

SECTION 21 13 18

PRE-ACTION FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The Conditions of the Contract and applicable requirements of Division 1, "General Requirements", and Section 23 01 00, "Mechanical General Provisions", govern this Section.

1.2 DESCRIPTION OF WORK:

- A. This Section of the Specification includes the providing of all labor and materials for the installation of a hydraulically calculated automatic pre-action, dry-pipe sprinkler system(s) in areas as specified herein and in Section 21 12 00, "Fire Protection Systems", and as shown on the Drawings, complete in all respects and ready for operation. The work includes the design of a pre-action, dry-pipe automatic sprinkler system, complete and ready for operation. Design and installation of the sprinkler system shall be such that no parts interfere with general construction, doors, windows, heating, plumbing, air conditioning systems or electrical equipment.
- B. The Work shall be installed in accordance with the Drawings and Specifications. All devices and equipment shall be listed by Underwriters' Laboratories, Inc. or Factory Mutual-approved, individually and as a system, as applicable.
- C. Sprinkler heads shall be spaced, located, and positioned as shown on the Architectural reflected ceiling plans, where shown, as specified herein as required to suit the building partition layout according to NFPA 13. Piping sizes and configurations shall be on the basis of hydraulic calculations. Where head layouts shown on the Drawings or requirements specified herein are more stringent than NFPA requirements, the more stringent requirements shall apply. Special consideration of locations or conditions shall conform to NFPA 13.
- D. The preference of the University is to connect to the campus Fire Water Distribution System (FWDS) provided Code compliant combination wet automatic fire sprinkler and where possible, automatic standpipe systems that do not contain alarm valves or local alarm devices, and a minimum 10 psig or 10% safety factor, whichever is greater, without requiring a building fire pump.
- E. Provide a complete automatic sprinkler system as defined by the latest edition of NFPA 13. All fire sprinkler systems installed on campus are required to be wet pipe systems unless the area being protected cannot be maintained above 40 degrees F, as required per NFPA 13. These areas will require a dry pipe system to be installed. Antifreeze systems of any size are not permitted on campus. Rooms or areas where it is not desirable to have water filled piping within the room, such as special collections, computer rooms, etc. may utilize double interlock pre-action systems. Use of pre-action systems must be approved by the University prior to system design.
- F. If used the building fire pump(s) and combination standpipes shall serve the pre-action sprinkler system.
- G. Zone the pre-action sprinkler system **[as shown on the Drawings] [and] [such that each elevator machine room and its related elevator shafts are a separate sprinkler control zone]**.
- H. Coordinate the location of sprinkler heads and piping with elements in the ceiling such that it does not interfere with the installed ceiling configuration.

1.3 HYDRAULIC CALCULATIONS:

- A. Hydraulic calculations shall be prepared in accordance with Chapter 23 of NFPA 13 with the following exceptions:

1. Pipe friction losses may be calculated by using the nearest foot for all piping over one foot (1') in length. Horizontal lengths less than one foot (1') may be neglected. Vertical length less than one foot (1') shall be included for elevation purposes only.
2. Flows shall be calculated to the nearest whole gallon.
3. Velocity pressures may be neglected.
4. Velocities in underground piping shall not exceed 16' per second. Velocities in all other piping shall not exceed 20' per second. Velocities in standpipes must be calculated based on the combined sprinkler flow and hose flow.
5. Fire pumps shall supply only the sprinkler demand. Any point on the pump curve may be used to supply the water demand, provided that point is no more than 150% of rated capacity of the pump.
6. Total sprinkler system flow shall not exceed 110% of the required flow.
7. The sprinkler/standpipe risers accommodate both the sprinkler and standpipe hose stream flows. Each riser shall accommodate 250 gallons per minute flow for standpipe hose stream.
8. Hydraulic calculations shall be performed by a State of Texas Licensed Responsible Managing Employee (RME) in the direct employ of the Fire Protection Contractor.
9. Provide ten percent (10%) or 10 psig safety factor, whichever is greater, for all sprinkler system hydraulic calculations.
10. No flexible drop sprinkler heads will be allowed.

1.4 QUALITY ASSURANCE:

- A. Contractor: The fire protection system shall be designed and installed by a fire protection contractor who is licensed by the State of Texas to perform fire protection work of the type specified for this project. The fire protection contractor shall have a minimum of 5 years of experience in the installation of fire protection work of the type specified for this project.
- B. Applicable Publications: The University, the International Building Code, National Fire Codes as published by the National Fire Protection Association (NFPA), State Fire Marshal, and the University of Houston Fire Marshal's requirements contain fire protection criteria and requirements for the design of all fire suppression systems. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.
 1. National Fire Protection Association (NFPA):
 - a. NFPA 13 Standard for the Installation of Sprinkler Systems.
 - b. NFPA 14 Standard for the Installation of Standpipe and Hose Systems.
 - c. NFPA 20 Standard for the Installation of Pumps for Fire Protection.
 - d. NFPA 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
 - e. NFPA 70 National Electrical Code.
 2. Underwriters' Laboratories, Inc.:
 - a. Fire Protection Equipment Directory (Latest Edition).
 3. Factory Mutual Engineering Corporation (FM):
 - a. Approval Guild (Latest Edition).
 4. American National Standards Institute (ANSI):
 - a. Z53 Safety Color Code for Marking Physical Hazards.

- b. A 14 Safety Requirements for Fixed Ladders.
5. Materials shall be installed in accordance with NFPA 13. All valves, fittings, hose, sprinkler heads, and equipment shall be UL or FM-labeled. All necessary points of city connections shall be matched to city equipment.
6. Acceptable Manufacturers: The model numbers listed in the Specifications establish a level of quality and material. The following manufacturers are acceptable subject to compliance with the requirements of these Specifications.
 - a. Sprinkler Equipment:
 - 1) Viking Corporation.
 - 2) Grinnell Fire Protection Systems Co., Inc.
 - 3) Automatic Sprinkler Corporation.
 - 4) Central Sprinkler Corporation.
 - 5) Firematic Sprinkler Devices, Inc.
 - 6) Reliable Automatic Sprinkler Co.

1.5 SUBMITTALS:

- A. The University of Houston Project Manager shall review and distribute all submittals for approval by the University insurer, the U of H Fire Marshal, the Owner's representative, and others as appropriate.
- B. Refer to provisions established in the Project Specifications and in related section of Division 01 – General Requirements. All product data shall be submitted under provisions of Division 01.
- C. Shop drawing submittals shall include, but not be limited to:
 1. Cut sheets marked to clearly indicate all fire protection system materials and accessories to be used, including, but not limited to control panels, pipe and fittings, pipe hangers and supports, valves, sprinkler heads, specialties, waterflow switches, valve supervisory switches, and other required materials. This shall include cut sheets on all grooved piping system components [and all manufacturers'] which will be used on the project.
 2. Samples of sprinkler heads to be furnished.
 3. Preliminary submittal drawings showing all proposed sprinkler head locations for Architect/Engineer approval and including a layout and details sufficient to indicate the coordination of the location of sprinkler heads with the installed ceiling configuration shall be provided.
 4. The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 13, NFPA 14 (if applicable), and NFPA 24 for approval of all equipment to be constructed and installed. Shop drawings shall identify all materials and list all equipment to be used. Shop drawings shall include ceiling grid or reflected ceiling layout and shall be coordinated with other trades prior to submittal. Final fire protection system shop drawings showing all piping sizes and elevations, sprinkler head types and hydraulic calculations. Piping shall be sized and elevation of mains shall be indicated. Drawings shall be approved by state and local authorities prior to being submitted. Drawings shall be in accordance with Section 1-9 of NFPA 13 and Section 1-4.3 of NFPA 20 shall be prepared and shall be submitted to the Engineer for approval prior to fabrication of piping. Hydraulic calculations shall be a part of this submittal. A fire pump characteristic curve for the building fire pump shall also be a part of this submittal.
 5. Hydraulic calculations for sprinkler systems shall comply with NFPA 13 and shall include comprehensive hydraulic data sheets. Provide a 10 psi or 10% safety factor, whichever is greater, for all sprinkler system hydraulic calculations.
 6. No work shall be performed until the University has approved the shop drawings, calculations, and data sheets. The Contractor is solely liable for any work performed prior to this approval.

7. The submittal shall include a statement from the sprinkler contractor certifying that the design meets the hydraulic design parameters stated in this Specification.
8. Additional items as specified in Section 23 01 00 and Section 21 12 00.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver sprinkler system components in factory-fabricated water resistant packaging.
- B. Handle sprinkler system components carefully to avoid damage to components, enclosures, and finish.
- C. Store sprinkler system components in a clean, dry space and protect from weather.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION:

- A. The pre-action, dry-pipe sprinkler system shall be a fixed water type fire protection sprinkler system of the time delayed, recycling, pre-action type which automatically controls the water supply to fusible sprinkler heads for control of fire. **No flexible drop sprinkler heads will be allowed.**
- B. Sprinklers shall be listed or FM approved and shall not include O-rings seals. Any sprinkler that incurs damage, is painted, or is sprayed with any obstructive material during construction shall be replaced at no cost to the University. Installation of sprinklers shall be coordinated with other work, including duct and electric fixture installation, to prevent sprinkler obstructions.
- C. Sprinklers located less than eight feet above finished floor or that may be subject to mechanical damage shall be provided with guards listed for use with the model of sprinkler installed.
- D. The system shall sense a fire condition through a closed circuit electric heat detector system which turns the water supply on when heat is detected, turns the water supply off when heat is reduced below the detector operating temperature, and turns the water supply back on if the detector operating temperature is exceeded again. The sprinkler piping system in the protected area shall remain dry until a fire condition is sensed and shall be monitored with pressurized air. Should a leak occur in the piping system, an alarm shall sound, but water shall not enter the piping system until a fire condition is sensed.
- E. Where required by the project, sprinklers shall be centered in two directions in ceiling tiles. Pendant sprinklers required to be placed in the center of ceiling tiles, shall be supplied from a return bend that connects to an outlet at the top of the fire sprinkler branch line piping.
- F. Main electrical equipment rooms may have alternate protection such as a pre-action, dry sprinkler systems or chemical suppression system. Approval must be sought by appropriate department in cooperation with the UH Fire Marshal's Office.
- G. The sprinkler system shall be designed to meet the more stringent of the requirements of NFPA 13 or the following Industrial Risk Insurers (IRI) requirements:
 1. Storage rooms and mechanical equipment room shall be hydraulically calculated and designed to provide 0.18 gpm/sf over the hydraulically most remote 3000 square foot area (Ordinary Hazard Group 3) or over the entire area, whichever is less. Sprinkler heads shall be rated at 165°F.
 2. Minimum design shall be hydraulically calculated and designed to provide 0.12 gpm/sf over the hydraulically most remote 3000 square foot area. Sprinkler heads shall be rated at 165°F.
- H. All sprinkler heads in general shall be in a straight line, parallel to the lines of the building and shall be located in the **[approximate] [exact (double swing connection)]** center of ceiling tiles. The Contractor shall submit Sprinkler Head locations to the Architect and Engineer for location and type approval prior to completing the sprinkler system design, unless otherwise instructed, in writing, by the Architect.
- I. Sprinkler heads in rooms with electrical equipment shall be located as far as code requirements allow from electrical equipment.

2.2 SYSTEM COMPONENTS:

A. System Components: Components for each zone shall include, but not be limited to:

1. Pre-action control panel.
2. Battery charger.
3. Batteries.
4. Valve trim box.
5. Supervised system shutoff valve.
6. Flow control valve and trim.
7. Check valve.
8. Fire detectors.
9. Detector cables.
10. Main drain valves.
11. Intermediate drain valve.
12. Priming valve.
13. Position indicator.
14. Strainer.
15. Electric alarm bell.
16. Air maintenance device.
17. Pressure switch.
18. Alarm test valve.
19. Alarm shutoff valve.
20. Waterflow pressure switches.
21. Valve supervisory switches.
22. Piping.
23. Sprinkler heads.

2.3 SYSTEM OPERATION:

A. Automatic Operation:

1. When a fire occurs, a detector is heated to its trip point. The normally closed detector circuit then opens. The relays in the control panel open, shutting off power to the solenoid valves in the trim box and sounding the electric fire alarm bell. When the solenoid valves open, the pressurized water in the top chamber of the flow control is released and the clapper opens. The system then fills almost completely with pressurized water. When the sprinkler head reaches the operating temperature, it opens and sprays water on the fire. When the temperature in the fire area drops below the trip point of all detectors, the detector circuit is closed. A relay is closed in the panel which energizes the timer. Water will continue to discharge from the open sprinklers from one to 5 minutes, depending on the timer setting. When the timer cycle is complete, a relay in the control panel closes and energizes the solenoid valves in the trim box. The flow of water stops from above the clapper of the flow control valve thereby causing a pressure to build up which closes the valve clapper and stops the flow of water to the opened sprinklers. The electric fire alarm will continue to sound until the reset button is pushed.

2. Should the temperature build to the trip point of any detector during any phase of the cycle, the system will continue to flow or immediately start the flow of water to the fire.

B. Operation as a Dry System: Loss of air pressure operation shall be key-switch activated at the control panel. When a fire occurs and the temperature reaches the operating point of a sprinkler, the system's pressurized air escapes through the open sprinkler. When the pressure has dropped to approximately 12 psi (80 kPa), a pressure switch in the trim box opens a relay in the control panel causing the low air pressure alarm to sound. When the air pressure drops to approximately 7 psi (50 kPa), another pressure switch in the trim box opens causing a second relay to open in the control panel de energizing the solenoid valves in the trim box and sounding the electric fire alarm. When the solenoid valves open the pressurized water in the top chamber of the flow control valve is released and the clapper opens. The system then fills with pressurized water which sprays from the sprinkler and sounds the water motor alarm, if provided. The waterflow is stopped by closing the main control valve. The system will not recycle when used as a standard dry-pipe system.

2.4 PRE-ACTION CONTROL PANEL:

- A. The control panel shall incorporate all necessary relays, timers, switches, alarms, and trouble lights necessary for system operation. The panel shall be factory-prewired.
- B. The control panel shall be flush-mounted in the location shown on the Drawings.
- C. All valves which control the flow of water from the standpipe to the pre-action system shall be supervised via tamper switches monitored by the control panel.
- D. A battery charger and sealed battery suitable for operation of the system for 90 hours shall be provided. The battery and charger cabinets shall be installed in the floor air handling unit room.
- E. The control panel is connected to the normally closed fire detector circuit, valve trim box, power supply and electrical alarms.
 - 1. When a fire detector operates, the following sequence occurs:
 - a. Power is shut off to the solenoid valves in the valve trim box and the electric alarm operates.
 - b. The solenoid valves open and vent the upper chamber of the flow control valve allowing it to open and supply water to the sprinkler system piping.
 - 2. When all fire detectors reset:
 - a. The timer is energized allowing water flow to continue for a predetermined time period from one minute to 5 minutes.
 - b. At the end of that time the solenoid valves in the valve trim box are energized and shut off the flow of water from the top chamber off the flow control valve which in turn closes the flow control valve and stops the flow of water to the sprinkler system piping.
- F. A key-operated control, located on the side of the control panel, allows the system to be operated as a cycling pre-action system with the electrical detection circuit in service or as a dry system without the electrical detection circuit in service. (NO RECYCLING OF THE SYSTEM WILL OCCUR WHEN IT IS OPERATING AS A DRY SYSTEM). The control panel shall incorporate a system tripped light and a low air pressure light. System operation or low air pressure shall activate the audible trouble alarm and optional other alarms. These can be silenced by on/off switches. The key-operated thermal test button acts to open the detector circuit momentarily to cycle the system. The reset button resets timer and alarm circuits after system operation. The system may be operated as a wet-pipe sprinkler system if the detector circuit and/or pressurized air are unavailable for service; however, all alarms except the low air pressure alarm will operate constantly unless shut off and cycling features are negated.
- G. A normally open, dry contact rated at 120 volts, 10 amperes shall be provided in the preaction control panel and shall close upon system charging to shunt trip circuit breakers serving elevator [computer] equipment.

2.5 PRE-ACTION VALVE TRIM BOX:

- A. The valve trim box shall incorporate all solenoid valves, pressure switches, terminal blocks and accessories necessary for operation of the System. The valve trim box shall be factory pre-wired and pre-piped.
- B. The components of the valve trim box are operated through relays in the control panel (see Control Panel Data Page). The solenoid valves (referred to on the wiring diagram as V1 and V2) control the flow of water from the top chamber of the flow control valve. When the normally closed solenoid valves are opened, pressurized water trapped in the top chamber of the control valve escapes, allowing the control valve clapper to rise and pressurized water to fill the sprinkler system piping. When the solenoid valves are electrically closed, the flow of water from the top chamber of the control valve is stopped. Water pressure builds in the top chamber which forces the clapper to shut off the flow of water to the sprinkler system. The pressure switch, PS#2, controls the low air pressure alarm bell. If the sprinkler system air pressure drops below 12 psi (83 kPa), an alarm will sound. The pressure switch, PS#1, controls waterflow to the sprinkler system when the selection switch is turned to the OFF position and the system is being operated on loss of air pressure. If the pressurized air in the piping system drops below 7 psi (48 kPa), the solenoid valves will be de-energized and pressurized water will flow to the sprinkler system.

2.6 HEAT DETECTORS:

- A. Detectors shall be heat sensitive, electrical detectors which operate at a fixed temperature of 140°F. Detectors shall be rate compensating and feature automatic recycling. Detectors shall be connected in series from and to the control panel. When a detector is heated to the temperature set point, a mechanical switch shall open and break the series circuit interrupting the flow of current..
- B. Detectors shall be located on maximum **[20'x 20'] [Reduce smoke detector spacing for rooms or areas utilizing high air flow as required per NFPA 72]** centers and shall be coordinated with locations of light fixtures, grills, speakers, smoke detectors and other ceiling mounted devices.
- C. Detectors in finished ceiling areas shall be installed using through ceiling mounting.

2.7 DETECTOR CABLE:

- A. Detector cable shall consist of two number 16 conductors surrounded by a high temperature insulation encased in an aluminum sheath.

2.8 FLOW CONTROL VALVE AND TRIM:

- A. A flow control valve, check valve and complete trim for pre-action, dry-pipe, operation shall be provided.

2.9 AIR MAINTENANCE DEVICE:

- A. An air maintenance device shall be provided to supply each pre-action zone. The air maintenance device shall operate on 120 volt, 20 ampere, single phase power. A connection for a high capacity portable air compressor shall be provided for system charging.

2.10 PIPE AND FITTINGS:

- A. Refer to Section 21 12 00 for pipe and fitting requirements.

2.11 PIPING FABRICATION DRAWINGS:

- A. Piping fabrication/shop drawings shall be submitted for all fire protection and sprinkler piping. Refer to Section 15500 for additional requirements.

2.12 PIPE HANGERS AND SUPPORTS:

- A. Refer to Section 21 12 00 for pipe hanger and support requirements.

2.13 SLEEVES AND ESCUTCHEONS:

- A. Refer to Section 21 12 00 for pipe sleeve and escutcheon requirements.

2.14 VALVES:

- A. Refer to Section 21 12 00 for fire protection valve requirements.

2.15 SPRINKLER HEADS SPECIALTIES:

- A. Unless otherwise specified, sprinkler heads shall have 165°F ordinary degree rating. Heads located within the air streams of heat emitting equipment shall be selected and located at the top of elevator shafts for proper temperature rating. Corrosion-resistant sprinkler heads shall be installed where they are exposed to weather, moisture, or corrosive vapors. Heads installed where they might receive mechanical injury or are less than 7' above the floor level shall be protected with approved guards in accordance with NFPA13. Sprinkler guards must be provided for sprinklers in electrical closets. Sprinklers in areas with suspended ceilings shall be pendant type, with pipe and fittings located above the suspended ceiling. **No flexible drop sprinkler heads will be allowed.**
- B. Sprinkler heads in finished areas shall be Reliable Model **[G-1 "concealer"] [G-semi-recessed chrome-plated head]** with a **[white] [polished chrome-plated] [cover] [escutcheon]** plate or an approved equal. Sprinkler head shall be UL-listed and FM-approved with the provided **[cover] [escutcheon]** plate.
- C. Sprinkler heads in the unfinished areas shall be Reliable Model G or approved equal brass, upright pendant, or pendant heads as required.
- D. Sprinkler heads for all dry pipe sprinkler systems, in walk-in freezers and in all other areas where sprinkler heads are subject to freezing provide Reliable Model A, chrome plated dry pendant sprinkler heads with pendant length as required.
- E. Provide a metal cabinet containing a stock of spare sprinkler heads of all types and ratings installed. The cabinet shall be located where the temperature will not exceed 100°F; the location shall be approved by the Owner. The number of spare sprinklers shall conform to NFPA 13.

2.16 PRESSURE SWITCHES:

- A. An auxiliary pressure switch shall be provided to provide a loss of air flow alarm to the sprinkler control panel.

2.17 VALVE SUPERVISORY SWITCHES:

- A. All valves that affect the flow of fire protection water to the pre-action system shall be supervised. Switches shall be Potter Electric Signal Co. Model OSYS-U or and approved equal.
- B. Supervisory switches shall be furnished and installed by this Contractor and wired by Division 28. Coordinate wiring of all switches with Division 28.

2.18 WATER FLOW PRESSURE SWITCHES:

- A. Water flow pressure switches, with adjustable retard feature shall be provided in the supply pipe to each zone for remote alarm. Switch shall be double-pole single-throw type and shall be rated at least 7 amperes at 125/250 volts.
- B. Water flow pressure switches shall be furnished and installed by this Contractor and wired by Division 28. Coordinate wiring of all new and relocated flow switches with Division 28.

2.19 BUILDING FIRE ALARM SYSTEM INTERFACE:

- A. Each pre-action control panel shall provide a trouble signal output to the Building Fire Alarm System (wiring by Division 28) whenever a trouble condition exists in the pre-action system.

- B. Each pre-action control panel shall provide a trouble signal output to the Building Fire Alarm System (wiring by Division 28) whenever a loss of air condition exists in the pre-action system.
- C. The pre-action control panel shall provide an alarm signal output to the Building Fire Alarm System (wiring by Division 28) whenever there is waterflow in the pre-action system.
- D. Each valve which controls the flow of sprinkler system water shall be monitored by the Building Fire Alarm System (wiring by Division 28).

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Refer to Section 21 12 00 for installation of fire protection system piping and other general requirements.
- B. Where the project requires releasing of a pre-action system, the room or area in which the suppression system is located shall utilize two separate smoke detectors or activation of a manual release station to activate the suppression system.
- C. Pre-action System: Install and test the pre-action system in accordance with the system manufacturer's written installation instructions. All pre-action system wiring shall be concealed except where installed in mechanical rooms. All wiring which is not installed using aluminum-sheathed cable shall be installed in an approved raceway.
- D. Inspector's Test Valves: Test valves shall be provided in accordance with NFPA13, supplied from the highest and most remote part of the system in relation to the riser assembly, and shall discharge to the outside of the building or to a building drain. Test valves shall be conveniently accessible within 7' of floor. Inspector's test connections must be provided for all zones, so that the waterflow switch for the zone can be tested.
- E. Protection During Construction: Provide necessary fire protection during construction in accordance with NFPA and local codes. The existing sprinkler system shall be maintained in service to the maximum extent possible.

3.2 CLEANING:

- A. All fire protection piping shall thoroughly flushed out to remove any slag or debris prior to being tested or put into service.

3.3 SYSTEM PRESSURE REDUCTION:

- A. Where fire system pressures exceed 140 psi, provide pressure reducing valves to regulate the pressure at that point to no less than 100 psi.

3.4 TESTS AND INSPECTIONS:

- A. Inspections, examinations and tests required by the authorities or agencies specified shall be arranged and paid for by the fire protection subcontractor, as necessary, to obtain complete and final acceptance of the system as installed. The certificates of inspection shall be in quadruplicate, and shall be delivered to the Engineer for review and distribution.
- B. Sprinkler systems shall be hydrostatically-tested by the Contractor upon completion of the installation as required by NFPA 13 **[in the presence of the UH Fire Marshal]**. When hydrostatic and alarm tests have been completed and all necessary corrections made, a material and test certification shall be provided in accordance with NFPA 13. Final inspection shall include full flow testing through the inspector's test connection. Actuation of the flow switch shall occur within one minute of opening of the inspector's test valve. The final tests may be witnessed by the Engineer or Owner's Representative.
- C. Sprinkler system zone control assemblies shall be tested to demonstrate proper operation of the flow switch and valve supervisory switch.

- D. Pre-action sprinkler systems shall be tested to demonstrate that system charge time is within the requirements of NFPA13.
- E. Arrange and pay for all tests and inspections required by authorities having jurisdiction.

3.5 PERIODIC INSPECTION SERVICE:

- A. Refer to Section 21 12 00 for requirements.
- B. This agreement shall be executed at no cost to the Owner and shall include four inspections of the entire sprinkler system during the warranty period, each with a "Report of Inspection to the Owner". The final inspection shall include operation and lubrication of all valves, cleaning of all alarm valves and operational testing of all system Electrical and alarm components.

3.6 TRAINING:

- A. The system installation contractor shall provide a minimum of 8 hours of training for the Owner in operation and maintenance of the pre-action system.

END OF SECTION 21 13 18