SECTION 21 1316

PREACTION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

A. The publications listed below form a part of this specification section to the extent referenced. The publications are referred to within the text by the basic designation only. Use the latest edition, unless noted otherwise.

B. ASME INTERNATIONAL (ASME)
1. ASME B16.1 Gray Iron Pipe Flanges and Flanged Fittings; Classes 25, 125 and 250
2. ASME B16.3 Malleable Iron Threaded Fittings, Classes 150 and 300
3. ASME B16.4 Gray Iron Threaded Fittings; Classes 125 and 250

C. AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
4. ASSE 1013 Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers
5. ASSE 1015 Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

D. ASTM INTERNATIONAL (ASTM)
2. ASTM A183 Standard Specification for Carbon Steel Track Bolts and Nuts
4. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
5. ASTM A536 Standard Specification for Ductile Iron Castings

E. AMERICAN WATER WORKS ASSOCIATION (AWWA)
7. AWWA M14 Backflow Prevention and Cross-Connection Control: Recommended Practices
8. AWWA C203 Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape – Hot Applied
10. AWWA C104/A21.4 American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

F. FM GLOBAL (FM)
G. INTERNATIONAL CODE COUNCIL

H. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
   1. IEEE C62.41.1 Guide on the Surge Environment in Low-Voltage (1000 v and less) AC Power Circuits
   2. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 v and less) AC Power Circuits

I. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
   1. MSS SP-71 Gray Iron Swing Check Valves, Flanged and Threaded Ends

J. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

K. SRP Codes
   1. SRP AFC SRP Administrative Fire Code

L. UNDERWRITERS LABORATORIES (UL)
   1. UL 268 Smoke Detectors for Fire Protective Signaling Systems
   2. UL 521 Heat Detectors for Fire Protective Signaling Systems
   3. UL 668 Hose Valves for Fire Protection Service
   4. UL 405 Fire Department Connection Devices
   5. UL 213 Standard for Rubber Gasketed Fittings for Fire-Protection Service
   6. UL 262 Standard for Gate Valves for Fire-Protection Service
   7. UL 393 Standard for Indicating Pressure Gauges for Fire-Protection Service
   8. UL 789 Standard for Indicator Posts for Fire-Protection Service
   9. UL 864 Control Units and Accessories for Fire Alarm Systems

1.2 NOTICE TO BIDDERS

A. Before submittal of bid, examine all drawings, specification, addenda, alternatives, special conditions, and all other bidding documents of all sections of this project, verifying all governing conditions at the site, and become fully informed as to the extent and character of the work required, as well as its relation to other work in the building. Submittal of a bid is an agreement to all requirements of the contract documents and no consideration will be granted for any claimed misunderstanding thereof.

B. Submittal of a bid is deemed a representation by the bidder that he is qualified in all respects to properly perform the work for which he is bidding and has experience with similar work. Bidders are
deemed to be aware, on the basis of their background and experience, of materials which may be required in the discharge of their responsibilities, even though unspecified.

C. Any case of error, omission, discrepancy, inconsistency or lack of clarity in the specification or drawings shall be promptly identified to SRP.

### 1.3 DESCRIPTION OF WORK

A. Double-interlock preaction sprinkler systems shall be provided in areas indicated on the drawings. The sprinkler system shall provide preaction sprinkler protection for the entire area noted. Except as modified herein, the system shall be designed and installed in accordance with NFPA 13. Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation. The contractor shall design any portions of the sprinkler system that are not indicated on the drawings or specified herein, including locating and sizing sprinklers, piping and equipment. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein.

B. Control System: The control system shall meet the requirements of NFPA 72. The control panel shall be listed or approved for "releasing device service". The control panel and the solenoid valve that activates the water control valve shall be compatible with each other. Compatibility shall be in accordance with specific approval of the control equipment.

C. Power Supply: Provide the primary operating power from a single-phase 120 VAC circuit. Loss of primary power shall not prevent actuation of the respective automatic water control valve upon activation of any alarm initiating device. Provide backup power through use of rechargeable, sealed, storage batteries.

D. Circuit Requirements: All initiating device circuits (IDC), signal line circuits (SLC), and notification appliance circuits (NAC) shall be Class B in accordance with NFPA 72. Provide a separate circuit for each zone. Fully supervise the solenoid circuits so that the occurrence of a single open or a single ground fault condition is the interconnecting conductors will be indicated at the control panel.

E. System Operation Features: Include in the system a heat detection system (smoke detection in office buildings), supervisory and alarm switches, control panel and associated equipment.

F. System Actuation: Activation of any single detector shall actuate the associated alarm zone circuit on the control panel that, in turn, shall actuate the corresponding automatic water control valve. Actuation of the automatic water control valve shall cause water to fill the preaction system piping once the valve is tripped pneumatically from a loss of pressure in the piping.

G. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical. Deviations from approved working plans for piping require written approval from SRP.

H. Hydraulic Design: The system shall be hydraulically designed to discharge a minimum density as indicated on the drawings. Hydraulic calculations shall be in accordance with NFPA 13. A 10-psi safety margin shall be provided at the point of connection to the city water main.

I. Basis for Calculations: A waterflow test was performed on (DATE) at (LOCATION) and resulted in a static pressure of ___ psi with a residual pressure of ___ psi while flowing ____ gpm. The fire sprinkler subcontractor shall perform a fire hydrant flow test prior to shop drawings submittal. The results shall be included with the hydraulic calculations. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping and 150 for underground plastic piping.
J. Sprinkler Coverage: Sprinklers shall be uniformly spaced on branch lines. Sprinklers shall provide coverage throughout 100 percent of the area noted. Coverage per sprinkler shall be in accordance with NFPA 13. Provide sprinklers below all ducts over 4'-0" wide; coordinate with HVAC drawings.

1. The Small Room Rule shall NOT apply in SRP facilities.

1.4 SUBMITTALS

A. Submit six copies of the following, no later than 21 days prior to the start of system installation, in accordance with the General Conditions of the Contract. Drawings, unless noted otherwise, shall be no smaller than the Contract Drawings.

1. Shop Drawings: Detail drawings conforming to the requirements prescribed in NFPA 13 and NFPA 170. Drawing shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:
   a. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.
   b. Floor plans drawn to a scale not less than 1/8-inch equals 1-foot clearly showing locations of devices, equipment, risers, electrical power connections and other details required to clearly describe the proposed arrangement.
   c. Riser layout drawings drawn to a scale of not less than 1/2-inch equals 1-foot to show details of each system component, clearances between each other and from other equipment and construction in the room.
   d. Details of each type of pipe hanger and related components.
   e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring. The dimension from the edge of vertical piping to the nearest adjacent wall(s) shall be indicated on the drawings when vertical piping is located in stairs or other portions of the means of egress.
   f. Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams shall show connections from field devices to the releasing control panel.
   g. Complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.
   h. Shop drawings and calculations shall be prepared by a qualified NICET Level III (or IV) Technician.

2. The Contractor shall not order any equipment and shall not begin any work until the submittals have been approved in writing by SRP. The contractor shall not perform any installation prior to the receipt of a written authority to proceed from SRP. If submittals are found not to conform to all of the requirements of this specification section and the applicable referenced Codes, Standards and Regulations, the contractor shall be required to revise and resubmit the package with modifications.

3. Hydraulic calculations shall be as outlined in NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Calculations shall be based on the water supply data provided in the specification section. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and
their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type of fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used.

4. Product Data: Annotated catalog data showing manufacturer’s name, model, and catalog number for all equipment and components, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list with equipment description, model number, and quantity shall be provided. This shall include the following:
   a. Pipe, fittings, and mechanical couplings
   b. Valves, including preaction, gate, check, and globe
   c. Pipe hangers and supports
   d. Air compressor, air maintenance device
   e. Waterflow, tamper and low air switches
   f. Sprinklers
   g. Fire department connection
   h. Backflow prevention devices
   i. Fire hose valve
   j. Releasing control panel, initiating and notification devices, manual release station, relays, monitor modules and wire
   k. Miscellaneous equipment (such as spare sprinkler cabinet, signs, etc.)

5. Installers Qualifications: Data approved, prior to submittal of any other data or drawings, to substantiate that the proposed installer is regularly engaged in the installation of the type and complexity of the fire protection system included in this project. Data shall identify the location of three systems recently installed by the proposed installer which are comparable to the system specified. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.


7. As-Built Drawings: In addition to six hard copies, furnish one set of CD or DVD discs containing software back-up and CAD based drawings in the latest version of AutoCAD and DXF format and pdf copy of as-built drawings and schematics. A separate set of approved submittal drawings of the overall system, marked-up to indicate as-built conditions, shall be maintained on site. These drawings shall be maintained in a current condition at all times, and shall be made available for review immediately upon request during normal working hours. Variations from approved drawings, for whatever reason, including those occasioned by modifications, change orders, optional materials, and/or required for coordination between trades shall be indicated in sufficient detail to accurately reflect the as-built conditions. These drawings shall be submitted within 14 calendar days after the final acceptance test of the system. At least two sets of as-built (marked-up) drawings shall be provided to SRP at the time of, or prior to the final acceptance test.

8. Operation and Maintenance Data: Six manuals in loose-leaf binder format and grouped by technical sections consisting of manufacturer’s brochures, schematics, printed instructions, general operating procedures, and safety precautions. Manuals shall be submitted and approved prior to on-site training. In addition to items specified in Division 01 Section 017823 "Operation and Maintenance Data", the Manual shall include a narrative description of the sequence or sequences of operation of the overall fire protection system and a separate
description for each major subsystem. Information to be provided shall include specific open/close settings for all adjustable valves. The manual shall list routine maintenance procedures, possible breakdowns, and repairs, and troubleshooting guide. The manual shall include conduit layout, equipment layout, and simplified wiring and control diagrams for the system as installed. The manual shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

9. Impairment Plan: In the event the scope of work may remove from service or interfere with a fire suppression or alarm system, the design engineer shall consult and communicate with the SRP Fire Marshal to develop an Impairment Plan. The Impairment Plan developed by the design engineer shall be submitted at the same time as the design drawings for review and approval. The final plan shall be written on the drawings.

10. Training Documentation: Provide in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training shall familiarize SRP’s designated personnel with proper operation of the installed system. The maintenance training course shall provide SRP’s designated personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

11. Schedule: Provide a schedule indicating the delivery dates of the equipment to be supplied; installation sequence; time frame and the total amount of on-site technical assistance time (in man-hours per phase) that the supplier of the equipment has included in their bid to comply with the requirements of this specification section and SRP’s requirements; and final acceptance test dates to meet SRP’s scheduled project completion dates.

12. Preliminary Equipment List: Provide a preliminary equipment list identifying the type, quantity, make, and model number of each piece of equipment to be provided under this submittal. Types and quantities of equipment submitted shall coincide with the types and quantities of equipment used in the battery calculations and those shown on the shop drawings. A final equipment list shall be submitted with the Operating and Maintenance (O&M) manual.

13. In the event that the Contractor’s submittal package is required to be revised and resubmitted due to nonconformance with this specification section, illegibility of the submittal, incomplete submittals, noncompliance with the referenced local, state and national Codes, Standards and Regulations or nonconformance with pertinent documentation relative to the project, the contractor shall pay all fees associated with the additional submittal review. Payment of the fee shall be solely the contractor’s responsibility.

1.5 QUALITY ASSURANCE

A. The recommended practices stated in the manufacturer’s literature or documentation shall be considered as mandatory requirements.

B. Qualifications - Contractor: The contractor shall be an Arizona licensed contractor in possession of a valid fire sprinkler contractor’s license. Design and installation must be performed by a sprinkler contractor whose business is located within a 75-mile radius of the project site. The contractor shall have a minimum of 3 years of experience in the installation of automatic sprinkler systems in similar facilities.

C. Qualification - Fire Sprinkler Design Services: Shop (working) drawings and calculations shall be prepared under the direction of and signed by a qualified registered Professional Engineer or a NICET...
Level III (minimum) in water-based systems. For the purposes of meeting this requirement, a qualified engineer is defined as an individual meeting one of the following conditions:

1. A registered professional engineer having passed the NCEES examination in fire protection engineering.

2. Registered professional engineer with verification of experience and at least 5 years of current experience in the design of the fire protection and detection systems.

D. Qualifications - Fire Sprinkler Supervisor: A NICET Level III (minimum) in water-based systems shall supervise the installation of the fire sprinkler system.

E. Qualifications - Fire Sprinkler Installer: Fire sprinkler installers with a minimum of 2 years of experience or who possess a CSA certification shall be permitted to assist in the installation of the fire sprinkler system.

F. Qualifications - Fire Sprinkler Test Personnel: Fire sprinkler technicians with a minimum of 8 years of experience shall be utilized to test and certify the installation of the fire sprinkler system. The fire sprinkler technicians testing the equipment shall be factory-trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

G. Qualifications - Releasing System Design Services: Shop (working) drawings and calculations shall be prepared under the direction of and signed by a qualified registered Professional Engineer or a NICET Level III in fire alarm systems. For the purposes of meeting this requirement, a qualified engineer is defined as an individual meeting one of the following conditions:

1. A registered professional engineer having passed the NCEES examination in fire protection engineering.

2. Registered professional engineer with verification of experience and at least 5 years of current experience in the design of the fire protection and detection systems.

H. Qualifications - Releasing System Supervisor: A NICET Level III (minimum) fire alarm technician shall supervise the installation of the releasing system. The technician shall be factory-trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

I. Qualifications - Releasing System Technician: Technicians with a minimum of 4 years of experience shall be utilized to assist in the installation and termination of fire alarm devices, cabinets, and panels. The technicians installing the equipment shall be factory-trained in the installation and adjustment of the equipment specified herein and on the drawings.

J. Qualifications - Releasing System Installer: Installer with a minimum of 2 years of experience shall be permitted to assist in the installation of fire alarm devices, cabinets and panels. An electrician shall be permitted to install wire, cable, conduit and backboxes for the fire alarm system.

K. Qualifications - Releasing System Test Personnel: Technicians with a minimum of 8 years of experience shall be utilized to test and certify the installation of the releasing system devices, cabinets, and panels. The fire alarm technicians testing the equipment shall be factory-trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.
1.6 REGULATORY REQUIREMENTS

A. All system components shall be listed or approved for their intended use and shall be compatible with the system and its components. Where the terms "listed" or "approved" appear in this specification section, they shall mean UL-listed (UL Fire Prot Dir), FM-approved (FM App Guide), or listed by a nationally recognized testing laboratory (NRTL). The omission of these terms under the description of any item of equipment described shall not be construed as waiving the requirement for listing or approval. All listings or approvals shall be based on an existing ANSI or UL published standard.

B. Compliance with referenced standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. In the event of a conflict between specific provisions of this specification section and applicable standards, this specification section shall govern. Reference to "authority having jurisdiction" shall be interpreted to mean SRP or SRP’s Representative.

C. Install all work in full conformance with the requirements of all local and governmental authorities having jurisdiction over these matters, utility company requirements, and requirements of the latest issues of all applicable Codes. The building permit will be secured by SRP, any additional permits, inspections, close out shall be the responsibility of the contractor.

D. The fire protection installation and the installing contractor shall comply fully with all city, county and state laws, ordinances and regulations applicable to fire protection installations.

E. Should any change in plans or specification be required to comply with governmental regulations, the contractor shall notify the Engineer at the time of submitting his bid.

F. Secure and pay for necessary approvals, permits, inspections, etc., and deliver the official records of the granting of permits to the SRP Representative without additional cost to SRP.

G. A Work Authorization is required for all sprinkler work. The SRP Project Manager (PM) shall apply for and receive the Work Authorization. The fire protection contractor will receive the Work Authorization from the SRP PM. The Work Authorization must be prominently displayed at the jobsite before any work, to include demolition, can begin. Upon completion of the work, a final inspection by the SRP Fire Marshal, and the satisfactory resolution of all issues identified by the Final Inspection, the SRP Fire Marshal shall sign and close out the Work Authorization which indicates acceptance of the permitted work.

1.7 VERIFYING ACTUAL FIELD CONDITIONS

A. Before commencing work, examine all adjoining work on which the contractor’s work is in any way dependent for perfect workmanship according to the intent of this specification section, and report to the SRP Representative any condition which prevents performance of first class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

B. The contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the SRP Representative of any discrepancy before performing the work.

1.8 COORDINATION OF TRADES

A. The contract documents are not intended to serve as coordinated construction documents showing all minor adjustments in locations required for a fully coordinated installation that respects the work of all trades.
B. Piping offsets, fittings, and any other accessories required shall be furnished as required to provide a complete installation and to eliminate interference with other construction. Sprinklers shall be installed over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

C. Wherever the contractor's work interconnects with work of other contractors, the contractor shall coordinate his work with other contractors to ensure that all contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access (dampers, etc.) concealed above hung ceilings by permanent colored pins/tabs in the ceiling directly below the item.

D. Provide required supports and hangers for piping, conduit and equipment, so that loading will not exceed allowable loadings of structure. Submittal of a bid shall be a deemed representation that the contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

E. Field drilling and cutting of holes in structural decks, roofs, walls, etc., required for work under this section shall be coordinated through various trades in their respective materials and approved by the SRP Representative. All such drilling, cutting, and reinforcing costs shall be borne by the contractor.

F. Due to the type of installation, a fixed sequence of construction is required to properly install the complete systems. It shall be the responsibility of the contractor to coordinate, protect, and schedule his work with other trades in accordance with the construction sequence.

G. Cooperate with all other contractors and subcontractors to facilitate the completion of the work as a whole, subject to the direction of the SRP Representative.

1.9 SCHEDULING

A. Provide a schedule to SRP indicating the installation sequence and timeframe prior to beginning work. Provide weekly updates to SRP. All wiring, circuit testing and device installation shall be completed in time for the equipment supplier to make all final connections and conduct all tests as outlined in these specification sections.

B. Coordinate the Acceptance Test for each fire alarm system with SRP and other necessary parties identified by SRP.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants in accordance with manufacturer's instructions.

B. All pipes shall either be capped or plugged until installation.

C. Coordinate the storage arrangement and location with SRP.

D. Deliver and store products in shipping containers/boxes, with labeling in place.

E. Provide temporary protective coating on cast iron and steel valves.
1.11 WASTE REMOVAL

A. At the conclusion of each day's work, clean up and stockpile on site all waste, debris, and trash, which may have accumulated during the day as a result of work by the contractor and of his presence on the job.

B. Sidewalks and street adjoining the property shall be kept broom clean and free of waste, debris, trash and obstructions of any kind caused by work of the contractor, which will affect the condition and safety of streets, walks, utilities and property.

1.12 SPARE PARTS

A. Repair Service/Replacement Parts: During warranty period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site.

B. The contractor shall provide spare sprinklers, sprinkler wrench and sprinkler cabinet in accordance with NFPA 13.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Standard Products: Material and equipment shall be the standard products of a manufacturer, where possible, and not a combination of manufacturers for any particular classification of materials. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid opening. All materials and equipment supplied shall be new, first quality and the manufacturer’s best type and latest model capable of complying with all requirements of this specification section and shall have been in continuous production and in continuous service in commercial applications for at least 1-year. All equipment furnished shall be new and listed for its intended application. Obsolete equipment shall not be used.

B. Nameplates: Major components of equipment shall have the manufacturer's name, model or serial number, and date of installation provided on a new plate permanently affixed to the item or equipment. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.2 UNDERGROUND PIPING SYSTEMS

A. Pipe: Pipe shall comply with NFPA 24. Minimum pipe size shall be minimum [4 inches]/[6 inches]. Piping more than 5 feet outside the building walls shall comply with [Section 33 11 00] WATER UTILITY DISTRIBUTION PIPING. A continuous section of welded stainless steel fire water service piping from a point outside the building perimeter to a flanged fitting at least 1-foot above the finished floor within the building is acceptable.

B. Fittings and Gaskets: Fittings shall be ductile-iron conforming to AWWA C110/A21.10 with cement mortar lining conforming to AWWA C104/A21.4. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile-iron pipe joints shall conform to AWWA C111/A21.11.

C. Gate Valve and Indicator Posts: Installation shall comply with NFPA 24. Gate valves for use with indicator post shall conform to UL 262. Indicator posts shall conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.
D. Valve Boxes: Except where indicator posts are provided, for each buried valve, provide a cast-iron, ductile-iron, or plastic valve box of a suitable size. Plastic boxes shall be constructed of acrylonitrile-butadiene-styrene (ABS) or inorganic fiber-reinforced black polyolefin. Provide cast-iron, ductile-iron, or plastic cover for valve box with the word "WATER" cast on the cover. The minimum box shaft diameter shall be 5.25 inches. Coat cast-iron and ductile-iron boxes with bituminous paint applied to a minimum dry-film thickness of 10 mils.

E. Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold block letters continuously and repeatedly over the entire tape length. Warning and identification shall read "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.3 ABOVEGROUND PIPING SYSTEMS

A. Pipe: Pipe shall be standard weight conforming to ASTM A795, ASTM A53, or ASTM A135. Piping less than 3-inch in diameter shall be minimum schedule 40 and joined by threaded fittings. Piping 4 inches and greater shall be minimum schedule 10 and joined by threaded, grooved or flanged fittings. Pipe in which threads or grooves are cut shall have a corrosion resistance ratio (CRR) of 1.00 or greater after threads or grooves are cut. Pipe shall be marked as to the brand or name of the manufacturer, kind of pipe and the ASTM designation in accordance with the "Product Marking" provisions of the ASTM standard.

B. Plastic Pipe: Plastic piping (PVC, CPVC, polybutylene) is not permitted.

C. Grooved Fittings and Couplings: Grooved fittings, couplings and bolts shall be provided by the same manufacturer. Fittings and couplings shall be malleable iron complying with ASTM A47 or ductile-iron complying with ASTM A536. Couplings shall be of the rigid type except that flexible type will be provided where flexible joints are specifically required by NFPA 13. Coupling gaskets shall be Grade E (EPDM) approved for dry pipe fire protection service. Gasket shall be the flush type that fills the entire cavity between the coupling and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated. Plain-end fittings with mechanical couplings, fittings which require drilling a hole in the pipe, and fittings which use steel gripping devices to bite into the pipe, shall not be used.

D. Non-Grooved Fittings: Non-grooved fittings shall be threaded or flanged. Threaded fittings shall be cast-iron conforming to ASME B16.4, malleable iron conforming to ASME B16.3 or ductile-iron conforming to ASTM A536. Flanged fittings shall be cast-iron conforming to ASME B16.1. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which require drilling a hole in the pipe, and fittings which use steel gripping devices to bite into the pipe, shall not be used.

E. Flanges and Gaskets: Flanges shall conform to NFPA 13 and ASME B16.1. Flanges shall be the type that are welded or threaded to the pipe. Flanges which are bolted to grooved pipe shall not be permitted. Gaskets shall be full-face type EPDM or other approved material.

F. Pipe Hangers: Hangers shall be listed or approved and be of the type suitable for the application, construction and size pipe involved. Earthquake bracing shall be listed.

G. Control Valve: Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type or butterfly type and shall be listed.
H. Check Valve: Check valve 2 inches and larger shall be listed or approved. Check valves 4 inches and larger shall be of the swing type with flanged cast-iron body and flanged inspection plate, shall have a clear waterway and shall meet the requirements of MSS SP-71, for Type 3 or 4.

I. Hose Valve: Valve shall comply with UL 668 and shall have a minimum rating of 300 pounds per square inch. Valve shall be non-rising stem, all bronze, 90-degree angle type, with 2 1/2-inch American National Standard Fire Hose Screw Thread (NH) male outlet in accordance with NFPA 1963. Hose valves shall be equipped with lugged cap with drip drain, cap gasket and chain. Valve finish shall be polished brass.

J. Preaction Valve: Preaction valve shall be electrically and pneumatically actuated and rated for a working pressure of 175 pounds per square inch. Valve shall be capable of being reset without opening the valve. Electrical solenoid valve used to actuate the water control valve shall be an integral component of the valve or shall be approved for use by the water control valve manufacturer. Solenoid valve shall be rated at 24 volts direct current, and shall be normally closed type that operates when energized. Solenoid valves shall be rated for a maximum pressure differential of 175 pounds per square inch. Preaction valve shall be equipped with a means to prevent the valve from returning to the closed position until being manually reset. Assembly shall be complete with the valve manufacturer's standard trim piping, drain and test valves, pressure gauges, and other required appurtenances.

2.4 ALARM INITIATING AND SUPERVISORY DEVICES

A. Sprinkler Waterflow Indicator Switch, Vane Type: Switch shall be vane type with a cast aluminum housing. The device shall sense water movements and be capable of detecting a sustained flow of 10 gallons per minute or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall be tamper resistant and contain two SPDT (Form C) contacts arranged to transfer upon removal of the housing cover, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

B. Valve Supervisory (Tamper) Switch: Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain two sets of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

C. High/Low-Air Pressure Supervisory Switch: Each preaction system shall be provided with an air pressure switch connected to the control panel. The pressure switch shall supervise the air pressure in the system and shall be set to activate at 10 psi above the dry pipe valve trip point pressure (low) and 10 psi above normal air pressure (high). The switch shall have an adjustable range between 5 and 80 psi. The switch shall have screw terminal connection and shall be capable of being wired for normally open or normally closed circuit.

2.5 SPRINKLERS

A. Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Extended coverage sprinklers shall not be used.

B. Areas with finished ceilings: Pendent sprinkler, recessed, quick-response, glass bulb, white finish (unless noted otherwise), ordinary temperature, minimum k-factor of 5.6. Pendent sprinklers shall be dry pendent or installed on return bends.

C. Areas without finished ceilings: Upright sprinkler, standard-response, glass bulb, brass finish, ordinary temperature, minimum k-factor of 5.6.
D. Sprinklers shall be of the same manufacturer and same temperature characteristics throughout any single room or area, but not necessarily throughout the entire building.

2.6 SUPERVISORY AIR SYSTEM

A. Air Compressor: Air compressor shall be single stage, oil-less type, air-cooled, electric motor driven, equipped with a check valve, centrifugal pressure and moisture unloader, pressure switch for automatic starting and stopping. A safety relief valve, set to operate at 65 pounds per square inch shall be provided. The compressor shall be sized to pressurize the system to its designed pressure within 30 minutes.

B. Air Pressure Maintenance Device: Device shall be a pressure regulator that automatically reduces supply air pressure to the minimum pressure required to be maintained in the piping system. The device shall have a cast bronze body and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1/16-inch restriction to prevent rapid pressurization of the system, and adjustment screw. The device shall be capable of reducing maximum inlet pressure of 100 pounds per square inch into a fixed outlet pressure adjustable to 10 pounds per square inch.

C. High/Low-Air Pressure Switch: Each system shall be provided with a high/low-air pressure switch connected to the control panel.

2.7 BACKFLOW PREVENTION ASSEMBLY

A. [Reduced-pressure principle][Double-check] valve assembly backflow preventer complying with ASSE 1013, ASSE 1015 and AWWA M14. Each check valve shall have a drain. Backflow prevention assemblies shall have current "Certificate of Approval from the Foundation for Cross-Connection Control and Hydraulic Research, FCCCHR List" and be listed for fire protection use. Listing of the specific make, model, design, and size in the FCCCHR List shall be acceptable as the required documentation.

B. Backflow Preventer Test Connection: Test connection shall consist of a series of listed hose valves with 2 1/2-inch National Standard male hose threads with cap and chain. Provide one valve for each 250 gpm of system demand and provide enough valves to flow the total system design demand, including interior hose steam allowances, during the test. Provide a permanent sign that reads "TEST VALVES" immediately adjacent to these valves on the wall.

2.8 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall be [freestanding][projecting][flush] type with cast brass body, matching [wall ]escutcheon lettered "Auto Spkr" with a polished brass or chromium-plated finish. The connection shall have individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2 1/2-inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963 and comply with UL 405.

2.9 RELEASING CONTROL PANEL (RCP)

A. Panel shall be listed or approved for "releasing device service" or shall have modules approved for this purpose. The panel shall be capable of supporting independent detection and releasing zones. The panel shall be capable of putting one zone in maintenance mode without affecting operation of the other zones.

B. Primary Electric Power: Power shall be 120 VAC for the RCP from the normal AC service to the building in accordance with NFPA 72.
C. Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

D. Batteries: Provide sealed, maintenance-free, lead-acid batteries as the source for emergency power to the RCP. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid-state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of a failure of primary power. Upon return of building power, the system shall automatically retransfer thereto, and the batteries shall automatically recharge.

1. Capacity, Releasing System: Battery size shall have sufficient capacity to operate the releasing system under supervisory and trouble conditions, including audible trouble signal devices for 24 hours and audible and visual signal devices under alarm conditions for an additional [5][15] minutes.

2. Battery Power Calculations: Verify that battery capacity exceeds supervisory and alarm power requirements. Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Include ampere-hour requirements for each system component and each panel component, and compliance with UL 864. Provide complete battery calculations for the alarm, alert, and supervisory power requirements. Include a 1.2 derating factor in all calculations.

3. For battery calculations use the following assumptions: Assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required amp-hours for the specified standby time, and then calculate the required amp-hours for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period.

E. Battery Chargers: Provide a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 120 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (20.4 VDC), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours after a single discharge cycle as described in paragraph Capacity above. Provide a pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

F. Maintenance Switch: Provide a supervised, keyed maintenance releasing bypass switch for each zone. Activation of switch shall physically interrupt the solenoid power and annunciate a supervisory condition at the panel.

2.10 COMBINATION FIXED TEMPERATURE AND RATE-OF-RISE HEAT DETECTORS

A. Provide heat detectors for detection of fire by combination fixed temperature and rate-of-rise principle. Heat detector spacing shall be rated in accordance with UL 521. Detectors shall be supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication which is readily visible. The UL 521 test rating for the fixed temperature portion shall be 135 degrees F. The UL 521 test rating for the rate-of-rise detectors shall be rated for 50 by 50 feet.

2.11 SMOKE DETECTORS

A. Photoelectric Smoke Detectors: Provide addressable photoelectric smoke detectors as follows:
1. Provide analog/addressable photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke detectors shall be listed for use with the releasing control panel.

2. Provide self-restoring type detectors that do not require any re-adjustment after actuation at the RCP to restore them to normal operation.

3. Components shall be rust and corrosion resistant. Vibration shall have no effect on the detector’s operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.

4. Provide twist lock bases constructed of white, high impact polycarbonate designed for mounting on a standard 3 1/2-inch or 4-inch octagonal or 4-inch square outlet box for detectors. The detectors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on No. 12 AWG screw terminals. The detector shall have a visual indicator to show actuation. Insertion of an incorrect detector type into the base shall cause a "Wrong Device" trouble condition at the RCP until the proper type of detector is installed, or the system is reprogrammed. The system program shall recognize the insertion of a wrong device and shall automatically default to the set point values corresponding to the inserted device and shall monitor alarm and trouble conditions according to the default parameters.

5. Sounder bases shall produce a minimum of 90 dBA at 10 feet.

6. The detector address shall identify the particular unit, its location within the system, and its sensitivity setting. Detectors shall be of the low voltage type rated for use on a 24 VDC system.

7. An operator at the control panel, having the proper access level, shall have the capability to manually access the following information for each initiating device.
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Detector range (normal, dirty, etc.)

2.12 NOTIFICATION APPLIANCES

A. Notification appliances shall be suitable for connection to supervised notification appliance circuits. Appliance shall have a separate screw terminal for each conductor. The surface of the appliance shall be red in color.

B. Alarm Horn: [Surface-mounted][Recessed], [[single][double] projector,] grill,] vibrating type suitable for use in an electrically supervised circuit and shall have a sound output rating of at least 90 decibels at 10 feet.

2.13 WIRING

A. Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein. NFPA 70 accepted fire alarm cables that do not require the use of raceways except as modified herein are permitted.

B. Alarm Wiring: The SLC wiring shall be solid copper cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. 16
AWG size twisted and shielded solid conductors at a minimum. Notification appliance circuit conductors shall be solid copper No. 14 AWG size conductors at a minimum. Wire size shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than the listed voltages for the detectors and/or appliances. Power wiring, operating at 120 VAC minimum, shall be a minimum No. 12 AWG solid copper having similar insulation. Acceptable power-limited cables are FPL, FPLR or FPLP as appropriate with red colored covering. Non-power-limited cables shall comply with NFPA 70.

2.14 LINE VOLTAGE SURGE PROTECTIVE DEVICES

A. Line voltage surge protective devices shall be provided to suppress all voltage transients which might damage fire alarm panel components. The surge protective device shall wire in series to the power supply of the protected equipment with screw terminations. Line voltage surge arrester shall be installed directly adjacent to power panel where FACU breaker is located.

B. Line voltage surge protective devices for nominal 120 volt shall be UL 1449 listed with a maximum 500 volt suppression level and have a maximum response of 5 nanoseconds. The surge protective device shall also meet IEEE C62.41.1 and IEEE C62.41.2 category B tests for surge capacity. The surge protective device shall feature multi-stage construction and be provided with a long life indicator lamp (either light emitting diode or neon) which extinguishes upon failure of protected components. Any unit fusing shall be externally accessible.

C. Line voltage surge protective device for nominal 24 volt shall be UL 497B listed and have a maximum response time of 1 nanosecond. The surge protective device shall feature multi-stage construction and be self-resetting. Surge protective device shall be a base and plug style. Base assembly shall have screw terminals for fire alarm wiring. Base assembly shall accept "plug-in" surge protective module.

D. Line voltage surge protective devices for alarm telephone dialer shall be UL 497B listed and have a maximum response time of 1 nanosecond. The surge protective device shall feature multi-stage construction and be self-resetting. Surge protective device shall be a base and plug style. The base assembly shall have screw terminals for fire alarm devices. Base assembly shall accept a "plug-in" surge protective module.

E. All surge protective devices (SPD) shall be the standard product of a single manufacturer and be equal or better than the following:

1. For 120 VAC nominal line voltage: DITEK DTK-120S20A series-connected, 20 A AC power SPD.
2. For 24-volt nominal line voltage: DITEK DTK-24MHLP24BWB series-connected, modular, 5A maximum current SPD.
3. For alarm telephone dialers: DITEK DTK-MRJ31XSCPWP or approved equal.

2.15 ACCESSORIES

A. Sprinkler Cabinet: Spare sprinklers shall be provided in accordance with NFPA 13 and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

B. Sprinkler Escutcheon: Sprinkler escutcheons shall be white finish unless otherwise noted. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.
C. Escutcheon Plates: Provide escutcheons for pipes passing through walls, partitions, and suspended ceilings. Escutcheons shall be steel, primed and finish painted to match the adjacent wall or ceiling finish.

D. Sprinkler Guard: Guards shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers subject to damage.

E. Identification Sign: Valve identification signs shall meet the following:

1. Furnish and install properly lettered and approved metal or plastic signs to each control valve, alarm device, inspector's test valve, drain valve, and alarm bypass valve. Each sign shall indicate the normal valve position as well as the portion of the system that the valve serves. Valve identification signs shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gage steel or 0.024-inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain", auxiliary drain", "inspector's test", "alarm test", "alarm line", and similar wording as required to identify operational components.

2. Permanently affix metallic hydraulic design data nameplates complying with NFPA 13 to the riser of each system. Hydraulic information shall be permanently engraved on the nameplate. The use of permanent marker only is not acceptable.

3. Provide a laminated 8.5-inch x 11-inch diagram, hung on each riser, showing the floor area protected by that riser.

2.16 SPECIALTY SPRINKLER FITTINGS

A. Listed, made of steel, ductile-iron, or other materials compatible with piping.

B. Drop-Nipple Fittings: Adjustable drop nipples are not permitted.

C. Mechanical-T Fittings: UL 213, ductile-iron housing with pressure-responsive gasket, bolts, and threaded or locking-lug outlet.

D. Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gasket, bolts, and threaded or locking-lug outlets.

E. Sprinkler, Drain and Alarm/Inspector's Test Fittings: Cast-iron or ductile-iron body; with threaded inlet and outlet, test valve, and orifice and sight glass.

F. Sprinkler, Branch Line Test Fittings: Brass body; with threaded inlet and capped drain outlet and threaded outlet for sprinkler.

2.17 PRESSURE GAUGES

A. Pressure gauges shall be UL-listed (UL 393), 3 1/2-inch to 4 1/2-inch diameter dial with dial range of 0 to 250 pounds per square inch gauge.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. The installation shall be in accordance with the applicable provisions of NFPA 13, NFPA 24, NFPA 1963, NFPA 72 and publications referenced herein.
B. The Work Authorization must be prominently displayed at the job site before any work, to include demolition, can begin.

C. Upon completion of the work, a final inspection by the SRP Fire Marshal, and the satisfactory resolution of all issues identified by the Final Inspection, the SRP Fire Marshal shall sign and close out the Work Authorization which indicates acceptance of the permitted work.

3.2 UNDERGROUND PIPING INSTALLATION

A. The fire protection water main shall be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover shall be 3 feet from the top of the pipe.

B. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor.

C. Joints shall be anchored in accordance with NFPA 24 using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe.

D. Buried steel components shall be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 5 feet outside the building walls shall meet the requirements of [Section 33 11 00] WATER UTILITY DISTRIBUTION PIPING.

3.3 ABOVEGROUND PIPING INSTALLATION

A. Piping: Group piping at common elevations where practical. Route piping in an orderly manner, plumb and parallel to the building structure where practical and as indicated on the approved drawings.

B. Piping in Exposed Areas: Exposed piping shall be installed so as not to diminish exit access widths, corridors, or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

C. Fittings: Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes. Install unions adjacent to each valve in pipes 2 inches and smaller. Unions are not required on flanged devices or in piping installations using grooved joints. Install flanges or flange adapters on non-grooved valves, apparatus, and equipment having 2 1/2-inch and larger connections.

D. Pendent Sprinklers: Drop nipples to pendent sprinklers shall consist of minimum 1-inch pipe with a reducing coupling into which the sprinkler shall be threaded. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished spaces. The outlet of the reducing coupling shall not extend more than 1-inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer’s listed range and shall be of uniform depth throughout the finished area.

1. All sprinklers in suspended ceilings shall be center of tile (+/- 2 inches).
E. Upright Sprinklers: Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

F. Install specialty sprinkler fittings according to manufacturer's written instructions.

G. Pipe Joints: Pipe joints shall conform to NFPA 13, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints shall be permitted, only if welding operations are performed as required by NFPA 13 at the contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings, and grooving tools shall be products of the same manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used to conceal locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

H. Reducers: Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2-inch.

I. Pipe Penetrations: Cutting structural members for passage of pipes for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile-iron or cast-iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be firestopped with a listed or approved through-penetration firestopping assembly. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

J. Escutcheons: Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

K. Inspector's Test Connection: Unless otherwise indicated, test connection shall consist of 1-inch pipe; a test valve located approximately 7 feet above the floor; a sight glass assembly; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test". The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge. Concrete splash blocks shall be provided.

L. Drains: Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by NFPA 13. Concrete splash blocks shall be provided.

M. Hangers and Supports: Comply with NFPA 13 for hanger materials and installation.
N. Sway Brace Protection: Install piping according to NFPA 13 to protect from building sway damage.

O. Air Supply Piping System: Each preaction system shall be equipped with a separate pressure maintenance device, shutoff valve, bypass valve and pressure gauge. Piping shall be galvanized steel in accordance with ASTM A795 or ASTM A53.

P. Identification Signs: Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Hydraulic design data nameplates shall be permanently marked and permanently affixed to each sprinkler riser as specified in NFPA 13.

3.4 LABELING AND IDENTIFICATION

A. Manufacturers pipe labeling shall be visible.

B. Identify all bulk feed, cross mains, primary and secondary mains at maximum 20-foot intervals with red stenciled or adhesive pipe labels, readable from floor level.

3.5 ELECTRICAL WORK

A. Overcurrent and Surge Protection: All equipment connected to alternating current circuits shall be protected from surges in accordance with IEEE C62.41.1, IEEE C62.41.2, and NFPA 70. Cables and conductors that serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

B. Grounding: Grounding shall be provided to building ground.

C. Wiring: System field wiring shall be installed in 3/4-inch minimum diameter electrical metallic tubing or metallic conduit. Wiring for the sprinkler system fire detection and control system shall be installed in tubing or conduits dedicated for that use only and not installed in conduit, outlet boxes or junction boxes which contain lighting and power wiring or equipment. Circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked and labeled in accordance with the wiring diagram. No more than one conductor shall be installed under any screw terminal. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors is not permitted. Wiring within any control equipment shall be readily accessible without removing any component parts. Conductors shall be color-coded and shall be identified within each enclosure where a connection or termination is made. Conductor identification shall be by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Circuits shall be wired to maintain electrical supervision so that removal of any single wire from any device shall cause a "trouble" condition on the control panel.

D. Control Panel: The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 24 inches and not more than 78 inches above the finished floor.

E. Conductor Terminations: Labeling of conductors at terminal blocks in terminal cabinets and control panel shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet and control panel shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12-point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color scheme where connecting to existing equipment.
F. Releasing Control Panel (RCP): Locate the RCP where indicated on the drawings. Semi-recess the enclosure with the top of the cabinet 6 feet above the finished floor or center the cabinet at [5][___] feet, whichever is lower.

G. Smoke and Heat Detectors: Locate detectors [as required by NFPA 72 and their listings][as indicated] on a 4-inch mounting box. Locate smoke and heat detectors on the ceiling. Install heat detectors not less than 4 inches from a side wall to the near edge. Heat detectors located on the wall shall have the top of the detector at least 4 inches below the ceiling, but not more than 12 inches below the ceiling. Smoke detectors are permitted to be on the wall no lower than 12 inches from the ceiling with no minimum distance from the ceiling. Install smoke detectors no closer than 5 feet from air handling supply outlets.

H. Manual Stations: Locate manual stations as required by NFPA 72 shall be mounted so that their operating handles are 4 feet above the finished floor. Mount stations so they are no farther than 5 feet from the exit door they serve, measured horizontally.

I. Notification Appliance Devices: Locate notification appliance devices as required by NFPA 72 where indicated. Mount assemblies on walls as required by NFPA 72 and to meet the intelligibility requirements.

3.6 PROTECTIVE PAINTING

A. Provide protective painting as herein specified.

   1. Metal surfaces shall first be thoroughly wire brushed and cleaned of all dirt, rust, grease, or other foreign matter before priming coat is applied.

   2. Paint all sprinkler piping exposed to view, except stainless steel piping, red.

B. Clean up all equipment and leave in condition for finish painting before acceptance.

C. Provide a heavy field coat of black asphaltum paint on all steel pipe, cradles, vibration isolating mounts, and the like, that will be encased or partially encased in building construction, set in cement or fill, before items are built into the general construction.

   1. All equipment where the surface is not factory finished shall be fully painted with one priming coat and two finishing coats of oil paint and finished with one coat of spar varnish.

3.7 PRELIMINARY TESTS

A. The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with NFPA 13 and NFPA 24. Upon completion of specified tests, complete certificates as specified in paragraph SUBMITTALS.

B. Experienced technicians regularly employed by the contractor in the installation of the system and manufacturer’s representative referred to elsewhere in this section shall conduct the testing.

C. Underground Piping.

   1. Flushing: Underground piping shall be flushed in accordance with NFPA 24. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.
2.  Hydrostatic Test: New underground piping shall be hydrostatically tested in accordance with NFPA 24. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 1.89 L2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

D.  Aboveground Piping.

1.  Hydrostatic Test: Aboveground piping shall be hydrostatically tested in accordance with NFPA 13 at not less than 1400 kPa200 psi or 350 kPa50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be read from a gauge located at the low elevation point of the system or portion being tested.

2.  Backflow Preventer Full Forward Flow Test: Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose steams, as specified in NFPA 13. Provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5-inch diameter hoses, playpipe nozzles, calibrated pressure gauges, pitot tube gauge, plus all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. Provide a metal placard on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate. The pressure drop shall be compared to the manufacturer's data.

3.  Alarm Devices: Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm device shall be tested to verify proper operation.

4.  Main Drain Flow Test: Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

E.  Air Pressure Test: As specified in NFPA 13, an air pressure leakage test at 350 kPa50 psi shall be conducted for 24 hours. There shall be no drop in gauge pressure in excess of 10 kPa1.5 psi for the 24 hours. This air pressure test is in addition to the required hydrostatic test.

F.  Detection and Control Panel Tests: Conduct preliminary tests to ensure that devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests". After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and operated properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

G.  Minimum System Tests: Test the system in accordance with the test procedures in NFPA 72. The required tests are as follows:

1.  Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The test shall be witnessed by SRP and test results recorded for use at the final acceptance test.

2.  Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.
3. Verify that the control unit is in the normal condition as detailed in the manufacturer’s O&M manual.

4. Test each initiating device and notification appliance and circuit for proper operation and response at the control unit. Detectors shall be tested in accordance with manufacturer’s recommended calibration test method. Use of magnets is prohibited. At least 20 percent of devices shall be disconnected and tested for circuit supervision. If there is a failure at these devices, then supervision shall be tested at each device.

5. Test the system for specified functions in accordance with the contract drawings and specification and the manufacturer’s O&M manual.

6. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

7. Determine that the system is operable under trouble conditions as specified.

8. Visually inspect wiring.

9. Test the battery charger and batteries.

10. Verify that red-line drawings are accurate.

11. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

12. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

13. Disconnect the verification feature for smoke detectors during tests to minimize the amount of smoke needed to activate the detectors. Testing of smoke detectors shall be conducted using real smoke or the use of canned smoke which is permitted.

14. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

3.8 FINAL TEST

A. The system will be considered ready for acceptance testing only after the following have been accomplished:

1. Preliminary tests have been made and deficiencies corrected.

2. Testing reports have been submitted and approved.

B. Final acceptance testing shall be coordinated and performed by the contractor, in the presence of SRP. In order to assure attendance of the necessary representatives, each representative scheduled to witness the test shall be provided a minimum of 5 working days’ notification of the proposed test date by the contractor. The test shall not be conducted until all parties agree on the scheduled test date. The contractor shall provide all the necessary personnel and equipment to conduct the tests.

C. The final acceptance test shall be a repeat of preliminary tests and shall include operation of control valves and flowing of inspector’s test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the contractor shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not
be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received. The contractor shall correct system failures and other deficiencies identified during testing and shall retest portions of the system affected by the required corrections.

D. If the Final Acceptance Test fails, the contractor shall pay all costs incurred to SRP for any and all retesting.

E. Upon satisfactory completion of the tests, the contractor shall leave the system in proper working order.

F. Warranty: Except as otherwise expressly provided in the contract documents, and excepting only items of routine maintenance, ordinary wear and tear or unusual abuse or neglect, contractor guarantees all work executed by the contractor and all supplies, materials, and devices of whatsoever nature incorporated in, or attached with the work, or otherwise delivered to SRP as part of the work pursuant to the contract to be absolutely free of all defects of workmanship and materials for a period of 2 years after final acceptance of the work by SRP. Include service directory with telephone numbers for 24-hour emergency service.

3.9 TRAINING

A. Instructor: Include in the project the services of an instructor, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the employees designated by SRP, in the care, adjustment, maintenance, and operation of the fire sprinkler system. Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work. Submit the instructor’s information and qualifications including training history to SRP prior to training.

B. Required Instruction Time: Provide [4][8] hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as selected by SRP. The instruction may be divided into two or more periods at the discretion of SRP. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

END OF SECTION