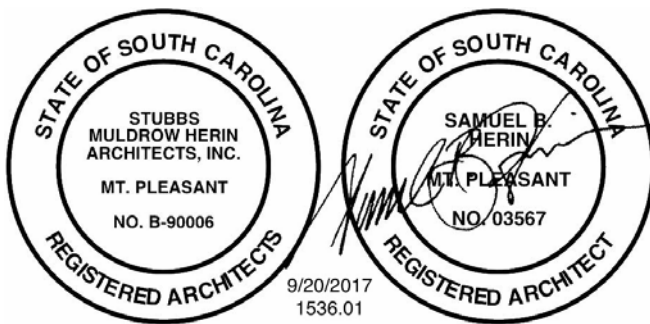


Volume 2



Brooks Stadium Additions – Phase 2 Project Manual

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STUBBS MULDROW HERIN architects, inc. – Architect of Record
400 Hibben Street, Mount Pleasant, SC 29464 • 843-881-7642



Heery International – Sports Architect / Design Architect
999 Peachtree Street NE, Suite 300, Atlanta, GA 30309 • 404-946-2016

Seamon Whiteside & Associates, Civil & Land Planning
ADC Engineering, Structural
DWG, Inc., Electrical, Mechanical, Plumbing, Fire Protection

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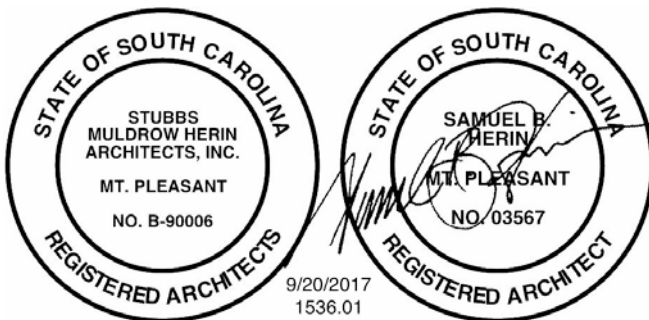
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Valve tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- C. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass - 0.032 inch, stainless steel - 0.025 inch, aluminum - 0.032 inch, or anodized aluminum - 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 4. Fasteners: Stainless-steel self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), the Specification Section number and title where equipment is specified, and the equipment's function.

- C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), the Specification Section number and title where equipment is specified, and equipment's function. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: multicolor, metal labels for mechanical stamping or engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
- B. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- C. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- D. Fasteners: Stainless-steel self-tapping screws.
- E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- F. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping-system abbreviation, valve function, and normally open/closed position and 1/2-inch numbers.
 - 1. Tag Material: Brass - 0.032 inch, stainless steel - 0.025 inch, aluminum - 0.032 inch, or anodized aluminum - 0.032 inch thick, with predrilled holes for attachment hardware.
 - 2. Fasteners: Brass beaded chain.
 - 3. Valve-Tag Color: Red.
 - 4. Letter Color: White.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), function, and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 LABEL INSTALLATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. Provide metal stamped or engraved sprinkler riser data plate.

3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule. Tag shall include function of valve or device.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
 - 1. Valve-Tag Size and Shape:
 - a. Dry-Pipe Sprinkler System: 1-1/2 inches, round.

END OF SECTION 210553

SECTION 211200 - FIRE-SUPPRESSION STANDPIPES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Hose connections.
 - 4. Fire-department connections.
 - 5. Alarm devices.
 - 6. Pressure gages.
- B. Related Sections:
 - 1. Section 211316 "Dry-Pipe Sprinkler Systems" for dry-pipe sprinkler piping.
 - 2. Section 283100 "Fire Detection, Alarm, and Mass Notification" for alarm devices not specified in this Section.

1.3 SYSTEM DESCRIPTIONS

- A. Manual Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Does not have permanent water supply. Piping is dry. Water must be pumped into standpipes by a fire department pumper truck to satisfy demand.

1.4 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig minimum working pressure.
- B. Design fire-suppression standpipes using performance requirements and design criteria indicated.
 - 1. See drawings for flow test information and design criteria on Fire Protection Sprinkler System Specification Sheet (FSSSS).
 - 2. All fire flow tests must be rerun if the calculations are performed twelve months or later than the fire flow test indicated on the FSSSS.
 - 3. If retesting is required, it will be provided by the Owner; request from A/E.
- C. Fire-suppression standpipe design shall be approved by the Office of the State Fire Marshal.
 - 1. Minimum residual pressure at each hose-connection outlet is as follows:

- a. NPS 2-1/2 Hose Connections: 100 psig.
- 2. Maximum residual pressure at required flow at each hose-connection outlet is as follows unless otherwise indicated:
 - a. NPS 2-1/2 Hose Connections: 175 psig.
- D. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.5 ACTION SUBMITTALS

- A. Submittal process shall be in accordance with the Fire Protection Sprinkler Systems Act, SCCL Title 40 Chapter 10. Submittal must be approved prior to installation.
- B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- C. Shop Drawings: For standpipe systems. Working plans, prepared according to NFPA 14, including plans, elevations, sections, details, seismic bracing and restraint, attachments to other work, and hydraulic calculations.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- D. Seismic bracing calculations. Provide calculations and attachment details.
- E. Welding certificates.
- F. Fire-hydrant flow test report, if new one has been provided since flow test indicated in FSSSS.
- G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- H. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-suppression standpipe specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes. Base calculations on results of fire-hydrant flow test indicated on Fire Sprinkler System Specification Sheet.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14, 2010 edition, "Installation of Standpipe and Hose Systems."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

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

2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 40, Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, seamless steel pipe with threaded ends.
- C. Galvanized-Steel Couplings: ASTM A 865, threaded.
- D. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. ~~Cast-Iron Flanges: ASME B16.1, Class 125.~~
- F. ~~Galvanized steel Flanges and Flanged Fittings: ASME B16.5, Class 150.~~
- G. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Pressure Rating: 175 psig minimum.
 - 2. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 3. Galvanized grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

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2.3 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed or FM approved.
 - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
- B. Check Valves:
 - 1. Standard: UL 312.
 - 2. Pressure Rating: 250 psig minimum.
 - 3. Type: Swing check.
 - 4. Body Material: Cast iron.
 - 5. End Connections: Grooved.

C. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Cast or ductile iron.
4. End Connections: Grooved.
5. Valve Operation: Integral electrical, prewired, two-circuit, supervisory switch with visual indicating device, geared hand wheel actuator.

2.4 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

2.5 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Grooved.

B. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.6 HOSE CONNECTIONS

A. Nonadjustable-Valve Hose Connections:

1. Standard: UL 668 hose valve for connecting fire hose.
2. Pressure Rating: 300 psig minimum.
3. Material: Brass or bronze.
4. Size: NPS 2-1/2, as indicated.
5. Inlet: Female pipe threads.
6. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
7. Pattern: Angle.
8. Finish: Rough brass or bronze.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Standard: UL 405.
2. Type: Flush, for wall mounting.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Corrosion-resistant metal.
5. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
6. Caps: Brass, lugged type, with gasket and chain.
7. Escutcheon Plate: Rectangular, polished bronze or brass, wall type.
8. Outlet: With pipe threads.
9. Body Style: Square.
10. Number of Inlets: Four.
11. Outlet Location: Bottom.
12. Escutcheon Plate Marking: Similar to "STANDPIPE."
13. Finish: Polished bronze or brass.
14. Outlet Size: NPS 6.

2.8 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Double-circuit, single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.

2.9 PRESSURE GAGES

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0 to 250 psig minimum.
- D. Water System Piping Gage: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

- B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
 - C. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 SERVICE-ENTRANCE PIPING
- A. Comply with requirements for exterior piping in Civil documents.
- 3.3 PIPING INSTALLATION
- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect/Engineer before deviating from approved working plans.
 - B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.
 - C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.
 - D. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
 - E. Install drain valves on standpipes. Extend drain piping to outside of building.
 - F. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.
 - G. Install supervisory devices in piping systems.
 - H. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.
 - I. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
 - J. Drain dry-type standpipe system piping.
 - K. Pressurize and check dry-type standpipe system piping.
 - L. Install sleeves for piping penetrations of walls, ceilings, and floors.
 - M. Install sleeve seals for piping penetrations of concrete walls and slabs.
 - N. Install escutcheons for piping penetrations of walls, ceilings, and floors

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- G. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- H. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

3.6 HOSE-CONNECTION INSTALLATION

- A. Install freestanding hose connections for access and minimum passage restriction.
- B. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device.

3.7 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.8 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Coordinate with fire-alarm tests. Operate as required.
 - 5. Verify that equipment hose threads are same as local fire-department equipment.
- C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.10 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Refer to Civil documents.
- B. Standard-pressure, dry-type, fire-suppression standpipe piping and fittings shall be the following:
 - 1. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end couplings and fittings for steel piping; and grooved joints.

Deleted: grooved-end-pipe couplings for steel piping;

END OF SECTION 211200

SECTION 211316 - DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Fire-department connections.
 - 4. Sprinkler specialty pipe fittings.
 - 5. Sprinklers.
 - 6. Alarm devices.
 - 7. Control panels.
 - 8. Pressure gages.

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

- A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air/nitrogen. Opening of sprinklers releases compressed air/nitrogen and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Design sprinkler system(s) using performance requirements and design criteria indicated.
 - 1. See drawings for flow test information and design criteria on Fire Protection Sprinkler System Specification Sheet (FSSSS).
 - 2. All fire flow tests must be rerun if the calculations are performed twelve months or later than the fire flow test indicated on the FSSSS.
 - 3. If retesting is required, it will be provided by the Owner; request from A/E.
- C. Sprinkler system design shall be approved by the Office of the State Fire Marshal.

1. Margin of Safety for Available Water Flow and Pressure: 5 psi, including losses through water-service piping, valves, and backflow preventers.
 2. Sprinkler Occupancy Hazard Classifications:
 - a. See drawings.
 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. See drawings.
 4. Maximum Protection Area per Sprinkler: Per UL listing.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.6 SUBMITTALS

- A. Submittal process shall be in accordance with the Fire Protection Sprinkler Systems Act, SCCL Title 40 Chapter 10. Submittal must be approved prior to installation.
- B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- C. Shop Drawings: For dry-pipe sprinkler systems. Working plans, prepared according to NFPA 13, including plans, elevations, sections, details, seismic bracing and restraint, attachments to other work, and hydraulic calculations.
 1. Wiring Diagrams: For power, signal, and control wiring.
- D. Seismic bracing calculations. Provide calculations and attachment details.
- E. Welding certificates.
- F. Fire-hydrant flow test report, if new one has been provided since flow test indicated in FSSSS.
- G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- H. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

- B. Provide new booklet of NFPA 25, 2011 edition, in fire pump room.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems. Base calculations on results of fire-hydrant flow test indicated on Fire Sprinkler System Specification Sheet.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, 2010 edition, "Installation of Sprinkler Systems."
2. NFPA 24, 2010 edition, "Installation of Private Fire Service Mains and Their Appurtenances."

1.10 COORDINATION

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

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. All piping, fittings, couplings, hangers and supports, valves, and other pipe appurtenances shall be listed by a qualified testing agency and labeled.

2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, Schedule 40, seamless steel pipe with threaded ends.
- C. Galvanized, Steel Couplings: ASTM A 865, threaded.

- D. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Or approved equal.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic and asbestos free.
 - 1. Class 125, Cast-Iron and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 - 2. Class 250, Cast-Iron and Class 300, Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 HANGERS & SUPPORTS

A. METAL PIPE HANGERS AND SUPPORTS

- 1. Stainless-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. TRAPEZE PIPE HANGERS

- 1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural stainless-steel shapes with MSS SP-58 stainless-steel hanger rods, nuts, saddles, and U-bolts.

C. METAL FRAMING SYSTEMS

- 1. MFMA Manufactured Metal Framing Systems:
 - a. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - b. Standard: MFMA-4.

- c. Channels: Continuous slotted stainless steel channel with inturred lips.
- d. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- e. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

D. FASTENER SYSTEMS

- 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

E. PIPE STANDS

- 1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support piping.
- 2. High-Type, Single-Pipe Stand:
 - a. Base: Stainless steel.
 - b. Vertical Members: Two or more stainless-steel, continuous-thread rods.
 - c. Horizontal Member: stainless-steel rod with stainless-steel, roller-type pipe support.
- 3. High-Type, Multiple-Pipe Stand:
 - a. Bases: stainless steel.
 - b. Vertical Members: Two or more stainless-steel channels.
 - c. Horizontal Member: Stainless-steel channel.
 - d. Pipe Supports: Stainless-steel, clevis-type pipe hangers.

F. PIPE POSITIONING SYSTEMS

- 1. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

G. EQUIPMENT SUPPORTS

- 1. Description: Welded, shop- or field-fabricated equipment support made from structural stainless-steel shapes.

H. MISCELLANEOUS MATERIALS

- 1. Structural Steel: ASTM A 36/A 36M, stainless-steel plates, shapes, and bars.
- 2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - a. Properties: Nonstaining, noncorrosive, and nongaseous.
 - b. Design Mix: 5000-psi, 28-day compressive strength.

2.5 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Nibco.
 - c. Victaulic Company.
 - d. Or approved equal.
2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3: Ductile-iron body with grooved ends.

C. Iron Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Or approved equal.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Cast or ductile iron.
5. Style: Lug or wafer.
6. End Connections: Grooved.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Milwaukee Valve Company.
 - c. Mueller Co.; Water Products Division.
 - d. Reliable Automatic Sprinkler Co., Inc.
 - e. Tyco Fire & Building Products LP.
 - f. United Brass Works, Inc.
 - g. Victaulic Company.
 - h. Viking Corporation.
 - i. Or approved equal.
2. Standard: UL 312

3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

E. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Milwaukee Valve Company.
 - b. NIBCO INC.
 - c. Tyco Fire & Building Products LP.
 - d. United Brass Works, Inc.
 - e. Watts Water Technologies, Inc.
 - f. Or approved equal.
2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

2.6 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Protection Products, Inc.
 - b. Nibco.
 - c. United Brass Works, Inc.
 - d. Or approved equal.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Watts Water Technologies, Inc.
 - g. Or approved equal.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Protection Products, Inc.
 - b. Nibco.
 - c. United Brass Works, Inc.
 - d. Or approved equal.

2.7 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Dry-Pipe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
 - e. Or approved equal.
2. Standard: UL 260
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Reliable Automatic Sprinkler Co., Inc.
 - 2) Tyco Fire & Building Products LP.
 - 3) Victaulic Company.
 - 4) Viking Corporation.
 - 5) Or approved equal.
 - b. Standard: UL 260.

- c. Type: Automatic device to maintain minimum air pressure in piping.
- d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.

6. Air Compressor:

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Gast Manufacturing Inc.
 - 2) General Air Products, Inc,
 - 3) Viking Corporation.
 - 4) Or approved equal.
- b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- c. Motor Horsepower: Fractional.
- d. Power: See electrical drawings.

7. Integrated Nitrogen Generator:

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) General Air Products, Inc,
 - 2) Potter Electric Signal Company.
 - 3) South-Tek Systems.
 - 4) Or approved equal.
- b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- c. Motor Horsepower: Fractional.
- d. Power: See electrical drawings.

C. Automatic (Ball Drip) Drain Valves:

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AFAC Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Or approved equal.
- 2. Standard: UL 1726.
- 3. Pressure Rating: 175 psig minimum.
- 4. Type: Automatic draining, ball check.
- 5. Size: NPS 3/4.
- 6. End Connections: Threaded.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

- A. General Requirements for Dry-Pipe-System Fittings: UL listed for dry-pipe service.
- B. Flow Detection and Test Assemblies:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Or approved equal.
 - 2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded.
- C. Sprinkler Inspector's Test Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company.
 - c. Viking Corporation.
 - d. Or approved equal.
 - 2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 3. Pressure Rating: 175 psig minimum.
 - 4. Body Material: Cast- or ductile-iron housing with sight glass.
 - 5. Size: Same as connected piping.
 - 6. Inlet and Outlet: Threaded.

2.9 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Reliable Automatic Sprinkler Co., Inc.
 - 2. Tyco Fire & Building Products LP.
 - 3. Victaulic Company.
 - 4. Viking Corporation.
 - 5. Or approved equal.
- B. General Requirements:
 - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.

- C. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Nonresidential Applications: UL 199.
 - 2. Characteristics: Nominal 1/2-inch orifice with discharge coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Special Coatings (where noted):
 - 1. UL listed corrosion-resistant PTFE coating.

2.10 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire-Lite Alarms; a Honeywell company.
 - b. Notifier; a Honeywell company.
 - c. Potter Electric Signal Company.
 - d. Or approved equal.
 - 2. Standard: UL 464.
 - 3. Type: Vibrating, metal alarm bell.
 - 4. Size: 6-inch minimum diameter.
 - 5. Finish: Red-enamel factory finish, suitable for outdoor use.
- C. Pressure Switches:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Potter Electric Signal Company.
 - b. System Sensor; a Honeywell company.
 - c. Tyco Fire & Building Products LP.
 - d. Viking Corporation.
 - e. Or approved equal.
 - 2. Standard: UL 346.
 - 3. Type: Electrically supervised water-flow switch with retard feature.
 - 4. Components: Single-pole, double-throw switch with normally closed contacts.
 - 5. Design Operation: Rising pressure signals water flow.
- D. Valve Supervisory Switches:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Kennedy Valve; a division of McWane, Inc.
 - b. Potter Electric Signal Company.
 - c. System Sensor; a Honeywell company.

- d. Or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. AMETEK, Inc.; U.S. Gauge Division.
 2. Ashcroft, Inc.
 3. Brecco Corporation.
 4. WIKA Instrument Corporation.
 5. Or approved equal.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 250 psig minimum.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect/Engineer before deviating from approved working plans.
- B. Piping Standard: Comply with requirements in NFPA 13 for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or to outside building.
- J. Connect compressed-air/nitrogen supply to dry-pipe sprinkler piping.
- K. Connect air compressor/nitrogen generator to the following piping and wiring:
 - 1. Pressure gages and controls.
 - 2. Electrical power system.
 - 3. Fire-alarm devices, including low-pressure alarm.
- L. Install alarm devices in piping systems.
- M. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.
- N. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- O. Drain dry-pipe sprinkler piping.
- P. Pressurize and check dry-pipe sprinkler system piping and air compressor/nitrogen generator.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs.
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - 2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Install air compressor/nitrogen generator and compressed-air/nitrogen supply piping.
 - b. Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.

3.4 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

3.5 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install flush-mounted, polished bronze, wall-type, fire-department connections with cast escutcheon ring.
- B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.
- C. Refer to Civil documents for more information.

3.6 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Start and run air compressors.
 - 6. Coordinate with fire-alarm tests. Operate as required.
 - 7. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.8 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and/or equipment.

3.10 PIPING SCHEDULE

- A. Standard-pressure, dry-pipe sprinkler system shall be one of the following:
 - 1. Schedule 40, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 - 2. Schedule 40, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; galvanized, grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:

1. Areas without Ceilings: Upright sprinklers.
2. Areas with Suspended Ceilings: Concealed pendent sprinklers with flat cover plates to match ceiling color.
3. Wall Mounting: Recessed sidewall sprinklers.
4. Special Applications: Extended-coverage sprinklers only where needed.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
2. Sprinklers exposed to exterior condition, where noted: UL listed corrosion-resistant PTFE coating.

END OF SECTION 211316

SECTION 213113 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. In-line fire pumps.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to the IBC/IFC.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Product Certificates: For each fire pump, from manufacturer.
- C. Source quality-control reports.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

A. Description: Factory-assembled and -tested fire-pump and driver unit.

B. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.2 IN-LINE FIRE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A-C Fire Pump Systems; a subsidiary of Xylem, Inc.
2. Aurora Pump.
3. Peerless Pump Co.
4. Or Equal

B. Pump:

1. Standard: UL 448 for in-line pumps for fire service.
2. Casing: Radially split case, cast iron with ASME B16.1 pipe-flange connections.
3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
4. Wear Rings: Replaceable bronze.
5. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

- 6. Mounting: Pump and driver shaft is vertical, with motor above pump and pump on base.
- C. Coupling: None or rigid.
- D. Driver:
 - 1. Standard: UL 1004-5.
 - 2. Type: Electric motor; NEMA MG 1, polyphase Design B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of fire pumps.
- B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
- B. Equipment Mounting:
 - 1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations where specified elsewhere.
 - 2. Comply with requirements for vibration isolation and seismic control devices in accordance with NFPA and the IFC.
- C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
- D. Support piping and pumps separately so weight of piping does not rest on pumps.
- E. Install valves that are same size as connecting piping.
- F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tapings.
- G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
- H. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.
- I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

- J. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

- A. Align pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
- B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
- C. Align piping connections.
- D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

- A. Install piping adjacent to pumps and equipment to allow service and maintenance.
- B. Connect relief-valve discharge to drainage piping or point of discharge.
- C. Connect flowmeter-system meters, sensors, and valves to tubing.
- D. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

- A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

- A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Section 213900 "Controllers for Fire-Pump Drivers."
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. After installing components, assemblies, and equipment including controller, test for compliance with requirements.
 - 2. Test according to NFPA 20 for acceptance and performance testing.

3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

G. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 213113

SECTION 213900 - CONTROLLERS FOR FIRE-PUMP DRIVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Full-service, reduced-voltage controllers rated 600 V and less.
 - 2. Controllers for pressure-maintenance pumps.
 - 3. Low-suction-shutdown panels.

1.2 DEFINITIONS

- A. ATS: Automatic transfer switch(es).
- B. ECM: Electronic control module.
- C. MCCB: Molded-case circuit breaker.
- D. N.O.: Normally open.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-pump controllers and alarm panels shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each type of product indicated. Include dimensioned plans, elevations, sections, details, and attachments to other work, including required clearances and service spaces around controller enclosures.
 - 1. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Enclosure types and details for types other than NEMA 250, Type 2.
 - c. Factory-installed devices.
 - d. Nameplate legends.
 - e. Short-circuit current (withstand) rating of integrated unit.

- f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.
 - g. Specified modifications.
 - 2. Detail equipment assemblies and indicate dimensions, weights, loads, method of field assembly, components, and location and size of each field connection.
 - 3. Schematic and Connection Diagrams: For power, signal, alarm, and control wiring and for pressure-sensing tubing.
- C. Seismic Qualification Certificates: For each type of product indicated, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of product indicated, from manufacturer.
- E. Manufacturer's factory test reports of fully assembled and tested equipment.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For each type of product indicated to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
 - 2. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor-based logic controls.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of an NRTL.
- B. Source Limitations: Obtain fire-pump controllers and all associated equipment from single source or producer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with standards of authorities having jurisdiction pertaining to materials and installation.
- E. Comply with NFPA 20 and NFPA 70.
- F. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section "Vibration and Seismic Controls for Electrical Systems."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- B. If stored in areas subject to weather, protect controllers from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 250 W per controller.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Ambient Temperature Rating: Not less than 40 deg F (5 deg C) and not exceeding 122 deg F (50 deg C) unless otherwise indicated.
 - 2. Altitude Rating: Not exceeding 6600 feet (2010 m) unless otherwise indicated.

1.8 COORDINATION

- A. Coordinate layout and installation of controllers with other construction including conduit, piping, fire-pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of fire-pump drivers.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 FULL-SERVICE CONTROLLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASCO Power Technologies, LP; Firetrol Products.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. Hubbell Incorporated; Hubbell Industrial Controls.
 - 4. Metron, Inc.
 - 5. Or Equal
- B. General Requirements for Full-Service Controllers:
 - 1. Comply with NFPA 20 and UL 218.
 - 2. Listed by an NRTL for electric-motor driver for fire-pump service.
 - 3. Combined automatic and nonautomatic operation.
 - 4. Factory assembled, wired, and tested; continuous-duty rated.
 - 5. Service Equipment Label: NRTL labeled for use as service equipment.
- C. Method of Starting:
 - 1. Pressure-switch actuated.

- a. Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
 - b. System pressure recorder, electric ac driven, with spring backup.
 - c. Programmable minimum-run-time relay to prevent short cycling.
 - d. Programmable timer for weekly tests.
 - 2. Magnetic Controller: Autotransformer type.
 - 3. Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.
- D. Method of Stopping: Automatic and nonautomatic shutdown after automatic starting.
- E. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at controller location.
- F. Method of Isolation and Overcurrent Protection: Interlocked isolating switch and nonthermal MCCB; with a common, externally mounted operating handle, and providing locked-rotor protection.
- G. Door-Mounted Operator Interface and Controls:
- 1. Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
 - 2. Method of Control and Indication:
 - a. Microprocessor-based logic controller, with multiline digital readout.
 - b. Membrane keypad.
 - c. LED alarm and status indicating lights.
 - 3. Local and Remote Alarm and Status Indications:
 - a. Controller power on.
 - b. Motor running condition.
 - c. Loss-of-line power.
 - d. Line-power phase reversal.
 - e. Line-power single-phase condition.
 - 4. Audible alarm, with silence push button.
 - 5. Nonautomatic START and STOP push buttons or switches.
- H. Optional Features:
- 1. Extra Output Contacts:
 - a. One N.O. contact(s) for motor running condition.
 - b. One set(s) of contacts for loss-of-line power.
 - c. One each, Form C contacts for high and low reservoir level.
 - 2. Local alarm bell.
 - 3. Door-mounted thermal or impact printer for alarm and status logs.
 - 4. Operator Interface Communications Ports: USB, Ethernet, and RS485.
- I. ATS:
- 1. Complies with NFPA 20, UL 218, and UL 1008.

2. Integral with controller as a listed combination fire-pump controller and power transfer switch.
3. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure. Provide a “make-be fire breaker” ATS.
4. Allows manual transfer from one source to the other.
5. Alternate-Source Isolating and Disconnecting Means: Integral molded-case switch, with an externally mounted operating handle.
6. Local Alarm and Status Indications:
 - a. Normal source available.
 - b. Alternate source available.
 - c. In normal position.
 - d. In alternate position.
 - e. Isolating means open.
 - f.
7. Audible alarm, with silence push button.
8. Nonautomatic (manual, nonelectric) means of transfer.
9. Engine test push button.
10. Start generator output contacts.
11. Timer for weekly generator tests.

2.2 CONTROLLERS FOR PRESSURE-MAINTENANCE PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ASCO Power Technologies, LP; Firetrol Products.
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. Hubbell Incorporated; Hubbell Industrial Controls.
 4. Metron, Inc.
 5. Or Equal

- B. General Requirements for Pressure-Maintenance-Pump Controllers:
 1. Type: UL 508 factory assembled, -wired, and tested, across-the-line; for combined automatic and manual operation.
 2. Enclosure: UL 508 and NEMA 250, Type 2 for wall-mounting.
 3. Factory assembled, wired, and tested.
 4. Finish: Manufacturer's standard color paint.

- C. Rate controller for scheduled horsepower and include the following:
 1. Fusible disconnect switch.
 2. Pressure switch.
 3. Hand-off-auto selector switch.
 4. Pilot light.
 5. Running period timer.

2.3 ENCLOSURES

- A. Fire-Pump Controllers, ATS, Remote Alarm Panels, and Low-Suction-Shutdown Panels: NEMA 250, to comply with environmental conditions at installed locations and NFPA 20.

1. Indoor Locations: Type 12 (IEC IP12).
- B. Enclosure Color: Manufacturer's standard "fire-pump-controller red".
- C. Nameplates: Comply with NFPA 20; complete with capacity, characteristics, approvals, listings, and other pertinent data.
- D. Optional Features:
 1. Floor stands, 12 inches (305 mm) high, for floor-mounted controllers.
 2. Tropicalization.

2.4 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect fire-pump controllers according to requirements in NFPA 20 and UL 218.
 1. Verification of Performance: Rate controllers according to operation of functions and features specified.
- B. Fire-pump controllers will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive equipment, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine equipment before installation. Reject equipment that is wet or damaged by moisture or mold.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROLLER INSTALLATION

- A. Install controllers within sight of their respective drivers.
- B. Connect controllers to their dedicated pressure-sensing lines.
- C. Wall-Mounting Controllers: Install controllers on walls with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, and bottom of enclosure not less than 12 inches (305 mm) above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section "Hangers and Supports for Electrical Systems."
- D. Floor-Mounting Controllers: Install controllers on 4-inch (100-mm) nominal-thickness concrete bases, using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches (305

mm) above finished floor. Comply with requirements for concrete bases specified in Section "Cast-in-Place Concrete" or Section "Miscellaneous Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- E. Seismic Bracing: Comply with requirements specified in Section "Vibration and Seismic Controls for Electrical Systems."
- F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- G. Comply with NEMA ICS 15.

3.3 POWER WIRING INSTALLATION

- A. Install power wiring between controllers and their services or sources, and between controllers and their drivers. Comply with requirements in NFPA 20, NFPA 70, and Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 CONTROL AND ALARM WIRING INSTALLATION

- A. Install wiring between controllers and the building's fire-alarm system.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect remote manual and automatic activation devices where applicable.

3.5 IDENTIFICATION

- A. Comply with requirements in NFPA 20 for marking fire-pump controllers.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20 and as specified in Section "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Inspect and Test Each Component:

- a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
- b. Test insulation resistance for each element, component, connecting supply, feeder, and control circuits.
- c. Test continuity of each circuit.

2. Verify and Test Each Electric-Driver Controller:

- a. Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify Architect before starting the motor(s).
- b. Test each motor for proper phase rotation.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Field Acceptance Tests:

1. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to Architect and authorities having jurisdiction.
2. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.
3. Engage manufacturer's factory-authorized service representative to be present during the testing.
4. Perform field acceptance tests as outlined in NFPA 20.

E. Controllers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. Adjust controllers to function smoothly and as recommended by manufacturer.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers.

C. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

- D. Set field-adjustable pressure switches.

3.9 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain controllers.

END OF SECTION 213900