

SECTION 21 13 19

PRE-ACTION / DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes design, installation and certification of pre-action / dry-pipe sprinkler systems. Areas to include main electrical, telecom any emergency 24 hour operational room and as required by tenant. At Jury Room 819, and Court Room 816, Museum on First Floor and as required by Program.
- B. Related Sections:
 - 1. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
 - 2. Division 21 - Wet-Pipe Sprinkler Systems: For wet-pipe sprinkler piping.
 - 3. Division 21 - Fire Protection (Wet & Dry Standpipe System).
 - 4. Division 21 - Fire Pumps: For fire pumps, pressure-maintenance pumps and fire-pump controllers.

1.02 REFERENCE

- A. National Fire Protection Association
 - 1. 2002 NFPA No. 13-Installation of Sprinkler Systems.
 - 2. 2002 NFPA No. 25-Inspection, Testing, & Maintenance of Water Based Fire Protection Systems.
 - 3. 2002 NFPA No. 70-National Electrical Code.
 - 4. 2002 NFPA No. 72-National Fire Alarm Code.
- B. Underwriter's Laboratories, Inc.
 - 1. UL Standard 864, 9th Edition-Standard on Control Units and Accessories for Fire Alarm Systems.
- C. Authority Having Jurisdiction
 - 1. Requirements of the Authority Having Jurisdiction (AHJ).

1.03 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: The pre-action sprinkler system contractor shall submit the following items to the local fire prevention bureau, owner's insurance underwriter, County's Representative, and all other authorities having jurisdiction, for approval prior to starting work on this project:
 - 1. Plans, elevations, sections, details, and attachments to other work. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Drawings shall show mounting details, proposed pipe runs and sizes
 - 3. Wiring Diagrams shall provide an internal control panel-wiring diagram, which shall include power supply requirements and field wiring termination points. All power, signal and control wiring shall be shown.
 - 4. The graphic annunciator panel artwork drawing shall be shown. (If applicable)
 - 5. System component data submittal package with material data sheets and CSFM listings.

6. Reflected Ceiling Plans: Show ceiling penetrations, ceiling-mounted items, and the following:
 - a. Piping, sprinkler heads, detectors, and accessories.
 - b. Method of attaching hangers to building structure.
 - c. Other ceiling-mounted items including light fixtures, diffusers, grilles, speakers, and access panels.
 7. Occupied Work Area Plans: Show the following:
 - a. Controls and alarms.
 - b. Piping and sprinkler heads, detectors, and accessories.
 - c. Equipment and furnishings
 8. Access Floor Space Plans: Show the following:
 - a. Piping, sprinkler heads, detectors, and accessories.
 - b. Method of supporting piping and conduit.
 9. A complete sequence of operation shall be submitted detailing all alarm devices, shutdown functions, remote signaling, for each zone or system.
- D. Permit Approved Drawings: Working plans, prepared according to NFPA 13/72, that have been approved by authorities having jurisdiction. Include hydraulic calculations if applicable. A copy of all the approved fire suppression system drawings and calculations shall be sent to the Developer Design/Builder and the County's Representative for their records.
1. Provide standby power calculations for the pre-action system control panel. Calculations shall take into consideration the power requirements of all alarms, initiating devices and auxiliary components under full load conditions.
- E. Design Data: Submit design calculations.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and 72. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- H. Field quality-control reports.
- I. Operation and maintenance data.

1.04 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and accessories.
- C. Operation and Maintenance Data: Submit manufacturers' literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 13 and State of California.
- B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
2. The installing fire suppression contractor shall be responsible to design, install, test and maintain the pre-action fire suppression system, the pre-action detection and controls for this system.
3. The installing contractor shall employ a NICET, Level IV, certified special hazards designer, who will be responsible for this project.
4. The installing contractor shall submit a resume of the engineer, project manager, site foreman and commissioning technician, showing experience in similar projects. Resumes to be submitted with bid.
5. The installing contractor shall show evidence that they carry a minimum \$3,000,000 liability and completed operations insurance policy. Due to the critical function this system serves these limits shall supersede limits required in the general conditions of the specifications if less stringent.
6. The installing contractor shall be an authorized stocking distributor of the pre-action detection/control system manufacturer so that immediate replacement parts are available from inventory.

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.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Accept fire pumps and components on site in factory packing. Inspect for damage. Comply with manufacturers rigging and installation instructions.
- C. Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.
- D. Furnish temporary, inlet and outlet caps and maintain in place until installation.

1.08 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for air compressor and pump components.

1.09 MAINTENANCE SERVICE

- A. Division 01 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish service and maintenance of fire pump, driver, and controller for five years from Date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one set of gaskets, screens and seals for each pump type and model supplied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:

1. Fike Corp
2. Substitutions: Not Permitted.

2.02 SYSTEM DESCRIPTIONS

A. Pre-action Sprinkler System Double Interlocked:

1. Supply and install a double interlocked pre-action cabinet with electric-pneumatic release containing all hydraulic and electrical components required for the control of a pre-action system. The cabinet shall include the following: - Remote Controlled Unit Enclosure. (Releasing Control Panel to be mounted separately from enclosure). Provides Field Wiring Junction Box Only in sturdy free-standing 14 gauge steel cabinet, measuring 57" x 36" x 20" for 1 ½", 2" & 3" systems; and 57" x 46" x 24" for 4" & 6" systems.
 - a. Textured rust proof coating, inside and outside, fire red, and oven baked polyester powder on phosphate base.
 - b. Two locked access doors to reduce front area required for opening, easily removable without tools to allow easy installation & servicing.
 - c. Individual access doors for the hydraulic and electrical sections and the emergency release (unlocked) with a neoprene gasket to avoid vibrations.
 - d. Deluge valve, complete with Schedule 40 galvanized steel with trim rated at 250 psi.
 - e. Addressable remote mounted releasing control panel, with emergency batteries.
 - f. Field wiring terminal strips integrated with the cabinet for connection of field wiring for detection system, audible devices, auxiliary contacts and power supply for air compressor.
 - g. Pressure gauges to indicate water supply pressure, priming water pressure and air pressure of the system.
 - h. Release trim with solenoid valve and each supervisory device required.
 - i. Schedule 40 steel pipe header with grooved ends to be connected to supply water.
 - j. Schedule 40 steel pipe drain manifold of 2" diameter for drain connections. Open drain cups in the cabinet and multiple drain manifolds will not be accepted.
2. The automatic sprinkler piping is supervised by air from a compressed air source installed inside (or outside) the pre-action cabinet.
3. The air supply must be regulated and of the proper size in order to be able to restore normal system air pressure within 30 minutes.
4. Air compressor and supervisory trim (Air Option "A") shall be factory installed inside the cabinet and adjusted for the selected configuration.
5. The cabinet assembly must be pre-assembled, pre-wired and factory tested under ISO-9001 conditions, as a total system. It shall also be UL listed, FM and MEA approved as an assembled unit.

- #### B. Automatic Sprinklers for Pre-action & Dry Pipe System:
- Fire sprinklers shall be of one manufacturer throughout the building. No mixing of sprinkler brands shall be permitted. Sprinklers shall be of all brass frame construction with a metal Belleville spring seal, coated on both sides with Teflon film. Sprinklers utilizing non-metal parts in the sealing portion of the sprinkler are strictly prohibited. Sprinklers shall have a quick response frangible bulb type fusible element. Sprinklers to be installed in areas with no ceilings shall be of a brass finish and shall be of adequate temperature for the hazard. Exposed sprinklers subject to corrosive atmospheres shall have a factory applied corrosion resistant coating.

1. Quick Response Dry Concealed Pendent Sprinkler
 - a. Dry pendent barrel shall be of steel construction with an electro-deposited epoxy base coating. The quick response dry pendent sprinklers shall have a 3 mm frangible bulb type fusible element.
 - b. Dry pendent sprinklers shall have a 1" NPT, a standard orifice, and a nominal K Factor of 5.6. The installation of concealed dry pendent sprinklers shall be in conformance with the manufacturer's installation guidelines.
 - c. The dry concealed pendent sprinkler shall be installed with an adapter and a push-on, thread-off cover assembly, with up to 1/2" of adjustment, and a cover diameter no greater than 3-1/8".
 - d. The cover plate for the sprinkler will have a chrome finish (or finish as specified elsewhere).
 - e. Dry quick response concealed pendent sprinklers shall be UL listed. Dry quick response concealed pendent sprinklers shall be listed for installation in an Ordinary Hazard occupancy if installed in an Ordinary Hazard occupancy.

- C. Air Supply: The automatic sprinkler piping is supervised by air from a compressed air source installed inside the pre-action cabinet. The air supply must be regulated and of the proper size in order to be able to restore normal system air pressure within 30 minutes.

- D. Detection & Signaling System: Supply and install a complete electrical detection system including all conduit, wiring, smoke detectors, signaling devices, control panel and connections to auxiliary functions. A bell or a horn shall be installed near the cabinet.

2.03 PERFORMANCE REQUIREMENTS

- A. Design a pre-action system, complete with detection and controls, and obtain approval from authorities having jurisdiction.

- B. The system shall be complete in all ways. It shall include all mechanical and electrical installation, all detection and control equipment, pipe and fittings, audible and visual alarm devices, auxiliary devices and controls, alarm interface, signage, functional checkout and testing, training and all other operations necessary for a functional, U.L. Listed and/or F.M. approved, pre-action suppression system.

- C. Performance Requirements (Piping):
 1. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
 2. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified NICET Level IV certified technician for special hazards, using performance requirements and design criteria indicated.
 3. Developer Design/Builder to provide fire-hydrant flow test records indicate the following conditions:
 - a. Date:
 - b. Time:
 - c. Performed by:
 - d. Location of Residual Fire Hydrant:
 - e. Location of Flow Fire Hydrant:
 - f. Static Pressure at Residual Fire Hydrant:
 - g. Measured Flow at Flow Fire Hydrant
 - h. Residual Pressure at Residual Fire Hydrant
 4. Sprinkler system design shall be approved by authorities having jurisdiction
 5. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

6. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group.
 - b. Electrical Equipment Rooms: Ordinary Hazard, Group.
 - c. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 7. Minimum Density for Automatic-Sprinkler Piping Design: Ordinary-Hazard, Group 1 Occupancy: 0.15 GPM over 1500-sq. ft. area.
 8. Maximum Protection Area per Sprinkler: Per UL listing.
 9. Maximum Protection Area per Sprinkler:
 - a. Electrical Equipment Rooms: 130 sq. ft.
 - b. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
 10. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated: Ordinary-Hazard Occupancies: 250 GPM for 60 to 90 minutes
 11. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.
- D. Performance Requirements (Detection): The system shall be actuated by a combination of addressable spot type ionization and/or photoelectric detectors installed at a maximum spacing of 250 square feet per detector, in both the room and sub-floor protected spaces. If the airflow exceeds one air change per minute, photoelectric detectors only shall be installed at a spacing not to exceed 125 square feet per detector. (Ref. NFPA 72)
1. Provide and install an early warning air sampling system for open area protection. This active smoke detection system will be cross-zoned with the spot type addressable detectors. A high level interface (HLI) shall be provided to integrate with the addressable releasing control panel so that manual reset of the control panel will reset all units into alarm without having to reset each individual unit.
 2. When early warning air sampling is provided at 200 square feet per sampling port, the ceiling photoelectric spot type detectors can be installed at a maximum of 250 square feet per detection.
 3. Where false ceilings are installed, the sampling pipe shall be installed above the ceiling, and sampling points shall be installed on the ceiling and connected by means of a capillary tube.
- E. System Operating Sequence: Automatic as follows:
1. Actuating A Single Detector: Visual indication on control panel, light an individual lamp on graphic annunciator (if applicable), signal pre-action solenoid, and send signal to fire alarm system.
 2. System Operating Sequence (Single Interlock): The activation of an electrical detector AND the opening of an automatic sprinkler is necessary to cause the water to discharge.
 - a. The activation of any detector will energize the solenoid valve, open the deluge valve and cause the system to fill the piping network with water. This will sound an alarm, and activate alarm and water flow contacts for auxiliary functions.
 - b. The opening of an automatic sprinkler OR damage to system piping without electrical detection will initiate the sounding of a warning device and the activation of a supervisory alarm contact but will not cause the system to fill.
 - c. Pressure loss on the sprinkler system will activate an auxiliary contact indicating same. A separate Low Air Pressure indicator shall be provided to indicate the condition.
 - d. Operation of the emergency manual release will depressurize the priming chamber of the deluge valve, causing the system to fill the piping network with water, and activate alarm and water flow contacts for auxiliary functions.
 - e. Main water inlet valve or optional shut-off valve in abnormal position shall initiate the sounding of a warning device and flash yellow LED indicators indicating Supervisory, System Supervision and Valve Monitoring.

3. System Operating Sequence (Double Interlock):
 - a. The activation of an electrical detector AND the opening of an automatic sprinkler is necessary to cause the water to discharge.
 - b. The opening of an automatic sprinkler OR damage to system piping without the detection condition satisfied will activate the pneumatic actuator, sound a supervision signal and activate dry contacts for auxiliary functions but will not cause the system to fill with water.
 - c. Activation of BOTH the detection condition AND the opening of an automatic sprinkler will activate both the solenoid valve and pneumatic actuator, open deluge valve and sound an alarm. This will activate alarm and water flow contacts connected to the remote control panel.
 - d. Pressure loss on the sprinkler system will activate an auxiliary contact indicating same, connected to the remote control panel.
 - e. Operation of the emergency manual release will depressurize the priming chamber of the deluge valve, causing the system to fill the piping network with water, and activate alarm and water flow contacts connected to the building fire alarm panel.

2.04 PIPING MATERIALS NOTE: For FM Global Insured Protection System requiring galvanized-steel piping system.

- A. Standard Weight, Galvanized-Steel Pipe: ASTM A 53, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized-Steel Pipe: ASTM A 135; ASTM A 795, or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Galvanized-Steel Pipe: ASTM A 135 or ASTM A 795, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Galvanized-Steel Pipe Nipples: ASTM A 733 made of ASTM A 53, standard-weight, seamless steel pipe with threaded ends.
- E. Galvanized, Steel Couplings: ASTM A 865, threaded.
- F. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- G. Malleable- or Ductile-Iron Unions: UL 860.
- H. Cast-Iron Flanges: ASME B16.1, Class 125.
- I. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.
- J. Grooved-Joint, Steel-Pipe Appurtenances:
 1. Pressure Rating: 250 psig minimum.
 2. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 3. 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.

2.05 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic and asbestos free. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

2.06 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53/A53M, Grade B; threadable, light wall; Schedule 10 black.

1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings ASTM 47.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon-steel housing with integral pipe stop and O-ring pocked and O-ring uniformly compressed into permanent mechanical engagement onto pipe.

2.07 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.08 LISTED FIRE-PROTECTION VALVES

A. Manufacturers:

1. Jenkins
2. Stockham
3. Milwaukee
4. Substitutions: Not Permitted.

B. General Requirements:

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

C. Globe Valves:

1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable rubber disc, threaded ends, with back seating capacity [packable under pressure].
2. Over 2 inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

- D. Ball Valves:
 - 1. Up to and including 2 inches: Bronze three piece body, brass, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.
 - 2. Over 2 inches: Manufacturers: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle or gear drive hand wheel for sizes 10 inches and over, flanged.

- E. Check Valves:
 - 1. Standard: UL 312
 - 2. Pressure Rating: 250 psig minimum.
 - 3. Type: Swing check.
 - 4. Body Material: Cast iron.
 - 5. End Connections: Flanged or grooved.

- F. Gate Valves:
 - 1. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.
 - 2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze wedge, flanged ends.
 - 3. Over 4 inches: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.06 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed and FM approved.
 - 2. Minimum Pressure Rating: 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: Flanged or grooved.

- C. Bronze OS&Y Gate Valves:
 - 1. Standard: UL 262.
 - 2. Pressure Rating: 175 psig.
 - 3. Body Material: Bronze.
 - 4. End Connections: Threaded.

- D. Iron OS&Y Gate Valves:
 - 1. Standard: UL 262.
 - 2. Pressure Rating: 250 psig minimum 300 psig.
 - 3. Body Material: Cast or ductile iron.
 - 4. End Connections: Flanged or grooved.

- E. Indicating-Type Butterfly Valves:
 - 1. Standard: UL 1091.
 - 2. Pressure Rating: 175 psig minimum.

3. Valves NPS 2 and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
4. Valves NPS 2-1/2 and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
5. Valve Operation: Integral electrical, 115-V ac, pre-wired, two-circuit, supervisory switch, visual indicating device.

2.07 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. Minimum Pressure Rating: 175 psig.

B. Ball Valves: Subject to compliance with requirements.

2.08 SPECIALTY VALVES

A. General Requirements:

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

B. Dry-Pipe Valves:

1. Standard: UL 260
2. Design: Differential-pressure type.
3. 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.
4. Air Compressor:
 - a. Standard: UL's "Fire Protection Equipment Directory," listing or "Approval Guide," published by FM Global, listing.
 - b. Motor Horsepower: Fractional.
 - c. Power: 120-V ac, 60 Hz, single phase.

- C. Pre-action Valves: The Pre-action systems shall utilize a 90° pattern or straight-through pattern type of deluge valve. The deluge valve shall be externally resettable by hydraulic means. The deluge valve shall employ a positive vent on the priming line to ensure that the deluge valve will not prematurely reset. The inlet and outlet connections of deluge valve can be flanged by flanged, flanged by grooved or grooved by grooved, respectively. The deluge valve shall be capable of installation in the vertical or horizontal position. The deluge valve shall be UL Listed and Factory Mutual Approved. The deluge valve shall have a working pressure of 250 PSI. The valve trim shall be compatible and shall be installed following the manufacturer's specifications

2.09 SPRINKLER SPECIALTY PIPE FITTINGS

- A. General Requirements for Dry-Pipe-System Fittings: UL listed for dry-pipe service.
- B. Branch Outlet Fittings:
 - 1. Standard: UL 213.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - 4. Type: Mechanical-T and -cross fittings.
 - 5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 - 6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 - 7. Branch Outlets: Grooved, plain-end pipe, or threaded.
- C. Flow Detection and Test Assemblies:
 - 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 housing with orifice, sight glass, and integral test valve.
 - 4. Size: Same as connected piping.
 - 5. Inlet and Outlet: Threaded.
- D. Branch Line Testers:
 - 1. Standard: UL 199.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Body Material: Brass.
 - 4. Size: Same as connected piping.
 - 5. Inlet: Threaded.
 - 6. Drain Outlet: Threaded and capped.
 - 7. Branch Outlet: Threaded, for sprinkler.
- E. Sprinkler Inspector's Test Fittings:
 - 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 housing with sight glass.
 - 4. Size: Same as connected piping.
 - 5. Inlet and Outlet: Threaded.
- F. Adjustable Drop Nipples:
 - 1. Standard: UL 1474.
 - 2. Pressure Rating: 250 psig minimum.

3. Body Material: Steel pipe with EPDM O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

G. Flexible, Sprinkler Hose Fittings:

1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175 psig minimum.
4. Size: Same as connected piping, for sprinkler.

2.10 SPRINKLERS

A. Automatic Sprinklers for Pre-action & Dry Pipe System: Fire sprinklers shall be of one manufacturer throughout the building. No mixing of sprinkler brands shall be permitted. Sprinklers shall be of all brass frame construction with a metal Belleville spring seal, coated on both sides with Teflon film. Sprinklers utilizing non-metal parts in the sealing portion of the sprinkler are strictly prohibited. Sprinklers shall have a quick response frangible bulb type fusible element. Sprinklers to be installed in areas with no ceilings shall be of a brass finish and shall be of adequate temperature for the hazard. Exposed sprinklers subject to corrosive atmospheres shall have a factory applied corrosion resistant coating.

1. Quick Response Dry Concealed Pendent Sprinkler

- a. Dry pendent barrel shall be of steel construction with an electro-deposited epoxy base coating. The quick response dry pendent sprinklers shall have a 3 mm frangible bulb type fusible element.
- b. Dry pendent sprinklers shall have a 1" NPT, a standard orifice, and a nominal K Factor of 5.6. The installation of concealed dry pendent sprinklers shall be in conformance with the manufacturer's installation guidelines.
- c. The dry concealed pendent sprinkler shall be installed with an adapter and a push-on, thread-off cover assembly, with up to 1/2" of adjustment, and a cover diameter no greater than 3-1/8".
- d. The cover plate for the sprinkler will have a chrome finish (or finish as specified elsewhere).

B. Dry quick response concealed pendent sprinklers shall be UL Listed. Dry quick response concealed pendent sprinklers shall be listed for installation in an Ordinary Hazard occupancy if installed in an Ordinary Hazard occupancy.

C. 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.
3. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.

D. 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.

E. Sprinkler Finishes: Chrome plated.

F. Special Coatings: Wax.

- G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Plastic, white finish, one piece, flat.
 - 2. Sidewall Mounting: Plastic, white finish, one piece, flat.
- H. Sprinkler Guards:
 - 1. Standard: UL 199.
 - 2. Type: Wire cage with fastening device for attaching to sprinkler.

2.11 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electric Alarm:
 - 1. Type: Electrically operated.
 - 2. Alarm: Cast aluminum with red-enamel factory finish.
 - 3. Size: 10-inch diameter.
- C. Valve Supervisory Switches:
 - 1. Standard: UL 346.
 - 2. Type: Electrically supervised.
 - 3. Components: Single-pole, double-throw switch with normally closed contacts.
 - 4. Design: Signals that controlled valve is in other than fully open position.
- D. Water Flow Switch:
 - 1. Type: Vane for mounting horizontally or vertically with two contacts rated 10 amps, 120 volts.

2.12 PRE-ACTION RELEASING CONTROL PANEL

- A. Description: Control panel and its components shall be listed and approved by UL 864, 9th Edition, no exceptions. Control panels which are not UL 864, 9th Edition approved will become obsolete per NFPA 72-2005 edition, causing hardship to the client when components need to be replaced in the near future.
- B. The addressable control panel shall be UL listed and FMG approved for use as a local fire alarm system, and/or releasing clean agent, deluge and pre-action sprinkler fire suppression systems.
- C. Control panels shall use extreme intelligence with peer-to-peer operation. Intelligence shall be in the field devices, not just the control plane, thus eliminating a potential single point of failure. Control panels shall be capable of networking with similar panels to allow for internal and external NOC communications.
- D. Power Requirements: 120-Vac; with electrical contacts for connection to system components and fire alarm system, and transformer or rectifier as needed to produce power at voltage required for accessories and alarm devices.
- E. The control panel shall respond to an alarm-initiating device, including analog smoke sensors in as little as ¼ second. Response times shall be measured from the activation of the initiating device to the activation of the associated notification devices.
- F. Supervised Circuits: Separate circuits for each independent hazard area.
 - 1. Detection circuits equal to the required number of zones, or addressable devices assigned to the required number of zones.

2. Manual pull-station circuit.
3. Alarm circuit.
4. Release circuit.
5. Abort circuit.
6. Shutdown circuit.

G. Provide the following control-panel features:

1. Electrical contacts for shutting down fans, activating dampers, and operating system electrical devices.
2. Automatic switchover to standby power at loss of primary power.
3. Storage container, low-pressure indicator.
4. Service disconnect to interrupt system operation for maintenance with visual status indication on the control panel.

H. Standby Power: Lead-acid or nickel-cadmium batteries with capacity to operate system for 24 hours and alarm for minimum of 5 minutes. Include automatic battery charger, with varying charging rate between trickle and high depending on battery voltage that is capable of maintaining batteries fully charged.

2.13 DETECTION DEVICES

A. Description: Comply with NFPA 2002 and NFPA 72, and include the following types:

1. Ionization Detectors: Comply with UL 268, dual-chamber type, having sampling and referencing chambers, with smoke-sensing element.
2. Photoelectric Detectors: Comply with UL 268, consisting of LED light source and silicon photodiode receiving element.
3. Remote Air-Sampling Detector System: Includes air-sampling pipe network, a laser-based photoelectric detector, a sample transport fan, and a control unit.
 - a. Comply with UL 268 listed, operating at 24-V dc, nominal.
 - b. Pipe Network: CPVC tubing connects control unit with calibrated sampling holes.
 - c. Smoke Detector: Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of four preset values.
 - d. Signals to the Central Fire Alarm Control Panel: Any type of local system trouble is reported to the central fire alarm control panel as a composite "trouble" signal. Alarms on each system zone are individually reported to the central fire alarm control panel as separately identified zones.
 - e. The air-sampling detector shall use intelligent remote displays and/or a high level interface with the pre-action releasing control panel

2.14 AUXILIARY PANELS

A. Graphic Map: The graphic map shall be a full color image on a white background mounted on rigid backing and laminated. Provide a concealed secured hanging system. The graphic map shall include, but not limited to:

1. Building outline, including address, and adjacent streets.
2. Map shall be to scale.
3. All exterior door and doors exiting the protected room.
4. Fire suppression control panel
5. Pre-action sprinkler riser
6. Compass direction and the map shall be oriented to the room when mounted. "You Are Here" shall be indicated
7. Zone area separations and designations.
8. Legend of devices and other symbols.
9. Addresses at each addressable device.

2.15 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" or "AIR/WATER" label on dial face.
- E. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

2.16 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw.
- E. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated finish with concealed hinge and set-screw.
- F. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed hinge, set-screw.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.17 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
- E. Underdeck Clamp: Clamping ring with set-screws.

2.18 SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.19 GROUT

- A. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink, and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.03 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements in Division 22 "Facility Water Distribution" for interior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.04 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Developer Design/Builder is to coordinate with all trades.
- 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 sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Drain dry-pipe sprinkler piping.
- O. Pressurize and check dry-pipe sprinkler system piping and air compressors.
- P. Install piping in accordance with NFPA 13 for sprinkler systems, NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains.
- Q. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- R. Install piping to conserve building space, to not interfere with use of space and other work.
- S. Group piping whenever practical at common elevations.
- T. Install pipe sleeve at piping penetrations through footings, partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
- U. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- V. Pipe Hangers and Supports:
 - 1. Install in accordance with NFPA 13 and NFPA 14.
 - 2. Install hangers to with minimum 1/2 inch space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every [other] floor. Support riser piping independently of connected horizontal piping.
 - 6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Install sheet lead packing between hanger or support and piping.
 - 8. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- W. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.

- X. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Division 09.
- Y. Do not penetrate building structural members unless indicated.
- Z. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.
- AA. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- BB. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.
- CC. Install gate, ball or butterfly valves for shut-off or isolating service.
- DD. Install drain valves at main shut-off valves, low points of piping and apparatus.
- EE. Where inserts are omitted, drill through concrete slab from below and install through-bolt with recessed square steel plate and nut above slab.

3.05 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. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. 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.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.06 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.
 - 3. Install air compressor and compressed-air supply piping.

3.06 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.07 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.

3.08 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 "Joint Sealants".
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 "Joint Sealants".
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.

- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Galvanized-steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 07 "Sheet Metal Flashing and Trim".
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Galvanized-steel pipe.
 - 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
 - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe when sleeve seals are used.
 - 6. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Galvanized-steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 "Penetration Firestopping" for firestop materials and installations.

3.09 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.10 IDENTIFICATION

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

3.11 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. Coordinate with fire-pump tests. Operate as required.
 8. 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.

3.12 CLEANING

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

END OF SECTION