

October 13, 2023

ADDENDUM NUMBER ONE (1)

**Project:** SCSD Raleigh Football Renovation – 2023 Rebid  
Smith County School District  
Raleigh, MS  
PN: 22050

**FROM:** Dean Architecture  
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Ridgeland, MS 39157  
(601) 939-7717

The following additions, changes, clarifications and/or substitutions to the Project Drawings as indicated, are hereby made a part of the Contract Documents. Acknowledge receipt of this Addendum by inserting its number and date in the Proposal Form where indicated.

General

- Item #1:** The bid date has been moved to Thursday, October 26, 2023 at 2:00 p.m. and bids will be opened at 3:00 p.m. in the Smith County School District Office located at 212 Sylvarena Avenue, Raleigh, Mississippi, 39153.
- Item #2:** Attached is a list of attendees for the Pre-Bid Conference held on Thursday, October 5, 2023. This is provided for informational purposes only.
- Item #3:** It is absolutely recommended that all General Contractors or Subcontractors who are considering submitting proposals, take the time to visit the Football Stadium, the High School Building and High School Baseball Field to become familiar with the actual conditions at all portions of the areas that are identified to have renovation work done. Due to the wide array of issues that are being addressed under this project, the extent of the scope of the work requires thorough assessment of all existing conditions.

Specifications

- Item #1:** The Table Of Contents has been updated to include Mechanical and Electrical.

Drawings

- Item #1:** Sheet A100, clarify the following:
- At the southwest corner of the home bleachers, change reference to the required gate to read as follows:
- 3'-6" x 3'-6" gate that matches a design and construction to the picket fencing type #2 that is used in the new bleacher walkway detail 1/A100.1 with hasp and keeper.
- Item #2:** Sheet A100.1, clarify the following:
- At the work referenced at the Athletic Field House Building, the general contractor shall survey the existing structure to determine the amount of siding and trim that will be painted under the base bid or replaced under Alternate #2.
- The existing field house as indicated on drawings is approximately 70 feet x 42 feet in size.

**Item #3:** Sheet A100.1, C100 and C200, clarify the following:

At the area to the northwest of the football field adjoining the existing gymnasium building which is the "Visitor's Entrance" to the stadium, under the base bid, the contractor shall clean up and remove all debris such as broken up asphalt, miscellaneous concrete or any other inorganic material and dispose from this area. After all debris is removed, recompact and regrade this area smooth and ready for foot traffic. The existing sidewalks shall remain in place. See sheet C200 and A100.1 for clear delineation of the area to which this directive pertains.

**Item #4:** Sheet A101: Home Concessions Renovation Floor Plan, change the following:

At the group of renovations indicators under the "Home Concessions #101" room indicator, omit the reference to the renovation note #23. This not does not apply to this plan.

**Item #5:** Sheet A101.1: Clarify the following:

The fencing subcontractor shall survey the existing on-site conditions and furnish fencing as called for here and described on Sheet A100.1.

1. All new fencing, no matter the type, shall match in height to the existing fencing that is demolished and removed. Verify at site.
2. All totally new fencing, no matter the type, shall match in height to existing fence that the new will adjoin to. Verify at site.
3. All replacement fencing gates, no matter the type, shall match in dimension to the gates that are demolished and removed. Verify at site.
4. Around the west and south side of the stadium, the fencing subcontractor shall determine the exact length of fencing that will be required to replace that is removed. See demolition note #3 and renovation note #8 on sheet A100.1.
5. All totally new gates shall match in height to the new fencing, no matter the type, that is installed where the existing fencing is demolished or totally new fencing is installed.

**Item #6:** Sheet A201: Elevation 4/A201, change the following:

Change the designation of "South Elevation" to read "North Elevation".

Mechanical

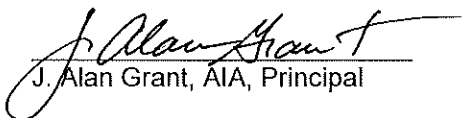
SEE ATTACHED MECHANICAL ITEMS PROVIDED BY HESM&A

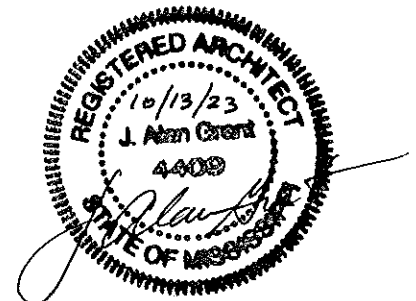
Electrical

SEE ATTACHED ELECTRICAL ITEMS PROVIDED BY THE POWER SOURCE

END OF ADDENDUM NUMBER ONE (1)

Dean Architecture, P.A.

  
J. Alan Grant, AIA, Principal



PLEASE ATTACH THIS ADDENDUM TO THE INSIDE FRONT COVER OF EACH SET OF SPECIFICATIONS.

## PRE-BID CONFERENCE

[illegible]

**DEAN**  
**ARCHITECTURE**  
GEDDIE | GRANT | OUBRE

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## **SECTION 220500**

### **PLUMBING GENERAL**

#### **PART 1 GENERAL**

##### **1.01 DESCRIPTION**

- A. This division and the accompanying drawings cover furnishing of all labor, equipment, appliances, and materials and performing all operations in connection with the installation of complete plumbing systems as specified herein and as shown on the drawings.
- B. The general provisions of the contract including the Conditions of the Contract (General, Supplementary, and other conditions) and other divisions as appropriately apply to work specified in this division.

##### **1.02 CODES, ORDINANCES, AND PERMITS**

- A. All plumbing materials and workmanship shall comply with the following codes and standards as applicable:
  - 1. The National Electric Code (2017 Edition)
  - 2. The International Building Code (2018 Edition)
  - 3. The International Plumbing Code (2018 Edition)
  - 4. City of Raleigh, MS Plumbing Code
- B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.
  - 1. Air Conditioning and Refrigeration Institute Standards (ARI)
  - 2. American National Standards Institute, Inc. Standards (ANSI)
  - 3. American Society for Testing and Materials Publications (ASTM)
  - 4. American Society of Mechanical Engineers Code (ASME)
  - 5. Factory Mutual Underwriters (FM)
  - 6. National Fire Protection Association Standard (NFPA) – Latest Adopted Edition
  - 7. Underwriters Laboratories Inc. (UL)
- C. All work done under this Contract shall comply with all state and local code authorities having jurisdiction and with the requirements of the Utility Companies whose services may be used. All modifications required by these codes and entities shall be used made by the Contractor without additional charges. Any conflict between these documents and the governing codes shall be immediately brought to the attention of the Engineer of Record. Where code requirements are less than those shown on the Drawings or in the Specifications, the Drawings and Specifications shall be followed. Where applicable, N.F.P.A. requirements shall be met.



- D. The Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction, and deliver certificates of approval to the Architect. All fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor.
- E. The Contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

### **1.03 APPLICABILITY**

- A. The work specified herein shall include all labor, materials, equipment, tools, supplies and supervision required to install and place in operation the plumbing systems and appurtenances specified herein and/or indicated on the drawings or reasonably implied as necessary for completion of the various systems.

### **1.04 COORDINATION OF MECHANICAL DOCUMENTS**

- A. The plumbing work listed in these documents shall be coordinated with the work indicated on all other mechanical drawings, schedules, schematics, and specifications. Should a conflict occur, the contractor shall submit a request for clarification to the engineer prior to bid opening. NO ALLOWANCES shall be made for any assumptions made by the contractor or any sub-contractors that are in direct conflict with the intent of the construction documents; in the event a conflict is discovered after construction has commenced, the resolution of the conflict shall be decided by the Engineer of Record, whose interpretation of the documents shall be final.

### **1.05 WELDERS QUALITY ASSURANCE**

- A. All welders shall be certified by ANSI B31.1.0-1967 "Standard Qualification Welding Procedures, Welders and Welding Operators" or "Qualification Tests" in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests shall be made in strict accordance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder's qualification tests shall be assumed by the Contractor. Two copies of the qualification test report and certification with the welder's identification number, recommendation letter, etc. shall be delivered to the Architect before any welding commences.

## **PART 2 PRODUCTS**

### **2.01 COORDINATION OF PRODUCTS**

- A. The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the plumbing systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that result from the use of any other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before shop drawing submittals and shall be clearly indicated on the shop drawings. Any related modifications shall be the responsibility of the contractor and shall be performed without any additional cost to the Contract.

### **2.02 DESCRIPTION**

- A. All components of the mechanical systems shall be new. All equipment and products for which independent laboratory testing and labeling is applicable and/or required shall bear the Underwriter's Laboratories, Inc. (UL) label.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. The Contractor shall provide and prepare all openings for plumbing work as required in walls, roof, ceilings, etc.; he shall also do all painting as may be required. He shall coordinate the installation of all plumbing equipment in the exterior wall and roof.
- B. The Plumbing Drawings do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and to thereby provide an integrated, coordinated and satisfactorily operating installation.
- C. If the Contractor proposes to install equipment, including piping, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accomplished by Shop Drawings of the space in question, including plans, sections, elevations, etc., sufficient to indicate that the revised layout will fit and allow for required access to clearance.
- D. The Contractor is responsible for the proper location and size of all slots, holes, or openings, in the building structure pertaining to his work, and for the correct location of sleeves, inserts, cores, etc.
- E. The Contractor shall so coordinate the work of the several various trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interference shall be handled by giving precedence to pipelines which require a stated grade for proper operation. For example, sewer lines and condensate piping shall take precedence over water lines in determination of elevations. Where there is interference between sewer lines and condensate lines, the sewer lines shall have precedence and provisions shall be made in the condensate lines for looping them around the sewer lines. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.
- F. Except where otherwise noted, all piping in finished areas shall be installed in chases, furred spaces, above ceilings, etc. In all cases, pipes shall be installed as high as possible. Runs of piping shall be grouped whenever it is feasible to do so.
- G. The Electrical Contractor shall bring adequate power to and make final connections to all equipment furnished under this contract. All control wiring shall be by the Controls Contractor.
- H. Piping or equipment shall not be installed in electrical equipment rooms or elevator machine rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or locate equipment, with respect to switchboards, panelboards, power panels, motor control centers, or dry type transformers:
  - 1. Within 42" in front (and rear if free standing) of equipment; or
  - 2. Within 36" of sides of equipment,
  - 3. Clearances apply vertically from floor to structure.

4. Provide access to equipment and apparatus requiring operation, service, or maintenance within the life of the system. Including, but not limited to, motors, valves, shock absorbers, etc. Equipment located above lay-in type ceilings is considered accessible.

### **3.02 ELECTRICAL WORK**

- A. All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

### **3.03 PROTECTION OF EQUIPMENT**

- A. Store equipment, including pipe and valves, off the ground and under cover. For storage outdoors, minimum 4-mil thick plastic shall be fitted to withstand splattering, ground water, precipitation, and wind.
- B. Plug ends of pipe when work is stopped with plastic taped in place until work resumes.
- D. Damaged equipment shall be repaired or replaced at the option of the Engineer of Record.

### **3.04 PAINTING**

- A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.
- B. All un-insulated black ferrous metal items exposed to sight inside the building, such as equipment hangers and supports not provided with factory prime coat, shall be cleaned, and painted with one coat of rust inhibitor primer. In addition, such items in finished spaces shall also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.
- C. Black ferrous metal items exposed outside the building, such as un-insulated pipe and pipe supports not provided with factory prime coat, shall be cleaned, and painted with one coat of rust inhibiting primer and two coats of an asphalt base aluminum paint. Insulated pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.
- D. In lieu of painting hanger rods, cadmium plated, or galvanized rods may be furnished.
- E. No nameplates or equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation. Labels shall also be protected from becoming illegible due to weathering.
- F. Galvanizing broken during construction shall be re-coated with cold galvanizing compound.
- G. All piping, insulation, conduit, or other appurtenances visible from finished spaces through grilles, diffusers or other such required openings shall be painted flat black.

### **3.05 PROTECTION OF EXISTING UTILITIES**

- A. The Contractor shall use extreme caution during excavation operations not to damage or otherwise interrupt the operations of existing utilities. The Contractor shall be responsible for the continuous operation of these lines and shall provide bypasses or install such shoring, bracing, or underpinning as may be required for proper protection.

- B. Schedule work so existing systems will not be interrupted when they are required for normal usage of the existing building. Obtain approval from the Architect at least 7 days prior to any interruption to service of utilities.

### **3.06 CUTTING AND PATCHING**

- A. The Contractor shall assume all cost of, and be responsible for, arranging for all cutting and patching required to complete the installation of his portion of the Work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure.
- B. All surfaces shall be patched to the condition of the adjacent surfaces.
- C. The Contractor shall make suitable provisions for adequately waterproofing at his floor penetrations of waterproof membrane floors. This shall include but not be limited to floor drains, open sight drains, hub drains, clean-outs, and sleeves for the various piping. This also applies to membrane roofing systems.

### **3.07 SLEEVES, FLOOR AND CEILING PLATES**

- A. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all piping, equipment and devices furnished under each section of the Specification.
- B. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.
- C. Where pipes pass through floor slabs, sleeves shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.
- D. Each pipe passing through walls, floors, ceilings, or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes or ducts.
- E. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.
- F. All penetrations through rated walls and floors shall be packed, sealed, and encapsulated per the applicable U.L. details(s).
- G. Sleeves through exterior wall shall be steel or cast-iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.
- H. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to 3/4" diameter and permitting lateral adjustment.

### **3.08 ESCUTCHEONS**

- A. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.
- B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.
- C. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

### **3.09 CLEANING**

- A. Flush new water piping systems until water runs clean. Mild chemical cleaning may be required. If so, flush all cleaning chemicals out of the piping system before recharging with water.
- B. Remove all stickers, rust, stains, labels, and temporary covers before final acceptance.
- C. The exterior surfaces of all plumbing equipment, piping, etc., shall be cleaned of all grease, oil, paint, dust, and other construction debris.
- D. Clean and polish identification plates.

### **3.10 EQUIPMENT, MATERIALS AND BID BASIS**

- A. It is the intention of these Specifications to indicate a standard of quality for all material incorporated in this work. Manufacturer's names are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only these manufacturers' products shall be considered, and the Contractor's bid shall be based on their products. Other named manufacturers, although acceptable as manufacturers, must prove their product will perform satisfactorily and will meet space requirements, etc., and shall obtain pre-approval of their equipment, before submitting shop drawings, when their equipment achieves the required results in a manner different than that of the first named manufacturer. Where only one manufacturer is named, unless the Specifications state otherwise, manufacturers of similar quality products will be considered. Such unnamed manufacturer's products will, however, be considered as substitutions and shall not be used as a basis for bidding. In the event the Contractor wishes to submit substitutions to the Architect for review prior to bid, he shall furnish descriptive catalog material, text data, samples, etc., as well as any other pertinent data necessary to demonstrate that the proposed substitutions are acceptable equals to the specified product. No substitutions shall be made without the written consent of the Architect.
- B. The use of one named manufacturer named in the schedules and on the drawings is for guide purposes. The provisions of the above paragraph will govern in the selection of products to be used.

### **3.11 GUARANTEE**

- A. All systems and components shall be provided with a one-year guarantee from the time of final acceptance or beneficial occupancy (Coordinate with the Architect). The guarantee shall cover all materials and workmanship. During this guarantee period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring additions to the Contract.

### **3.12 FOUNDATIONS**

- A. All concrete foundations required by equipment furnished under the Plumbing Division shall be constructed in conformance with the recommendations of the manufacturer of the respective equipment actually applied, and with the approval of the Architect. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up tight and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundation shall be rubbed. Unless otherwise noted, foundations shall be six inches (6") high. All concrete work performed shall conform entirely to the requirements of the General Specifications that describe this class of work.

### **3.13 RECORDS AND INSTRUCTIONS FOR OWNER**

- A. The Contractor shall accumulate during the job's progress the following data in triplicate form, prepared in neat brochures and/or packet folders and turned over to the Architect/Engineer for checking and subsequent delivery to the Owner. This data shall include the following:
  - 1. Provide all warranties and guarantees, manufacturer's directions and material covered by the Contractor.
  - 2. Provide approved fixture brochures, wiring diagrams, and control diagrams.
  - 3. Provide copies of all approved shop drawings.
  - 4. Three sets of operating instructions for plumbing systems shall be provided. Operating instructions shall also include recommended periodic maintenance and seasonal changeover procedures, and suggested procedures in operation of all systems in this particular building to promote energy conservation. These instructions must be written expressly for this project and shall refer to equipment, valves, etc., by mark number from project schedules. Operating instructions and procedures shall be submitted in draft form, for approval prior to final issue of complete brochures. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
  - 5. All other data and/or drawings required during construction.
  - 6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
- B. All the above data shall be submitted to the Architect/ Engineer for approval at such time as the Contractor submits his last pay request, but in no case, less than two weeks before the final inspection.
- C. The Contractor shall also give operating instructions, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The written operating instructions referred to in the paragraph above shall be used as a basis for this on-the-job training.

### **3.14 RECORD DRAWINGS**

- A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings" reflecting an accurate dimensional record of all buried or concealed work. In addition, the "Record Drawings" shall be marked to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect. The "Record Drawings" shall consist of a set of Mylar sepia prints of the Contract Drawings for this Division with the Engineer's seal and Engineer's firm name removed or blacked out. Prior to commencing work, the Contractor shall purchase from the Architect a set of Mylar sepia prints to be used for the "Record Drawings".
- B. Record dimensions shall clearly and accurately delineate the work as installed; locations shall be suitably identified by at least two (2) dimensions to permanent structures.
- C. The Contractor shall mark all "Record Drawings" on the front lower right-hand corner with a rubber stamp impression that states the following:

"RECORD DRAWINGS – "3/8" high letters to be used for recording field deviations, and "5/16" high letters to be used for dimensional data only.

### **3.15 INSTALLATION**

- A. All equipment shall be installed in strict conformance with manufacturer's recommendations, as specified herein. If any conflict arises between these instructions, notify the Engineer immediately for clarification.

### **3.16 ACCESS DOORS**

- A. Furnish and install access doors at each point required to provide access to concealed valves, cleanouts, water hammer arrestors, and other devices requiring operation, adjustment, or maintenance. Access doors shall be 16 gauge steel, prime coat finish, with mounting straps, concealed hinge and screwdriver locks, designed for the doors to open 180 degrees.
- B. Access doors installed in firewalls or partitions shall be UL Labeled to maintain the fire rating of the wall or partition.
- C. Access doors shall be provided under this section of the specifications and furnished to the General Contractor for installation.
- D. Access doors shall be MILCOR or approved equal in accordance with the following:

Style AT Door for Acoustical Tile Ceilings  
Style AP Door for Acoustical Plaster Ceilings  
Style K Door for Plastered Wall and Ceiling Surfaces  
Style DW Door for Drywall  
Style ATR for Suspended Drywall Ceilings  
Style M Door for Masonry, Ceramic Tile, Etc.  
Fire-Rated 1-1/2 hr. (B-label) Door where required.
- E. Size and type shall be as required for proper service and/or as may be directed by the Architect.

- F. Access door finish shall be chemically bonded to steel with a prime coat of baked on electrostatic powder. Color shall be as selected by Architect.

### **3.18 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS**

- A. All materials and adhesives used throughout the project for the installation of plumbing systems including the jackets or coverings of any kind, or for piping or system components, shall have a flame-spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame-spread rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard.)
- B. "Flame-Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials," NFPA No. 255, ASTM E84, Underwriter's Laboratories, Inc., Standard". Such materials are listed in the Underwriters' Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)".

### **3.19 EQUIPMENT FURNISHED BY OWNER**

- A. The contractor shall unload, uncrate, assemble, and connect any and all equipment shown on the drawings or called out in the specifications to be furnished by the Owner for installation by the Contractor.
- B. The Contractor shall take full charge of such equipment from the time the items are delivered to the job, set in place, connected, tested, adjusted, and placed into operation.

### **3.20 HAZARDOUS MATERIALS**

- A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.
- B. Handling of any hazardous material is not covered in specification Division 22. Any requirements for such are beyond the scope of this contract and shall be done only by those persons contracted to do so.

**END OF SECTION**



## **SECTION 220503**

### **PLUMBING DEMOLITION**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY OF WORK SECTION INCLUDES**

- A. General Scope of Work
- B. Sub-Contractor Use of Site and Premises
- C. Work Sequence
- D. Scheduling of Work
- E. Damage to Others Work
- F. Safety and Health Requirements
- G. Clean Up
- H. Insurance
- I. Codes and Regulations
- J. Site Visit
- K. Drawings and Specifications

##### **1.02 GENERAL SCOPE OF WORK**

- A. The intent and meaning of the Contract Documents is that this Contractor shall provide labor, materials, supplies, equipment, transportation facilities and appurtenances thereto which are indicated or reasonably implied by the Demolitions Drawings and Specifications to provide a complete demolition of this existing facility. This Contractor shall visit the site to become aware of all existing conditions. He shall carefully read all specifications for additional information on the project phasing. He shall be aware of the responsibilities of these interfaces. These plans and specifications are considered cooperative and complimentary. Where one contradicts the other, notify the Architect/Engineer for clarifications.
- B. Work to be done:
  - 1. This work involves the demolition of plumbing fixtures and piping where indicated on drawings. This work will include the demolition and removal of plumbing fixtures and piping, and all other ancillary plumbing items found on the premises in areas shown to be demolished. Other work associated with this demolition also includes the removal from the site and the disposal of said plumbing materials that may remain as a result of the demolition. This work will include the haul-off of the demolition materials including all disposal fees and permits as may be required for the proper disposal.

2. Plumbing work to remain in place will include the existing storm water system. This system includes the existing roof drains, all related storm water piping, scuppers, downspouts, etc. The storm water system must remain in place during the entire demolition period
3. Perform all plumbing work as outlined hereinafter to include all demolition of existing systems, devices, controls and all patching and repair of any existing materials, finishes and other building components damaged during the process of the work.
4. Electrical demolition work for this project shall be as described in Division 26. All Plumbing demolition work shall include the work as described in these specification and as shown on the Demolition Contract Drawings.
  - a. Cutting and Patching: All cutting and patching required for the demolition of this project shall be done by the General Contractor or under his supervision.

#### **1.03 SUB-CONTRACTOR USE OF SITE AND PREMISES**

- A. This Contractor may work, with the permission of the General Contractor, on the immediate site as necessary to complete the work per the milestone dates established at the Preconstruction Conference.

#### **1.04 WORK SEQUENCE**

- A. All work shall be performed within the allocated time frame as set forth by the Architect. This work shall be in accordance with the milestone dates for this project as established at the Preconstruction Conference.

#### **1.05 SCHEDULING OF WORK**

- A. Before any work within the scope of the contract has begun, this Contractor shall confer with the General Contractor, the Architect and Owner and agree on the following:
  - 1 Means of access and egress to the site.
  1. Space for temporary storage of demolition materials and equipment.
  2. Work hours that Sub-Contractor has access to job site.
- B. As provided in the documents and in no case later than the preconstruction meeting, this Contractor shall provide sufficient information to the General Contractor for the scheduling of his work and for the planning of the overall "work schedule". At a minimum, this schedule shall illustrate the following:
  - 1 Each task should be indicated in bar format with timeline in weekly periods, Indicate total man-hours to accomplish each task.
  2. Each task should be shown indicating the starting period and ending period of that operation. Non-continuous operations shall be so indicated.
  3. Completion of each task should conform to the milestone dates as set forth in the preconstruction meeting. The schedule shall be updated on a bi-weekly basis to the Architect.

#### **1.06 DAMAGE TO OTHER WORK**

- A. This Contractor shall be responsible for damage caused by his work or employees to adjoining property, the existing facilities, and any on-going work effort.
- B. It is the responsibility of this Contractor to make a report immediately to the General Contractor if a utility line or service source of any kind is encountered or interrupted unexpectedly. He shall protect and maintain it until instructions for its repair or disposal can be issued.

#### **1.07 SAFETY AND HEALTH REQUIREMENTS**

- A. This Contractor shall acknowledge his obligation to comply with any applicable federal, state and local acts and regulations. In addition to any other indemnities, he shall provide for, in his contract, and agree to comply with the Occupational Health and Safety Act of 1970 (OSHA) with latest amendments.

#### **1.08 CLEANUP**

- A. This Contractor shall keep the work area reasonably clean and free of debris. He shall clean up debris on a daily basis and place it in his designated dumpster.

#### **1.09 INSURANCE**

- A. This Contractor shall carry adequate insurance coverage, documented with a Certificate of Liability Insurance, stating that he has in force sufficient coverage of liability for the work in this contract. This liability coverage shall include General Liability, Automobile Liability, Excess/Umbrella Liability and Workers Compensation and Employers' Liability. The coverage amount/values shall be determined by the Architect and attached thereto the General Contractor's insurance coverage.

#### **1.10 CODES AND REGULATIONS**

- A. All work shall comply with all local laws, ordinances and regulations applicable to the mechanical and electrical safety code for the demolition of the systems as mentioned herein, or the regulations of NFPA, OSHA, ANSI, municipal ordinances governing electrical work, and with the requirements of the latest National Electrical Code or latest edition approved by the local authority having jurisdiction (LAHJ).
- B. Where different sections of any of the aforementioned codes and regulations may dictate, the specifications or the plans require different materials, methods of demolition or construction, or other requirements, the most restrictive or stringent of these regulations and/or codes shall govern. In any conflict between a general provision and any special provisions, the special provisions shall govern.
- C. Obtain all permits and licenses, and pay all fees as required for execution of the Contract. Arrange for necessary inspections required by the Architect, city, county, state and other local authorities having jurisdiction (LAHJ) and present certificates of approval to the Owner or his designated representative.
- D. All work with reference to asbestos or asbestos related materials, to be by others.

### **1.11 SITE VISIT**

- A. In advance of any project activity or submission of bids, all interested parties shall visit the site and thoroughly familiarize themselves with the local and existing conditions which may affect the cost of the Work. No extras will be allowed for failure to comprehend, or lack or knowledge of, any existing conditions which may affect the completion of the project in the intended manner. Any such items discovered will be presented to the Architect/Engineer for solution prior to Bidding.

### **1.12 DRAWINGS AND SPECIFICATIONS**

- A. The Drawings and Specifications shall both be considered as part of the Contract. Any work or material shown in one and omitted in the other, or which may fairly be implied by both or either, shall be provided in order to give a complete job.
- B. Should conflicts exist between the Drawings and Specifications, notify the Architect/Engineer.
- C. No deviations from the drawings and specifications shall be made without the full authorization and consent of the Architect/Engineer.
- D. If it is found that existing conditions or demolition methods make desirable a modification to the project scope, or to methods of completing the work, the Contractor shall report such item(s) to the Architect/Engineer for their decision and instructions. Obtain written approval prior to any work required by those revisions.

**END OF SECTION**

## **SECTION 220529**

### **HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

#### **PART 1 GENERAL**

##### **1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General Conditions, Supplemental Conditions, and - Section 220500, "Plumbing General" apply to work of this section.
- B. Refer to Specification Section 220600, titled "Plumbing Schedule of Submittal Data" for the submittal and approval requirements regarding the piping system.
- C. Refer to Specification Section 221013, titled "Plumbing Basic Materials and Methods" for the specification and installation requirements of the vibration isolation system.

##### **1.02 DESCRIPTION OF WORK**

- A. Furnish hangers to support the required loads. Where necessary, supports shall be designed to permit movement due to expansion and contraction. Where drawings show details of supports and anchors, conform to details shown. Where details are not shown, conform to general requirements specified herein.
- B. "C" CLAMPS may be used as point of attachment to building structure for pipe hangers and/or all-thread rods; however, piping shall not be supported directly by "C" clamps.
- C. Do not pierce waterproofing with support bolts.
- D. All ferrous metal hangers and supports, not otherwise coated, shall be provided with a field-applied coat of zinc chromate primer prior to any installation. In lieu of field painting, the contractor may furnish cadmium plated, or galvanized hangers and supports.

##### **1.03 QUALITY ASSURANCE**

- A. All hangers, support, anchors, and guides shall be in accordance with the American National Standard Code for Pressure Piping, ANSI B31.1 with addenda 31.1 OA-69.
- B. Provide an adequate suspension system in accordance with recognized engineering practices, using where possible, standard commercially accepted pipe hangers and accessories. Submit fastening methods to the Structural Engineer for approval and as approved copy to the engineer.
- C. Horizontal suspended pipe shall be hung using adjustable pipe hangers with bolted hinged loops or turnbuckles. Chains, wire, perforated strap iron or flat steel straps are not acceptable.
- D. For the purpose of this specification, Anvil International product figure numbers are given. Equal products by B-Line and Michigan Hanger Co. (M-Co) are acceptable.

## **1.04 DESIGN**

- A. Supporting steel not shown for the equipment will be designed, supplied, and erected by the Contractor; the supporting steel is that steel which is connected to the structural steel shown on the drawings and carries the weight of the mechanical items. This supporting steel design must carry the dead weight and dynamic load imposed by the equipment, piping, and other mechanical components.
- B. The supporting steel shall be connected to the structural steel in such a manner as not to overload the structural steel. It is the responsibility of the General Contractor, Mechanical Contractor, and the steel fabricator to verify that this purpose is accomplished. It is the responsibility of the General Contractor to call to the attention of the Architect-Engineer any deficiency prior to bidding.
- C. Where thermal movement in the pipeline will occur, the pipe hanger assembly must be capable of supporting the line in all operating conditions. Accurate weight balance calculations shall be made to determine the supporting force at each hanger in order to prevent excessive stress in either pipe or connected equipment.

## **PART 2 PRODUCTS**

### **2.01 UPPER ATTACHMENTS**

- A. New Concrete Construction:
  - 1. Support piping in new concrete construction with adjustable type inserts, Anvil International Fig. 282. Where the pipe load exceeds the recommended load of the insert, use two inserts with a trapeze-type connecting member below the concrete.
  - 2. Where hangers are required between structural members, (beams) provide side beam brackets, Anvil International Fig. 202, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hangers. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.
- B. Existing Concrete Construction:
  - 1. Support piping in existing concrete construction with Cadmium plated, malleable iron, expansion case, Anvil International Fig. 117.
  - 2. Where hangers are required between structural members (beams) side beam brackets Anvil International Fig. 20, attached to the upper 1/3 of the beam, and all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC Steel Handbook and shall receive a field coat of zinc chromate primer.
- C. Steel Construction:
  - 1. Support piping in steel construction with adjustable beam clamps and tie rods, Anvil International Fig. 218, or side beam brackets bolted or welded to the side of the beam.

2. Where hangers are required between structural members (beams or joist) provide all auxiliary steel for the installation of the pipe hanger. Supports shall be designed in accordance with the AISC steel Handbook and shall receive a field coat of zinc chromate primer.

D. Wood Construction:

1. Support piping in wood construction with Side Beam Bracket, Anvil International Fig. 202 or Hanger Flange, Anvil International Fig 128R, using lag screws.

## 2.02 WALL SUPPORTS

- A. Where piping is run adjacent to walls or steel columns welded steel brackets Anvil International Fig. 195 and 199 may be used. The bracket shall be bolted to the wall and a back plate of such size and thickness as to properly distribute the weight.

## 2.03 FLOOR SUPPORTS

- A. Where pipelines are located next to the floor and no provision for expansion are required support piping with Anvil International Fig. 258, pipe rest with nipple and floor flange.
- B. Where provisions for expansion are required support piping with Anvil International adjustable pipe stand Fig. 274, or pipe roll stand Fig. 271.
- C. Vertical piping shall be supported at every other floor using riser clamps Anvil International Fig. 261, for steel and cast-iron pipe, and copper clad riser clamp Anvil International Fig. CT-121 for all copper piping.

## 2.04 SUPPORTS FOR PIPING OUTSIDE THE STRUCTURE

- A. Support piping outside the structure on adjustable pipe supports Anvil International Fig. 264.

## 2.05 INTERMEDIATE ATTACHMENTS

- A. Supports for horizontal piping shall be all-thread galvanized steel rods, ASTM A-107, Anvil International Fig. 146, of the following sizes:

| Pipe Size      | Hanger Rod Diameter |
|----------------|---------------------|
| 2" and smaller | 3/8"                |
| 2-1/2" and 3"  | 1/2"                |
| 4" and 5"      | 5/8"                |
| 6"             | 3/4"                |
| 8" to 12"      | 7/8"                |
| 14" and 16"    | 1"                  |

## 2.06 PIPE ATTACHMENTS

- A. Hangers for insulated pipe shall be sized to bear on the outside of the insulation.
- B. Hangers for steel and cast-iron horizontal piping where provision for expansion is not required shall be Anvil International Fig. 260, clevis type with vertical adjustment.

- C. Hangers for uninsulated copper pipe 4" and smaller shall be copper plated adjustable band hangers Anvil International Fig. CT. 99C, for pipe sizes over 4" provide Anvil International copper clad clevis type hanger with a copper clad saddle at each hanger location.
- D. Hanger for PVC pipe shall be Anvil International Fig. CT. 99, adjustable band hanger.
- E. Hangers for steel and copper piping where provisions for expansion are required shall be Anvil International Fig. 171 or Fig. 181, adjustable roller hanger with Anvil International Fig. 160, pipe covering protection saddles.
- F. Support hot and cold water piping in spaces behind plumbing fixtures with plastic coated brackets and plastic coated U-bolts.
- G. Pipe guide shall be Anvil International Fig. 256.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Support horizontal equipment such as in-line pumps, strainers, independently of the piping system.
- B. Hang pipe from substantial building structure. Pipe shall not be hung from other piping.
- C. Provide a hanger within one foot of each elbow.
- D. Provide a hanger within one foot of each riser in addition to the riser clamp support at every other floor.
- E. Unless specified otherwise, provide the following support spacing:

| <b>Pipe Size</b>  | <b>Support Spacing</b> |
|-------------------|------------------------|
| 1" and smaller    | 5'-0"                  |
| 1-1/4" and larger | 10'-0"                 |

**END OF SECTION**



## SECTION 220553

### IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

#### PART 1 GENERAL

##### 1.01 APPLICABILITY

- A. All work specified in this Section shall comply with the provision of Section 220500, "Plumbing General".
- B. All above ground piping inside the building shall be identified with color bands at each shut-off valve, each piece of equipment, branch take-off, and 40'-0" maximum spacing on exposed straight pipe runs.
- C. All new underground plastic water and sewer, piping outside the building shall have #14-copper (TW) tracer wire attached to pipe. Install directly above pipe a continuous 6-inch wide vinyl plastic tape with printing identifying buried service, 12 inches below finished grade, during backfilling operation.

#### PART 2 PRODUCTS

##### 2.01 PIPE MARKINGS

- A. Pipe markings shall be manufactured preprinted markings in accordance with the following:
  - 1. No tape or self-adhering markers will be allowed.
  - 2. Snap on pipe markers, W. H. Brady Co. or approved equal are acceptable.
  - 3. Markers shall be strapped on with nylon fasteners.
  - 4. Markers will be non-corrosive, non-conductive, mildew resistant and impervious to moisture.

##### 2.02 BAND AND LETTER SIZE

- A. Band and letter sizes shall conform to American Society of Heating, Air Conditioning Engineers (ASHRAE) standards of the following table:

| O.D. of Pipe       | Width of Color Band | Size of Letter/Numbers |
|--------------------|---------------------|------------------------|
| 1-1/4" and smaller | 8"                  | 1/2"                   |
| 1-1/2" to 2"       | 8"                  | 3/4"                   |
| 2-1/2" to 6"       | 12"                 | 1- 1/4"                |
| 6" to 10"          | 24"                 | 2- 1/2"                |
| Over 10"           | 32"                 | 3- 1/2"                |

## 2.03 IDENTIFICATION

A. Band legend and color and letter color shall conform to the following table:

| Piping Band                      | Legend    | Letters | Band Color |
|----------------------------------|-----------|---------|------------|
| Cold Water (Domestic)            | CW (Dom)  | White   | Green      |
| Hot Water (Domestic)             | HW (Dom)  | Black   | Yellow     |
| Hot Water Circulation (Domestic) | HWC (Dom) | Black   | Yellow     |
| Natural Gas                      | Nat. Gas  | Black   | Yellow     |
| Drain                            | D         | Black   | Green      |

- B. All equipment, such as water heaters, pumps, etc., furnished by this Contractor, shall be permanently labeled, in an approved manner, corresponding to the mark or name shown on the drawings and/or specifications, or Owner's sequences.
- C. For applications where existing color schemes may already be in place, all new work requiring identification and color coding shall match the existing color schemes.

## PART 3 EXECUTION

### 3.01 EXECUTION

- A. Locate pipe identification in the following areas:
1. Each riser and each valve,
  2. One on each side where piping pass thru walls and floors,
  3. Locate at or near each change in direction,
  4. Every 40 feet along continuous runs,
  5. Located within 4 feet of exit or entrance to a vessel or tank.
- B. Indicate pipe content flow direction with arrows of matching style and placed so the arrow points away from the legend.
- C. Manufactured preprinted markings shall be attached to the piping with self-locking nylon fasteners.

**END OF SECTION**

## **SECTION 220600**

### **PLUMBING SCHEDULE OF SUBMITTAL DATA**

#### **PART 1 GENERAL**

##### **1.01 RELATED DOCUMENTS**

- A. The requirements of the General Conditions, Supplementary Conditions, and Section 220500 - Plumbing General, apply to all work herein.

##### **1.02 QUALITY ASSURANCE**

- A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this contract. The Contractor shall submit to the Architect an electronic, Adobe compatible, Portable Document Format (.PDF) copy of all such Shop Drawings or catalog data.
- B. Before submitting Shop Drawings to the Architect for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of the Shop Drawings is not intended to take the place of the official review by the Architect. Any Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.
- C. The review of Shop Drawings or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from the Plans and Specification unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect. Also, it shall not relieve him from responsibility for error of any kind in Shop Drawings. When the contractor does call such deviations to the attention of the Architect, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.
- D. Verification and assignment of dimensions, quantities, and construction means, methods, sequences or procedures, the correctness of which is set forth in the Contract Documents or submittal, shall be the sole responsibility of the Contractor.
- E. Reproduction of design documents in any portion for use in a submittal is not acceptable.

#### **PART 2 PRODUCTS**

##### **2.01 GENERAL**

- A. All products shall be new and bear all labels which are identified by the applicable specification section and Contract Documents.

## PART 3 EXECUTION

### 3.01 SUBMITTAL DATA

#### A. General

1. The submittal data to be furnished for this project shall comply with the Specifications and Contract Documents in their entirety. Any submittals herein scheduled are as a minimum only and shall not be construed to limit the submittal data required within the individual Sections of these Specifications.
2. Shop Drawings will be returned unchecked unless the following information is included: Reference to all pertinent data in the Specifications or on the Drawings, such as sound power levels of motor driven equipment where called for in the specifications, electrical characteristics and horse power, capacities, construction material of equipment, UL labels where required, accessories specified, manufacturer, make and model number, weights where specified, starters where required by Division 22, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings. All submitted equipment must be identified on Shop Drawings with the same "Mark Numbers" as identified on Drawings or in Specifications. All pertinent data such as accessories shall also be marked. Any deviation from any part of the Contract Documents shall be clearly and completely highlighted.
3. The Contractor shall submit plumbing data in electronic, Adobe compatible, Portable Document Format (.PDF). Each submittal shall include an index of submitted specification sections. A separate identification page for each specification section with included materials list shall precede the associated submittal data. Each identification page must provide blank space for the engineer's review stamp and associated comments. **FAILURE to provide PROPERLY IDENTIFIED SUBMITTALS will result in the AUTOMATIC REJECTION of the submittal data with NO EXCEPTION.**

B. All submittals are to be submitted for review within 30 days after the Contract is awarded. Only piping fabrication drawings are exceptions.

C. By providing submittals, the Contractor is stating that all electrical characteristics of the mechanical equipment to be supplied have been fully coordinated with the electrical contractor. Any changes to the electrical requirements from the Contract Documents resulting from alternate equipment being submitted shall be performed without any additions to the Contract Sum. Submit attachment and fastening methods for piping and equipment to the Structural Engineer for approval. Shop Drawings shall be submitted for each of the following:

Backflow Preventers  
Cleanouts  
Drains  
Flexible Pipe Connectors  
Hydrants  
Insulation  
Pipe Hangers and Supports  
Plumbing Drains  
Plumbing Fixtures, Carriers and Fittings  
Shock Absorbers

Strainers  
Thermometers, Gauges, etc.  
Vacuum Breakers  
Valves  
Water Heaters  
Water Supplies and Stops

### **3.02 OPERATING AND MAINTENANCE INSTRUCTIONS**

#### **A. Description**

1. Complete operating and maintenance instructions shall be provided to the Owner. Four (4) separate copies (three for the owner, one for the Architect) shall be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instruction shall be included for each piece of equipment. Manufacturers' Standard literature is acceptable for each piece of equipment. However, the contractor shall prepare a SYSTEM O&M manual including overall system descriptions, operating and energy conservation techniques.
2. A system wiring and control diagram shall be included in the operating and maintenance instruction.
3. Prior to final acceptance or beneficial occupancy, provide the services of a competent representative to instruct the Owner in the operation of all systems. This instruction shall include a complete walk-through of all equipment and systems. The Architect reserves the right to attend any such meeting and shall be duly notified.

### **3.03 OTHER SUBMITTALS – CLOSEOUT DOCUMENTS**

- #### **A. Submit two copies of the following prior to occupancy of the project by the Owner. See contract close-out specification by Division 01.**
1. As built drawings for plumbing systems.
  2. Request for final payment.
  3. Letter or "Release of Liens".
  4. Letter of "Guarantee".
  5. Submit two (2) copies of welder's certificate.
  6. Consent of Surety Company to final payment.
  7. Power of Attorney.
  8. Contractor's Affidavit of Payment of Debts and Claims.

**END OF SECTION**

## SECTION 221013

### PLUMBING BASIC MATERIALS AND METHODS

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

- A. This Section of the Specifications and related drawings describe requirements pertaining to the plumbing piping and equipment.
- B. Refer to the following sections for related work:

|        |  |
|--------|--|
| 220600 | Plumbing Schedule of Submittal Data                    |
| 220553 | Identification for Plumbing Piping and Equipment       |
| 220529 | Hangers and Supports for Plumbing Piping and Equipment |
| 221016 | Drains, Cleanouts and Drainage Accessories             |
| 223300 | Electric Domestic Water Heaters                        |
| 224200 | Commercial Plumbing Fixtures                           |

##### 1.02 RECORD DOCUMENTS

- A. Provide corrected Record Documents in accordance with the Project Record Documents Sections and the Mechanical General Section.

##### 1.03 GENERAL PROVISIONS AND BASIC MATERIALS

- A. The requirements of the Plumbing General Section 220500 apply to this work.

##### 1.04 CODE:

- A. The work shall comply with the International Plumbing Code; acceptability under the codes shall not authorize any substitution, smaller size, lighter weight, or less durable materials for the items specified.
- B. The Contractor shall obtain and pay for all required permits and inspections and shall deliver one copy of each inspection certificate to the Architect before the date of Substantial Completion.

#### PART 2 PRODUCTS

##### 2.01 PIPING MATERIALS FOR DRAINAGE SYSTEMS

- A. Waste and vent piping all sizes: Polyvinyl chloride pipe (PVC), Type 1, Grade I compound having a cell classification of 12454 conforming to ASTM D-1784. DWV fittings shall meet the requirements of ASTM D-2665 for Polyvinyl Chloride (PVC) Plastic DWV Molded Fittings and ASTM D-3311 for DWV Fitting Patterns. PVC pipe and fittings shall have solvent weld joints.
- B. All traps shall have brass cleanout plug except where buried.

## **2.02 ROOF FLASHING**

- A. Vent pipes passing through built-up/flat roofs shall be flashed with four (4) pound lead sheet or 16 oz. copper, at least twenty inches (20") square, and shall be extended up and turned down at least 1" inside pipe, with pipe at least twelve inches (12") above roof at center line. Vents shall offset in roof joist area or ceiling cavity if necessary, so that no vent shall be closer than 4'-0" from outside wall line.
- B. Vent pipes passing through standing seam metal roofs shall be flashed with a one-piece pipe flashing unit constructed of E.P.D.M. rubber with an aluminum reinforcing ring suitable for a temperature range of -25°F to 250°F as manufactured by Butler Manufacturing Company or approved equal. Flashing to be installed in accordance with metal building manufacturer recommendations. Vents shall offset in roof joist area or ceiling cavity if necessary, so that no vent shall be closer than 4'-0" from outside wall line.

## **2.03 WATER PIPING**

- A. Aboveground piping 3" and smaller: Type "L" copper tubing with tin-antimony soldered joints and wrought copper socket fittings.
- B. Underground piping 1 1/4" to 3" below building slab to 5'-0" outside building: Type "K" hard drawn copper tubing, with 95-5 silver soldered joints and wrought copper socket fittings.
- C. Underground piping 1" and smaller below building slab: Below slab Type "L" soft drawn copper tubing, with no joints.
- D. Underground piping beyond 5'-0" outside building all sizes: Polyvinyl chloride (PVC) plastic piping Schedule 40, ASTM D-1785 with 150 PSI minimum pressure rating. Fittings shall conform to ASTM D-2466 with solvent weld joints conforming to ASTM D-2564.

## **2.04 BASIC PIPING SPECIALTIES**

- A. Unions:
  - 1. Unions shall be the same material and working pressure as the fittings specified for the piping system. Unions on piping 2-1/2" in size and larger shall be bolted flanged joint and on smaller than 2-1/2" shall be screwed connection.
  - 2. Unions and flanges provided between copper and ferrous pipe connections shall be insulating (dielectric) type to electrically separate dissimilar metal connections in piping system.
- B. Dielectric Adapters:
  - 1. Dielectric adapters shall be the union type for pipes 2" in size and larger. Adapters shall have working pressure of 250 psi for union type and 165 psi for flanged type. The insulating gaskets shall have an operating range of 40 degrees F to 240 degrees F and shall limit the galvanic corrosion to a maximum of 1% of the short circuit current. Dielectric adapters shall be Ebco, Crane, or Capitol.
  - 2. Provide a dielectric adapter between any ferrous and copper connection including piping and equipment.

C. Thermometers:

1. Thermometers shall be the red-reading mercury filled adjustable angle type. Thermometers shall be adjustable to any angle through a 180-degree arc and shall be provided with a locking device. Thermometers shall have V-cast aluminum case with baked enamel finish and 9-inch scale. Thermometers shall be provided with separable sockets and, where installed on insulated pipes, sockets shall be extended neck type. Thermometer scale range shall be 0 to 160 degrees F. Thermometers shall be Weksler Adjust-Angle Series Type AA-5, Terice Adjustable Angle Series Type BX, or Weiss Vari-Angle Series Type VS.

D. Pipe Sleeves:

1. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all piping, equipment and devices furnished under each section of the Specification.
2. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.
3. Where pipes pass through floor slabs, sleeve shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.
4. Each pipe passing through walls, floors, ceilings, or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes.
5. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.
6. All penetrations through rated walls and floors shall be sealed with an approved fire rated sealant as manufactured by 3M or Hilti.
7. Sleeves through exterior wall shall be steel or cast-iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.
8. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to  $\frac{3}{4}$  inch diameter and permitting lateral adjustment.

E. Floor, Wall, and Ceiling Plates:

1. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.
2. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.



3. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

## **2.05 BACKFLOW PREVENTERS**

- A. Reduced Pressure Principle - Provide reduced pressure principle backflow preventer assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventer shall include test cocks, airgap drain funnel, and pressure-differential relief valve located between two (2) positive seating check valves. Assembly shall be constructed in accordance with ASSE Standard 1013 and University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research. Extend drain to nearest floor drain.
- B. Double Check Valve - Provide double check valve backflow preventer assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventer shall include test cocks and shall be suitable for supply pressures up to 175 psi. Assembly shall be constructed in accordance with ASSE Standard 1013 and University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research.
- C. Provide backflow preventers as indicated on drawings. Backflow preventers shall be Watts or approved equal as follows:

| Size        | Double Check | Reduced Pressure Zone |
|-------------|--------------|-----------------------|
| ½" to 2"    | 007QT-S      | 009QT-S               |
| 2 ½" to 10" | 757NRS-S     | 957NRS-S              |

## **2.06 WATER HAMMER ARRESTORS**

- A. Water hammer arrestors shall be piston operated, type "K" copper, pressure rated for 250 psi, tested, and certified in accordance with PDI standard WH-201; Precision Plumbing Products, Inc., or approved equal.

## **2.07 VALVES**

- A. All shutoff valves shall be gate or ball valves unless otherwise noted. All drain valves shall be globe or angle valves unless otherwise noted.
- B. Gate valves 2" and smaller shall be of Class 125, body and bonnet shall be of ASTM B-62 cast bronze composition, solid disc, copper-silicon alloy stem, brass packing gland, solder ends, Teflon-impregnated packaging, and malleable handwheel; NIBCO S-11 or approved equal.
- C. Class 150 valves meeting the above specifications shall be used where pressure requires; NIBCO S-134 or approved equal.
- D. Ball valves 2" and smaller shall be 600 psi CWP, have cast brass bodies, replaceable reinforced Teflon seats, conventional port, blowout proof stems, chrome-plated brass ball, solder ends with extended solder cups; NIBCO S-580-BR-R-70 or approved equal.
- E. Gate valves 2-1/2" and larger shall be Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, with Teflon-impregnated packing and two-piece packing gland assembly; NIBCO F-617-0 or approved equal.

- F. Globe valves 2" and smaller shall be of Class 125, body and bonnet of ASTM B-62 cast bronze composition, solder ends, copper silicon alloy stem, brass packing gland, Teflon-impregnated packing and malleable handwheel; NIBCO S-235-Y or approved equal.
- G. Globe valves 2-1/2" and larger shall be of Class 125 iron body, bronze mounted with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged end, with Teflon-impregnated packing and two-piece packing gland assembly; NIBCO F-178-B or approved equal.
- H. Check valves 2" and smaller shall be of Class 125, solder ends, with bodies and caps conforming to ASTM B-62 cast bronze composition, swing type disc; NIBCO S-413-BYW or approved equal.
- I. Check valves 2-1/2" and larger shall be iron body, bronze mounted, with body and cap conforming to ASTM A-126 Class B cast iron, flanged ends, swing type disc; NIBCO F-918-B or approved equal.

## **2.08 PLUMBING SYSTEM INSULATIONS**

- A. All pipe insulation material shall have a permanent composite insulation, jacket and adhesive fire and smoke hazard rating as tested by procedure ASTM-B84, NFPA 255, and UL 723 not exceeding Flame Spread 25, Smoke Developed 50.
- B. The use of staples for securing insulation will not be permitted.
- C. Insulation shall be applied on clean dry surfaces. All insulation shall be continuous through wall and ceiling openings and sleeves.
- D. Ends of fiberglass pipe insulation on cold pipelines shall be sealed off with white vapor barrier coating at valves, flanges, and fittings.
- E. Unions shall not be insulated.
- F. Pipe covering protection shields and saddles shall be provided around exterior of pipe insulation at pipe hangers which fit around pipe insulation. Foamglass pipe insulation shall be used under saddles on pipe 2" and larger.

## **2.09 FIBERGLASS PIPE INSULATION**

- A. Insulation shall be one-piece fibrous glass sectional pipe insulation with white all service jacket. Longitudinal jacket laps and butt strips shall be self-sealing. Insulation shall have an average thermal conductivity not to exceed 0.23 BTU-in. per square foot per degrees F. per hour at a mean temperature of 75-degree F. Insulation shall be Manville Fiberglass Micro-Lok AP-T Plus or approved equal.

## **2.10 APPLICATION**

- A. Butt all joints of pipe insulation together and secure all jacket laps with lap adhesive. Seal all butt joints with joint straps furnished with insulation.
- B. Fittings, valves, and flanges shall be insulated with molded fiberglass insulation of the same thickness as adjoining pipe insulation. Insulation at fittings shall be covered with white PVC jacket as manufactured by Zeston or equal.

| INSULATION THICKNESS IN INCHES<br>FOR PIPE SIZES |                      |             |                 |                 |              |
|--|----------------------|-------------|-----------------|-----------------|--------------|
|  | Temperature<br>Up to | Up to<br>1" | 1 1/4" to<br>2" | 2 1/2" to<br>4" | 4" &<br>Over |
| Cold Water                                       | 50°-65°F             | 1/2"        | 1"              | 1"              | 1"           |
| Hot Water  | 200°F                | 1/2"        | 1"              | 1"              | 1 1/2"       |
| Drains Connecting A/C<br>Equipment               | 40°-55°F             | 1/2"        | 1"              | 1"              | 1 1/2"       |

## 2.11 PIPE HANGERS AND SUPPORTS

- A. Provide pipe hangers and supports in accordance with Section 220529.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install soil and vent piping pitched to drain at minimum slope of 1/4" per foot (2%) for piping 2 1/2" and smaller, and 1/8" per foot (1%) for piping 3" and larger.
- B. Install piping and make all joints in accordance with the pipe manufacturer's recommendations. Make provisions for thermal expansion and contraction.
- C. Install cleanouts on drainage piping where indicated on the drawings and as required by the code, and at every change in direction of more than 45 degrees in horizontal piping. Locate wall cleanouts as low as possible but high enough for the cover plate to clear the base. Locate test tees where necessary to separate sections of piping for testing.
- D. Rough-in for fixtures in accordance with the fixture manufacturer's roughing-in drawings to provide the heights and locations indicated on the Architectural drawings or as specified.
- E. Set floor cleanouts so that the top rims are level and flush with the finished floor surface and so that square and rectangular tops are parallel to the walls, unless otherwise noted.
- F. Install piping and pipe supports as specified. Keep pipe ends closed except for vent and drain openings; protect vent and drains from the entrance of materials that could cause stoppage.
- G. Vents shall terminate at 1'-0" above roof.
- H. Install shut-off valves where indicated on the drawings and required by the code including valves at all fixture groups, and equipment.
- I. Install drain valves at low points of all new water piping except buried piping.

### 3.02 EXCAVATION, TRENCHING AND BACKFILLING

- A. Perform all excavation, trenching and backfilling for work under Division 22. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfilling shall be removed and disposed of. Grading shall be done to prevent surface water from flowing into trenches and other excavation and any water accumulating therein shall be removed by pumping. All excavations shall be made by open cut. No tunneling shall be done.

- B. Bottom of trench shall be uniformly graded to provide firm support and even bearing surface for pipe.
- C. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that barrels of pipe rest evenly on bottom of trench along entire length of pipe.
- D. Pipe shall be inspected and tested prior to backfilling. No roots, rocks or foreign materials of any description shall be used in backfilling the trenches. Trench shall be hand filled to a minimum of 12" above the top of the pipe with clean earth and tamped to 95 percent compaction after first layer using the modified Proctor test method of compaction.

### **3.03 SERVICE CONNECTIONS**

- A. Before installing any underground drainage piping contractor shall verify and coordinate all invert elevations required for connections to outside utilities and ensure that these can be connected with proper slope for drainage.

### **3.04 TESTS OF PIPING**

- A. Install temporary connections and plugs or valves at all points necessary for venting air from the piping, filling, holding test pressure, draining, and flushing the piping.
- B. Test all new soil, waste, and vent piping under 10 feet head of water (except for the uppermost 10 feet) as required by the Plumbing Code, with zero leakage allowed. The test pressure shall be maintained for at least 30 minutes before inspection starts and maintained for the time necessary to inspect all joints but not less than 15 minutes.
- C. Test all new pressure piping roughing hydrostatically to show zero leakage in eight (8) hours at the following pressures measured at the low points: Domestic water (C.W. and H.W.), 125 psi.

### **3.05 FLUSHING AND STERILIZING**

- A. Flush all new water piping after pressure tests and repairs are completed by draining from the low points, refill with clean water.
- B. Sterilize the above ground water piping after fixtures and equipment are installed with 50 ppm chlorine solution distributed throughout all C.W. and H.W. piping; let stand for 24 hours, then flush enough water at drinking fountains and lavatories to reduce the residual chlorine content to less than one (1) ppm. Domestic water heater shall have the heat source shut off while sterilization is in progress.

### **3.06 WATER TESTS**

- A. The Contractor shall have representative water samples from the fixtures tested by the local Health Department, or a laboratory approved by the Health Department. If the tests do not indicate potable water, the sterilizing procedure and the test shall be repeated. Submit test report to the Architect.

### **3.07 START-UP, ADJUSTMENT, INSTRUCTION**

- A. Start-up, lubricate, adjust, and test equipment installed under this Section and furnish instructions to the Owner as specified in the Plumbing General Section.

### **3.08 OPERATIONAL TESTS**

- A. When installation and adjustment of all fixtures and equipment is complete, perform operational tests of all plumbing system components at normal operating pressures as specified under the Mechanical General Section and include the following tests:
  - 1. Operate all manual and automatic valves at least one full open-closed cycle; examine for stem leakage, failure to close or other malfunction.
  - 2. Pour at least five (5) gallons of water into every floor drain to test for pipe stoppage.

**END OF SECTION**

## **SECTION 221016**

### **DRAINS, CLEANOUTS AND DRAINAGE ACCESSORIES**

#### **PART 1 GENERAL**

##### **1.01 RELATED DOCUMENTS**

- A. All work specified in this section is subject to the provisions of Section 220500 "Plumbing General".
- B. Refer to the following sections for related work in connection with drains, cleanouts, and drainage accessories.

|        |                                      |
|--------|--------------------------------------|
| 220600 | Plumbing Schedule of Submittal Data  |
| 221013 | Plumbing Basic Materials and Methods |

##### **1.02 DESCRIPTION OF WORK**

- A. The number and size of the drains and cleanouts are indicated and scheduled on the drawings.

##### **1.03 QUALITY ASSURANCE**

- A. Manufacturing firms shall be regularly engaged in the manufacture of plumbing products of type and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Subject to compliance with requirements, provide drains, cleanouts & drainage accessories of one of the following manufacturers:
  - 1. Josam Mfg. Co.
  - 2. Smith (Jay R.) Mfg. Co.
  - 3. Wade Div., Tyler Pipe
  - 4. Zurn Industries, Hydromechanics Div.

#### **PART 2 PRODUCTS**

##### **2.01 GENERAL**

- A. Provide factory fabricated drainage piping products of the size and type as indicated on drawings; including features as specified herein. Where not indicated, provide proper selection as determined by installer to comply with installation requirements and governing regulations.
- B. Floor drains shall be provided with trap primer connections where indicated on drawings.
- C. All floor drains without trap primers shall be provided with deep seal "P" traps.
- D. All floor drains and floor sinks located on elevated floors shall be provided with seepage holes and flashing collar or clamping rings to provide for leak proof installation.

## **2.02 CLEANOUTS**

- A. Vertical and horizontal lines exposed - Test Tee – Smith 4510.
- B. Vertical lines concealed – Smith 4472 with stainless steel access cover.
- C. Horizontal lines under unfinished floors – Smith 4405.
- D. Finished floors – Smith 4023 cast iron adjustable floor level cleanout assembly with round polished bronze top.
- E. Finished Floors - Linoleum, Terrazzo or Tile – Smith 4143 cast iron adjustable floor level cleanout assembly with round polished bronze top. Top depression to be covered with surrounding floor pattern bonded with waterproof adhesive.
- F. All lines outside of building - Smith 4400.
- G. Finished floors - Carpet Smith 4023-Y cast iron adjustable floor level cleanout assembly with nickel bronze top and 1-1/2" diameter stainless steel carpet marker. Carpet shall cover top of cleanout with carpet marker exposed above carpet to serve as cleanout locator.

## **PART 3 EXECUTION**

### **3.01 EXECUTION**

- A. All floor drain strainers shall be securely fastened to drain body.
- B. During construction drains shall be kept covered so that traps, sediment buckets and dome type strainers are kept free from debris and trash.

**END OF SECTION**

## **SECTION 223300**

### **ELECTRIC DOMESTIC WATER HEATERS**

#### **PART 1 GENERAL**

##### **1.01 RELATED DOCUMENTS**

- A. All work specified in this section is subject to the provisions of Section 220500 "Plumbing General".
- B. Refer to the following sections for related work in connection with electric water heaters:

|        |  |
|--------|--|
| 220600 | Plumbing Schedule of Submittal Data                    |
| 220553 | Identification for Plumbing Piping and Equipment       |
| 220529 | Hangers and Supports for Plumbing Piping and Equipment |
| 221013 | Plumbing Basic Materials and Methods                   |

##### **1.02 DESCRIPTION OF WORK**

- A. The number and size of the electric water heaters are indicated on the drawings and schedules.

##### **1.03 QUALITY ASSURANCE**

- A. Manufacturing firms shall be regularly engaged in the manufacture of electric water heaters of type and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Provide water heaters which comply with ASHRAE 90A for energy efficiency.
- C. U.L. and NEMA Compliances - Provide electrical components required as part of electric water heaters, which have been listed and labeled by Underwriters Laboratories and comply with NEMA Standards.
- D. NEC Compliance - Comply with the National Electric Code as applicable to installation and electrical connections of ancillary electrical components of electric water heaters.

##### **1.04 SUBMITTALS**

- A. Product Data - Submit manufacturer's plumbing equipment specifications, installation and start-up instructions.
- B. Shop Drawings - Submit assembly type shop drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.
- C. Wiring Diagrams - Submit ladder type wiring/diagrams for all components, clearly indicating all required field electrical connections.
- D. Maintenance Data - Submit maintenance data and parts lists for each item of accessory equipment. Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.



## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. Electric water heaters shall be of same manufacturer. Refer to schedule for heater sizes, capacities, electrical characteristics, and element operation.

### **2.02 ELECTRICAL STORAGE TYPE WATER HEATERS**

- A. Tank Materials - Tank shall be welded steel construction, 150 psi working pressure.
- B. Lining - All interior tank surfaces shall be glass lined.
- C. Elements - Electric heating elements shall be low watt density with zinc plated copper sheath.
- D. Enclosure - Heater shall be factory insulated and provided with steel enclosure with baked enamel finish.
- E. Controls - Adjustable thermostat, high temperature cut off and low water cut off.
- F. Accessories - Provide the following water heater accessories:
  - Magnesium anode
  - ASME combination temperature and pressure relief valve.
  - Brass tank blowdown drain valve.
  - Thermometer
  - Automatic air vent
  - Watts No. 530 adjustable bleeder pressure relief valve.
- G. Warranty - Furnish three (3) year limited warranty for tank leakage.
- H. Manufacturer - Provide water heaters meeting specification requirements of one of the following manufacturers:
  - A.O. Smith
  - Lochinvar
  - Rheem
  - Ruud
  - State Industries

### **2.03 ELECTRIC INSTANTANEOUS HEATERS**

- A. Electric instantaneous thermostatic point of use water heater shall have copper heating coils and shall be flow switch operated.
- B. Provide flow control fitting at inlet of heater. Provide ball valve at inlet and outlet of heater.
- C. Instantaneous heater shall be equal to Eemax, Inc., Chronomite Laboratories, Inc., or Stiebel Eltron.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION OF WATER HEATERS**

- A. Install water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.
- B. Bolt tanks to concrete housekeeping pads, level and plumb. Provide concrete pad.
- C. Connections - Make connections between water heaters and domestic water piping shutoff valves with unions or flanges as indicated. Provide dielectric isolation at all tank connections.
- D. Pipe heater drain and relief valve drain, full size to floor drain.
- E. Install bleeder pressure relief valve in tank drain line, set 25 psi below relief valve setting.
- F. Where water heaters are indicated to be suspended above floor either above or below ceiling install heaters as detailed on drawings. Provide all necessary hanger rods, bolts, plates, and miscellaneous steel as required.
- G. Drain Pans - Provide drain pans constructed of 20 gauge galvanized sheet metal for all water heaters suspended above finished floor or installed within cabinets. Provide a minimum 1 inch drain from bottom of pan to nearest floor drain.
- H. Identification - Provide sign securely attached to water heater identifying equipment number, service, and capacity. Provide valve tags on all valves and provide identification on all piping connections to water heaters.
- I. Testing - Upon completion of installation, pressure test water heaters hydrostatically to assure structural integrity and freedom from leaks.
- J. Disinfection and Flushing - Disinfect in accordance with potable water piping requirements and flush water heaters upon completion of installation in accordance with manufacturer's instructions and comply with applicable health codes.

**END OF SECTION**

## **SECTION 224200**

### **COMMERCIAL PLUMBING FIXTURES**

#### **PART 1 GENERAL**

##### **1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. All work specified in this Section is subject to the provisions of Section 220500 "Plumbing General".

##### **1.02 DESCRIPTION OF WORK**

- A. Extent of plumbing fixtures and trim work is indicated by drawings and schedules, and by requirements of this section.
- B. Refer to Division 26 sections for electrical connections to water coolers and other plumbing fixtures; not work of this section.

##### **1.03 QUALITY ASSURANCE**

- A. Manufacturing: Firms shall be regularly engaged in the manufacturing of plumbing fixtures of the type, style and configuration required, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Comply with applicable portions of the Plumbing Code, latest edition, pertaining to materials and installation of plumbing fixtures.
- C. Comply with applicable ANSI standards pertaining to plumbing fixtures and systems, and bathtub units.
- D. Comply with ANSI A117.1 standard and the Americans with Disabilities Act (ADA) pertaining to plumbing fixtures for handicapped.
- E. Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.

##### **1.04 SUBMITTALS**

- A. Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished, roughing-in dimensioned drawings, templates for cutting substrates, fixture carriers, and installation instructions.
- B. Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in maintenance manual.

##### **1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.
- B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

- C. Fixtures shall be protected after installation to prevent scratches, dents, surface mar or any other damage during the course of construction.

## **PART 2 PRODUCTS**

### **2.01 PLUMBING FIXTURES**

- A. Provide factory-fabricated fixtures of type, style and material scheduled on drawings. For each type of fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where more than one type is indicated, selection is Installer's option; but all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
- B. Fixture color shall be white unless noted otherwise.

### **2.02 MATERIALS**

- A. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.
- B. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

### **2.03 PLUMBING FITTINGS, TRIM AND ACCESSORIES**

- A. At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.
- B. Include removable P-traps where drains are indicated for direct connection to drainage system.
- C. Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- D. Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated cast-brass escutcheons with set screw.
- E. Provide aerators on all faucet sets of types approved by Health Departments having jurisdiction.
- F. Comply with additional fixture requirements contained in fixture schedule.

## 2.04 MANUFACTURERS

- A. Subject to compliance with requirements, provide plumbing fixtures and trim of one of the following:
1. Plumbing Fixtures
    - American Standard, U.S. Plumbing Products
    - Eljer Plumbing-ware Division, Wallace-Murray Corporation
    - Kohler Company
    - Toto USA, Inc.
    - Bradley Corporation
    - Acorn Engineering Co.
  2. Plumbing Trim
    - American Standard, U.S. Plumbing Products
    - Chicago Faucet Company
    - Eljer Plumbing-ware Division, Wallace-Murray Corporation
    - Kohler Company
    - Delta Commercial Faucet Co.
    - T & S Brass and Bronze Works, Inc.
    - Eastman Brasscraft
    - McGuire Manufacturing Co.
  3. Flush Valves
    - Coyne & Delaney Company
    - Sloan Valve Company
    - Zurn Industries, Inc., Hydromechanics Div.
    - Toto USA, Inc.
  4. Fixture Seats
    - Bemis Mfg. Co.
    - Beneke Corp., Div. of Beatrice Foods
    - Church
    - Olsonite Corp., Olsonite Seats
  5. Stainless Steel Sinks
    - American Standard, U.S. Plumbing Products
    - Elkay Mfg. Co.
    - Just Mfg. Co.
    - Kohler Co.
  6. Fixture Carriers
    - Josam Mfg. Co.
    - J.R. Smith
    - Wade
    - Zurn Industries, Inc.

## **PART 3 EXECUTION**

### **3.01 INSPECTION AND PREPARATION**

- A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Plumbing Code pertaining to installation of plumbing fixtures.
- C. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.
- D. Where fixtures are mounted against or abut walls, caulk along fixture.

### **3.02 CLEAN AND PROTECT**

- A. Clean plumbing fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during the remainder of the construction period.

### **3.03 FIELD QUALITY CONTROL**

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match shall be judged by Architect. Remove cracked or dented units and replace with new units.

### **3.04 EXTRA STOCK**

- A. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one (1) device for every ten (10) units.

**END OF SECTION**

## **SECTION 230500**

### **HVAC GENERAL**

#### **PART 1 GENERAL**

##### **1.01 DESCRIPTION**

- A. This division and the accompanying drawings cover furnishing of all labor, equipment, appliances, and materials and performing all operations in connection with the installation of complete air conditioning, ventilating, and heating systems as specified herein and as shown on the drawings.
- B. The general provisions of the contract including the Conditions of the Contract (General, Supplementary, and other conditions) and other divisions as appropriately apply to work specified in this division.

##### **1.02 CODES, ORDINANCES, AND PERMITS**

- A. All heating, ventilating and air conditioning materials and workmanship shall comply with the following codes and standards as applicable:
  - 1. The National Electric Code (2017 Edition)
  - 2. The International Fuel Gas Code (2018 Edition)
  - 3. The International Building Code (2018 Edition)
  - 4. The International Mechanical Code (2018 Edition)
  - 5. City of Raleigh Heating, Ventilation and Air Conditioning Code.
- B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.
  - 1. Air Conditioning and Refrigeration Institute Standards (ARI)
  - 2. American National Standards Institute, Inc. Standards (ANSI)
  - 3. American Society for Testing and Materials Publications (ASTM)
  - 4. American Society of Mechanical Engineers Code (ASME)
  - 5. Factory Mutual Underwriters (FM)
  - 6. National Fire Protection Association Standard (NFPA) – Latest Adopted Edition
  - 7. Sheet Metal and Air Conditioning Contractor's National Association Inc. (SMACNA)
  - 8. Underwriters Laboratories Inc. (UL)

- C. All work done under this Contract shall comply with all state and local code authorities having jurisdiction and with the requirements of the Utility Companies whose services may be used. All modifications required by these codes and entities shall be used made by the Contractor without additional charges. Any conflict between these documents and the governing codes shall be immediately brought to the attention of the Engineer of Record. Where code requirements are less than those shown on the Plans or in the Specifications, the Plans and Specifications shall be followed. Where applicable, N.F.P.A. requirements shall be met.
- D. The Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction, and deliver certificates of approval to the Architect. All fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor.
- E. The Contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

#### 1.03 APPLICABILITY

- A. The work specified herein shall include all labor, materials, equipment, tools, supplies and supervision required to install and place in operation the mechanical systems and appurtenances specified herein and/or indicated on the drawings or reasonably implied as necessary for completion of the various systems.

#### 1.04 TEMPORARY HVAC

- A. New HVAC equipment, i.e. fans, wall heaters, etc. **shall not be placed into service until the facility has been turned over to the Owner.** All HVAC equipment warranties shall start on the day of the Owner's acceptance of the facility.

NOTE: The temporary use of the building HVAC systems during the construction period SHALL NOT be permitted with the following exceptions:

1. HVAC systems may be placed in operation only when temperature and humidity control is critical for the installation of final finishes, i.e., interior painting, lay-in ceilings, flooring, paneling, etc.
2. HVAC systems must be operational during the time required for the TAB Sub-contractor to do the final testing, adjusting, and balancing.

The above exceptions shall be permitted only at a point in time when the building has been cleared of all debris and swept clean and all air systems are fitted with high quality, construction grade air filters. The Architect and/or Engineer shall also be notified of any and all temporary use of the HVAC systems and shall be documented by the General Contractor. NO EXCEPTIONS.

**NOTE: HVAC systems SHALL NOT be in operation when sheet rock sanding is being performed.**

- B. If space conditioning is required before the above conditions are satisfied, such space conditioning shall be the responsibility of the Contractor. If the Contractor elects to utilize the permanently installed building HVAC systems to provide the space conditioning, it shall be the responsibility of the General Contractor to ensure that the required warranty periods for all equipment provided are effective from the date of acceptance of the project.



## **1.05 COORDINATION OF MECHANICAL DOCUMENTS**

- A. The mechanical work listed in these documents shall be coordinated with the work indicated on all other mechanical drawings, schedules, schematics, and specifications. Should a conflict occur, the contractor shall submit a request for clarification to the engineer prior to bid opening. NO ALLOWANCES shall be made for any assumptions made by the contractor or any sub-contractors that are in direct conflict with the intent of the construction documents; in the event a conflict is discovered after construction has commenced, the resolution of the conflict shall be decided by the Engineer of Record, whose interpretation of the documents shall be final.

## **1.06 WELDERS QUALITY ASSURANCE**

- A. All welders shall be certified by ANSI B31.1.0-1967 "Standard Qualification Welding Procedures, Welders and Welding Operators" or "Qualification Tests" in Section IX, ASME Boiler and Pressure Vessel Code. Welder performance qualification tests shall be made in strict accordance with the above codes. Welders shall be certified for the type of pipe material specified herein. All costs incident to procedures and welder's qualification tests shall be assumed by the Contractor. Two copies of the qualification test report and certification with the welder's identification number, recommendation letter, etc. shall be delivered to the Architect before any welding commences.

## **PART 2 PRODUCTS**

### **2.01 COORDINATION OF PRODUCTS**

- A. The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that result from the use of any other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before shop drawing submittals and shall be clearly indicated on the shop drawings. Any related modifications shall be the responsibility of the contractor and shall be performed without any additional cost to the Contract.

### **2.02 DESCRIPTION**

- A. All components of the mechanical systems shall be new. All equipment and products for which independent laboratory testing and labeling is applicable and/or required shall bear the Underwriter's Laboratories, Inc. (UL) label.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. The Contractor shall provide and prepare all openings for ducts and other mechanical work as required in walls, roof, ceilings, etc.; he shall also do all painting as may be required. He shall coordinate the installation of all mechanical equipment in the exterior wall and roof.

- B. The mechanical plans do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, and to thereby provide an integrated, coordinated and satisfactorily operating installation.
- C. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accomplished by Shop Drawings of the space in question, including plans, sections, elevations, etc., sufficient to indicate that the revised layout will fit and allow for required access to clearance.
- D. The Contractor is responsible for the proper location and size of all slots, holes, or openings, in the building structure pertaining to his work, and for the correct location of sleeves, inserts, cores, etc.
- E. The Contractor shall so coordinate the work of the several various trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interference shall be handled by giving precedence to pipelines which require a stated grade for proper operation. For example, sewer lines and condensate piping shall take precedence over water lines in determination of elevations. Where there is interference between sewer lines and condensate lines, the sewer lines shall have precedence and provisions shall be made in the condensate lines for looping them around the sewer lines. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.
- F. Except where otherwise noted, all piping and ductwork in finished areas shall be installed in chases, furred spaces, above ceilings, etc. In all cases, pipes and ducts shall be installed as high as possible. Runs of piping shall be grouped whenever it is feasible to do so.
- G. The Electrical Contractor shall bring adequate power to and make final connections to all equipment furnished under this contract. All control wiring shall be by the Controls Contractor.
- H. Piping, equipment, or ductwork shall not be installed in electrical equipment rooms or elevator machine rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or ductwork, or locate equipment, with respect to switchboards, panelboards, power panels, motor control centers, or dry type transformers:
  - 1. Within 42" in front (and rear if free standing) of equipment; or
  - 2. Within 36" of sides of equipment,
  - 3. Clearances apply vertically from floor to structure.
  - 4. Provide access to equipment and apparatus requiring operation, service, or maintenance within the life of the system. Including, but not limited to, motors, valves, filters, dampers, shock absorbers, etc. Equipment located above lay-in type ceilings is considered accessible.

### **3.02 ELECTRICAL WORK**

- A. All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 26.

### **3.03 PROTECTION OF EQUIPMENT**

- A. Store equipment, including pipe and valves, off the ground and under cover. For storage outdoors, minimum 4-mil thick plastic shall be fitted to withstand splattering, ground water, precipitation, and wind.
- B. Protect air handling unit coils by use of protective sheet metal panels or plywood.
- C. Plug ends of pipe when work is stopped and close ends of ducts with plastic taped in place until work resumes.
- D. Damaged equipment shall be repaired or replaced at the option of the Engineer of Record.

### **3.04 PAINTING**

- A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.
- B. All un-insulated black ferrous metal items exposed to sight inside the building, such as equipment hangers and supports not provided with factory prime coat, shall be cleaned, and painted with one coat of rust inhibitor primer. In addition, such items in finished spaces shall also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.
- C. Black ferrous metal items exposed outside the building, such as un-insulated pipe and pipe supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of an asphalt base aluminum paint. Insulated pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.
- D. In lieu of painting hanger rods, cadmium plated, or galvanized rods may be furnished.
- E. No nameplates or equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation. Labels shall also be protected from becoming illegible due to weathering.
- F. Galvanizing broken during construction shall be re-coated with cold galvanizing compound.
- G. All ductwork, piping, insulation, conduit, or other appurtenances visible from finished spaces through grilles, diffusers or other such required openings shall be painted flat black.

### **3.05 PROTECTION OF EXISTING UTILITIES**

- A. The Contractor shall use extreme caution during excavation operations not to damage or otherwise interrupt the operations of existing utilities. The Contractor shall be responsible for the continuous operation of these lines and shall provide bypasses or install such shoring, bracing, or underpinning as may be required for proper protection.
- B. Schedule work so existing systems will not be interrupted when they are required for normal usage of the existing building. Obtain approval from the Architect at least 7 days prior to any interruption to service of utilities.

### **3.06 CUTTING AND PATCHING**

- A. The Contractor shall assume all cost of, and be responsible for, arranging for all cutting and patching required to complete the installation of his portion of the Work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure.
- B. All surfaces shall be patched to the condition of the adjacent surfaces.
- C. The Contractor shall make suitable provisions for adequately waterproofing at his floor penetrations of waterproof membrane floors. This shall include but not be limited to floor drains, open sight drains, hub drains, clean-outs, and sleeves for the various piping. This also applies to membrane roofing systems.

### **3.07 SLEEVES, FLOOR AND CEILING PLATES**

- A. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of all piping, duct, equipment and devices furnished under each section of the Specification.
- B. Cutting of openings and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around opening shall be left smooth and finished to match surrounding surface.
- C. Where pipes pass through floor slabs, sleeves shall be standard weight black steel pipe with top of sleeve 3" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flush with wall surfaces.
- D. Each pipe or duct passing through walls, floors, ceilings, or partitions shall be provided with sleeves having internal diameter one inch larger than the outside dimensions of insulated pipes or ducts.
- E. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors, and roofs are built.
- F. All penetrations through rated walls and floors shall be packed, sealed, and encapsulated per the applicable U.L. details(s).
- G. Sleeves through exterior wall shall be steel or cast-iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in an approved manner.
- H. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to 3/4" diameter and permitting lateral adjustment.

### **3.08 ESCUTCHEONS**

- A. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls, or partitions in finished areas.

- B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.
- C. Escutcheons shall be split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

### **3.09 CLEANING**

- A. Remove all stickers, rust, stains, labels, and temporary covers before final acceptance.
- B. The exterior surfaces of all mechanical equipment, piping, ducts, etc., shall be cleaned of all grease, oil, paint, dust, and other construction debris.
- C. Ducts, plenums, and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces.
- D. Bearings that require lubrication shall be lubricated in accordance with the manufacturer's recommendations. Provide written certification of lubrication.
- E. Equipment rooms shall be left broom clean.
- F. Any fans operated during construction shall have temporary filters, furnished by the General Contractor. Temporary filters shall be changed regularly to prevent contamination of the equipment and duct systems. Permanent filter shall be installed prior to final inspection.
- G. End of open ducts and pipes shall be covered during construction except when working directly on such one prohibits covering. Cover with minimum four (4) mil thick polyethylene taped, tied or wired in place.
- H. Clean and polish identification plates.

### **3.10 EQUIPMENT, MATERIALS AND BID BASIS**

- A. It is the intention of these Specifications to indicate a standard of quality for all material incorporated in this work. Manufacturer's names are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only these manufacturers' products shall be considered, and the Contractor's bid shall be based on their products. Other named manufacturers, although acceptable as manufacturers, must prove their product will perform satisfactorily and will meet space requirements, etc., and shall obtain pre-approval of their equipment, before submitting shop drawings, when their equipment achieves the required results in a manner different than that of the first named manufacturer. Where only one manufacturer is named, unless the Specifications state otherwise, manufacturers of similar quality products will be considered. Such unnamed manufacturer's products will, however, be considered as substitutions and shall not be used as a basis for bidding. In the event the Contractor wishes to submit substitutions to the Architect for review prior to bid, he shall furnish descriptive catalog material, text data, samples, etc., as well as any other pertinent data necessary to demonstrate that the proposed substitutions are acceptable equals to the specified product. No substitutions shall be made without the written consent of the Architect.
- B. The use of one named manufacturer named in the schedules and on the drawings is for guide purposes. The provisions of the above paragraph will govern in the selection of products to be used.

### **3.11 GUARANTEE**

- A. All systems and components shall be provided with a one-year guarantee from the time of final acceptance or beneficial occupancy (Coordinate with the Architect). The guarantee shall cover all materials and workmanship. During this guarantee period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring additions to the Contract.
- B. All air conditioning compressors shall be guaranteed for an additional four years. This additional guarantee shall be non-prorated on all parts, refrigerant, and labor.

### **3.12 RECORDS AND INSTRUCTIONS FOR OWNER**

- A. The Contractor shall accumulate during the job's progress the following data in triplicate form, prepared in neat brochures and/or packet folders and turned over to the Architect/Engineer for checking and subsequent delivery to the Owner. This data shall include the following:
  - 1. Provide all warranties and guarantees, manufacturer's directions and material covered by the Contractor.
  - 2. Provide approved fixture brochures, wiring diagrams, and control diagrams.
  - 3. Provide copies of all approved shop drawings.
  - 4. Three sets of operating instructions for heating and cooling and other mechanical systems shall be provided. Operating instructions shall also include recommended periodic maintenance and seasonal changeover procedures, and suggested procedures in operation of all systems in this particular building to promote energy conservation. These instructions must be written expressly for this project and shall refer to equipment, valves, etc., by mark number from project schedules. Operating instructions and procedures shall be submitted in draft form, for approval prior to final issue of complete brochures. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
  - 5. Any and all other data and/or drawings required during construction.
  - 6. Repair parts lists of all major items and equipment including name, address, and telephone number of local supplier or agent.
- B. All of the above data shall be submitted to the Architect/ Engineer for approval at such time as the Contractor submits his last pay request, but in no case, less than two weeks before the final inspection.
- C. The Contractor shall also give adequate operating instructions, during the adjustment and testing period, to the Owner's operating personnel in order to familiarize them with the proper care and operation of the equipment. The written operating instructions referred to in the paragraph above shall be used as a basis for this on-the-job training.
- D. A competent technician employed by the Temperature Control Subcontractor shall be required to instruct the Owner in proper operating procedures and shall explain the significance of the temperature control literature filed in the maintenance manual while the system is in continuous operation as specified above.

### **3.13 RECORD DRAWINGS**

- A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings" reflecting an accurate dimensional record of all buried or concealed work. In addition, the "Record Drawings" shall be marked to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect. The "Record Drawings" shall consist of a set of Mylar sepia prints of the Contract Drawings for this Division with the Engineer's seal and Engineer's firm name removed or blacked out. Prior to commencing work, the Contractor shall purchase from the Architect a set of Mylar sepia prints to be used for the "Record Drawings".
- B. Record dimensions shall clearly and accurately delineate the work as installed; locations shall be suitably identified by at least two (2) dimensions to permanent structures.
- C. The Contractor shall mark all "Record Drawings" on the front lower right-hand corner with a rubber stamp impression that states the following:

"RECORD DRAWINGS – "3/8" high letters to be used for recording field deviations, and "5/16" high letters to be used for dimensional data only.

### **3.14 INSTALLATION**

- A. All equipment shall be installed in strict conformance with manufacturer's recommendations, as specified herein. If any conflict arises between these instructions, notify the Engineer immediately for clarification.

### **3.15 ACCESS DOORS**

- A. Furnish and install access doors at each point required to provide access to concealed valves, fire dampers and other devices requiring operation, adjustment, or maintenance. Access doors shall be 16 gauge steel, prime coat finish, with mounting straps, concealed hinge and screwdriver locks, designed for the doors to open 180 degrees.
- B. Access doors installed in firewalls or partitions shall be UL Labeled to maintain the fire rating of the wall or partition.
- C. Access doors shall be provided under this section of the specifications and furnished to the General Contractor for installation.
- D. Access doors shall be MILCOR or approved equal in accordance with the following:

Style AT Door for Acoustical Tile Ceilings  
Style AP Door for Acoustical Plaster Ceilings  
Style K Door for Plastered Wall and Ceiling Surfaces  
Style DW Door for Drywall  
Style ATR for Suspended Drywall Ceilings  
Style M Door for Masonry, Ceramic Tile, Etc.  
Fire-Rated 1-1/2 hr. (B-label) Door where required.
- E. Size and type shall be as required for proper service and/or as may be directed by the Architect.
- F. Access door finish shall be chemically bonded to steel with a prime coat of baked on electrostatic powder. Color shall be as selected by Architect.

### **3.16 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS**

- A. All materials and adhesives used throughout the project for the installation of mechanical and electrical systems including the jackets or coverings of any kind, or for piping or conduit system components, shall have a flame-spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame-spread rating not over 25 and a smoke developed rating not higher than 50. (Note: Materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard.)
- B. "Flame-Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials," NFPA No. 255, ASTM E84, Underwriter's Laboratories, Inc., Standard". Such materials are listed in the Underwriters' Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)".

### **3.17 EQUIPMENT FURNISHED BY OWNER**

- A. The contractor shall unload, uncrate, assemble, and connect any and all equipment shown on the drawings or called out in the specifications to be furnished by the Owner for installation by the Contractor.
- B. The Contractor shall take full charge of such equipment from the time the items are delivered to the job, set in place, connected, tested, adjusted, and placed into operation.

### **3.18 HAZARDOUS MATERIALS**

- A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.
- B. Handling of any hazardous material is not covered in specification Division 23. Any requirements for such are beyond the scope of this contract and shall be done only by those persons contracted to do so.

**END OF SECTION**



## **SECTION 230600**

### **HVAC SCHEDULE OF SUBMITTAL DATA**

#### **PART 1 GENERAL**

##### **1.01 RELATED DOCUMENTS**

- A. The requirements of the General Conditions, Supplementary Conditions, and Section 230500, "HVAC General", apply to all work herein.

##### **1.02 QUALITY ASSURANCE**

- A. Shop drawings or fully descriptive catalog data shall be submitted by the Contractor for all items of material and equipment furnished and installed under this contract. The Contractor shall submit to the Architect an electronic, Adobe compatible, Portable Document Format (.PDF) copy of all such Shop Drawings or catalog data.
- B. Before submitting Shop Drawings to the Architect for review, the Contractor shall examine them and satisfy himself that they are correctly representative of the material or equipment to which they pertain. The Contractor shall so note these Drawings before submitting them. The Contractor's review of the Shop Drawings is not intended to take the place of the official review by the Architect. Any Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.
- C. The review of Shop Drawings or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from the Plans and Specification unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect. Also, it shall not relieve him from responsibility for error of any kind in Shop Drawings. When the contractor does call such deviations to the attention of the Architect, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.
- D. Verification and assignment of dimensions, quantities, and construction means, methods, sequences or procedures, the correctness of which is set forth in the Contract Documents or submittal, shall be the sole responsibility of the Contractor.
- E. Reproduction of design documents in any portion for use in a submittal is not acceptable.

#### **PART 2 PRODUCTS**

##### **2.01 GENERAL**

- A. All products shall be new and bear all labels which are identified by the applicable specification section and Contract Documents.

## PART 3 EXECUTION

### 3.01 SUBMITTAL DATA

#### A. General

1. The submittal data to be furnished for this project shall comply with the Specifications and Contract Documents in their entirety. Any submittals herein scheduled are as a minimum only and shall not be construed to limit the submittal data required within the individual Sections of these Specifications.
2. Shop Drawings will be returned unchecked unless the following information is included: Reference to all pertinent data in the Specifications or on the Drawings, such as sound power levels of motor driven equipment where called for in the specifications, electrical characteristics and horse power, capacities, construction material of equipment, UL labels where required, accessories specified, manufacturer, make and model number, weights where specified, starters where required by Division 23, size and characteristics of the equipment, name of the project and a space large enough to accept an approval stamp. The data submitted shall reflect the actual equipment performance under the specified conditions and shall not be a copy of the scheduled data on the drawings. All submitted equipment must be identified on Shop Drawings with the same "Mark Numbers" as identified on Drawings or in Specifications. All pertinent data such as accessories shall also be marked. Any deviation from any part of the Contract Documents shall be clearly and completely highlighted.
3. The Contractor shall submit HVAC data in electronic, Adobe compatible, Portable Document Format (.PDF). Each submittal shall include an index of submitted specification sections. A separate identification page for each specification section with included materials list shall precede the associated submittal data. Each identification page must provide blank space for the engineer's review stamp and associated comments. **FAILURE to provide PROPERLY IDENTIFIED SUBMITTALS will result in the AUTOMATIC REJECTION of the submittal data with NO EXCEPTION.**

B. All submittals are to be submitted for review within 30 days after the Contract is awarded. Only Automatic Temperature Controls, ductwork and piping fabrication drawings are exceptions.

C. By providing submittals, the Contractor is stating that all electrical characteristics of the mechanical equipment to be supplied have been fully coordinated with the electrical contractor. Any changes to the electrical requirements from the Contract Documents resulting from alternate equipment being submitted shall be performed without any additions to the Contract Sum. Submit attachment and fastening methods for piping and equipment to the Structural Engineer for approval. Shop Drawings shall be submitted for each of the following:

Dampers  
Disconnect Switches  
Ductwork Accessories and Details  
Fans  
Flexible Connectors  
Grilles, Registers and Diffusers  
Motor Starters  
Pipe Hangers and Supports  
Vibration Isolators

### **3.02 OPERATING AND MAINTENANCE INSTRUCTIONS**

#### **A. Description**

1. Complete operating and maintenance instructions shall be provided to the Owner. Four (4) separate copies (three for the owner, one for the Architect) shall be provided, and each copy shall be bound in a separate 3-ring, loose leaf notebook. Operating instructions shall be provided for each system, and shall include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instruction shall be included for each piece of equipment. Manufacturers' Standard literature is acceptable for each piece of equipment. However, the contractor shall prepare a SYSTEM O&M manual including overall system descriptions, operating and energy conservation techniques.
2. A system wiring and control diagram shall be included in the operating and maintenance instruction.
3. Prior to final acceptance or beneficial occupancy, provide the services of a competent representative to instruct the Owner in the operation of all systems. This instruction shall include a complete walk-through of all equipment and systems. The Architect reserves the right to attend any such meeting and shall be duly notified.

### **3.03 OTHER SUBMITTALS – CLOSEOUT DOCUMENTS**

- #### **A. Submit two copies of the following prior to occupancy of the project by the Owner. See contract close-out specification by Division 01.**
1. As built drawings for Ductwork.
  2. Request for final payment.
  3. Letter or "Release of Liens".
  4. Letter of "Guarantee".
  5. Consent of Surety Company to final payment.
  6. Power of Attorney.
  9. Manufacturer's representative shall certify that HVAC equipment is installed in accordance with the manufacturer's recommendations.
  10. Contractor's Affidavit of Payment of Debts and Claims.

**END OF SECTION**

## **SECTION 233113**

### **HVAC DUCTWORK & ACCESSORIES**

#### **PART 1 GENERAL**

##### **1.01 DESCRIPTION**

- A. All work specified in this Section is subject to the provisions of Section 230500.
- B. Ductwork shall be provided to meet the minimum capacities indicated, shall meet all constraints of construction, and shall comply with all Specification Sections.
- C. No ductwork shall be fabricated until fabrication shop drawings have been prepared, submitted, and reviewed.

#### **PART 2 PRODUCTS**

##### **2.01 DUCTWORK - GENERAL**

- A. SMACNA Standards indicated shall mean standard published by the Sheet Metal and Air Conditioning Contractor's National Association, Inc. Ductwork shall be constructed in complete conformance with the latest edition of the SMACNA Manual. Ductwork shall be round, oval, or rectangular as indicated on drawings. All duct dimensions indicated are net clear inside dimensions. Duct classification shall be as follows:
  - 1. From terminal units to diffusers, toilet exhaust ductwork: Low Pressure - 1" static pressure, Class B seals.
- B. Ductwork – Rectangular Low Pressure: Provide all ductwork as indicated in these documents for each and every air conditioning system. This includes all mains, all branches, related fittings and accessories. All duct and fittings shall be manufactured by the same company. Ductwork shall be constructed of G90 galvanized sheet steel, unless otherwise specified herein. Low pressure duct including fittings shall be constructed of steel sheet metal. All duct sheet metal gauges for the various duct sizes shall be as listed in the latest edition of SMACNA.
- C. Elbows: The construction of radius type elbows in rectangular ductwork shall maintain a centerline radius of 1-1/2 times the cross-sectional dimension of the duct in the horizontal plane of the duct turn. Ductwork shall be constructed of G90 galvanized sheet steel, unless otherwise specified herein. Where radius turns are prohibited, hard 90 degree elbows with turning vanes may be installed. All duct fittings (tees, elbows, etc.) metal gauges for the various fittings shall be as listed in the latest edition of SMACNA. Ductwork fabrication shop drawings shall including drawings of fittings as a part of the shop drawing submittal.
- D. Turning Vanes: Turning vanes shall be installed in all 90 degree square and rectangular elbows and at other locations as shown. Vanes shall also be installed on all turns greater than 40 degrees in all rectangular supply, return, outside air and exhaust ductwork. All turning vanes shall be constructed of galvanized steel, two metal gauges heavier than that of the adjacent ductwork. All vanes shall have minimum 4" radius of the curvature, a maximum 4" spacing and no less than 3 vanes in each installation. The turning vanes shall be double thickness type, with vanes secured to the runners and runners secured to the duct. Elbows in round ductwork and other radius elbows shall have an inside radius equal to the diameter of the duct. All duct specialties, i.e., turning vanes, shall be as listed in the latest edition of SMACNA.

- E. Ductwork – Round Low Pressure; Low pressure round ducts up to and including 12" in diameter shall be longitudinal lock seam construction. Low pressure round ducts larger than 12" and all medium pressure round ducts shall be spiral lock seam construction. All duct sheet metal gauges for the various duct sizes shall be as listed in the latest edition of SMACNA.
1. Girth joints in ducts up to and including 12" shall be beaded crimp type and each joint shall be fastened with sheet metal screws, equally spaced, not more than 8" on centers and with a minimum of 3 screws in each joint. The beaded-crimp joint shall provide at least a 1" lap to accommodate the sheet metal screws.
  2. Girth joints in ducts larger than 12" shall be the beaded sleeve type. The beaded sleeve joints shall be fabricated of the same gauge galvanized sheet steel and the duct shall be a minimum of 3 screws in each section.
- F. Hangers and Supports: Duct hangers and supports shall be in accordance with Section IV (pages 4-1 through 4-13) of the referenced SMACNA Standard, except:
1. Hangers shall be spaced not over 8'-0" on centers.
  2. For rectangular ducts with longest dimensions up through 60", hangers shall be the galvanized steel strap type; with the longest dimension 61" and larger, hangers shall be trapeze type constructed of galvanized steel angles with round hanger rods. Sizes for strap hangers and trapeze angles and rods shall be based on duct size as scheduled in the SMACNA Standard, Table 4-1 (page 4-8) for strap hangers and Table 4-3 (page 4-10) for trapeze hangers.
  3. For round ducts, hangers shall be galvanized steel strap hangers. Sizes and number of strap hangers shall be based on duct size as scheduled in the SMACNA Standard, Table 4-2 (page 4-9). For duct sizes requiring 2 hangers, the hanger supports shall be minimum 3/8" round steel hanger rods.

## **2.02 MANUAL DAMPERS AND DAMPER HARDWARE**

- A. Volume Control Dampers:
1. Dampers shall be single blade butterfly type in ducts up to and including 12" x 12" size; for ducts larger than 12" x 12", in either or both dimensions, the dampers shall be the multi-blade type. All dampers in O.A. ductwork shall shut tightly and have vinyl edge seals.
  2. Single blade butterfly dampers shall be constructed of not less than 16 gauge galvanized steel blade mounted in a galvanized steel frame. For rectangular dampers, the top and bottom edges of the blade shall be crimped to stiffen the blade. Damper shall be provided with an extended rod to permit installation of a damper regulator.
  3. Dampers larger than 12" in either direction shall be multi-blade dampers and shall be the opposed blade type, constructed of not less than 16 gauge galvanized steel blade mounted in galvanized steel channel frame. Blade spacing shall not exceed 6" and the top and bottom edges of the blade shall be crimped to stiffen the blades. Damper blades shall be interconnected by rods and linkages to provide simultaneous operation of all blades. Damper shall be provided with an extended rod to permit installation of a damper regulator.

4. When dampers occur above other than lay-in ceilings, provide a worm gear drive type damper equal to Young Regulator model 1200 (5020-1200 round duct, 820-1200 rectangular duct). These duct mounted balance dampers shall include a remote operator equal to Young Regulator flex shaft assembly model 301-FS with a primed cover plate. Cover plate shall be field painted to match the surface on which it is installed.
- A. Hardware for Manual Dampers:
1. Splitter damper hardware - When neither dimension of a damper exceeds 18", the damper shall be provided with a ball joint bracket attached to the outside of the duct. The bracket shall have a setscrew for securing damper rod in position. The damper operating rod shall be not less than 1/4" diameter steel rod and shall be secured to the damper blade with a clip. When either dimension of a damper exceeds 18", the damper shall be provided with 2 ball joint brackets and rods. The rods shall be located at quarter points on the damper.
  2. Duct mounted regulators with operating handle and locking quadrant shall be provided on manual volume control dampers.
  3. Damper hardware shall be Ventfabrics, Young Regulator or Duro-Dyne provided the equipment meets or exceeds the Contract Documents.
- D. Dampers shall be Ruskin or approved equal by Air Balance, Price, or American Warming and Ventilating.

### **2.03 FLEXIBLE DUCTWORK**

- A. Flexible ductwork shall be Class 1, UL 181-air duct with an aluminized mylar or polyester inner liner laminated to a corrosion resistant steel wire helix. Aluminum helix is not acceptable. Flexible ductwork shall comply with NFPA 90A and 90B.
- B. A 1" thick, one (1) pound density fiberglass insulation and vinyl outer jacket shall cover the wire helix.
- C. The maximum allowable length of low-pressure flexible ductwork shall be 4'-0" and shall be limited to short run-outs and end runs connected to round neck ceiling supply diffusers. Provide a spin-in fitting with integral volume damper at all flexible run-out connections in low-pressure ductwork.
- D. The maximum allowable length of medium pressure flexible ductwork shall be 1'-0" and shall be limited to short runouts connecting FPB and VAV units to medium pressure sheet metal ductwork.
- E. Flexible ductwork shall be designed for pressures up to 4" W.G. for low-pressure ductwork and 10" W.G. for medium pressure ductwork.
- F. Flexible ductwork insulation shall be fiberglass and have a minimum insulation R-value of 6.0.
- G. Low pressure and medium pressure flexible ductwork shall be equal to FlexMaster Model 5B, Thermaflex Model M-KE, or Wiremold Type WGC.

## **2.04 FLEXIBLE DUCT CONNECTIONS**

- A. Flexible duct connections shall be non-combustible, installed at all belt-driven equipment and where shown. Material shall be glass fabric double coated with neoprene (30 Oz. per square yard minimum) and shall be Vent Fabrics, Duro-Dyne or Young Regulator, provided the equipment meets or exceeds the Contract Documents. Provide duct supports on each side of flexible connections.

## **2.05 FIRE DAMPERS**

- A. Fire dampers (FD) shall be provided at all penetrations through fire rated walls and partitions. Fire dampers shall be UL labeled and shall be Type B (blades out of the air stream) or Type C (round or oval duct). Damper shall be Ruskin Model 1BD2 or approved equal.
  - 1. Hat channel frame shall be 16 gauge minimum galvanized steel with tabbed corners for reinforcement. Bearings shall be stainless steel sleeve. Blades shall be airfoil shaped double skin construction with 14 gauge equivalent thickness. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked in blade edge (adhesive or clip fastened seals not acceptable) and shall withstand 450 F. Jamb seals shall be flexible metal compression type.
  - 2. Each damper shall be 1-1/2 hour rated under UL555 and shall further be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems. Leakage rating under UL555S shall be Class 1 (4-cfm/sq. ft. at 1" w.g. and 8" cfm/sq.
  - 3. Dampers shall operate (open and close) under HVAC system operating conditions with pressures of at least 8" w.g. in the closed position and 4000 fpm air velocity in the open position.
  - 4. In addition to the leakage ratings, the dampers and their actuators shall be qualified as a single entity under UL555S to 350 F elevated temperature. Actuators shall be installed at time of damper fabrication. Dampers shall be equipped with factory supplied caulked sleeve. All wiring or piping material required to interconnect the actuator with detection and/or alarm or other systems shall be furnished by others. Damper shall be Model FSD60 or approved equal.
- B. Acceptable manufacturers of fire dampers are Ruskin, or Greenheck provided the equipment meets or exceeds the requirements of the Contract Documents.

## **2.06 ACCESS DOORS**

- A. Provide a duct access door at each fire damper where required for access. Access doors 18" x 18" and larger shall have a continuous hinge on one side with latch on the other side. Access door shall be designed for five (5) times the pressure of the duct in which it is mounted. Access doors shall be of sufficient size to provide access to the dampers for resetting or replacing thermal links. Access doors shall be double metal faced, internally insulated same as duct, and provided for gasket seal. Access doors downstream of fire dampers in medium pressure ductwork shall be the implosion type.
- B. Coordinate the location of access doors above inaccessible ceilings with the Architect.
- C. Access doors shall be equal to Ruskin Model "ADR16" for round duct and Model "ADC22" for square ductwork.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install all ductwork and accessories as shown and in accordance with applicable SMACNA Standards.
- B. All joints in ductwork shall be sealed with a fire-retardant duct sealant. Tape is not acceptable.
- C. Soundproof Construction for Duct Penetrations is required for openings between ductwork and interior spaces. The method for soundproofing shall be as follows:
  - 1. Fill openings with fibrous glass blanket or board for full depth of penetration.
  - 2. Caulk each side of opening with non-hardening, non-aging caulking compound equal to Johns-Manville "Duxeal".
  - 3. Penetrations through fire-rated partitions and shafts shall be sealed with Dow-Corning RTV fire-retardant foam.
- D. Duct system sound levels shall be maintained at such as level as to not exceed a maximum of NC 35 for all spaces. Duct fabrication and installation shall be altered if noise levels are exceeded at no cost to the Contract.
- E. Unavoidable obstruction: Where structural elements or pipes must pass through a duct, provide two-piece streamliners, and enlarge duct to compensate for net loss of area. Round pipes and rods smaller than three (3) inches need not have special treatment. Note: This provision will not be used to justify obstructions which can be avoided.

### 3.03 PRESSURE TESTING OF DUCTWORK

- A. Testing Procedures: All pressure testing of ductwork shall be performed prior to the installation of external insulation. Duct sealant shall be applied within the factory recommended temperature range and fully cured prior to any tests.
- B. The contractor shall determine pressure range and capacity of the test apparatus to insure the pressure is suitable for the ductwork being tested.
- C. Allowable leakage chart:

| System Types |  | Minimum Test Press | Max Allowable Leakage |
|--------------|--|--------------------|-----------------------|
| 1.           | Small exhaust/supply fans, fractional HP fan systems | 0.5" W.C.          | 2%                    |



D. Report of Test Data:

1. Once the testing of all duct systems has been completed, this contractor shall provide a report of leakage results that will include the following:
  - a. The project name and location
  - b. Date of test
  - c. Name of person making test including the name of Architect, Engineers, Contractor, or witness to said test.
  - d. Description of test including the sealing clarification and duct classification
  - e. The design and actual test static pressure
  - f. The design and actual leakage rate
  - g. Duct test to conclude if test passed or failed

- E. All pressure testing of ductwork shall be in accordance with the Associated Air Balance Council (AABC) standards for Total System Balance, Latest Edition.

**END OF SECTION**

## **SECTION 233400**

### **HVAC FANS**

#### **PART 1 GENERAL**

##### **1.01 RELATED DOCUMENTS**

- A. Requirements of the General Conditions, Supplementary Conditions, and Section 230500, "HVAC General" apply to all work specified in this Section.
- B. Refer to Specification Section 230600 titled "HVAC Schedule of Submittal Data" for the submittal and approval requirements regarding fan systems.
- C. See other sections of these specifications that may specify accessories or features.
- D. Refer to the schedules on the drawings where equipment capacities are not included in this section.
- E. Review other sections of the specifications and the plans for services required to each piece of mechanical equipment. Any required accessories, appurtenances, or service omitted from the plans or specifications that are not called to the attention of the Architect at least 72 hours before bidding and corrected by addendum shall be provided as though shown.
- F. V-belt drives shall be designed for not less than 150% of connected driving capacity and motor sheaves shall be adjustable to provide not less than 20% speed variation. Sheaves shall be selected to drive the fan at a speed to produce the scheduled capacity indicated on the drawings when set at the approximate midpoint of the sheave adjustment. Motors with V-belt drives shall be provided with adjustable bases.
- G. Fan motor enclosure shall be the drip-proof type unless specifically indicated otherwise.
- H. Roof-mounted fans shall be waterproof design so that water cannot enter the building through the fan housing, whether or not the fan is operating.
- I. Belt driven power assemblies shall be mounted on vibration isolators.
- J. Centrifugal fan wheel shall be statically and dynamically balanced.

##### **1.02 COORDINATION**

- A. Motors required in connection with equipment shall be of sufficient size and speed for duty to be performed, not exceeding their full-rated load when driven equipment is operated at specified capacity under most severe conditions likely to be encountered.
- B. Belt drives shall be adjustable "V" belt type. Selection shall be based on 150% of the motor horsepower. Selection shall be factory-set so that specified capacity is at midpoint setting, allowing 20% overall speed adjustment. Motors shall be selected on 110% of the brake horsepower required with a service factor of 1. Motors and/or drives shall be changed if required to delivery specified CFM should static pressure differ from that specified.
- C. All exposed rotating machinery shall be equipped with guards.
- D. Submit all equipment for approval.

### **1.03 SUBMITTALS**

- A. In accordance with Section 230600, submittals shall be furnished for the following:
  - 1. All fan sections, including motors and drives. All centrifugal fans, including motors and drives.
  - 2. Ceiling and inline cabinet fans
- B. Complete maintenance and operating manuals.
- C. Sound power levels for all fans (Db and/or sone levels).
- D. Provide fan curves for each fan showing CFM versus static pressure, horsepower, and fan efficiency at the specified design point.

### **1.04 APPLICABLE STANDARDS:**

- A. All fans and power exhausters shall be listed in the current edition of AMCA and shall bear the AMCA seal.
- B. Fan performance criteria:
  - 1. Fans shall be scheduled on plans indicating manufacturer's name and model number, CFM, static pressure, sones, drive, horsepower, and voltage. Fan motors  $\frac{1}{2}$  horsepower and larger shall be sized based on full design CFM at 115% design static pressure.

## **PART 2 PRODUCTS**

### **2.01 COORDINATION**

- A. Units of one manufacturer have been used as the basis of design. Any modifications to electrical connections, building structure, etc., that result from the use of another manufacturer shall be coordinated with all other trades. This coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the contract.

### **2.02 FANS**

- A. Furnish and install all supply and exhaust fans as scheduled on drawings. Fans shall be of the type size and capacity as scheduled and shall be furnished as hereinafter specified and scheduled.
- B. All fans shall have been statically and dynamically balanced prior to leaving the factory. Fans found vibrating noticeable in the field, due to damage in shipment, improper handling, etc., shall be removed and replaced at no additional cost to the Owner.

### **2.03 DESCRIPTION:**

- A. Ceiling and Inline Cabinet Fans:
  - 1. Fans as indicated on drawings shall have acoustically insulated housings and shall not exceed sound level ratings shown.

2. Fans shall bear the AMCA Certified Ratings Seal and UL Label.
3. Integral back-draft damper shall be chatter-proof. Fans shall have true centrifugal wheels.
4. Face grille shall be aerodynamic white egg crate design and provide 85% free area.
5. Manufacturers shall submit vibration amplitudes and magnetic motor hum in decibels.
6. Fans shall be provided with cord, plug, and receptacle inside the housing. Entire fan, motor and wheel assembly shall be removable without disturbing the housing. Fan motors shall be suitably grounded and mounted on vibration isolators.
7. Fans shall be Greenheck, Cook or approved equal by Engineer.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. The Contractor, prior to installing any equipment, shall examine the conditions under which the equipment is to be installed, and shall notify the Architect of conditions detrimental to the proper installation of the equipment.
- B. All equipment shall be installed in accordance with the latest manufacturer's written instructions, and in accordance with governing codes and recognized industry standards and practices.
- C. Coordinate all work with other trades as necessary for proper interfacing.
- D. All proper equipment shall be protected from any form of damage. Any damaged equipment shall be replaced without additional cost.

#### **3.02 START-UP**

- A. An authorized representative of the equipment manufacturer shall make the initial start-up. The balancing contractor shall be responsible for final verification and reporting of all airflows.

#### **3.03 ADJUSTMENT**

- A. The equipment shall be tested and adjusted to ensure the scheduled capacities as indicated. All controls shall be tested and adjusted.

**END OF SECTION**

## **SECTION 238336**

### **ELECTRIC WALL HEATERS**

#### **PART 1 GENERAL**

##### **1.01 DESCRIPTION**

- A. All work specified in this Section is subject to the provisions of Section 230500, "HVAC General".
- B. All electric heating equipment shall be UL labeled.
- C. Refer to Division 26 for electrical characteristics and connections to all electrical heating equipment. Coordinate all electrical equipment with the Electrical Documents.
- D. Electric heaters shall be provided to meet the minimum capacities scheduled at the indicated conditions shall meet all constraints of construction.

##### **1.02 COORDINATION**

- A. Electric heaters of specific manufacturers have been used as the basis of design. Any modifications to controls, electrical connections, structural supports, etc., that result from the use of equipment by any other manufacturer shall be coordinated with all other trades; this coordination shall occur before delivery of the equipment from the manufacturer. Any modifications shall be performed without incurring any additional cost to the Owner.

##### **1.03 ACCEPTABLE MANUFACTURERS**

- A. Electric wall heaters shall be as manufactured by Markel, Berko, or QMark.

#### **PART 2 PRODUCTS**

##### **2.01 DESCRIPTION**

- A. Electric wall heater shall be heavy-duty, architectural surface mounted forced-air type, of the wattage, voltage and phase indicated on the drawings. The heater shall so be designed to provide an even distribution of heated air to the space by drawing return air in the periphery of the heater across the element which shall then be discharged from the center section of the heater by means of an electric motor and axial flow fan blade.
- B. Heater front shall withstand with less than 1/16" permanent distortion with 10.8 ft. lbs. (324 pounds) impact and 400 lbs. static force applied to an 8 sq. in. area at center grille location. Front assembly shall be attached to the chassis by hidden tamper-resistant screws. All other parts shall be 16-gauge steel zinc coated both sides finished in a high gloss baked enamel.
- C. Motor shall be a permanently lubricated unit bearing, totally enclosed, shaded pole type with impedance protection. Motors shall operate at no more than 1400 RPM and shall be the same voltage as the heater. A protective shield shall surround the motor to separate return air from heated air.

- D. Heater shall be equipped with a “zero voltage reset” thermal overload which disconnects elements and motor in the event normal operating temperatures are exceeded. For safety, if opened due to abnormal temperatures, thermal overload shall remain open until manually reset by turning heater off for five minutes. Automatic reset thermal overloads which allow the element to continue to cycle under abnormal conditions will not be accepted.
- E. Heater shall be Underwriters’ Laboratories listed. Heaters shall conform to Underwriters’ Laboratories, Inc. standard 1025. Heaters not conforming to these standards will not be acceptable.
- F. Heater shall be controlled by integrally mounted thermostat. Thermostat shall be heavy-duty, hydraulic type with a range of 40°F to 80°F and with remote sensing bulb placed in the return air. Thermostats shall be electrically rated at least 125% of heater rating. Thermostat shall also act as a disconnect by breaking all ungrounded conductors in the OFF position. Thermostat control knob shall be covered by a 16-gallon tamper-proof access plate to prevent adjustment by unauthorized personnel.
- G. Heater shall be equipped with built-in circuit breaker to allow the heater to be supplied from feeder taps. A separate switch providing a positive off for control circuits shall be included where required. Circuit breaker and control switch shall be arranged so that all line side conductors will be separately enclosed when heater front is removed for servicing so that no current carrying parts are accessible without the use of additional tools.

### **PART 3 EXECUTION:**

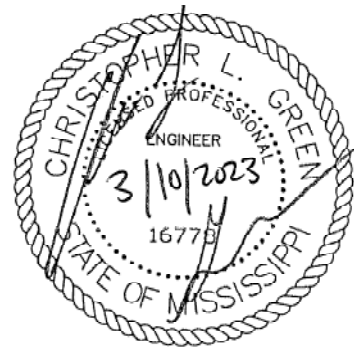
#### **3.01 INSTALLATION**

- A. Electric heaters shall be installed in complete conformance with the manufacturer's recommendations and the Contract Documents.

**END OF SECTION**

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**SECTION 260511**  
**ELECTRICAL GENERAL AND WORK IN EXISTING FACILITIES**

**PART 1 – GENERAL**

**1.1 GENERAL**

- A. All work shall conform to the latest editions of the National Electrical Code (NEC) [National Fire Protection Association (NFPA) 70], the Standard for Electrical Safety in the Workplace (NFPA 70E), the Life-Safety Code (NFPA 101), the International Building Code, the Americans with Disabilities Act, and all other applicable federal, state, and local codes and regulations.
- B. All work shall be performed in strict compliance with NFPA 70E. Submission of bid shall stand as an agreement by the Contractor to indemnify and hold harmless the Engineer and Owner from all liability related to damage and/or injury to personnel and equipment during the installation of the project.
- C. The contract documents are schematic in nature and are intended to convey the intent of the electrical work to be performed on this project. Provide all material, labor, equipment, etc., necessary to provide complete and operable electrical systems.
- D. The General Conditions, Supplementary Conditions, General Requirements, Information to Bidders, and all other parts of this set of Contract Documents are hereby adopted and are applicable to the Electrical Contractor.

**1.2 SCOPE OF WORK**

- A. Visit site prior to bid. Devise a plan for installation of complete and operable electrical systems meeting the requirements and intent of the Contract Documents. Submission of Bid stands as evidence that the Contractor accepts the Contract Documents as sufficient and complete for the work to be performed. Notify the engineer at least two weeks prior to bid of any discrepancies between the Contract Documents and actual field conditions. No change orders will be granted due to existing conditions that could have been observed during a site visit.
- B. Provide temporary power and lighting during construction. Coordinate with the General Contractor for the exact requirements.
- C. Electrical switchgear and panelboard layouts are based on sizes of Square D equipment. Equipment manufactured by General Electric, Siemens, and Cutler Hammer are equally acceptable. However, the Electrical Contractor is responsible for selecting and furnishing gear that will fit in the spaces provided and shall be responsible for arranging the gear to meet the required code clearances. Regardless of the manufacturer, the Electrical Contractor shall provide a drawn-to-scale electrical layout with the equipment brochures for all rooms in which panelboards, motor control centers, switchboards, or switchgear are placed. The drawings shall include the work of all other trades including mechanical system piping, ductwork, sprinkler piping, etc. No conduits shall be installed until layouts have been approved.
- D. Locate junction boxes, pull boxes, disconnects, and other equipment requiring access in such a manner that they are accessible at the end of construction. Notify the Architect where it is impossible to plan conduit routing or equipment placement in such a manner, and provide the necessary access panels in the ceiling or wall as required. The access panel type and style shall be subject to the Architect's approval. Employ a painter to provide the appropriate coatings as directed by the Architect.



- E. Relocate, or recircuit, all electrical equipment, conduit, and circuitry conflicting with or obstructing work on this project. Where the electrical systems are owned by other entities, pay them to relocate, or recircuit, their facilities.
- F. Arrange for connection of service to all electrical systems by the appropriate utility company. Coordinate completely with all utility company requirements even if they are different than the contract documents. If utility company requirements are different from the contract documents, notify the engineer at least ten days prior to bid. Pay all utility company charges necessary for installation and connection of service. **No change orders will be granted for utility company connection fees.**
- G. Provide all necessary equipment, raceway, circuitry, fittings, lugs, terminations, labor, etc. and connect to all equipment and appliances requiring electrical connections furnished herein, by the Owner, or by other Contractors. Prior to ordering electrical equipment and roughing in for equipment furnished by the Owner or other Contractors, verify all connection types, connection locations, connection heights, voltages, number of phases, conductor sizes, disconnecting means, breaker sizes, etc. Furnish the proper electrical equipment for the equipment actually being supplied.

#### 1.3 WORK IN EXISTING FACILITIES

- A. All work shall be scheduled and coordinated through the General Contractor with the Owner. Provide necessary costs for all work during both normal and premium work hours in bid.
- B. Provide continuous uninterrupted power to all existing facilities to remain during the entire construction process. Any required power outages must be scheduled and approved by the Owner in writing at least three days prior to the outage.

#### 1.4 SCOPE OF WORK IN EXISTING FACILITIES

- A. Prior to beginning work, survey existing electrical systems. Document, in writing, signed by the Owner any portions of existing systems that are not operating properly before construction begins. Any electrical systems found inoperable at the end of the construction process that has not been so documented shall be repaired at the end of construction.
- B. Remove electrical equipment in areas being demolished and electrical equipment feeding other equipment being demolished. Remove raceways and circuitry back to the panel of origination. Where raceways are installed in inaccessible areas, remove conductors back to the panel of origination. Where circuits are not being completely demolished, remove conductors back to a junction box or other connection point outside of the renovated area and recircuit existing electrical equipment that is to remain as required. Where necessary, completely refeed existing electrical equipment that is to remain. It is the intent of this specification that all existing equipment to remain be left completely operable at the end of the construction process.
- C. Survey existing panel board circuitry and provide new typewritten directories giving complete as-built circuitry information for all panelboards affected by the construction on this project.
- D. Where new circuit breakers are installed in existing equipment, the new circuit breakers shall be manufactured for installation in that equipment. The Amperes Interrupting Current (AIC) Rating shall equal the AIC rating of the existing equipment. A breaker with a lower AIC rating may be used if the contractor provides calculations showing that the breaker rating is sufficient to handle the available fault current. Submit these calculations for approval prior to ordering the breaker. An AIC rating on an existing breaker in the panelboard or switchboard does not demonstrate sufficient proof that the available fault current is less than that breaker's AIC rating.

## 1.5 SUBMITTALS AND SHOP DRAWINGS

- A. Within 30 days after award of Contract and prior to beginning work, provide six bound copies of manufacturers' cut sheets containing information concerning each article of electrical equipment to be furnished on this project. These cut sheets shall contain sufficient information to prove compliance with the contract documents. Information addressing the requirements of the contract documents shall be highlighted. Each bound set shall bear the stamp of the Electrical Contractor as well as the General Contractor.
- B. Within 30 days after award of Contract and prior to beginning work, provide six sets of full size shop drawings showing exact equipment locations with all equipment drawn to scale. Show all raceways with their junction boxes and pull boxes. Show all connection types, locations, and heights to equipment. Provide mounting and support details for all raceways and equipment. Coordinate with all other trades to ensure that there are no conflicts between systems. Each set of shop drawings shall bear the stamp of the Electrical Contractor, the General Contractor, and all Project Sub-Contractors. Failure to submit these Shop Drawings will render the Electrical Contractor responsible for resolving all conflicts between trades at his own expense.
- C. Submittals and Shop Drawings are reviewed to determine quality of materials. Approval of submittals and shop drawings does not relieve the Contractor of meeting the requirements and intent of the Contract Documents.
- D. Outlet, light fixture, and device locations are shown in their approximate locations on the drawings. Coordinate with Architectural drawings to get final locations. Mount all electrical outlets shown at counters such that the bottom of the box is two inches above the backsplash or six inches above a counter with no backsplash. The Owner reserves the right to relocate outlets, light fixtures, and devices a distance not to exceed twenty feet prior to the installation of outlet boxes.

## PART 2 - PRODUCTS

- 2.1 All electrical equipment and materials shall be new. All equipment and materials shall be stored on the job site in weatherproof enclosures. Electronic equipment shall be stored in facilities where the temperature and humidity are controlled. In addition, comply completely with all manufacturers' requirements for storage and handling.
- 2.2 All equipment shall be UL listed for the application in which it is used and shall be labeled as evidence of its UL listing.
- 2.3 Each circuit breaker supplying a multiwire branch circuit shall be installed with a manufacturer supplied handle tie to simultaneously disconnect all ungrounded conductors. Each multi-wire branch circuit shall comply with NEC article 210.4.
- 2.4 Products shall be selected to maintain or improve the aesthetics of the facility. Gain approval of the Architect or Engineer prior to ordering or installing any electrical equipment or raceway.

## PART 3 – EXECUTION

### 3.1 WORKMANSHIP

All work shall be performed with an emphasis on neatness. The Engineer, Architect, and Owner retain the right to reject work that is, in their judgment, unsatisfactory.

### 3.2 EXPERIENCE

The Contractor shall have completed at least two jobs of similar size and scope within the past five years. The Engineer reserves the right to reject Contractors based on their inability to submit evidence of their experience, or based on experience with the Contractor on previous projects.

### 3.3 PERMITS

Obtain and pay for all permits required for work.

### 3.4 FIREPROOFING

- A. Fireproof all penetrations through firewalls with a fireproofing compound listed to maintain the rating of the wall through which the raceway passes.
- B. The fire-stopping caulk shall be a one-part, intumescent, latex elastomer. The caulk shall be capable of expanding a minimum of 3 times at 1000°F. The material shall be thixotropic and be applicable to overhead, vertical and horizontal fire-stops. The caulk shall be listed by independent test agencies such as UL or FM and be tested to, and pass the criteria of, ASTM E 814 Fire Test, tested under positive pressure. It shall comply with the requirements of the NEC (NFPA-70), BOCA, ICBO, SBCCI and NFPA Code 101. Fire-stopping caulk shall be paintable, but shall be non-hardening. Fire-stopping caulk shall be 3M Fire barrier CP or approved equal.
- C. The fireproofing materials shall be installed by individuals certified to perform such work. Submit evidence of personnel certifications with electrical equipment brochures.
- D. Where cable trays are shown crossing firewalls, terminate the cable tray on each side of the wall and run the conductors through conduits installed in the wall. Fireproof around the conductors after installation.
- E. Provide mineral wool packing and all other materials recommended by the manufacturer for a complete installation.

### 3.5 FLASHING

Provide all necessary equipment and flash all roof penetrations in such a manner to ensure that all penetrations are completely sealed and all roof warranties remain in effect. Where there are no roof warranties, the Electrical Contractor shall guarantee the electrical penetrations against leaking for a period of one year from project completion. Employ a professional roofing contractor to perform all flashing.

### 3.6 PROTECTION

- A. Keep energized equipment covered during all phases of construction. Use enclosures, doors, covers, etc., to ensure that neither personnel nor machinery contact live electrical equipment.
- B. Replace electrical equipment that is damaged during construction.

### 3.7 DAMAGED FACILITIES

- A. Locate all existing site equipment and utilities prior to beginning construction. Repair all equipment and utilities damaged during construction, or pay for the repair of the equipment and utilities where required by the Owner of the damaged facilities.

- B. Coordinate the routing of all circuits and the locations of all devices with the Architect or Engineer and the Owner. Shop drawings shall describe completely the locations and elevations of all raceways, boxes, fittings, and equipment.

### 3.8 EXCAVATION AND BACKFILL

- A. Excavate in such a manner as to minimize erosion of the soil. Backfill trenches around conduits with fine sand that is free of rocks, clods, and debris. Fill sand a minimum of 4" over conduits. Backfill the rest of the trench in six inch increments, wetted, and tamped. Final compaction shall be a minimum of 95% of that of the adjacent earth. Resurface the grade with the same material as that excavated from the grade whether it be paving, concrete, sod, etc. Repair work shall be comparable to the quality of the original site prior to excavation.
- B. Provide a 3" wide plastic labeled marker tape 12" below grade over all electrical conduits buried underground. Tapes for power circuits shall have a warning such as "Caution: Buried Electrical Line Below." Labels on tapes for telephone, data, cable television, and other facilities shall adequately describe the line over which they are buried.
- C. Provide a #12 AWG wire in each buried conduit run labeled accordingly on each end.

### 3.9 IDENTIFICATION

- A. Label all switchboards, panel boards, motor starters, disconnects, and motor control centers furnished under Division 26, 27, and 28 and other divisions of this contract with engraved rigid plastic nameplates having letters at least ¼ inch high. Nameplates shall be bolted to the enclosure. All labels shall indicate the voltage, number of phases, the AIC rating, and the panelboard and circuit number from which the device is fed.
- B. All circuit breakers in Switchboards, Motor Control Centers, Square D I-Line, and similar panel boards shall be labeled with plastic nameplates (as described in Part A) providing the name of the load served and the ampacity and number of poles of the breaker.
- C. All Square D NQOD, NF and similar panel boards shall have typewritten circuit directories.
- D. Label all conductors at all junction boxes, pull boxes, and terminations with typewritten adhesive markers indicating the panel board or switchboard name and circuit number of the conductor. Labels shall be Brady Datab or approved equal.
- E. Label all junction boxes and pull boxes with stenciled painted letters containing the name of the panel board and circuit numbers of the circuits contained within. Use black paint for normal circuits, red paint for emergency circuits, and orange paint for fire alarm circuits. The Contractor may select other colors for junction boxes and pull boxes for auxiliary systems.
- F. Label all conduits in the most likely direction of access and view every 50' and on both ends of each bend with stenciled painted letters containing the name of the panel board and circuit numbers of the circuits contained within. Use black paint for normal circuits, red paint for emergency circuits, and orange paint for fire alarm circuits. The Contractor may select other colors for conduits for auxiliary systems.

### 3.10 AS-BUILT DRAWINGS

Maintain one set of drawings during construction for as-built markings. Mark these drawings in red to indicate field changes. Provide these drawings to the Engineer at the end of the construction process. Where required under the General Conditions, Special Conditions, or

other portions of this contract, provide revised computer drawn as-built drawings to the Engineer at the end of construction.

### 3.11 TESTING

- A. Test all systems, or pay testing agencies as required, for compliance with the requirements of all regulatory agencies.
- B. Test the electrical power service ground using a Biddle Three-Terminal Ground Resistance Tester, or approved equal. Grounds shall meet the requirements of the NEC, or of Specification 26 05 26, whichever is more stringent. Test grounds only when the earth is dry. Provide additional ground rods as necessary to achieve the required results.
- C. Prior to making final equipment connections, test all service, feeder, and branch circuit conductors for continuity, phase-to-phase faults, and phase-to-ground faults using a Megger BM100 or approved equal test instrument generating 500 Vdc. Insulation resistance shall be a minimum of 500,000 Ohms between any conductor and ground and 1,000,000 Ohms between any two conductors.
- D. Test other systems as required in their respective specifications.
- E. Provide three bound copies of all test results to the Engineer at the end of the construction process. No Recommendation of Substantial Completion will be granted until all testing reports have been submitted.

### 3.12 WARRANTY

Provide the Owner a written guarantee to repair, or replace, all faulty equipment and systems for a period of one year from date of Substantial Completion. During this one-year period, a representative of the Contractor shall be on the site actively working on the repairs within 24 hours of the Owner's telephone call. During this period of time, the Owner shall not be charged for any repair work or expenses related with the repair work unless the Contractor can prove that the Owner has damaged the equipment or system.

END OF SECTION

## **SECTION 260519 600V CONDUCTORS**

### **PART 1 – GENERAL**

Provide all circuitry, terminations, splices, connectors, lugs, and other equipment necessary for connection of all equipment requiring electrical connections.

### **PART 2 – PRODUCTS**

- 2.1 All electrical conductors shall be soft-drawn annealed copper having 98% conductivity and an insulation rating of 600V.
- 2.2 Conductors shall be UL listed for installation in the raceway in which they are to be installed.
- 2.3 Conductors shall be rated 90 degrees C for use in residential, commercial, industrial, and institutional facilities, and shall be listed as 105 degrees C appliance wire. Conductors shall be listed under UL 83, UL 1063, and UL 758. If XLP or EPR insulation is used, conductors shall be listed under UL 44 and NEMA WC7.
- 2.4 Conductors used for branch circuits, feeders, auxiliary systems, and controls run in dry locations shall have PVC insulation and a Nylon outer jacket. They shall be THHN/THWN or XHHW-2.
- 2.5 Conductors used for branch circuits, feeders, auxiliary systems, and controls run in wet locations shall have XLP or EPR insulation and be type XHHW-2.
- 2.6 Conductors used for operating room isolation panels and associated branch circuits shall be copper stranded conductor having a cross-linked polyethylene insulation or equivalent with a dielectric constant of 3.5 or less. Wire-pulling compounds that increase the dielectric constant shall not be used on the secondary conductors of isolation panels. The isolated circuit conductors shall be identified as follows:

Isolated Circuit #1 – Orange

Isolated Circuit #2 – Brown

For 125 volt, 15 & 20 ampere receptacles: The orange conductor shall be connected to the terminal on the receptacle that is identified in accordance with NEC 200.10(B) for connection to the grounded circuit conductor.

- 2.7 Conductors used for services shall be type SE for aerial services or type USE-2 for underground services.
- 2.8 Sizes #10 and #12 shall be solid conductors except where used for controls. All controls conductors shall be stranded.
- 2.9 Use minimum #14 AWG conductors for controls and auxiliary circuits. Use larger conductors as required to compensate for voltage drops exceeding 3% of the system voltage.
- 2.10 Conductors shall be furnished in the colors described below unless local ordinances require different colors. Conductors #8 and smaller shall be furnished with colored insulation; conductors larger than #8 shall be taped with the appropriately colored tape for a length of at least 2" at each panelboard, junction box, pull box, load, or other exposed location. Ground conductors shall be taped green for their entire exposed length.

| <b>System Voltage</b> | <b>208Y/120V, 3-Phase, 4-Wire</b> | <b>120/240V, 3-Phase, 4-Wire</b> | <b>480Y/277V, 3-Phase, 4-Wire</b> |
|-----------------------|-----------------------------------|----------------------------------|-----------------------------------|
| Phase A               | Black                             | Black                            | Brown                             |
| Phase B               | Red                               | Orange                           | Orange                            |
| Phase C               | Blue                              | Blue                             | Yellow                            |
| Neutral               | White                             | White                            | Gray                              |
| Ground                | Green                             | Green                            | Green                             |

#### 2.11 Conductor sizing chart:

| <b>Voltage Drop Chart for 20amp single pole circuits</b> |                |                      |
|--|----------------|----------------------|
| Voltage  | Circuit Length | Conductor size (awg) |
| 120  | < 90'          | #12                  |
| 120  | > 90'          | #10                  |
| 120  | > 145'         | #8                   |
| 120  | > 230'         | #6                   |
|  |                |                      |
| 277  | < 200'         | #12                  |
| 277  | > 200'         | #10                  |
| 277  | > 325'         | #8                   |
| 277  | > 525'         | #6                   |

- A. Circuit sizes indicated on the drawings are minimum NEC requirements. Refer to this chart for upsizing conductors based on circuit length.
- B. Do not connect conductors larger than #10 directly to a receptacle or a switch. Provide a junction box to downsize the conductor to #12 at the device.
- C. For circuits longer than those listed above, consult with the Engineer for conductor sizes.

### PART 3 – EXECUTION

- 3.1 Install conductors carefully using a minimum of two tradesmen – one feeding the conductors into the conduit, and the other pulling the conductors into the conduit.
- 3.2 **Each branch circuit and multiwire branch circuit shall be run with its own neutral conductor complying with NEC article 200.4.**
- 3.3 Join stranded conductors with appropriate mechanical or compression lugs. Wire nuts may be used for solid conductors only.
- 3.4 Splices shall only be made in approved enclosures. Splices shall not be pulled inside conduits.
- 3.5 Provide cable supports and strain relief connectors as required by the NEC.
- 3.6 Furnish junction boxes, pull boxes, handholes, manholes, etc. as required to ensure that the maximum number of bends allowed by the NEC are not exceeded and to ensure that the cables are not damaged during installation.

END OF SECTION

**SECTION 260526**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 – GENERAL**

1.1 GENERAL

Ground all equipment, systems, structures, etc., per the latest edition of the National Electrical Code (NEC).

**PART 2 – PRODUCTS**

- 2.1 Use mechanical bolted connections in dry locations that are accessible.
- 2.2 Use exothermic welds in wet locations and locations that will be inaccessible at the end of construction.
- 2.3 Ground rods shall be UL listed 3/4" x 10' copper-clad steel ground rods with a minimum copper cladding thickness of 10 mils.

**PART 3 – EXECUTION**

- 3.1 Ground rods shall be installed with their tops no less than 6" below grade.
- 3.2 Bond ground connections to metal raceways at each end of the conduit run. Provide grounding bushings where required by the NEC. Where cable trays are used, bond the ground conductor to each section and fitting of the tray.
- 3.3 Provide all circuits with an equipment grounding conductor sized per the NEC, or as shown on the drawings. Circuitry shown on drawings does not include the required equipment grounding conductor. Where multiple circuits are run with a common neutral, only one equipment grounding conductor is needed. The equipment grounding conductor shall be furnished with green insulation for conductors #8 AWG and smaller; where larger than #8, the equipment grounding conductor shall be taped green for its entire exposed length.
- 3.4 The grounding electrode conductor(s) shall be bare or shall be colored green for its entire exposed length.
- 3.5 Individual ground conductors shall be installed in PVC conduit sized per the NEC.
- 3.6 Provide receptacles, luminaires, and other devices with a green conductor that bonds the receptacle grounding screw or pigtail, the outlet box grounding screw, and the equipment grounding conductor together.
- 3.7 In health care facilities, where two or more different panel boards serve the same patient-care area, an 8 AWG insulated continuous copper conductor shall bond these different panel boards together.
- 3.8 Telephone, cable television, and other auxiliary systems shall be bonded to the electrical building service ground using a conductor no smaller than #6 AWG.

END OF SECTION



## **SECTION 260573 ELECTRICAL STUDIES**

### **PART 1 – GENERAL**

- 1.1 The Electrical Studies in this specification shall be performed by the electrical gear Manufacturer. The Electrical Studies shall be preliminarily performed at the electrical gear submittal time and then updated when all of the electrical gear is installed and the exact electrical parameters are known.
- 1.2 The purpose of the preliminary study (Fault Current Study) is to verify that the electrical gear is specified with the correct AIC ratings for the facilities' power system. The initial study shall be conducted using the electrical gear specified in the construction documents. The Single Line Diagram in the construction drawings shall be used for circuitry sizes of the major electrical gear. The Power, Mechanical, and Equipment Plans in the construction drawings shall be used for circuitry sizes of the remaining electrical gear. The Utility transformer shall be modeled using "worst case" parameters for impedance and infinite short circuit current available at the primary of the transformer. Dry type transformers shall be modeled using typical impedances for the size of transformer specified. Emergency generators shall be modeled using "worst case" parameters for sub-transient reactance and a typical decrement curve for the kW size of generator specified utilizing a permanent magnet alternator. The Electrical Contractor shall assist the electrical gear Manufacturer's Engineer with estimated circuitry lengths. The studies shall be run, evaluated, and then submitted along with the electrical gear submittals. The equipment AIC ratings on the Drawings and in the Specifications represent the minimum acceptable ratings. Higher rated equipment shall be provided as necessary, based on study results. Electrical gear submittals will not be approved without the results of this study. An electronic copy of the power system model shall be saved by the electrical gear Manufacturer's Engineer.
- 1.3 After all of the electrical gear is installed and the exact electrical parameters of the project are known, the Electrical Contractor shall give that information to the electrical gear Manufacturer's Engineer. The saved power system model shall be updated with the exact utility X/R ratios (three phase and phase-to-ground), utility primary voltage over-current protection devices, transformer impedances, circuitry sizes, circuitry lengths, generator sub-transient reactance, and generator overload curves. The purpose of updating the preliminary power system model is to provide accurate information for Arc Flash Labels, Available Fault Current Labels, and Protective Device Settings. A Fault Current Study, a Protective Device Coordination Study, and an Arc Flash Study shall be run, evaluated, and then submitted to the electrical engineer for approval. The approved study report shall be used for setting the Protective Devices, producing Arc Flash Labels, and producing Available Fault Current Labels.

### **PART 2 – ELECTRICAL STUDIES PERFORMED**

#### **2.1 PROTECTIVE DEVICE COORDINATION AND ARC FLASH STUDIES**

- A. The Contractor shall employ the equipment Manufacturer's Engineers to perform the Protective Device Coordination and Arc Flash studies. The Engineer responsible for the study shall perform such work as his job responsibility, and shall have performed at least 100 such studies in his career. Submit the Engineer's credentials with the study results.
- B. Analyses shall be prepared to demonstrate that the equipment and system to be provided meet the specified requirements for equipment ratings, coordination, and protection. They shall include a fault current analysis and protective device coordination study.
- C. Scope of Analyses. The Fault Current Analysis, Protective Device Coordination, and Arc Flash Studies shall include all electrical equipment where the incident energy level is greater than 1.2 Cal/cm<sup>2</sup>. The term electrical gear shall include the following: Transformers (Utility & Dry Type), Switchboards, Panelboards, Motor Control Centers, Disconnects, Loadcenters, Enclosed Circuit Breakers, Motor Starters, Contactors, etc.

- D. Determination of Facts. The time-current characteristics, features, and nameplate data for each existing protective device shall be determined and documented. The Contractor shall coordinate with the commercial power company for three phase and single phase fault current availability and X/R ratios at the site.
- E. Single-Line Diagram. Provide a single-line diagram to show the electrical system buses, devices, transformation points, and all sources of fault current (including generator and motor contributions). A fault-impedance diagram or a computer analysis diagram shall be provided. Each bus, device or transformation point shall have a unique identifier. If a fault-impedance diagram is provided, impedance data shall be shown. Locations of switches, breakers, and circuit interrupting devices shall be shown on the diagram, together with available fault data, and the device interrupting rating.
- F. Arc Flash Hazard Analysis:
1. Method. The Arc Flash Hazard analysis shall be performed in accordance with the latest applicable NFPA 70E, OSHA 29-CFR, Part 1910 Sub part S, IEEE 1584, and NESC Standards. The study must be performed using IEEE 1584 for equipment rated 50 to 15kV and NESC for equipment rated above 15kV. **The use of NFPA 70E Task Tables to determine Hazard Classification is not acceptable.**
  2. Data. The analysis shall consider all operating scenarios during normal conditions, alternate operations, emergency power conditions, and any other operations, which could result in maximum Arc Flash Hazard. The label shall list the maximum incidental energy calculated and the scenario. Possible scenarios include, but are not limited to: Normal Utility Power, Emergency Generator Power, Bus Tie Breaker Open, Bus Tie Breaker Closed, UPS Power, etc..
- G. Fault Current Analysis:
1. Method. The fault current analysis shall be performed in accordance with methods described in IEEE Std 242, and IEEE Std 399.
  2. Data. Actual data shall be utilized in final fault calculations. Bus characteristics and transformer impedances shall be those proposed for the initial analysis. Data shall be documented in the report.
- G. Fault Current Availability. Balanced three-phase fault, bolted line-to-line fault, and line-to-ground fault current values shall be provided at each voltage transformation point and at each power distribution bus. This data shall be shown in tabular form on the diagram or in the report.
- H. Coordination Study. The study shall demonstrate that the maximum possible degree of selectivity has been obtained between all electrical equipment, consistent with protection of equipment and conductors from damage from overloads and fault conditions. The study shall include a description of the coordination of the protective devices in this project. Provide a written narrative that describes: which devices may operate in the event of a fault at each bus; the logic used to arrive at device ratings and settings; any situations where system coordination is not achievable due to device limitations (an analysis of any device curves which overlap); coordination between upstream and downstream devices; and settings. Provide recommendations to improve or enhance system reliability and detail where such changes would involve additions or modifications to the Contract. Cost changes (addition or reduction) shall be provided. Composite coordination plots shall be provided on log-log graph paper.
- I. Study Reports (Initial and Final)

1. The reports shall include a narrative: the analyses performed; the bases and methods used; and the desired method of coordinated protection of the power system.
2. The reports shall include descriptive and technical data for existing devices and new protective devices proposed. The data shall include Manufacturer's published data, nameplate data, and definition of the fixed or adjustable features of the existing or new protective devices.
3. The reports shall document utility company data including system voltages, fault MVA, system three phase X/R ratio and magnitude, system single line to ground X/R ratio and magnitude, time-current characteristic curves, current transformer ratios, relay device curves, and protective device ratings & settings.
4. The reports shall contain fully coordinated composite time-current characteristic curves for each bus in the system as required to ensure coordinated power system protection between protective devices or equipment. The report shall include recommended devices or equipment. The report shall include recommended ratings and settings of all protective devices in tabulated form.
5. The reports shall provide the calculations performed for the analyses including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

### **PART 3 – LABELS**

- 3.1 The Electrical Gear Manufacturer shall print Arc Flash Labels for all electrical gear [Switchboards, Panelboards, Transformers (all except Utility), Motor Control Centers, Disconnects, Loadcenters, Enclosed Circuit Breakers, Motor Starters, Contactors, etc.] complying with the label detail in the construction drawings. The labels shall be of a type and quality to last in the environment in which they are installed. The labels shall be furnished to the Electrical Contractor for installation.
- 3.2 The Electrical Contractor shall make the Available Fault Current Labels complying with the label detail in the construction drawings for each piece of electrical gear. The Protective Device Coordination Study report shall be used for providing the Available Fault Current at each location. The labels shall comply with NEC Article 110.24 of the 2011 edition. Available Fault Current labels shall be of a type and quality to last in the environment in which they are installed. The labels shall be mounted according to the label detail in the construction drawings.

END OF SECTION

## **SECTION 26023 SWITCHES AND RECEPTACLES**

### **PART 1 – GENERAL**

Furnish and install all switches and receptacles in accordance with this specification and the requirements of the NEC.

### **PART 2 – PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

Switches and receptacles shall be manufactured by Hubbell, Cooper Wiring Devices, Leviton, or Pass & Seymour.

#### **2.2 GENERAL**

- A. Switches and receptacles shall be specification grade. They shall have ampacity and voltage ratings suitable for the application in which they are used.
- B. Consult architect or engineer for device colors prior to ordering devices.
- C. Provide brushed stainless steel cover plates for all devices. A single cover plate shall cover all devices in one box.
- D. Light switches shall be 20 Ampere, 120-277V back-wired and side-wired toggle switches. They shall be rated up to 2 HP at 240V. Each switch shall be equipped with a grounding screw. Switches shall be Hubbell CSB series or approved equal.
- E. Duplex NEMA 5-20R receptacles shall be Hubbell HBL 5362A or approved equal.
- F. Duplex GFI NEMA 5-20R receptacles shall be Hubbell HBL GF5362A or approved equal.
- G. Weatherproof while-in-use cover plates shall be Teddico #34017-7 or approved equal. Cover plates shall be single gang, lockable, and constructed of heavy duty die cast metal.
- H. All 125V, 15 and 20 ampere receptacles installed in dwelling units shall be of the tamper-resistant type.
- I. All 15 and 20 ampere, 125 and 250V non-locking receptacles installed in wet or damp locations shall be listed as the weather-resistant type.
- J. Devices furnished in this Contract, but not listed above, shall be of the same standard of quality as those items listed.

### **PART 3 – EXECUTION**

- 3.1 Flush mount all devices unless specific written permission is obtained from the Engineer for a particular device in a particular location.
- 3.2 Install all devices vertically unless the drawings specifically state that the particular device should be mounted horizontally.

3.3 Install receptacles with the ground slot up.

END OF SECTION

## **SECTION 260926 VACANCY SENSORS**

### **PART 1 - GENERAL**

- 1.1 Furnish and install a complete system of Vacancy sensors as shown on the drawings and as specified herein to comply with IECC 2012. The drawings are provided to show the general scope of the work, and show the absolute minimum components required. Actual system components, quantities, and locations shall be determined by the motion detector vendor and provided to the Contractor with the installation shop drawings.
- 1.2 The Contractor and Sales Representatives are advised to take notice of specified component characteristics when attempting to select and propose substitutions. It is highly unlikely that substitutions on a one-for-one component basis will produce results that provide acceptable system performance.
- 1.3 Provide all power packs, hardware, software, devices, circuitry, and other components, material, and labor required to install, configure, and test the entire system to the satisfaction of the Architect, Owner, and Engineer.
- 1.4 Submit six sets of manufacturer's cut sheets describing completely all equipment, and six sets of shop drawings showing all circuitry including terminal-to-terminal connections.
- 1.5 The wiring diagrams on these drawings are based on our best interpretation of the manufacturer's data that was available at the time of design; however, they shall not be used for system installation and configuration. The controls equipment vendor is expected to be thoroughly knowledgeable of the equipment that is being proposed, and shall provide detailed shop drawings tailored for each circuit and lighting zone on the project. General manufacturer's data sheets shall not be acceptable. The shop drawings shall be suitable for the installing electrician to use for complete installation of the circuitry without referring to data sheets or installation manuals for connection of lighting control equipment. These requirements shall be followed whether the specified equipment, or products of other manufacturers, is provided.

### **PART 2 - PRODUCTS**

- 2.1 Hallway Vacancy sensors: Vacancy sensors used in the hallways shall be passive infrared, ceiling-mounted units with a coverage of 6' x 130'. They shall be Sensor Switch HW13 WV BR or approved equal.
- 2.2 Wall mounted LED lighting controls shall be 0-10V dimmer/vacancy sensor type equal to Lutron MS-Z101-V-XX
- 2.3 Wall mounted lighting controls shall be dual technology (ultrasonice/passive infrared) dual relay vacancy sensor type equal to Lutron MS-B202-V-XX
- 2.4 Areas up to 500 Square Feet: Ceiling mounted Vacancy sensors used in areas up to 500 square feet shall be dual technology infrared and passive infrared, ceiling-mounted units with a 360 degree, 500 square foot coverage.
- 2.5 Power Packs: Power packs shall be of the same manufacturer as the Vacancy sensors. Each shall be capable of controlling a 20 ampere circuit. They shall be rated for operation at the voltage of the system on which they will be used.
- 2.6 Circuitry: Provide control circuitry as required by the manufacturer for optimum system operation, but no less than the following: Control cables shall be 3-conductor #22 AWG copper with an overall jacket.

Adjust conductor sizes as required to overcome unacceptable voltage drop.

### **PART 3 - EXECUTION**

- 3.1 Vacancy sensors shall be provided so that their coverage areas overlap and there are no dead zones in the rooms where persons may stand and not be detected.
- 3.2 Vacancy Sensors shall be set for "manual on/automatic off" operation.
- 3.3 All work shall be done by qualified system technicians.
- 3.4 Wiring, including control wiring, shall be in Raceways meeting Specification 260533.
- 3.5 Guarantee workmanship and material for a period of one year after final acceptance. During the warranty period, repair or replace faulty equipment at no cost to the Owner for labor, material, or expenses.
- 3.6 Upon completion of job, test entire system. After testing submit a certificate to the Architect stating verification of the following:

### **PART 4 – CLOSE-OUT DOCUMENTS**

- 4.1 Provide the following documents to the Architect for delivery to the Owner at the time of substantial completion:
  - A. Written Guarantee
  - B. Two sets of data prepared by the manufacturer for each item of electrical equipment completely describing each piece of equipment. The data shall include parts lists, a description of operation, shop drawings, wiring diagrams, maintenance procedures, and other literature required for operation and maintenance of equipment.
- 4.2 Instruct the Owner on system operational procedures. Notify the Owner and Architect at least one week in advance of the training session. Provide written step-by-step instructional material.
- 4.3 Notify the General Contractor that you are to present during the Pre-final Inspection. During that inspection, demonstrate all system functionality and capabilities; remove cover plates and panels covers as required to show the quality of the installation. The Owner, Architect, and Engineer reserve the right to reject unsuitable workmanship or performance.

END OF SECTION

## **SECTION 262400 PANELBOARDS**

### **PART 1 – GENERAL**

- 1.1 Furnish and install all panelboards, complete with their circuit breakers, phase buses, neutral buses, ground buses, structural supports, and other equipment necessary for complete systems.
- 1.2 The equipment vendor shall perform all calculations necessary and provide complete Arc Flash Labels as required by the National Electrical Cod (NEC) and the drawings. Note: The drawings typically require more detail than required by the NEC.

### **PART 2 – PRODUCTS**

#### **2.1 GENERAL**

- A. Panelboards shall be designed, manufactured, and tested to be in compliance with NEMA PB 1, UL 50, UL 67, UL 489, NFPA 70, and the ASTM.
- B. Circuit breakers shall be designed, manufactured, and tested to be in compliance with NEMA AB 1, UL 489, and Federal Specification W-C-375B/GEN.
- C. Panelboards shall be UL listed for service entrance where used for that purpose.
- D. Panelboard ampere interrupting current (AIC) ratings shall equal the lowest rated device in the panelboard. Provide panelboards with the AIC ratings shown on the Contract Drawings. Buses shall be braced to withstand the AIC rating shown on the drawings. Series ratings shall only be used where shown on the panelboard schedules.
- E. All panelboards shall be furnished with dead-front, door-in-door construction.
- F. Lug locations shall be determined during the creation of shop drawings for proper arrangement with the raceway system.
- G. Buses shall be constructed of 98% conductivity copper or equivalently rated aluminum.
- H. Panelboard enclosures shall be NEMA 1 when they are to be mounted indoors, and NEMA 3R when they are to be mounted outdoors. Provide special enclosures where shown on the Contract Drawings.

#### **2.2 ACCEPTABLE MANUFACTURERS**

Panelboards shall be manufactured by Siemens, Square D, General Electric, or Cutler Hammer.

#### **2.3 PANELBOARD CLASSES**

- A. Power distribution panelboards shall be available with mains and branch devices up to 1200 amperes. AIC ratings shall be available up to 200,000 Amperes. Power distribution panelboards shall be equipped with a nameplate containing the appropriate system voltage, number of wires, and number of phases for the system on which they are installed.
- B. In 480Vac and less applications where a main breaker not exceeding 600 Amperes is required, the AIC rating does not exceed 65,000 Amperes, and no branch breakers exceed 125Amperes, Square D NF and equivalent panelboards may be used.



- C. In 480Vac and less applications where a main breaker not exceeding 225 Amperes is required, the AIC rating does not exceed 14,000 Amperes, and no branch breakers exceed 100Amperes, Square D NEHB and equivalent panelboards may be used.
- D. In 240Vac and less applications where a main breaker not exceeding 400 Amperes or main lugs not exceeding 600 Amperes is required, the AIC rating does not exceed 22,000 Amperes, and no branch breakers exceed 125 Amperes, Square D NQ and equivalent panelboards may be used. Loadcenters shall not be acceptable!

## 2.4 CIRCUIT BREAKERS

- A. Circuit breakers shall be of the bolt-on type (except for those used in ILINE panelboards and switchboards). Loadcenter, plug-in circuit breakers shall not be acceptable unless specifically indicated on the drawings. They shall be thermal magnetic, molded-case with quick-make, quick-break contact action. They shall have thermal and magnetic tripping elements on each pole. Breakers with multiple poles shall have common tripping of all poles. Circuit breaker ampere ratings shall be stamped on the handle. Interrupting ratings of the circuit breakers shall be equivalent to the specified AIC rating of the panelboard. Breakers handles shall reside in a position between "ON" and "OFF" after a trip condition. Breakers shall be rated HACR when used for heating, air-conditioning, and refrigeration; HID when used with High Intensity Discharge fixtures; and shall be rated SWD when used for switching duty.
- B. Circuit breaker sizes for motor loads are based on Square D recommendations for use of their breakers at the motor horsepowers listed on the mechanical drawings. If equipment is used other than Square D, adjust breaker sizes per the manufacturer's recommendations.
- C. Each circuit breaker supplying a multiwire branch circuit shall be installed with a manufacturer supplied handle tie to simultaneously disconnect all ungrounded conductors. Each multiwire branch circuit shall comply with NEC article 210.4.
- D. Circuit breakers with slash ratings, such as 120/240V or 480Y/277V, shall be used in solidly grounded systems where the nominal voltage of any conductor to ground does not exceed the lower of the two values of the breaker's voltage rating and the nominal voltage between any two conductors does not exceed the higher value of the circuit breaker's voltage rating.
- E. Circuit breakers with straight voltage ratings, such as 240V or 480V, shall be used in systems other than solidly grounded systems (Corner-Grounded Delta, Ungrounded, Impedance Grounded, etc.) where the nominal voltage between any two conductors does not exceed the circuit breaker's voltage rating. A two-pole circuit breaker shall not be used to protect a three-phase, Corner-Grounded Delta system unless the circuit breaker is marked 1 $\Phi$ -3 $\Phi$ .

## PART 3 – EXECUTION

- 3.1 Install panelboards in complete compliance with all manufacturers' installation instructions.
- 3.2 Install conductors neatly in panelboards. Group and tie-wrap circuits that share a common neutral.
- 3.3 Number circuits exactly as shown on the contract drawings.

END OF SECTION

**SECTION 262800**  
**DISCONNECTS AND SEPARATELY-MOUNTED CIRCUIT BREAKERS**

**PART 1 – GENERAL**

Furnish and install all disconnects and separately mounted circuit breakers as shown on the drawings, specified herein, and required by the NEC.

**PART 2 – PRODUCTS**

**2.1 GENERAL**

- A. Disconnects shall be of the heavy-duty type, and shall be UL listed for service entrance use. They shall meet or exceed the requirements of NEMA Standard KS1. Provide fuses sized to appropriately protect the load served. Equipment manufacturer's recommendations shall take precedence over the Contract Drawings.
- B. Fuses shall be dual element, time-delay, Class J fuses. They shall be Bussman Low-Peak or approved equal.
- C. Circuit breakers shall be thermal magnetic, molded-case with quick-make, quick-break contact action. They shall have thermal and magnetic tripping elements on each pole. Breakers with multiple poles shall have common tripping of all poles. Circuit breaker ampere ratings shall be stamped on the handle. Interrupting ratings of the circuit breakers shall be equivalent to the specified AIC rating of the panelboard. Breakers handles shall reside in a position between "ON" and "OFF" after a trip condition. Breakers shall be rated HACR when used for heating, air-conditioning, and refrigeration; HID when used with High Intensity Discharge fixtures; and shall be rated SWD when used for switching duty.
- D. Circuit breaker sizes for motor loads are based on Square D recommendations for use of their breakers at the motor horsepower listed on the mechanical drawings. If equipment is used other than Square D, adjust breaker sizes per the manufacturer's recommendations.
- E. Circuit breakers with slash ratings, such as 120/240V or 480Y/277V, shall be used in solidly grounded systems where the nominal voltage of any conductor to ground does not exceed the lower of the two values of the breaker's voltage rating and the nominal voltage between any two conductors does not exceed the higher value of the circuit breaker's voltage rating.
- F. Circuit breakers with straight voltage ratings, such as 240V or 480V, shall be used in systems other than solidly grounded systems (Corner-Grounded Delta, Ungrounded, Impedance Grounded, etc.) where the nominal voltage between any two conductors does not exceed the circuit breaker's voltage rating. A two-pole circuit breaker shall not be used to protect a three-phase, Corner-Grounded Delta system unless the circuit breaker is marked 1 $\Phi$ -3 $\Phi$ .
- G. Disconnect and individually-mounted circuit breaker ampere interrupting current (AIC) ratings shall equal the rating of the panelboard from which they are fed unless otherwise noted.
- H. Buses shall be constructed of 98% conductivity copper or equivalently rated aluminum.
- I. Switches shall be horsepower rated where used to serve motors.
- J. Enclosures shall be NEMA 1 when they are to be mounted indoors, NEMA 3R when they are to be mounted outdoors, and NEMA 4X where they are subject to washdown. Provide special enclosures where shown on the Contract Drawings.

## 2.2 ACCEPTABLE MANUFACTURERS

Disconnects and separately-mounted circuit breakers shall be manufactured by Siemens, Square D, General Electric, or Cutler Hammer.

## **PART 3 – EXECUTION**

- 3.1 Install disconnects and individually-mounted circuit breakers in complete compliance with all manufacturers' installation instructions. Where necessary, provide structural supports and bracing for installation.
- 3.2 Disconnects are to be surface-mounted.
- 3.3 Individually-mounted circuit breakers are to be flush-mounted unless otherwise shown.

END OF SECTION

**SECTION 264300**  
**SURGE PROTECTIVE DEVICE (SPD)**

**PART 1 – GENERAL**

**1.1 SCOPE**

- A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers. Refer to related sections for surge requirements in:

**1.2 RELATED SECTIONS**

- A. Section 262400 – Panelboards

**1.3 REFERENCES**

- A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3<sup>rd</sup> Edition).

**1.4 SUBMITTALS – FOR REVIEW/APPROVAL**

- A. The following information shall be submitted to the Engineer:
  - 1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current ( $I_n$ ).
  - 2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
- B. Where applicable the following additional information shall be submitted to the engineer:
  - 1. Descriptive bulletins
  - 2. Product sheets

**1.5 SUBMITTALS – FOR CONSTRUCTION**

- A. The following information shall be submitted for record purposes:
  - 1. Final as-built drawings and information for items listed in Section 1.04 and shall incorporate all changes made during the manufacturing process

**1.6 QUALIFICATIONS**

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

- D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

## 1.8 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be provided with each SPD shipped.

# PART 2 – PRODUCTS

## 2.1 MANUFACTURERS

- A. Eaton Cutler-Hammer

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

## 2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

- B. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

| Configuration      | Protection Modes |     |     |     |
|--------------------|------------------|-----|-----|-----|
|                    | L-N              | L-G | L-L | N-G |
| Wye                | •                | •   | •   | •   |
| Delta              | N/A              | •   | •   | N/A |
| Single Split Phase | •                | •   | •   | •   |
| High Leg Delta     | •                | •   | •   | •   |

5. Nominal Discharge Current ( $I_n$ ) – All SPDs applied to the distribution system shall have a 20kA  $I_n$  rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an  $I_n$  less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

| Modes         | 208Y/120 | 480Y/277 | 600Y/347 |
|---------------|----------|----------|----------|
| L-N; L-G; N-G | 700      | 1200     | 1500     |
| L-L           | 1200     | 2000     | 3000     |

- C. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
  - a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
    - i. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
    - ii. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
    - iii. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
  - b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
  - c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
  - d. Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of  $50 \pm 20A$  occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
    - i. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

## 6. Overcurrent Protection

- a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

## 8. Safety Requirements

- a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
- b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.
- c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

## 2.3 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

| Minimum surge current capacity based on ANSI / IEEE C62.41 location category |  |           |          |
|--|--|-----------|----------|
| Category   | Application  | Per Phase | Per Mode |
| C  | Service Entrance Locations<br>(Switchboards, Switchgear, MCC, Main Entrance) | 250 kA    | 125 kA   |
| B  | High Exposure Roof Top Locations<br>(Distribution Panelboards)               | 160 kA    | 80 kA    |
| A  | Branch Locations (Panelboards, MCCs, Busway)                                 | 120 kA    | 60 kA    |

- C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

## 2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
  2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
  3. The panelboard shall be capable of re-energizing upon removal of the SPD.
  4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
  5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
  6. The SPD shall be of the same manufacturer as the panelboard.
  7. The complete panelboard including the SPD shall be UL67 listed.
- B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.
- C. Switchgear, Switchboard, MCC and Busway Requirements
1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
  2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
  3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
  4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
  5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
  6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
  7. All monitoring and diagnostic features shall be visible from the front of the equipment.

## 2.5 ENCLOSURES

- A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
  2. NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only)



3. NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

### **PART 3 – EXECUTION**

#### **3.1 EXAMINATION**

#### **3.2 FACTORY TESTING**

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

#### **3.3 INSTALLATION**

- A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

#### **3.4 WARRANTY**

- A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

## SECTION 265100 LIGHTING

### **PART 1 – GENERAL**

- 1.1 Provide all lighting fixtures (luminaires), lamps, end caps, connectors, fittings, structural support members, supports, brackets, etc., for a complete and operable lighting system.
- 1.2 Prior to submitting electrical equipment brochures for review and approval, coordinate with the General Contractor and verify that the fixtures are appropriate for the ceiling types in which they are shown to be installed. Also verify that ballast voltage on the submittals is appropriate for the electrical system on which the fixtures are to be installed (regardless of voltage listed in the part number in the Fixture Schedule). Submit with equipment brochures a certificate stating that these items of coordination have been completed.
- 1.3 Provide photometric calculations where luminaires are proposed for substitution.
- 1.4 Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- 1.5 Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on construction, dimensions, ratings, finished, mounting requirements, listing, service conditions, and installed accessories. Include model number nomenclature clearly marked with all proposed features. Where the part number indicates components not shown on cut sheet, provide supporting cut sheet data for the part number. **Applicable data for fixtures proposed shall be highlighted – including any special notes about application!**

### **PART 2 – PRODUCTS**

#### 2.1 LUMINAIRES

- A. Luminaires are shown in the Luminaire Schedule on the drawings to establish a standard of quality. Manufacturer's names and model numbers shall not be interpreted as a proprietary specification. Notify the engineer at least two weeks prior to bid if an equivalent for a fixture listed in the schedule is not readily available,
- B. Provide the appropriate trim types, lenses, and accessories for proper installation in the area shown on the drawing. Coordinate with the ceiling contractor during the creation of shop drawings to ensure that fixtures are appropriate for the type of ceiling being installed.

#### 2.2 LAMPS

LED lamps shall be LM79 and LM80 tested.

#### 2.3 LED DRIVERS

- A. General Requirements:
  1. Operate for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.
  2. Provide thermal fold-back protection by automatically reducing power output (dimming) to protect LED driver and LED light engine/fixture from damage due to over-temperature

conditions that approach or exceed the LED driver's maximum operating temperature at calibration point.

3. UL 8750 recognized or listed as applicable.
4. Class A sound rating; Inaudible in a 27 dBA ambient.
5. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.
6. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.
7. Offer programmable output currents in 10 mA increments within designed driver operating ranges for custom fixture length and lumen output configurations, while meeting a low-end dimming range of 100 to 1 percent or 100 to 5 percent as applicable.
8. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.
9. LED driver may be remote located up to 100 feet (30 m) from LED light engine depending on power outputs required and wire gauge utilized by installer.

B. Driver Control:

1. Provide integral fault protection to prevent driver failure in the event of a mis-wire.
2. Operate from input voltage of 120 V through 277 V at 50/60 Hz.
3. Drivers and their associated controls shall be coordinated to ensure they are compatible.

## 2.4 EMERGENCY DRIVERS

- A. Emergency Drivers: Emergency drivers shall consist of an automatic power failure device, a test switch, and a pilot light that is visible from outside of the fixture. They shall contain a fully automatic solid state charger in a self-contained power pack. The fixture shall be factory wired in a manner that will allow the emergency lamps to be switched while still maintaining charging power to the battery. Wiring Diagrams shall be furnished with the fixture showing switching connections. The battery shall be of the sealed electrolyte type with the capacity to provide power to the lamps provided for a minimum of 90 minutes according to the following formula:

Delivered Lumens =  $1.25 \times \text{Output Power of Emergency Driver} \times \text{Lumen per Watt rating of the Luminaire}$

Note: See Fixture Schedule on Drawings for specified Emergency Driver

The battery shall be able to operate unattended with no maintenance for a period of no less than five years. Emergency ballasts shall be fully compatible with solid state ballasts. Battery packs shall be mounted inside the fixture unless remotely mounted ballasts are shown on the drawings, or unless the fixture is of a type that does not have room for internally mounted battery packs.

## 2.5 SUPPORTS

- A. Provide all structural members necessary to support fixtures in locations shown on the contract drawings. Submit mounting and support details to the Architect or Engineer for approval with the project shop drawings. Notify the General Contractor prior to bid of any structural work that will be required to support the fixtures.
- B. Provide hangers, cords, stems, etc., where required. Coordinate with the Architect or Engineer for proper stem lengths prior to ordering fixtures.
- C. Support the recessed light fixtures at all four corners of the fixture.
- D. Provide clips for fixtures installed in lay-in ceilings. Clips shall be equal to Erico Caddy clips # 515 or #515A.

### **PART 3 – EXECUTION**

- 3.1 Raceways for lighting systems in accessible ceilings shall be run to junction boxes mounted in locations that do not interfere with the ceiling installation, the luminaire installation, or other building systems. Provide final connections to fixtures using conductors in flexible conduit. Flexible conduit whips shall not exceed six feet in length.
- 3.2 All recessed fixtures shall be mounted with their trims flush against the ceiling.
- 3.3 Comply completely with all manufacturers' installation instructions.
- 3.4 Fixtures shall be warranted for a period of five years after beneficial occupancy.

END OF SECTION

**SECTION 265668  
EXTERIOR ATHLETIC LIGHTING**

**Lighting System with LED Light Source**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for Raleigh High School using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.
- C. The sports lighting will be for the following venues:
  - 1. Football
- D. The primary goals of this sports lighting project are:
  - 1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 25 years.
  - 2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors.
  - 3. Customer Service - It is a primary goal of this project to provide exceptional and timely customer service to the customer. That includes the availability of a call center, located in the USA, 24 hours per day, every day of the year, for troubleshooting any remote lighting needs such as turning lights on and off and troubleshooting technical needs.
  - 4. Cost of Ownership: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.
  - 5. Control and Monitoring – To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.
    - a. Control and monitoring system shall provide contactor control of all existing circuits. Key switches shall be provided to provide field-level control of existing circuit groups.
    - b. Entertainment Features: Incorporation of theatrical light shows enhance the presentation and enjoyment of players and spectators. Control system shall incorporate pre-programmed light shows such as "chase", "wave", and "score." Control system shall incorporate the ability to initiate these shows locally. System shall be able to time light shows to customer-supplied music.

**1.2 ONFIELD LIGHTING PERFORMANCE**

- A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting manufacturers will provide a guarantee that light levels will be sustained over the life of the warranty period. Lighting calculations shall be developed and field measurements taken on the grid spacing

with the minimum number of grid points specified below.

Manufacturers will provide lumen maintenance data of the LED luminaires used per TM-21-11 and will incorporate the lumen maintenance projections into the lighting designs to ensure target light levels are achieved throughout the guaranteed period of the system. Per IES guidelines, lumen maintenance hours should be reported based on the 6x multiplier of testing hours.

| Area of Lighting | Average Target Illumination Levels | Maximum to Minimum Uniformity Ratio | Grid Points | Grid Spacing |
|------------------|------------------------------------|-------------------------------------|-------------|--------------|
| Football         | 50 Footcandles                     | 2.0:1.0                             | 72          | 30' x 30'    |

- B. Color Temperature: The lighting system shall have a minimum color temperature of 5700K and a CRI of 75.
- C. Playability: Lighting design and luminaire selection should be optimized for playability by reducing glare onfield and providing sufficient uplight.
  - 1. Aiming Angles: To reduce glare, luminaire aiming should ensure the top of the luminaire field angle (based on sample photometric reports) is a minimum of 10 degrees below horizontal.
  - 2. Glare Control Technology – Luminaires selected should have glare control technology including, but not limited to: external visors, internal shields and louvers. No symmetrical beam patterns are acceptable.
  - 3. Aerial lighting – Adequate illumination must be provided above the field in order to see the ball in flight. It is recommended that a lighting analysis be performed above the field of play to evaluate the visibility of the ball over its typical trajectory to ensure the participants will adequately see the ball. Calculation planes should be evaluated up to the maximum anticipated height for the level of play.
  - 4. Mounting Heights: To ensure proper aiming angles, minimum mountings heights shall be as described below. Higher mounting heights may be necessary for luminaire with lesser glare control to meet field angle requirements of section 1.2.C.1.

| # of Poles | Pole Designation | Pole Height |
|------------|------------------|-------------|
| 4          | F1-F4            | 70'         |

### 1.3 **ENVIRONMENTAL LIGHT CONTROL**

- A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.
- B. Spill Light and Glare Control: To minimize impact on adjacent properties, spill light and candela values must not exceed the following levels taken at 3 feet above grade.

| Football Field  | Average | Maximum   |
|---|---------|-----------|
| 150' Specified Spill Line Horizontal Footcandles                  | 0.20 fc | 1.25 fc   |
| 150' Specified Spill Line Max Vertical Footcandles                | 0.35 fc | 1.50 fc   |
| 150' Specified Spill Line Max Candela (taken at 5 ft above grade) |         | 13,000 cd |

- C. Spill Scans: Spill scans must be submitted indicating the amount of horizontal and vertical footcandles along the specified lines. Light levels shall be provided in 30-foot intervals along the boundary line at 3 ft above grade.
- D. Sample Photometry: The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified testing laboratory with a minimum of five years experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.
- E. Field Verification: Lighting manufacturer shall supply field verification of environmental light control using a meter calibrated within the last 12 months:
  - 1. Spill verification: Illumination levels shall be taken in accordance with IESNA LM-5-04. The light sensing surface of the light meter should be held 36 inches above the playing surface with the sensing surface horizontal (for horizontal readings) or vertically pointed at the brightest light bank (for max vertical readings)

## **PART 2 – PRODUCT**

### **2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION**

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.
- B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- C. System Description: Lighting system shall consist of the following:
  - 1. Galvanized steel poles and cross-arm assembly.
  - 2. Non-approved pole technology:
    - a. Square static cast concrete poles will not be accepted.
    - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.
  - 3. Lighting systems shall use concrete foundations. See Section 2.4 for details.
    - a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole

erection, actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.

- b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or re-inforced pier design pole erection may occur after 7 days. Or after a concrete sample from the same batch achieves a certain strength.

4. Manufacturer will supply all drivers and supporting electrical equipment

- a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Integral drivers are not allowed.
- b. Alternate: The pole shall include steps, cables, and platforms for luminaire maintenance, if owner responsible for removal of faulty luminaires.
- c. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2\_2002.

5. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.

6. All luminaires, visors, and cross-arm assemblies shall withstand 150 mi/h winds and maintain luminaire aiming alignment.

7. Control cabinet to provide remote on-off control, monitoring, and entertainment features of the lighting system. See Section 2.3 for further details.

8. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.

- a. Integrated grounding via concrete encased electrode grounding system.
- b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

## 2.2 **ELECTRICAL**

A. Electric Power Requirements for the Sports Lighting Equipment:

- 1. Electric power: \_\_\_\_\_ Volt, \_\_\_\_\_ Phase
- 2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

B. Energy Consumption: The kW consumption for the field lighting system shall be 45.85 kW.

## 2.3 **CONTROL**

A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.

B. Lighting contactor cabinet(s) constructed of NEMA Type 4 aluminum, designed for easy



installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

- C. Contactor control of lights: To minimize wear on drivers and other electrical components and prevent lights from turning on due to communication loss, circuits must be controlled via contactor switching, not dimming driver output to zero.
- D. Dimming: System shall provide for 3-stage 4-stage dimming (high-medium-low-blackout). Dimming will be set via scheduling options (Website, app, phone, fax, email) or via an onsite user interface tablet or device.
- E. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute "early off" commands by phone. Scheduling tool shall be capable of setting curfew limits.

Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

- F. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
- G. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.

Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.

  - 1. Cumulative hours: shall be tracked to show the total hours used by the facility
  - 2. Report hours saved by using early off and push buttons by users.
- H. Communication Costs: Manufacturer shall include communication costs for operating the control and monitoring system for a period of 25 years.
- I. Communication with luminaire drivers: Control system shall interface with drivers in electrical components enclosures by means of powerline communication.
- J. Entertainment Features: Show controller shall provide six (6) preprogrammed light shows per field with option for customized scenes, plus four (4) minutes of custom preprogrammed light shows set to music supplied by customer. Manufacturer-provided user interfaces include touchscreens, pushbuttons, and/or other external control devices.

## **2.4 STRUCTURAL PARAMETERS**

- A. Wind Loads: Wind loads shall be based on the 2018 International Building Code. Wind loads to be calculated using ASCE 7-16, an ultimate design wind speed of 115 mph and exposure

category C.

- B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2013 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).
- C. If no geotechnical report is available, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2018 IBC Table 1806.2.

### **PART 3 – EXECUTION**

#### **3.1 SOIL QUALITY CONTROL**

- A. It shall be the Contractor's responsibility to notify the Owner if soil conditions exist other than those on which the foundation design is based, or if the soil cannot be readily excavated. Contractor may issue a change order request / estimate for the Owner's approval / payment for additional costs associated with:
  - 1. Providing engineered foundation embedment design by a registered engineer in the State of Mississippi for soils other than specified soil conditions;
  - 2. Additional materials required to achieve alternate foundation;
  - 3. Excavation and removal of materials other than normal soils, such as rock, caliche, etc.

#### **3.2 DELIVERY TIMING**

- B. Delivery Timing Equipment On-Site: The equipment must be on-site 10-12 weeks from receipt of approved submittals and receipt of complete order information.

#### **3.3 FIELD QUALITY CONTROL**

- A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- B. Field Light Level Accountability
  - 1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 years. These levels will be specifically stated as "guaranteed" on the illumination summary provided by the manufacturer.
  - 2. The contractor/manufacturer shall be responsible for conducting initial light level testing and an additional inspection of the system, in the presence of the owner, one year from the date of commissioning of the lighting.
  - 3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.
- C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles, uniformity ratios, uplight for aerial visibility, and offsite candela readings are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

#### **3.4 WARRANTY AND GUARANTEE**

- A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.
- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Manufacturer is responsible for removal and replacement of failed luminaires, including all parts, labor, shipping, and equipment rental associated with maintenance. Owner agrees to check fuses in the event of a luminaire outage.

## **PART 4 – DESIGN APPROVAL**

### **4.1 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)**

- A. Design Approval: The owner / engineer will review pre-bid submittals per section 4.1.B from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.
- B. Approved Product: Musco's Light-Structure System™ with TLC for LED® is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.
- C. Lighting systems by Qualite and Techline are not acceptable.
- C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.
- D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

**REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS (NOT PRE-APPROVED) 10  
DAYS PRIOR TO BID**

*All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. **Submit checklist below with submittal.***

| <b>Yes / No</b> | <b>Tab</b> | <b>Item</b>                   | <b>Description</b>   |
|-----------------|------------|-------------------------------|--|
|                 | <b>A</b>   | Letter/ Checklist             | Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.  |
|                 | <b>B</b>   | Equipment Layout              | Drawing(s) showing field layouts with pole locations   |
|                 | <b>C</b>   | On Field Lighting Design      | Lighting design drawing(s) showing:<br>a. Field Name, date, file number, prepared by<br>b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified<br>c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics<br>d. Height of light test meter above field surface.<br>e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaires, total kilowatts, average tilt factor; light loss factor. |
|                 | <b>D</b>   | Off Field Lighting Design     | Lighting design drawing showing initial spill light levels along the boundary line (defined on bid drawings) in footcandles. Lighting design showing glare along the boundary line in candela. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights.  |
|                 | <b>E</b>   | Photometric Report            | Provide first page of photometric report for all luminaire types being proposed showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience.  |
|                 | <b>F</b>   | Performance Guarantee         | Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for warranty period.   |
|                 | <b>G</b>   | Structural Calculations       | Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Mississippi, if required by owner.   |
|                 | <b>H</b>   | Control & Monitoring System   | Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system and entertainment packages. They will also provide ten (10) references of customers currently using proposed system in the state of Mississippi.  |
|                 | <b>I</b>   | Electrical Distribution Plans | Manufacturer bidding an alternate product must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Mississippi.   |
|                 | <b>J</b>   | Warranty                      | Provide written warranty information including all terms and conditions. Provide ten (10) references of customers currently under specified warranty in the state of Mississippi.  |
|                 | <b>K</b>   | Project References            | Manufacturer to provide a list of ten (10) projects where the technology and specific fixture proposed for this project has been installed in the state of Mississippi. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.  |

|  |          |                     |  |
|--|----------|---------------------|--|
|  | <b>L</b> | Product Information | Complete bill of material and current brochures/cut sheets for all products being provided.                                  |
|  | <b>M</b> | Delivery            | Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information. |
|  | <b>N</b> | Non-Compliance      | Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.     |

The information supplied herein shall be used for the purpose of complying with the specifications for Raleigh High School Football. By signing below, I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

**Manufacturer:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Contact Name:** \_\_\_\_\_

**Date:** \_\_\_\_/\_\_\_\_/\_\_\_\_

**Contractor:** \_\_\_\_\_

**Signature:** \_\_\_\_\_