SECTION 21 13 16

DRY-PIPE 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 providing all labor and materials for the installation of a hydraulically calculated automatic, 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 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 and 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. Zone the dry-pipe sprinkler system **as shown on the Drawings.**

G. Coordinate the location of sprinkler heads and piping such that it does not interfere with the installed ceiling configuration or other building construction and equipment.

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. Total sprinkler system flow shall not exceed 110% of the required flow.
6. 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.
7. Hydraulic calculations shall be performed by a State of Texas Licensed Responsible Managing Employee (RME) in the direct employ of the fire protection contractor.
8. Provide 10 psi safety factor for all sprinkler system hydraulic calculations.
9. **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 System.
   c. NFPA 20- Standard for the Installation of Centrifugal Fire Pumps.
   d. NFPA 24- Standard for the Installation of Private Fire Service Mains.
   e. NFPA 70- National Electrical Code.
2. Underwriters' Laboratories, Inc.:
   a. Fire Protection Equipment Directory (Latest Addition).
3. Factory Mutual Engineering Corporation (FM):
   a. Approval Guild (Latest Addition).
4. American National Standards Institute (ANSI):
   a. Z 53 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) Firematic Sprinkler Devices, Inc.

5) 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, accessories and manufacturers to be used, including, but not limited to dry pipe valve assemblies, 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 NFPA 13 and NFPA 20 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 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% whichever is greater safety factor 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 dry-pipe sprinkler system shall be a fixed water type fire protection sprinkler system of the air charged 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. Quick-response sprinklers are required throughout all light-hazard occupancies, and may also be installed in ordinary-hazard occupancies for the quick-response hydraulic design area reduction per NFPA 13 for utilizing quick-response sprinklers. Extended coverage sprinklers may be utilized if proven in the hydraulic calculations.

E. Where required by the project, sprinklers shall be centered in two directions in ceiling tiles. Pendent 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 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 3900 square foot area (Ordinary Hazard Group 3) or over the entire area, whichever is less.
2. Parking garage and ramps shall be hydraulically calculated and designed to provide 0.15 gpm/sf over the hydraulically most remote 2600 square foot area (Ordinary Hazard Group 1) or over the entire area, whichever is less.
3. Minimum design shall be hydraulically calculated and designed to provide 0.12 gpm/sf over the hydraulically most remote 3900 square foot area.

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 center of ceiling tiles. **[Sprinkler heads in public finished areas shall be located exactly (double swing connection) where shown on the Architectural reflected ceiling plans.]** Sprinkler head quantities, where shown, are the minimum which must be provided. If additional heads are required to meet NFPA 13, the location of additional heads must be approved by the Architect. 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 for each zone shall include, but not be limited to:

1. Dry-pipe valves and trim.
2. Main drain valves.

3. Air supplies.
4. Pressure switch.
5. Alarm test valve.
6. Waterflow pressure switches.
7. Valve supervisory switches.
8. Piping.
9. Sprinkler heads.

2.3 DRY PIPE VALVES:

A. Valve: Provide a 175 psi WWP rated, bronze fitted, cast iron body dry-pipe valve assembly with EPDM seats, spring-loaded latching clapper and required tapped trim connections. Valve shall be Viking Model E, Reliable Model D, or an approved equal.

B. Trim: Provide valve with all required trim including, but not limited to, drip check valve, drain cup, reset bar, alarm test shutoff valve, drain check valve, accelerator, variable pressure retard, air pressure switch, and other required trim.

2.4 AIR SUPPLIES:

A. Dry pipe systems shall be filled from a constant source of air (if shown on the drawings) or from a high capacity portable air compressor. The air pressure in the system shall be maintained by a self-contained air pressure maintenance device which is set at design pressure. To automatically maintain the design air pressure a maintenance air compressor shall be provided and shall operate on 120 volt, 20 ampere, single phase power. A pressure switch shall be provided to turn the compressor off when the design air pressure is reached, and on when the pressure falls below the design air pressure.

2.5 PIPE AND FITTINGS:

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

2.6 PIPING FABRICATION/SHOP DRAWINGS:

A. Piping fabrication/shop drawings shall be submitted for all fire protection and sprinkler piping. Refer to Section 21 12 00 for additional requirements.

2.7 PIPE HANGERS AND SUPPORTS:

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

2.8 SLEEVES AND ESCUTCHEONS:

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

2.9 VALVES:

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

2.10 SPRINKLER HEADS/SPECIALTIES:

A. Unless otherwise specified, sprinkler heads shall have 165^{3}F ordinary degree rating. Heads located within the air streams of heat emitting equipment and located at the top of elevator shafts shall be selected 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 NFPA 13. Sprinkler guards shall 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 semi-recessed chrome-plated heads with a **[white] [polished chrome-plated]** escutcheon or an approved equal. Sprinkler head shall be UL-listed and FM-approved with the provided escutcheon plate.

C. Sprinkler heads in the unfinished areas shall be Reliable Model G or approved equal brass, upright pendant heads as required.

D. Pendant sprinkler heads for dry pipe sprinkler systems shall be 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 Section 3-16.7 of NFPA 13.

2.11 PRESSURE SWITCH:

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

2.12 VALVE SUPERVISORY SWITCHES:

A. All valves that affect the flow of fire protection water to any area 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.

2.13 WATERFLOW PRESSURE SWITCHES:

A. Viking or equal waterflow 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. Waterflow pressure switches shall be furnished and installed by this Contractor and wired by Division 16. Coordinate wiring of flow switches with Division 28.

2.14 BUILDING FIRE ALARM SYSTEM INTERFACE:

A. Each dry-pipe system 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 dry-pipe system.

B. Each dry-pipe system shall provide an alarm signal output to the Building Fire Alarm System (wiring by Division 28) whenever there is waterflow in the zone.

C. 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. Dry-pipe System: Install and test the dry-pipe system in accordance with the system manufacturer's written installation instructions. Locate dry-pipe valves and trim in a heated space.

C. Inspector's Test Valves: Test valves shall be provided in accordance with Section 22 of NFPA 13, 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.

D. Protection During Construction: Provide necessary fire protection during construction in accordance with NFPA and applicable codes.

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 175 psi, provide of the pressure reducing valves to regulate the pressure at that point to 165 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 and shall be witnessed by the UH Fire Marshal.

C. Sprinkler system zone control assemblies shall be tested to demonstrate proper operation of the flow switch and valve supervisory switch.

D. Dry-pipe sprinkler system shall be tested to demonstrate that system charge time is within the requirements of NFPA 13.

E. Arrange and pay for all tests and inspections required by UH Fire Marshal.

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 NASFCA "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 4 hours of training for the Owner in operation and maintenance of the dry-pipe sprinkler system.

3.7 IDENTIFICATION:

A. Refer to Section 23 03 00, "Basic Materials and Methods", for applicable painting, nameplates and labeling requirements. All drain valves, test valves, and other system valves shall be clearly labeled as to use and the fact that they are fire protection system valves.

END OF SECTION 21 13 16