overload/Overheat protection.
 4. Soft starts to protect bearings/hardware.
 5. Low & High voltage & over-torque protections.

PART 3 EXECUTION

- 3.1 Power wiring external to the unit by the Electrical Contractor. Control wiring external to the unit not shown on Electrical Drawings to be by the HVAC Contractor.
- 3.2 The unit shall be installed on factory furnished field assembled, insulated rooftop equipment curb, with a Kinetics model KSR vibration isolation rail between the Dedicated Outside Air Unit and

the roof curb.

- 3.3 The manufacturer shall provide a factory trained serviceman to supervise startup of the unit and instruct the Owner's maintenance personnel in the proper operation.
- 3.4 HVAC contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.
- 3.5 Manufacturer's published start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.
- 3.6 Do not operate unit for any purpose, temporary or permanent, until ductwork is clean, filters and controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.
- 3.7 Install new filters at completion of equipment installation and before testing, adjusting, and balancing.
- 3.8 Pipe condensate drains from drain pans to a splash block located on the roof.

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 74 33 – PACKAGED DX DOAS MAKEUP AIR UNITS

1.02 SUMMARY

- A. Siemens, Inc. will be the basis of design for this project. Siemens is already in the building and alternate manufacturers will not be accepted. This system shall be engineered, programmed, and installed by personnel trained by the manufacturer and regularly employed by the manufacturer's recognized, approved, certified, and authorized agent. The agent shall have complete responsibility for proper installation and operation including checkout, test, calibration, commissioning, and warranty of the equipment and the entire system. The system shall be installed in strict compliance with the specifications. Supplier shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

1.03 SCOPE

- A. Connect to existing DDC temperature control system in the existing building as shown on the Drawings and as specified herein. System shall communicate with the Oxford campus DDC control systems. 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.
 - 1. Provide BACnet MSTP integration for the new roof mounted packaged DX DOAS unit.
 - 2. Monitor status of the new kitchen hood and associated exhaust fan.
 - 3. Update BAS graphics to include the new kitchen equipment.
 - 4. This specification is a performance type specification. Detailed design, conduit routing, programming, graphics generation, etc., is the responsibility of the HVAC Contractor. The materials and equipment specified are set up as a standard, and the Base Bid must be submitted on this basis.
 - 5. multiple client workstations that perform a variety of specific monitoring, programming, and alarm notification functions. New Desigo panels shall be provided where necessary to accomplish the operating sequences described in this Section. Existing Desigo panels currently located in the lower level mechanical room of Symmes Hall. 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 HVAC 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.

1.04 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.

1.05 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.

1.06 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.

1.07 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.

1.08 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 1 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 Rooftop DOAS
 2. Kitchen hood and associated exhaust fan

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. PACKAGED DX ROOF MOUNTED DOAS UNIT

1. The DOAS unit, kitchen hood, and kitchen exhaust fan are being furnished with a protocol translator and shall communicate with BACnet/MSTP to the existing Siemens Insight (BAS). Siemens shall provide control wiring from the existing temperature control panel located in the lower level of Symmes Hall (extend MS/TP wiring from end of line in room 001G).
2. The Temperature Control Sub-Contractor is responsible for obtaining specific control point addresses from the kitchen equipment manufacturer and have them properly integrated into the Building Automation System so that all available control, monitoring and alarm points are accessed, monitored, alarmed and graphically displayed at the Central Operator Workstation.

All available control points to be imported to the BAS.

3. The DOAS unit, kitchen hood, and hood exhaust fan shall be enabled to run whenever the kitchen is operational. During unoccupied hours the DOAS unit, hoods, and exhaust fan will be off. The third party DOAS controller shall initiate the unoccupied mode through an "Off" command to the RTU controllers, during which the RTUs shall be shutdown. During unoccupied mode, the supply fan shall be off, the outside air dampers shall be closed.

Space conditioning during night setback mode will be provided by the existing VAV box VAV-1-8 as described below.

B. EXISTING VAV BOX 1-8

1. The existing VAV box 1-8 shall run at a constant 250 CFM to provide makeup air for the dishwasher exhaust fan during business hours. The DDC controller in box 1-8 shall modulate its Volume damper to maintain 250 cfm during business hours. When the kitchen closes the DOAS unit shall be off and box 1-8 will provide the space conditioning. When the DOAS unit is off box 1-8 max CFM shall be increased to 750. The DDC controller in box 1-8 shall modulate its volume damper (open/closed) in response to deviation from setpoint (75°F adjustable) of its respective zone sensor during unoccupied hours.

C. DISHWASHER EXHAUST FAN CONTROL EF-11

1. Provide “on/off” control and status for restroom exhaust fan EF-1. Fan to run during kitchen hours of operation.

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

ELECTRICAL SPECIFICATIONS - INDEX

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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. 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.
- B. Submit data taken during such test to Engineer. Pay all professional engineering fees involved in required testing of equipment.
- C. 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.
- D. 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.
- E. Work shall be unacceptable when found to be defective or contrary to the Plans, Specifications, Codes specified or accepted standards of good workmanship.
- F. 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 AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.
- 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

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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 required for this section.

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. 44 Thermoset-Insulated Wires and Cables
 - b. UL Std. 83 Thermoplastic-Insulated Wires and Cables
 - c. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
 - d. UL Std. 1569 Metal Clad Cables
 - 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 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: All conductors shall be stranded unless noted otherwise.
 2. Minimum Conductor Size: #14 for control wiring or where otherwise note. #12 for all other conductors.
 3. Conductor Material: Copper for all wires and cables.
 4. Insulation: Provide XHHW, THW, THHN, or THWN insulation for all conductors. Provide XHHW, THW, or THWN for all conductors installed outdoors, underground, or below slab.
 5. 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.
- D. Metal Clad, Type MC Cable- branch circuits:
1. Multi-conductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC cable.
 2. Type MC armored cable in #12 AWG and #10 AWG sizes only, with 600 volt insulation and full size insulated ground conductor.
 3. All conductors shall be stranded copper. Solid conductors are prohibited.

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.
 2. Type MC armored cable may be used for the following.
 - a. Fixture whips 6'-0" in length or less from a conduit system junction box to a light fixture. Installation of MC cable between fixtures is prohibited.
 - b. Concealed in stud walls and above ceilings for lighting, and receptacle branch circuits only in the student rooms. The MC cable may not be used for circuiting back to the panelboard. The MC cable shall transition from MC to EMT/conductors near the entry door of the student room and the EMT/conductors shall be used for the circuiting back to the panelboard.
 - c. Where approved in writing by the Miami University Electrical Project Manager under special circumstances.
- B. Conductors
1. Types of conductor insulation for general use may be any of the following, subject to limitations listed:
 - a. Type THW- no restrictions
 - b. Type THHN- restrictions
 - 1) Do not use for conductors in slab
 - 2) Do not use in wet location
 - c. Type THWN- no restrictions
 - d. Type XHHW- no restrictions
 2. Circuit wiring through ballast channels shall be 600 V, 105 degree F.
 3. Fixture wiring in flexible conduit drops from ceiling junction boxes to fixtures shall be Type THHN/THWN.
- C. Direct buried cable is prohibited.

3.2 PREPARATION

- A. Completely and thoroughly clear raceway with a mandrel or swab 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. Sparingly 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. 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.
- G. 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.
- H. Verify that interior of building has been protected from weather.
- I. Verify that mechanical work likely to damage wire and cable has been completed.
- J. Install products in accordance with manufacturer's instructions.
- K. Use conductor not smaller than Number 12 AWG for power and lighting circuits.
- L. Single conductors used for control circuits shall not be smaller than Number 14 AWG.
- M. Use Number 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet, unless drawings requirements are more stringent.
- N. Use Number 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet, unless drawings requirements are more stringent.
- O. Feeder conductors shall be continuous and shall not contain splices.
- P. Neatly train wiring inside boxes, equipment, and panelboards. Observe NEC 310- 15 (b)(2)(a) adjustment factors.
- Q. Clean conductor surfaces before installing lugs and connectors.
- R. MC cable shall not be utilized for circuiting back to the panelboard. MC cable shall terminate in a junction box located above an accessible ceiling in the corridor. Home run wiring shall be provided from the junction box to the panelboard in conduit.

3.4 CONNECTORS

- A. Keep conductor splices to minimum.
- B. 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.

- C. All connections are to be made using pressure type terminals.
- D. Where connections are to be made to devices or equipment under screw heads only, install insulated, crimp type spade clips on the wire ends before the connections are made.
- E. Devices shall not be used as through connection points. Where through circuits are involved they shall be spliced in the box and a pigtail connected to the device.
- F. Connectors shall contain only one wire unless they are listed for multiple conductors.
- G. Joints in #10 and smaller wire shall be made using the following types of connectors: Minnesota Mining and Manufacturing "Scotch Lok", Ideal Industries, Inc. "Wing Nut", or Thomas and Betts Co. Type "PT". Connectors shall be used only within their range. Other threaded-on types of insulated connectors shall not be used.
- H. Joints in #8 and larger wire or joints in any wires above the range of threaded-on connectors shall be made using pressure type mechanical connectors applied after wires are cleaned and then insulated using two (2) layers of "Scotchfil" brand electrical insulation putty and covered by two (2) half- lapped layers of "Scotch 88", or Plymouth Slipnot Gray vinyl plastic electrical tape. Connectors can be installed and sealed against moisture by installing Raychem "TCS (indoor) or WCSM (exterior)" sealant coated heat shrink tubing.
- I. Wiring in vertical raceways shall be supported per code requirement with strain relief devices.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Identify each conductor with its circuit Number or other designation indicated on Drawings.

3.6 MARKING

- A. All branch circuits shall be marked in panelboard gutters. Markers shall indicate corresponding branch circuit numbers.
- B. All signal and control wiring shall be marked at all termination points, such as cabinets, terminal boxes, equipment racks, control panels, consoles, etc.
- C. The wire markers shall be Thomas and Betts vinyl tape type WM wrapped once around the wire and the adhesive sides placed together to form a flag.
- D. Wire markers shall be installed when the wire is pulled.

3.7 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 w/stripe*	Neutral	Gray
Green	Equipment Ground	Green

- * Neutral wires for AFCI protected circuits (which require a dedicated neutral per circuit) shall be white in color, with a permanent stripe/tracer for the entire length to match the associated phase conductor color (black, red, or blue).
2. All control circuits shall be purple. On 3-way and 4-way switches the travelers shall be same color as the phase used.
3. 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 8 AWG. Field applied color coding shall be applied at each terminal, each conduit entrance, and at intervals not more than 12" apart in all boxes, panel tubs, switchboards, etc.

1. For phase conductors:
- a. 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. For neutral conductor:
- a. Same as for phase conductors.
- b. Dedicated neutral wires serving AFCI protected circuits shall be white in color and include a permanent stripe or tracer with a color matching phase used.
3. For ground conductor:
- a. Factory applied color.

F. Prior to energizing, test wires and cables for electrical continuity and for short circuits.

G. 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 contractor 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. A.B. Chance Co.
 - 2. Blackburn Co.
 - 3. Erico Products, Inc.
 - 4. Ideal Industries, Inc.
 - 5. Kearney-National.
 - 6. McGill Mfg.
 - 7. O-Z/Gedney Co.
 - 8. Raco, Inc.

9. Thomas & Betts Corp.

2.2 GROUNDING AND BONDING PRODUCTS

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

2.3 WIRE AND CABLE CONDUCTORS

- A. General: Comply with Division 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: Nonferrous material, 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: All feeders and branch circuit raceways (over 100 volts) shall include and equipment grounding conductor. Comply with NEC Article 250 and Table 250.122 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated. Equipment grounding conductors shall not be smaller than #12 for lighting and power and #14 for control circuits.
- B. Install separate insulated equipment grounding conductors with circuit conductors for all feeders and branch circuits.
- C. 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.
- D. 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.
- E. Underground Conductors: Bare, stranded copper except as otherwise indicated.
- F. 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 #6 copper or as shown on drawings, whichever is larger.
- G. Enclosures, junction and pull boxes shall utilize a "panel" type ground bar or U.L. listed grounding lugs or screws, as the number of ground conductors dictates.
- H. All panels shall be furnished with a copper ground bar similar to the neutral bar and having the same number, size and type of lugs. The ground bar shall be factory bonded to the panel tub above or below the neutral assembly, but shall not be in a gutter.

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.
- F. Separately derived systems required by NEC to be grounded shall be grounded in accordance with the NEC.
- G. Bond electrical system grounding, telephone, CATV, other communications systems, water piping, gas piping, and other piping systems together.
- H. All enclosures, boxes, fixtures, receptacles, etc., shall be grounded by being securely bonded to the grounding conductor. Boxes, conduit, etc., shall not be used as part of the grounding "conductor" system.
- I. Enclosures not requiring a ground bar shall have all ground conductors connected together and a pigtail the size of the largest conductor bonded to the enclosure with a single ground connector used for no other purpose.
- J. Motor terminal boxes shall be grounded by the use of manufacturer-supplied ground lug or by drilling and tapping a hole for a ground screw. Remove paint prior to making the connection.
- K. Conduit system shall be electrically continuous. All locknuts shall cut through enameled or painted surfaces on enclosures. Where enclosures and non-current carrying metals are isolated from the conduit system, use bonding jumpers with approved clamps. Where reducing washers are used and where concentric or eccentric knockouts are not completely removed bonding bushings shall be required.
- L. Main services shall be connected by a grounding electrode conductor to water service entrance as well as driven ground rod, building steel and concrete encased re-bar where available.
- M. Interconnection of grounding electrode conductor, system neutral and equipment ground conductors shall be made only within the service entrance equipment grounds and the identified neutral shall not be electrically interconnected on building side of service ground.
- N. Bond metallic conduits entering unit substation switchboard with ground wire connecting the grounding type bushing to equipment ground bar.
- O. The transformer secondary neutral shall be grounded separately from the neutral ground at service main unless close coupled in unit substation construction.
- P. Do not use neutral bus of panelboards for equipment grounds.

- Q. Equipment grounding conductors shall be grounded to cabinet of the panelboard by an uninsulated ground bus.
- R. Conduit crossing building expansion joint shall have provision to maintain grounding continuity.
- S. Bond protective conduits for ground conductors at both ends to reduce impedance in the ground path under fault current

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.

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 SEISMIC REQUIREMENTS

- A. Conform to requirements in Section 20 08 00 "Seismic Protection."

1.3 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.

1.4 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. 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

Raceway Size (Inches)	No. of Conduits in Run	Location	Maximum Spacing of Supports (Feet)		
			RMC & IMC*	EMT	
1) HORIZONTAL RUNS					
1/2, 3/4	1 or 2	Flat ceiling or wall.	5	5	
1/2, 3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7	7	
1/2, 3/4, 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 spacing for IMC above apply to straight runs only. Otherwise the maximums for EMT apply.

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

END OF SECTION

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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. PVC coated rigid metal conduit
 3. Intermediate metal conduit
 4. Rigid non-metallic conduit and duct
 5. Electrical metallic tubing (EMT)
 6. Flexible metal conduit
 7. Liquidtight flexible conduit
 8. Wireway
 9. Surface raceways
 10. Cable tray
 11. Boxes, enclosures, and cabinets include the following:
 - a. Device boxes
 - b. Outlet boxes
 - c. Pull and junction boxes
 - d. Cabinets and hinged cover enclosures
 - e. 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. 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 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Outlet Boxes:
 - a. Appleton
 - b. Crouse Hinds
 - c. Pass & Seymour
 - d. Raco
 - e. Steel City
 2. Conduit Fittings:
 - a. Midwest
 - b. Raco
 - c. Steel City
 - d. Thomas & Betts
 3. Wireways:
 - a. Square D; Schneider Electric

2.2 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.

2.3 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. PVC Coated 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. PVC coating of nominal 40 mil thickness shall be uniformly and consistently applied on the exterior of the conduit. Urethane coating of nominal 2 mil thickness shall be uniformly and consistently applied to the interior of the conduit and over the threads. Provide an enamel lubricating coating on the inside of the conduit. Conduit to be listed and labeled under UL 6 and shall be ETL PVC-001 Verified.
- 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.
 - 1. Fittings for rigid steel conduit and IMC to be single piece threaded, cadmium plated malleable iron, insulated with grounding bushing. 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.
 - 2. PVC coated rigid steel.
 - a. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
 - b. Form 8 Condulets shall have a V-Seal tongue-in-groove gasket to effectively seal against the elements. Form 8 Condulets shall be supplied with plastic encapsulated stainless steel cover screws.
 - c. A urethane coating of nominal 2 mil thickness shall be uniformly and consistently applied to the interior of conduit fittings and female threads.
- 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.

2.4 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.

- D. Fittings shall be malleable iron, “squeeze” type, non-insulated. Fittings shall meet ANSI/NEMA FB 1 - 1988.

2.5 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 or steel and have male and female thread for attachment to box or conduit as required.

2.6 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, concrete tight 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.

2.7 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.

2.8 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.

2.9 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.

2.10 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, removable.
- E. Finish: Components shall be hot dipped galvanized after fabrication or provided with a rust inhibiting phosphatizing coating and Manufacturer's standard enamel finish. All hardware shall be plated to prevent corrosion.

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 CABLE TRAY

- A. NEMA Class II aluminum, single or double tier with rectangular tube core spline and 6" or 9" rungs.
- B. Fittings and Accessories: Include couplings, offsets, seismic connections, bends, closures, junctions, and other fittings to match and mate with cable tray as required for complete system.

2.13 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 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 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 2 inches deep.
- D. Cast Metal Boxes: NEMA FB 1, type FD, cast ferrous alloy box with gasketed cover.

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. Rigid Steel Conduit
 - 1. Applications
 - a. Exterior and interior wet and damp locations.
 - b. Interior dry locations.
 - c. Stub ups through slabs from below grade.
 - 2. Restrictions (not to be used)
 - a. Underground, except for stub-ups as noted above.
 - b. Hazardous or corrosive atmospheres.
- B. PVC Coated Rigid Steel Conduit
 - 1. Applications
 - a. Hazardous or corrosive atmospheres.
- C. Intermediate Metal Conduit
 - 1. Applications
 - a. Interior dry locations.
 - 2. Restrictions (not to be used)
 - a. Underground.

- b. Hazardous or corrosive atmospheres.
 - c. Outdoor locations.

- D. Electrical Metallic Tubing
 - 1. Applications
 - a. Interior dry locations.
 - 2. Restrictions (not to be used)
 - a. Underground.
 - b. Hazardous or corrosive atmospheres.
 - c. Damp and wet locations.
 - d. Poured concrete.
 - e. Exterior locations.
 - f. From floor level to 4'-0" above floor in mechanical equipment rooms.

- E. Rigid Nonmetallic Conduit
 - 1. Applications – Limited to the following
 - a. Under concrete slabs on grade.
 - b. Exterior locations when encased in 3" of concrete.
 - c. Stub ups through slabs from below grade concealed inside a floor mounted enclosure.
 - d. Where noted on the drawings.
 - 2. Restrictions (not to be used)
 - a. Stub ups through slabs from below grade where exposed above slab.

- F. Flexible Metal Conduit
 - 1. Applications – Limited to the following
 - a. Connections to light fixtures. Length shall not exceed 6'-0".
 - b. Narrow moveable partitions where other raceways are not practical, when approved by the Owner's representative.
 - c. From floor level to 4'-0" above floor in mechanical equipment rooms.
 - d. Connections to Variable Frequency Drives.

- G. Liquidtight Flexible Metal Conduit
 - 1. Applications – Limited to the following
 - a. Connections to motors or controls on dynamic equipment and transformers. All motor connections shall be water tight and dust tight with fittings approved for wet locations. Maximum length shall be 3'-0".
 - b. Connections to equipment and boxes below 4'-0" in Mechanical Equipment Rooms

- H. Surface Metal Raceway
 - 1. Applications – Limited to the following
 - a. Where specifically indicated on the drawings.

- I. Boxes and enclosures
 - 1. Outdoor and Interior Wet and Damp Locations:
 - a. NEMA Type 3R or Type 4, unless noted otherwise on the drawings.
 - 2. Dry Interior Locations:
 - a. NEMA Type 1, unless noted otherwise on the drawings.

3.3 INSTALLATION

A. General

1. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
2. Avoid moisture traps; provide junction box with drain fitting at low points in raceway system.
3. Provide water tight boxes, slip expansions, and bonding jumpers where dictated by construction conditions.
4. 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.
5. 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.
6. 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.
7. Power actuated fasteners of any type are prohibited. This includes anchors which are driven into place by any device which produces an impact force by use of a powder charge, compressed air, gas or any other propellant.
8. The use of wire ties for conduit support is prohibited.

B. 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.

C. Raceways

1. Do not reduce the indicated sizes of raceways.

2. Do not install any raceway in concrete slabs. Install under slab. Under slab conduits to be a minimum of 3" below slab. Feeder conduits installed under slab shall be encased in 3" of concrete.
3. Raceway routing is shown on the 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.
4. Expansion:
 - a. 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.
5. Conceal conduit, unless otherwise indicated, within finished walls, ceilings, and floors.
6. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes and 4" away where crossing piping. Install horizontal raceway runs above water and steam piping.
7. 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.
8. Secure feeder conduit to basic structural elements with galvanized strap hangers and clamps; use of trapeze type hangers is encouraged for multiple conduits where space will permit. Conduit may not be attached to suspension grid. Galvanized metal clamps and screws may be used for attaching and supporting branch circuit conduit. Nonmetallic fasteners shall not be used except plastic inserts may be used in concrete for small conduits. Vertical conduits shall be supported at each floor by clamps.
9. Complete raceway installation before starting conductor installation.
10. During construction temporarily cap open ends of conduit to prevent foreign matter from entering raceway. Utilized caps or plugs made specifically for conduits.
11. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
12. 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.
13. Minimize the number of offsets, bends and junction/pull boxes as much as practical. For feeder conduit use large radius conduit bends or elbows, large pull boxes with screw covers. Boxes shall be located in an accessible area.
14. Generally install conduit as high as practicably possible against underside of floor slab in concrete construction or immediately below the top chord of bar joist construction unless otherwise shown. Installation of conduits randomly at various levels and directions is not acceptable. Installation at bottom chord level or ceiling grid level is not acceptable.
15. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

16. 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.
17. Vertical conduits passing through floor slabs shall be installed through a sleeve. Sleeves shall extend 1" above finished floor. Seal gap between sleeve and conduit with fire-stop sealant. Multiples of large conduit riser may be run through floor openings filled with concrete or metal curbs and closed with insulated fireproof steel plates to preclude passage of heat and smoke.
18. Raceways passing through exterior below-grade slabs:
 - a. 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.
19. 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.
20. 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.
21. 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.
22. 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.
23. Cable trays:
 - a. Support cable tray at 6'-0" intervals or as recommended by the cable tray manufacturer.
 - b. Support cable tray from wall shelf bracket in a manner to permit laying cables in trays without interferences.
 - c. Ground cable tray to the ground bus and bond each joint with bonding jumper for an absolute ground.
 - d. Branch or distribution conduits to or from the cable tray shall be bonded with an grounding conductor connecting an approved CuAl lug at the tray and a ground bushing on each conduit.
24. Wireways: Support wireways with factory made hangers and 3/8" diameter solid hanger rods approximately 5 feet on center or approved strap hangers for surface mounting.
25. 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.
 - a. 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.
 - b. 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.

- c. 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.
- d. 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.

D. Sealant and Fittings.

1. 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.
2. Exterior wall penetrations shall be sealed water tight.
3. Provide sealant to preserve smoke and fire partitions using materials and methods under the provisions of Section 07 92 00 "Joint Sealants."
4. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

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 18" x 18" hinged access panels, equal to Milcor, for boxes located above inaccessible ceilings.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Terminations into boxes shall be secured by locknuts or approved bushings.
- F. Support all boxes rigidly and independently of conduit. Use supports suitable for the purpose.
- G. Set floor boxes level and adjust to floor surface.
- H. Install hinged cover enclosures and cabinets plumb. Support at each corner.
- I. 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.
3. Provide covers for all boxes.
4. 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. Record routing of all underground branch circuit conduits and branch circuit conduits larger than 2 inches.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION

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 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
 6. Available fault current
- B. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.3 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 contractor 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."

PART 2 - PRODUCTS

2.1 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

2.2 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

3.1 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as 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 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.
- E. Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground line marking tape located 12" directly above each respective line.
- F. Conductor Color Coding for Conductors Rated 600 Volts and Less: See Specification Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- G. 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.
- H. 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.
- I. 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. Security monitoring master station or control panel
 - b. Fire alarm master station or control panel
 - c. Transformers
 - d. Electrical switchgear and switchboards
 - e. Motor starters, VFDs
 - f. Pushbutton stations
 - g. Contactors
 - h. Panelboards, electrical cabinets, and enclosures
 - i. Access doors and panels for concealed electrical items
- J. 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.

- K. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- L. 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.
- M. 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.
- N. 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.
- O. Fusible Switches: Install fuse manufacturer supplied labels inside the door of the fusible switch indicating the proper type and fuse required for replacement.
- P. Receptacles:
 - 1. All receptacles are to have the panelboard and circuit number feeding the receptacle noted on a high quality adhesive or laminated nameplate affixed to the receptacle cover plate. The nameplate shall be located on the top of the face of the plate.
 - 2. Receptacles connected to an emergency circuit shall be provided with a phenolic nameplate with the word "Emergency". The nameplate field shall be white and the letters shall be red. Locate nameplate on the bottom of the face of the cove plate.

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 indicated.
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 except where installed exposed to public spaces. Panelboard fronts in public spaces (RD Apartments) to be primed for field painting.
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.CLEANING
- B. 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

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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. Not Used:
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: Ivory except as otherwise indicated or required. Devices connected to generator power shall be red in color.
- 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, straight blade convenience receptacles, Specification Grade, Hard Use, 125 V, 20 A, NEMA 5-20R, Federal Spec WC 596. Pass & Seymour TR5362 or equal.
- F. Straight blade, convenience receptacles, Heavy Duty, Specification Grade, 125V, 20A, NEMA 5-20R, Federal Spec WC 596G. Hubbell HBL5362 or equal.
- G. Tamper-resistant, straight blade, Ground Fault Circuit Interrupter receptacles, Specification Grade, LED indicator, 4-6mA trip level, 125V, 20A, NEMA 5-20R, Self-testing, UL943 Class A, Federal Spec WC 596. Pass & Seymour 2097TR or equal. Install in student and resident apartment.
- H. Tamper-resistant, straight blade, Arc Fault Circuit Interrupter receptacles, Feed Through Type, Specification Grade, LED indicator, 125V, 20A, NEMA 5-20R, UL1699A, Federal Spec WC 596. Hubbell AFR20TR or equal.
- I. Locking or special type to be of NEMA configuration called out for the specific application on the drawings.
- J. 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.

- K. Snap Switches, Quiet-type A.C. switches, Industrial Grade, 120/277V, 20A UL 20.
- L. Cover Plates for Interior Wiring Devices: Single and combination types that mate and match with corresponding wiring devices. Features include the following:
 - 1. Type 302 stainless steel containing 18% chromium and 8% nickel, with brushed nickel satin finish, 0.032" thick. Screws shall be stainless steel, with countersunk heads.
 - 2. Receptacle cover plates for devices connected to emergency circuits shall be provided with an engraved nameplate stating "Emergency". Nameplate shall have white face and red letters.
- M. 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.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. 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.
- D. Protect devices and assemblies during painting.
- E. Adjust locations at which floor service outlets and telephone and power service poles are installed to suit the indicated arrangement of partitions and furnishings.

3.02 IDENTIFICATION

- A. Comply with Division 26 Section "Identification."
 - 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. For receptacles connected to emergency circuits provide a nameplate as specified in Section 260553.

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 28 13 - FUSES

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. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, switchboards, and enclosed controllers.
 - 2. Spare fuse cabinet.

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 contractor from full compliance with the plans and specifications.

1.4 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 use and purpose.
- C. Single-Source Responsibility: All fuses shall be the product of a single manufacturer.

1.5 EXTRA MATERIALS

- A. Furnish the following extra materials that match products installed, packaged with protective covering for storage, and with identification labels clearly describing contents.
 - 1. Spare Fuses: Furnish a minimum of 25% in quantity of each size for each type of installed fuses but not less than one set of each size and type. Store in spare fuse cabinet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide fuses by Bussmann Div., Gould-Shawmut, or Economy-Reliance.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1 nonrenewable cartridge fuse, class as specified or indicated, current rating as indicated, voltage rating consistent with circuit voltage.
- B. Cartridge Fuses: Cartridge fuses shall be as described below and shall have a minimum interrupting rating of 200,000 symmetrical amperes for the AC voltage at which they are rated.
 - 1. Fuses rated 600 amperes and less shall be UL Class RK-1 dual element time delay.
 - 2. Fuses rated 601 to 6000 amperes shall be UL Class L dual element time delay fuses.
 - 3. Class J fuses are prohibited.
- C. Control Circuit Fuses: Provide type KTK-R fast acting, rejection type, current-limiting fuses for control circuit protection.

2.3 SPARE FUSE CABINET

- A. Cabinet: Wall-mounted, 18-gage minimum steel unit with full-length, recessed piano-hinged door with key-coded cam lock and pull.
- B. Size: Adequate for orderly storage of spare fuses specified with 15 percent spare capacity minimum.
- C. Finish: Gray baked enamel.
- D. Identification: Stencil legend "SPARE FUSES" in 1-1/2-inch letters on door.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuses in fusible devices as indicated. Arrange fuses so that fuse ratings are readable without removing fuse.
- B. Fuses shall not be installed in equipment before the equipment has been set and anchored in its final position at the project site.
- C. Install spare fuse cabinet, located in the main electrical room of each building, adjacent to the main service entrance equipment.
- D. Attach a typewritten bill of material for the spare fuses and mount to the inside of the spare fuse cabinet door in a plastic cover.

3.2 IDENTIFICATION

- A. Install pre-printed labels from fuse manufacturer on the inside door of each fused switch to indicate exact fuse type and size for replacement information.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES

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:
 - 1. Fusible switches.
 - 2. Nonfusible switches.

1.3 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: ampere and voltage ratings, overcurrent device sizes, poles and type. Indicate all short circuit ratings.

1.4 QUALITY ASSURANCE

- A. Comply with the following standards.
 - 1. NEMA KS 1 "Enclosed Switches"
 - 2. NEMA 250 "Enclosures for Electrical Equipment"
 - 3. UL Standard 98 "Enclosed and Dead Front Switches"
- B. Switches identified for use as service equipment are to be labeled for this application.
- C. All switches 600 amperes and smaller shall be of the same manufacturer; switches larger than 600 amperes shall also be products of one manufacturer, although not necessarily the same manufacturer as switches rated 600 amperes and smaller.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D Company
 - 2. General Electric
 - 3. Eaton Cutler Hammer

2.2 SWITCHES- 1200 AMPERES AND SMALLER

- A. Nonfusible Switches.

1. Heavy duty, quick make, quick break, single throw, rated 600 volts AC, ampere rating as indicated on the drawings.
2. Unless indicated otherwise, provide 3 blade, with solid neutral, when a neutral is provided.
3. For motor and motor starter disconnects, provide units with horsepower ratings suitable to the loads.
4. NEMA 1 enclosure for interior installations, unless noted otherwise. NEMA 3R enclosure for exterior installations, unless noted otherwise. Provide NEMA 3R enclosures with raintight hubs.
5. Switches shall have provisions for padlocking the enclosure in the closed position and another provision for padlocking the switch operator in the open and closed positions. It shall not be possible to open the switch enclosure with the switch operator in the closed position, except by means of a defeat mechanism.
6. Provide mechanical lugs for number, size, and material of conductors indicated.

B. Fusible Switches

1. Fusible switches shall be as specified above with the addition of positive pressure, reinforced type Class R fuse clips for fusible switches 600 amperes or less; or for class L fuses for switches over 600 amperes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches for use as local disconnect switches with motor driven equipment within site of the associated equipment.
- B. Install enclosed switches and circuit breakers level and plumb.
- C. Provide free standing support frame for switches that cannot be wall or equipment mounted. Frame shall be full height and attached at the floor and ceiling, or angle braced to floor, or poured into concrete equipment pad to provide rigid structure. Minimum height to top of floor-mounted switches shall be 3'-0", maximum height shall be 6'-0".
- D. Install fuses in fusible devices.
- E. Tighten connectors and terminals, including screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.2 NAMEPLATES

- A. Provide a nameplate conforming with Section 260553 "Identification" on every disconnect defining what the load that it serves or disconnects.

3.3 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION

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SECTION 26 29 13 - ENCLOSED CONTROLLERS

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 alternating current motor control devices rated 600 volts and below.

1.3 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: ampere and voltage ratings, overcurrent device sizes, poles and type. Indicate all short circuit ratings.
- B. Submit the following to the owner at the completion of the project in accordance with Conditions of Contract and Division 01 Specification Sections.
 - 1. Maintenance data for products for inclusion in Operating and Maintenance Manual specified in Division 01 and in Division 26 Section "Common Work Results for Electrical Systems."
 - 2. Load Current and Overload Relay Heater List: Compiled by Contractor after motors have been installed. List shall show each motor designation, the motor's nameplate current rating, and the selected overload heater element or overload relay setting.

1.4 QUALITY ASSURANCE

- A. NEMA Compliance: NEMA ICS 2, "Industrial Control Devices, Controllers and Assemblies."
- B. UL Compliance: UL 508, "Electric Industrial Control Equipment."
- C. Single-Source Responsibility: Obtain similar motor-control devices from a single manufacturer.
- D. Warranty: Motor Controllers 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. Allen-Bradley
 - 2. General Electric

3. Square D Co.

2.2 FULL-VOLTAGE CONTROLLERS

- A. Comply with NEMA ICS 2, general purpose, Class A.
- B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
 1. Nonreversing.
 2. Surface mounting.
 3. Red pilot light.
- C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 1. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 2. Surface mounting.
 3. Red pilot light.
- D. Magnetic Controllers: Full voltage, across the line, electrically held.
 1. Configuration: Nonreversing.
 2. Contactor Coils: Pressure-encapsulated type.
 3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 4. Control Circuits: 120 volt ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 50 VA.
 5. Bimetallic Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Class 10 tripping characteristic.
 - c. Heaters in each phase matched to nameplate full-load current of actual protected motor.
 - d. Ambient compensated.
 6. External overload reset push button.
- E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
 1. Fusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 2. Nonfusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

- c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

F. ENCLOSURES

- 1. NEMA ICS 6, to comply with environmental conditions at installed location.
 - a. Dry and Clean Indoor Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - c. Kitchen Wash-Down Areas: Type 4X.

G. ACCESSORIES

- 1. Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 - a. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
 - b. Push Buttons: Shielded type; maintained or momentary as indicated.
 - c. Pilot Lights: LED type; colors as indicated; push to test.
 - d. Selector Switches: Rotary type.
- 2. N.C. and/or N.O. auxiliary contact(s) as indicated.
- 3. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- 4. Space heaters, with N.C. auxiliary contacts, to mitigate condensation in Type 3R and Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- 5. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 APPLICATION

3.2 INSTALLATION

- A. Install independently mounted motor control devices in accordance with manufacturer's written instructions.
- B. Locate controllers as indicated and within sight of motors controlled.
- C. Mounting: For control equipment at walls, bolt units to wall or mount on light-weight structural steel channels bolted to the wall. For controllers not at walls, provide freestanding racks fabricated of structural steel members and light-weight slotted structural steel channels.
- D. Except as otherwise indicated, install push buttons, pilot lights, and selector switches in covers enclosures. Install fuses in each fusible-switch enclosed controller.
- E. Install fuses in control circuits if not factory installed.
- F. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

3.3 IDENTIFICATION

- A. Identify motor control components, control wiring, and all automatically started equipment in accordance with Division 26 Section "Identification for Electrical System."

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between motor control devices and control/indicating devices as specified in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" for hard-wired connections.
- B. Make control connections so only the manual and automatic control devices that have no safety functions will be bypassed when the switch is in the hand position. Connect motor-control circuit in both hand and automatic positions for safety type control devices. Make control circuit connections to a hand-off-automatic switch or to more than one automatic control device in accordance with an indicated wiring diagram or one that is manufacturer approved.
- C. Install wiring in enclosures neatly bundled, trained, and supported.

3.5 CONNECTIONS

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

3.6 FIELD QUALITY CONTROL

- A. Visual and mechanical inspection.
- B. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's instructions.
- C. Check tightness of electrical connections of devices with calibrated torque wrench. Use manufacturer's recommended torque values.
- D. Clean devices using manufacturer's approved methods and materials.
- E. Verify proper fuse types and ratings in fusible devices, where used.
- F. Correct deficiencies and retest motor control devices.

3.7 CLEANING

- A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally using methods and materials as recommended by manufacturer.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

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 one 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. Fluorescent-fixture-mounted, emergency battery pack: One for every 50 emergency lighting unit.
 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 on the drawings.

- B. Contractor's option to provide the alternative fixture for each fixture that includes an alternative fixture listed in the lighting fixture schedule on the drawings. The Contractor may propose alternative fixtures for those fixtures in the schedule that do not include an alternative. Complete documentation for such fixtures shall be submitted for evaluation. Such proposed fixtures shall meet the performance and feature characteristics as the fixture in the schedule. The final acceptance of any proposed alternate fixture shall be as determined by the Project Architect.

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. LED fixtures: LEDs and associated drivers furnished as a component of the fixture.
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- F. 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 re-lamping and when secured in operating position.
- G. 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.
- H. 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.
- I. 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 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: LEDs, 50,000 hours minimum rated lamp life.

2.5 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 Architect, 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. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. 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.
- E. 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.
- F. 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

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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 cabling and equipment.
 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 bidding company's 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.
- 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 substitutions 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 ESDs 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.
- 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 the E-Z Path (sleeve system) shall be used.

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 Splicing – 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. Approved manufacturers: Panduit Corporation, General Cable
- 2. Approved P/N's for horizontal cabling may be found in Appendix B.

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) < 0.1 ohm
- d. Test all grounding conductors for current:
 - 1) AC: ≤ 1 A
 - 2) DC: ≤ 500 ma
- 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. 48 strand singlemode building feeds, 12 duplex single mode fibers terminated LC, 6 duplex singlemode fibers terminated "LC-APC" style duplex adapters and shall be color coded according to the optical fiber type for which they are applied. The last 6 duplex singlemode fibers will be unterminated and dressed to be available for future termination.
- 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 perform any and all fiber work. Full Corning Warranty is required on all fiber cables.
 - b. Full testing, Tier 1 and Tier 2, shall be performed on each cabling segment (connector to connector). Tests and inspections with 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. Provide 1 CAT 6 cable.
 - b. “D, 2D, 3D, or 4D” – Randl 5 square outlet box with Single-gang mud ring and faceplate for data, voice, and video applications. Provide 1 CAT 6 cable per D.
 - 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. Provide 1 CAT 6 cable per D.
 - d. “D-WAP” – Biscuit-jack with data for wireless above drop-ceiling with 10 foot cable coil. Provide 2 CAT 6 cables.
 - e. “DOS-WAP” – Biscuit-jack with data for outside wireless terminated into a Randl 5 square outlet box (refer to drawing for details). Provide 1 CAT 6 cable.
 - f. “D-S” – Single-gang 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”. Contractor shall install University furnished wire access point. One CAT 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. Provide 1 CAT 6 cable.
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 (ft)	TBB/TEBC size (AWG)
Less than 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

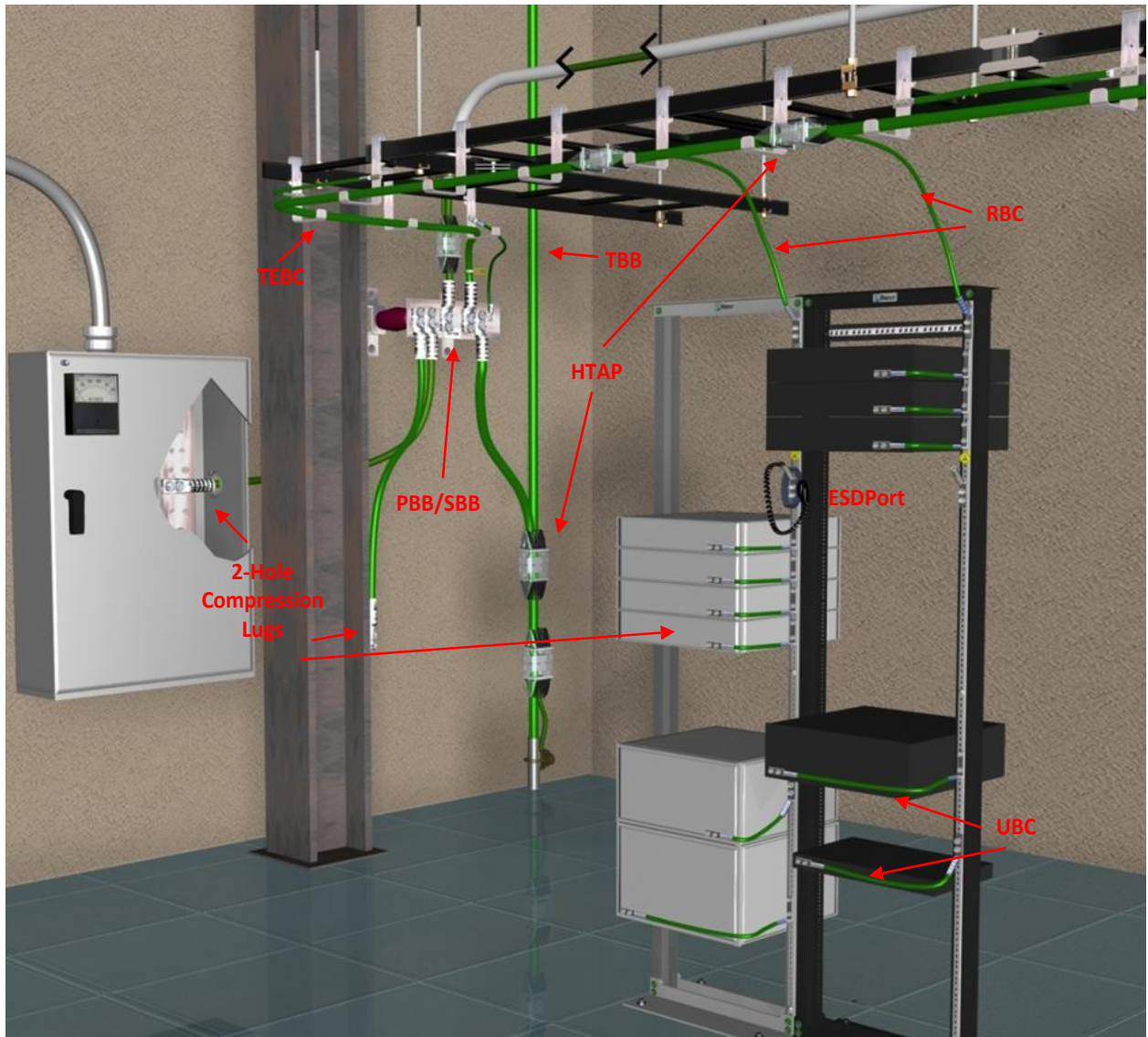


Figure 1 (grounding reference only)

APPENDIX B

Product Description	Manufacturer	Part Number	Additional Product Information
Category 6A Copper Cable			
Cat6A Copper Cable, Non Continuous Sheild, Plenum, Blue (Spool)	General Cable	7141849	
Cat6A Copper Cable, Non Continuous Sheild, Plenum, Blue (Spool-Pac)	General Cable	7141879	Substitute Packaging Option
Cat6A Copper Cable, Non Continuous Sheild, Plenum, Blue	Panduit	PUP6AV04BU-G	Cable
Cat6A Copper Cable, Non Continuous Sheild, Riser, Blue	General Cable	7133849	
Cat6A Outdoor Copper Cable, Black	General Cable	8136100	
Category 6A Copper Connectivity			
Category 6A, Jack Blue	Panduit	CJ6X88TGBU	
Category 6A, Shuttered Jack, Blue	Panduit	CJH6X88TGBU	
Category 6, 8-Position, 8-Wire Modular Plug	Panduit	SP6X88-C	
Category 6A, 45 Degree, Angled Left/Right Wire Cap	Panduit	CJLRCAPBU-X	For use with the TGSJT Termination Tool; 10 Pack
48-Port Unloaded Patch Panel	Panduit	CPP48FMWBLY	48-port Flush Mount Patch Panel Supplied w/Rear Mounted Faceplates
Strain Relief Bar	Panduit	SRB19D7BL	Strain relief bar extends 7" off the rack; supports & provides proper bend radius protection
Category 6 Copper Cable			

Category 6 Copper Cable, Plenum, White	General Cable	7131901	
Category 6 Copper Cable, Riser, White	General Cable	7133901	
Category 6 Outdoor Copper Cable, Black	General Cable	7136100	
Category 6 Copper Connectivity			
Category 6, Jack, White	Panduit	CJ688TGWH	Category 6, RJ45, 8-position, 8-wire Universal Jack, Blue
Category 6, Shuttered Jack, White	Panduit	CJH688TGWH	Category 6, RJ45, 8-position, 8-wire "spring shuttered" Universal Jack, White
Category 6, Corrosive Resistant Jack, White	Panduit	CJE688TGWH	Category 6, RJ45, 8-position, 8-wire Corrosive Resistant Universal Jack, White
Category 6, 8-Position, 8-Wire Modular Plug	Panduit	SP688-C	
48-Port Unloaded Patch Panel	Panduit	CPP48FMWBLY	48-port Flush Mount Patch Panel Supplied w/Rear Mounted Faceplates
Strain Relief Bar	Panduit	SRB19D7BL	Strain relief bar extends 7" off the rack; supports & provides proper bend radius protection
Faceplates, Frames & Surface Mount Boxes			
Mini-Com Furniture Faceplate, 4-Port, Black	Panduit	CFFP4BL	
Mini-Com Executive Faceplate Frame, Single Gang, International White	Panduit	CBEIWY	Single gang faceplate frame accepts two 1/2-size inserts or three 1/3-size inserts
Mini-Com Executive Faceplate Frame, Double Gang, International White	Panduit	CBEIW-2GY	Double gang faceplate frame accepts four 1/2-size inserts or six 1/3-size inserts
Mini-Com Executive Faceplate Insert, 2-Port, Sloped, International White	Panduit	CHSRE2IW-X	
Mini-Com 1/2-Size Blank Insert, International White	Panduit	CHB2IW-X	

Mini-Com 1-Port Blank Module, International White	Panduit	CMBIW-X	
Mini-Com, 1-port, Surface Mount Box Accepts 1 Mini-Com Module, Electric Ivory	Panduit	CBX1EI-AY	
Mini-Com, 2-port, Surface Mount Box Accepts 2 Mini-Com Module, Electric Ivory	Panduit	CBX2EI-AY	
Mini-Com, 4-port, Surface Mount Box Accepts 2 Mini-Com Module, Electric Ivory	Panduit	CBX4EI-AY	
Mini-Com 106 Frame, Accepts 4 Modules, Electric Ivory	Panduit	CF1064EIY	
Mini-Com Consolidation Point Box, 24 Port, Black	Panduit	CUFMB24BL	
Mini-Com Consolidation Point Box, 48 Port, Black	Panduit	CUFB48BL	
Telecommunication 5 Square Metal Outlet Box	Randl	T-55017	
Copper Backbone Category Cable			
Category 3, 25 Pair, Plenum, White	General Cable	2131505.99	Commscope or Essex Equivalent Accepted
Category 3, 25 Pair, Riser, Grey	General Cable	2133033.99	Commscope or Essex Equivalent Accepted
Category 3, 25 Pair, OSP, Black	General Cable	7525785.99	Commscope or Essex Equivalent Accepted
Copper Communication Termination Blocks			
50 Pair Punchdown Block	Power	R66M150X	
Stand Off Bracket for 50 Pair	Power	R891	
Fiber Optic Connectivity			

CCH Cassette Splicing, empty, for one CCH adapter panel	Corning	CCH-CS	
Rack Mount Fiber Housing, Accepts 4 CCH Connector Panels, 2U	Corning	CCH-02U	
Rack Mount Fiber Housing, Accepts 12 CCH Connector Panels, 4U	Corning	CCH-04U	
Fiber Connector Panel, Singlemode, OS2, LC, 12 Fiber	Corning	CCH-CP12-A9	
Fiber Connector Panel, Multimode, OM3/OM4, LC, 12 Fiber	Corning	CCH-CP12-E4	
Fiber Connector Panel Blank Insert for CCH Fiber Enclosure	Corning	CCH-BLNK	
Fan Out Kit, 12 Fiber	Corning	FAN-BT25-12	
Fiber Pigtail Splice Cassette, Multimode, OM3, LC, 12 Fiber, Shuttered	Corning	CCH-CS12-AD-P00TE	Shuttered Module
Fiber Pigtail Splice Cassette, Multimode, OM3, LC, 24 Fiber, Shuttered	Corning	CCH-CS24-AD-P00TE	Shuttered Module
Fiber Pigtail Splice Cassette, Singlemode, OS2, LC, 12 Fiber, Shuttered	Corning	CCH-CS12-AE-P00RE	Shuttered Module
Fiber Pigtail Splice Cassette, Singlemode, OS2, LC, 24 Fiber, Shuttered	Corning	CCH-CS24-AE-P00RE	Shuttered Module
Fiber Pigtail Splice Cassette, Singlemode, OS2, LC-APC, 12 Fiber, Shuttered	Corning	CCH-CS12-AF-P00RE	Shuttered Module
Fiber Pigtail Splice Cassette, Singlemode, OS2, LC-APC, 24 Fiber, Shuttered	Corning	CCH-CS24-AF-P00RE	Shuttered Module
Tight Buffered Fanout Cable, 12 Fiber Multimode + 12- Fiber Single Mode, Plenum	Corning	SX300/SMF28e	
Tight Buffered Fanout Cable, 12 Fiber Multimode + 12- Fiber Single Mode, Riser	Corning	SX300/SMF28e	
Fan-Out Kit, Indoor, 12 Fiber	Corning	FAN-BT25-12	
Outdoor Copper/Fiber Enclosures & Accessories			

Armadillo Re-Enterable Closures	Products	VARIOUS	Please Contact Miami IT For Approval
710 Series Splicing Components	3M	VARIOUS	Please Contact Miami IT For Approval
OSP Pull Rope	Grainger	3W517	
Cable Management			
1RU Horizontal D-ring Cable Manager	Panduit	CMPHHF1	
2RU Horizontal D-ring Cable Manager	Panduit	CMPHH2	
Double-Sided Vertical Cable Manager	CPI	11729-703	
Strain Relief Bar	Panduit	SRB19MDBL	Strain relief multi-depth bar extends 7" off the rack, supports; Ideal for 6A Cable Installs
Cable Management Bend Radius Clip	Panduit	CMSRC2	
Network Communication Racks & Cabinets			
2-Post Equipment Rack	Panduit	R2P	Standard 19" EIA Aluminum 45RU 2-Post Rack w/Hardware Kit
CUBE-iT Wall Mounted Floor Supported Cabinet	CPI	13493-772	72", 40U, Black w/Metal Door
Ladder Rack & Accessories			
Ladder Rack, 6 inches Wide, Black	CPI	10250-706	
Ladder Rack, 12 Inches Wide, Black	CPI	10250-712	
Ladder Rack, 18 Inches Wide, Black	CPI	10250-718	
3" Channel Mounting Plate, 6 Inch, Black	CPI	10595-706	
3" Channel Mounting Plate, 12 Inch, Black	CPI	10595-712	
3" Channel Mounting Plate, 18 Inch, Black	CPI	10595-718	

Wall Mounting Angle, 6 Inch, Black	CPI	11421-706	
Wall Mounting Angle, 12 Inch, Black	CPI	11421-712	
Wall Mounting Angle, 18 Inch, Black	CPI	11421-718	
Waterfall, 6 Inch, Black	CPI	12100-706	
Waterfall, 12 Inch, Black	CPI	12100-712	
Waterfall, 18 Inch, Black	CPI	12100-718	
Triangular Support Bracket, 6 inch, Black	CPI	11312-706	
Triangular Support Bracket, 12 inch, Black	CPI	11312-712	
Triangular Support Bracket, 18 inch, Black	CPI	11312-718	
Vertical Wall Bracket, Black	CPI	10608-701	
Cable Runway Foot Kit, Black	CPI	11309-701	
Butt Splice Kit, Black	CPI	11301-701	
Junction Splice Kit, Black	CPI	11302-701	
Corner Bracket 15 Inch, Black	CPI	11959-715	
Cable Runway Retaining Post	CPI	10596-706	
Cable Runway Pathway Divider	CPI	13392-712	
Protective End Cap	CPI	10642-001	Sold in pairs
Protective End Cap	CPI	10757-001	Sold in pairs
Vertical Backbone Cable Support	Erico Caddy	CAT600WM	
J-Hooks (Cable Pathways)			
2" J-Hook	Panduit	JP2W-L20	J-PRO Series
4" J-Hook	Panduit	JP4W-L20	J-Pro Series

J-Pro Cable Support Accessories	Panduit	VARIOUS	J-Pro Series
Grounding & Bonding			
1/4" X 4" X 24" Telecommunications Grounding Busbars for MCR	Panduit	GB4B1028TPI-1	
1/4" x 4" x 20" Grounding Busbar for TR	Panduit	GB4B0624TPI-1	
1/4" X 4" X 24" Telecommunications Grounding Busbars for MCR	Harger	GBI14424TMGBKT	Acceptable Substitute
1/4" x 4" x 20" Grounding Busbar for TR	Harger	GBI14420TMGBKT	Acceptable Substitute
Grounding Kit contains HTCT2-2-1 HTAP & CLRCVR2-1 Clear Cover	Panduit	HTWC2-2-1	#8-#14 AWG
Grounding Kit contains HTCT250-2-1 HTAP & CLRCVR3-1 Clear Cover	Panduit	HTWC250-2-1	Terminates 250 kmil-#2 AWG Run or flex 4/0 #2 AWG Run, #2-#6 AWG STR/SOL or flex #2-#14
Rack Mount Grounding busbar; 19"	Panduit	RGS134-1Y	Grounding strip, 78.65" L, .67" W, .05" (1.27mm) thickness
Grounding Busbar Kit	Panduit	RGRB19U	Grounding busbar, 19" (483mm) length, tin-plated, twenty holes arranged for flexibility in mounting
Grounding Bonding Jumper Kit	Panduit	RGCBNJ660P22	#6 AWG jumper, 60" length, 45° bent lug on grounding strip side
Equipment Bonding Jumper	Panduit	RGEJ624PFY	#6 AWG jumper; bent lug on grounding strip side to straight lug on equipment
ESD Port Kits	Panduit	RGESD2-1	Two-hole ESD Port Kit with 5/8 spacing is a telecommunications grounding accessory
ESD Wrist Straps	Panduit	ESD Wrist	Adjustable, fabric ESD wrist strap with 4mm snap is designed to ground a technician
Thread Forming Bonding Screw	Panduit	RGTBSG-C	Green thread-forming bonding screw, #12-24 x 1/2"
Thread Forming Bonding Screw	Panduit	RGTS	Thread-forming grounding screw, #12-24 x 1/2". Two-piece pack used with ACGK Armored Fiber Cable
Bonding Washer	Panduit	RGW-100-1Y	100 paint piercing bonding washers for 3/8" (M8) stud size

Armored Cable Grounding Kit	Panduit	ACG24K	#6 AWG (16mm) jumper for armored cable diameter (21.3mm), (609.6mm) length, factory terminated
Armored Cable Grounding Kit	Panduit	ACG24K-500	#6 AWG (16mm) jumper for armored cable diameter (21.3mm) to (26.2mm); 24 (609.6mm) length
Bonding Jumper Kit	Panduit	CGJ620UC	Front to back rail grounding jumper kit; two #6 AWG (16mm ²) jumpers
Code Conductor, Two-Hole, Long Barrel with Window Lug	Panduit	VARIOUS	Panduit LCC-W Series
Grounding Wire 6AWG, Green	Open	VARIOUS	
Communications Surface Raceway			
Surface Raceway With Adhesive, 3/4 Inch OD, 6 foot length, Electric Ivory	Panduit	LD3EI6-A	
Surface Raceway With Adhesive, 1 Inch OD, 6 foot length, Electric Ivory	Panduit	LD5EI6-A	
Surface Raceway With Adhesive, 1.5 Inch OD, 6 foot length, Electric Ivory	Panduit	LD10EI6-A	
Surface Raceway With Adhesive, 3/4 Inch OD, 8 foot length, Electric Ivory	Panduit	LD3EI8-A	
Surface Raceway With Adhesive, 1 Inch OD, 8 foot length, Electric Ivory	Panduit	LD5EI8-A	
Surface Raceway With Adhesive, 1.5 Inch OD, 8 foot length, Electric Ivory	Panduit	LD10EI8-A	
Surface Raceway With Adhesive, 3/4 Inch OD, 10 foot length, Electric Ivory	Panduit	LD3EI10-A	
Surface Raceway With Adhesive, 1 Inch OD, 10 foot length, Electric Ivory	Panduit	LD5EI10-A	
Surface Raceway With Adhesive, 1.5 Inch OD, 10 foot length, Electric Ivory	Panduit	LD10EI10-A	
LD3/5/10 Raceway Fittings	Panduit	VARIOUS	
TG-70 Raceway Base & Cover, 8 Foot, Electric Ivory	Panduit	TG70EI8	
TG-70 Raceway Base & Cover, 8 Foot, Electric Ivory	Panduit	TG70EI10	
TG-70 Raceway Fittings	Panduit	VARIOUS	
Angled Raceway Adpater For 5500 Wiremold Series	Wiremold	CM-ARA	

Coax Cable			
RG6 Plenum Quad Shield Coaxial Cable - White	CommScope	2227V	Use with Belden FSNS6PLQ-25 Connector
RG6 Riser Quad Shield Coaxial Cable - Black	CommScope	5740R	Use with Belden FSNS6PLQ-25 Connector
RG11 Riser Quad Shield Coaxial Cable - Black	CommScope	5940R	Use with Belden 716SNS1P11HQ-25 Connector
Coax Connectivity			
Mini-Com Snap-In F-Type Coupler, 75 OHM, Electric Ivory	Panduit	CMFSREIY	
RG6 Male Quad Shield F Connector Plenum, 75 Ohm (25 Pack)	Belden	FSNS6PLQ-25	PROSNS Snap-n-Seal (Use tool CPLCCT-SLMR)
RG11 Male Quad Shield F Connector, 75 Ohm (25 Pack)	Belden	716SNS1P11HQ-25	PROSNS Snap-n-Seal (Use tool CPLCCT-LS59/11)
Coax Compression Tools			
Universal Compression Tool for RG6 Quad Shield	Belden	CPLCCT-SLMR	PROSNS Snap-n-Seal
Universal Compression Tool for RG11 Quad Shield	Belden	CPLCCT-LS59/11	PROSNS Snap-n-Seal
Building Entrance Protection			
Protector Block, 25 Pair	TII Technologies	581P225GT	25-pair indoor building entrance terminal with 230V gas tube protector module, input 66/output 66
Fiber Optic Backbone Cabling			
Multimode, OM3, MIC, Indoor, Tight Buffered, Riser, 12 Fiber Cable	Corning	012T81-33180-24	
MIC® 250 2.0 Cable 12 F, 50 µm multimode (OM3)	Corning	012TD9-T1380-20	

Multimode, OM3, MIC, Indoor, Tight Buffered, Armored, Riser, 12 Fiber Cable	Corning	012T81-33180-A1	
MIC® 250 2.0 Interlocking Armored Cable 12 F, 50 µm multimode (OM3)	Corning	012TD9-T1380-A3	
Singlemode, OS2, Altos, Outdoor, Loose Tube, Armored, 12 Fiber Fiber Cable	Corning	012EUC-T4100D20	
Singlemode, OS2, MIC, Indoor, Tight Buffered, Riser, 12 Fiber Cable	Corning	012E81-33131-24	
MIC® 250 2.0 Cable 12 F, Single-mode (OS2)	Corning	012ED9-T1301-20	
Singlemode, OS2, MIC, Indoor, Tight Buffered, Armored, Riser, 12 Fiber Cable	Corning	012E81-33131-A1	
MIC® 250 2.0 Interlocking Armored Cable 12 F, Single-mode Ultra-Fiber (OS2)	Corning	012ZD9-T1301-A3	
FREEDM® Loose Tube Gel-Free Armored Cable, Riser, 48 F, Single-mode (OS2)	Corning	048EUF-T4101DA1	
FREEDM® Loose Tube Gel-Free Armored Cable, Riser, 72 F, Single-mode (OS2)	Corning	072EUF-T4101DA1	
FREEDM® Loose Tube Gel-Free Armored Cable, Riser, 144 F, Single-mode (OS2)	Corning	144EUF-T4101DA1	
Singlemode, OS2, Altos, Outdoor, Loose Tube, Armored, 48 Fiber Cable	Corning	048EUC-T4100D20	
Singlemode, OS2, Altos, Outdoor, Loose Tube, Armored, 72 Fiber Cable	Corning	072EUC-T4100D20	
Singlemode, OS2, Altos, Outdoor, Loose Tube, Armored, 144 Fiber Cable	Corning	144EUC-T4100D20	
Emergency Phones			
Recessed mounting sleeve for flush mounting VOIP-500	Talk-A-Phone	MS-600	Hall Entry & Hallway's
Stainless Steel Surface Mount Box Accessory	Talk-A-Phone	ETP-SM-1	Hall Entry & Hallway's
Identification			
1/4" Black-on-White Label Tape for Patch Panel	Brother	TZE211	P-Touch Labeler
3/8" Black-on-White Label Tape for Faceplates	Brother	TZE221	P-Touch Labeler

Firestopping			Please Contact Miami IT For Approval
Existing Conduit Sleeves to be upgraded with EZ Path Retrofit Device	STI	EZ Path	
All Sleeves and penetrations must be STI EZ Path or submitted equivalent	STI	EZ Path	
Miscellaneous			
4 Inch Insulated Bushing	Arlington	EMT400	

APPENDIX C

Contractor Business Partners	City	State	Key Contact	Email
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
Kastle Technologies	Monrie	OH	Lyman Smith	lsmith@kastle-tech.com
Apachi Networks	Cincinnati (Tri-County)	OH	Tim Anderson – President	tanderson@apachi-networks.com
RCS Robinson	Oxford	OH	Tim Robinson – Owner	rctim@fuse.net

END OF SECTION

SECTION 28 13 00 - ACCESS CONTROL

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 is a performance specification for the building security system for this project. The contractor shall provide all design, components, conductors, conduit, equipment, installation, etc. for a complete working turn-key installation, and shall include all costs in the bid. Installation shall meet Miami University Standards.

1.3 COORDINATION

- A. All work, rough-in, exact location of equipment, devices, alarms, etc. shall be coordinated with Miami University.

1.4 SYSTEM DESCRIPTION

- A. Building systems shall include an Ethernet ready embedded CBORD control panel, card readers, electric door strikes, door contacts, request for exit switches, emergency exit devices, door management alarms, power supplies and necessary cabling. The CBORD control panels(s) shall communicate on the Campus network.

1.5 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 01 Specification Sections.
- B. Product data for system components, including "Nationally Recognized Testing Laboratory" (NRTL) listing data and list of materials, dimensioned plans, sections, and elevations showing minimum clearances, mounting arrangements, and installed features and devices.
- C. Wiring diagrams for system, including all devices, components, and auxiliary equipment. System diagram is unique to the Project system; a manufacturer's generic system diagram is not acceptable. Diagrams differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
- D. System operation description, including method of operation and supervision of each component and each type of circuit, and sequence of operations for all manually and automatically initiated system inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are not acceptable.

- E. Operation and maintenance data shall be submitted to the owner for inclusion in "Operating and Maintenance Manual" specified in Division 01. Include data for each type product, including all features and operating sequences, both automatic and manual. Include user's software data and recommendations for spare parts to be stocked at the site. Provide names, addresses, and telephone numbers of service organizations that stock repair parts for the system.

1.6 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Firms experienced in manufacturing equipment of the types and capacities indicated that have a record of successful in-service performance. The prime system manufacturer and manufacturers of major system components are required to qualify separately.
 - 1. **Service Center:** Prime system manufacturer maintains a service center capable of providing training, parts, and emergency maintenance and repairs for the overall system at the Project site with 8 hours maximum response time.
- B. **Installer Qualifications:** Experience with systems of the type and scope indicated and authorized as a service representative of the prime system manufacturer.
- C. **Commissioning Agent Certifications.** Submit proof of CBORD certification.
- D. Comply with NFPA 70, "National Electrical Code."
- E. **Listing and Labeling:** Provide system and components that are listed and labeled for their indicated use and location on the Project.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. **Listing and Labeling Agency Qualifications:** A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- F. **Single-Source Responsibility:** Obtain system components from a single source (the prime system manufacturer) that assumes responsibility for system components and for their compatibility.
- G. **ADA Compliance:** Installation shall be in compliance with ADA Guidelines.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Suppliers and Installers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. The CBORD Group.
- B. Door locksets must be purchased directly from CBORD.
- C. Not all equipment is indicated on the drawings or specifications. All quantities of equipment and material shall be verified and provided under this contract.

2.2 ELECTRICAL POWER

- A. Normal System Power Supply: 120 V 60 Hz. System components shall be supplied with power through the system control panel or auxiliary power supplies supplied by installer.
- B. Power Source Transfer: When normal power is interrupted, system is automatically switched to backup supply without degradation of critical system function or loss of signals or status data.
 - 1. Backup Source: A dedicated power supply system rated to sustain full system load for 4 or 6 hours.
 - 2. Annunciation: Switching of the system or any system component to backup power is indicated on the system control panel as a change in system condition.

2.3 NETWORKED ACCESS CONTROLLER

- A. Multi-door access control panel with interface capacity up to 32 doors, CBORD V1000 EVO. Install in a lockable steel enclosure.

2.4 LAUNDRY CONTROLLER

- A. Card based account access and machine activation for laundry equipment. CBORD LR 3000.

2.5 VENDING READER

- A. Card based account access and merchandise payment transaction. CBORD Value Plus vending reader.

2.6 SINGLE DOOR CONNECTOR

- A. Interfaces with reader inputs and outputs, door position contact, strike or lock relay, and request to exit. CBORD D50.

2.7 PANEL INTERFACE MODULE

- A. Interface module for up to 16 wireless access devices. CBORD PIM400-485.

2.8 POWER SUPPLY

- A. System Control Panel Power Supplies: Altronix Maximal 75FE power supply system with the following features.
 - 1. 24VDC and 12VDC outputs.
 - 2. Power distribution module with 16 fused outputs, Altronix PD16W.
 - 3. Lockable steel enclosure. Controller Power Supply should be an Altronix Maximal 77 with one 12ah Battery.
 - 4. Arrange panel so normal operation, testing and maintenance are performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, provide matching enclosures. Accommodate all components to allow ample gutter space for interconnection of panels as well as field wiring.
- B. High in-rush power supply, Von Duprin PS914 with the following features.
 - 1. 24VDC and 12VDC outputs.

2. Two relay option board, Von Duprin 900-2RS.
3. Four relay option board, Von Duprin 900-4RL.
4. Fire alarm input board, Von Duprin 900-FA.

2.9 CARD READERS

- A. Multi-technology reader, single gang, Schlage MT-15.
- B. Multi-technology reader, mullion mount, Schlage MT-11.

2.10 DOOR POSITION SWITCH

- A. Door contact for door status reporting. GE 1076 series.

2.11 DOOR MANAGEMENT ALARM

- A. Electro-mechanical horn in zinc die-cast housing. Federal Signal Model 350.

2.12 EGRESS COMPONENTS

- A. Emergency Exit Push Button: Where identified, an exit button shall be installed allowing for passive REX. Device should be similar to Essex PEBSS1-US emergency exit button single gang with 30-second timer.

2.13 ENCLOSURES

- A. Lockable steel enclosure. CBORD Squadron 8-board enclosures, with 4 board mounting panels and mounting kit.

2.14 WIRE AND CABLE

- A. General: Stranded copper. Provide and size conductors as recommended by system manufacturer.
- B. Cable for Low-Voltage Control and Signal Circuits: Unshielded, twisted-pair cable, except where manufacturer recommends shielded cable.
- C. Cable for Communications- Category 6A, twisted pair, 4 pair 24 gauge.

2.15 RACEWAY

- A. All wiring to system components shall be in approved conduit or raceway.

2.16 MISCELLANEOUS HARDWARE

- A. General: Provide supports, mounting brackets, and installation hardware for components. Metal hardware is of corrosion-resistant material.
- B. Fire System Connection- Provide isolation relay for connection to Fire Alarm system. This relay must isolate the FACP from the Door Lock Power Supply; and must not require the Fire Alarm relay to switch more than 100mA. The contractor must coordinate connection to fire

alarm system with a local Siemens representative; include this coordination as a part of your bid package.

PART 3 - EXECUTION

3.1 GENERAL

- A. General: Install system according to NFPA 70, applicable codes, and manufacturer's printed instructions. It is the responsibility of the contractor to obtain all necessary permits required by local authority in order to perform this installation.
- B. Wiring within Enclosures: Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars and distribution spools.
- C. Wiring Method- Install wiring concealed in walls and above ceilings. Install wiring in raceways only in unfinished spaces and where subject to physical damage (such as mechanical rooms). Conceal raceways except in unfinished indoor spaces.
- D. Number of Conductors: As recommended by system manufacturer for functions indicated.
- E. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in terminal cabinets and equipment enclosures.
- F. Tighten connections to comply with tightening torques specified in UL Standard 486A.
- G. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams.

3.2 INSTALLATION

- A. Wiring
 1. All cable runs are home runs. No splicing of cables.
 2. All PIM and door cables need to have a 6 foot service loop in the communication room
 3. All PIM location cables need to have 20 foot service loop.
 4. Provide a 2 inch chase nipple for cable access in the top left hand corner and the top right hand corner of the Squadron 8 board enclosure for the V1000's
 5. Provide four 2 inch chase nipples for cable access in the Squadron 8 board enclosures for mounting D50's. Two in the top left corner and two in the top right corner.
 6. Use only the red/black pair plus shield for the communication cable between the V1000's and the D50's. The unused green/white pair is to be cut off.
 7. All shielded cable terminations are to be dressed out with heat shrink tubing.
 8. On cables with black and white wires, the black wire shall be positive and the white wire shall be negative.
 9. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams.
 10. PIM cables shall have heat shrink tubing applied to communication portion of cable from breakout point to termination point at V1000 and in PIM enclosure.
 11. Unused wires on card reader cables are to be folded back under the heat shrink.

12. All connections will be to screw terminals or by wire nuts.
13. NO scotch locks, dolphins, or crimp style terminals are to be used.

B. Hardware

1. When using 2 Maximal 75 power supplies enclosures configure one enclosure for 12 volt DC and one enclosure for 24 volt DC.
2. Mount up to 8 V1000's in each squadron 8 board enclosure.
3. Mount up to 16 D50's in each squadron 8 board enclosure.
4. Provide a dedicated 12 volt DC power circuit for each two V1000's.
5. Provide a dedicated 12 volt DC power circuit for every 4 D50's.
6. Provide a dedicated 12 volt DC power circuit for each PIM.
7. Provide a dedicated 24 volt DC power circuit for each D50. This is for the horn and the electric strike if installed.
8. Provide a separate high inrush current power supply for locks that require them. Mount the power supply in the communication room with the rest of the headend equipment.

3.3 ELECTRICAL DOOR HARDWARE

- A. Provide card access system connection to door lock that will release upon activation of card reader and by activation of door release device located on the interior side of the door.
- B. Electrical locks should be fail secure electric strikes.

3.4 DOOR POSITION SWITCH

- A. Provide door position switch at each exterior door and each door with a card reader to indicate the position of the door (open or closed). If the door remains in the open position beyond a predetermined time (time to be established by owner), the door management alarm will sound a local audible alarm, and report door position status to the campus security system. Mount door position switch flush in jamb of door. Coordinate mounting with architectural drawings and details.

3.5 DOOR MANAGEMENT ALARM

- A. A door management alarm shall be installed at each exterior door allowing for local door alarm reporting.
- B. Door Management Alarms shall be wired to an auxiliary output.

3.6 POWER SUPPLY

- A. Provide adequate circuit capacity for at least a 25 percent increase in load. All power supplies that provide power to door locks shall have 4 hour battery backup so that doors remain in operation for a minimum of 4 hours in the event of a power failure.

3.7 GROUNDING

- A. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.

3.8 FIELD QUALITY CONTROL

- A. Commissioning: Provide system start-up and commissioning according to CBORD certification specifications, to include, but not limited to:
 - 1. Development of data base.
 - 2. Device programming
 - 3. Inspection of lock sets.
 - 4. Firmware upgrades.
 - 5. Hardware link to PIMS.
- B. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and system pretesting, testing, adjustment, and programming.
- C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- D. Pretesting: Align and adjust the system and perform pretesting of all components, wiring, and functions to verify conformance with specified requirements. Correct deficiencies by replacing malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.
- E. Testing: Provide at least 10 days' notice of acceptance test performance schedule.
- F. Operational Tests: Perform operational system tests to verify conformance with specifications. Test all modes of system operation and intrusion detection. Methodically test for false alarms in each zone of space intrusion detection devices by simulating activities outside indicated detection patterns.
- G. Retesting: Correct deficiencies and retest until the total system meets the requirements of the Specifications and complies with applicable standards.
- H. Prepare test and inspection reports.
- I. As-Built Drawings: At completion of project a complete drawing package will be submitted to the Card Access office showing locations of all installed hardware components, devices along with communication circuits and power circuit's locations and information.

3.9 WARRANTY

- A. The contractor shall guarantee, in writing, the entire installed security system, including but not limited to all furnished equipment, cabling, connectors, workmanship, and all materials used in the installation, for a minimum of one (1) year. During this period, the Contractor shall provide free of charge, all materials, labor, and equipment necessary to correct all defects due to faulty materials or workmanship.

END OF SECTION

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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. Each building shall be equipped an independent fire alarm system as described in these specifications and Keltron fire alarm monitoring 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 Surge Protection Device (SPD) for all 120 VAC power circuits at each fire alarm equipment connected to 120 VAC power, and SPD 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. Voice messaging to include broadcasting of the campus wide emergency annunciation system.
- 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 or smoke 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 Siemens, XLSV 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. Multi-criteria Fire Detector: Photoelectric smoke detector and thermistor.
 1. Smoke Detector Sensitivity: Between 2.5 and 3.5 percent per foot smoke obscuration when tested according to UL 268.
 2. Smoke Sensor: An infrared detector light source with matching silicon cell receiver.

3. The detector shall analyze the smoke and thermal characteristics to determine a true fire condition.
4. The detector shall be a Siemens Model FDOOT441, no substitutions.

- 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 gridded 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. Emergency Voice Messaging: The University's emergency broadcast system is to interface with the fire alarm system to allow the campus wide emergency broadcast system to broadcast announcements over the fire alarm systems speakers. Provide the FACP with an audio input card (Siemens part number XLSV 6323) and all necessary programming to accomplish the interface (the University will provide the gateway and campus wide broadcast system programming). Audio card features to include:
 - 1. Two (2) independent analog audio inputs.
 - 2. Two (2) external switch inputs to activate the two (2) analog audio inputs.
 - 3. Inputs separately transformer isolated.
 - 4. Inputs separately supervised for loss of signal.
 - 5. Inputs that contain separate analog/digital conversion.
 - 6. Separate level indicator for each input.
 - 7. Controller Area Network (CAN) network module.
 - 8. UL 864 Listed, FM approved.

- K. 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 announcements.

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. Multi-criteria Fire Detector: Install in kitchen and kitchenette areas. Do not locate detector directly over cooking appliances. Where possible and allowable by Code, locate a minimum of 10' away from appliances.
- H. All detectors are to be accessible. Particular attention is to be paid to locating duct mounted smoke detectors.
- 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

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