

SECTION 21 05 00 - FIRE SUPPRESSION

PART 1 - GENERAL

1.1 REFERENCES

- A. Section 230000 - General Mechanical Provisions
- B. Section 210553- Mechanical Identification

1.2 DESIGN REQUIREMENTS

- A. Automatic Fire Sprinklers:
 - 1. Zone system according to location. Annunciate each zone at the building fire annunciator in accordance with NFPA regulations. Provide separate zones for each flow switch and each tamper switches.
 - 2. Install recessed sprinklers in 8-foot ceilings. Provide wire guards on sprinklers, which protrude beyond the ceiling and are lower than 8 feet. Wire guards may be painted.
 - 3. The type of sprinkler to be installed must be specified and approved no later than final design completion.
 - 4. Consult the University CBO, through the University Project Manager, for fire protection and life safety concerns.
 - 5. Supply all connections to the fire system from the domestic water system through a reduced pressure backflow prevention device.
 - 6. Provide fire sprinkler systems for every building. Provide sprinklers throughout the building. Discuss areas without sprinklers with the University Project Manager.
- B. System Design:
 - 1. General:
 - a. Base design on requirements of NFPA 13, including Appendices.
 - b. Verify fire hydrant flow test according to NFPA 13 and NFPA 291. Use hydrant flow results for system design calculations.
 - c. Base design of sprinkler system on hydraulic calculations for group and occupancy listed in NFPA 13. Include outside hose flows upon the same hazard as the building. No allowance will be made for inside hose station flows. Include a safety factor of 10 psi in hydraulic calculations.
 - d. Room design method is not acceptable.
 - e. Size flow velocity in underground water mains not to exceed 16 feet per second. Size velocity in above ground sprinkler systems not to exceed 20 feet per second
 - f. Protect all areas of each facility with an automatic sprinkler system unless specifically waved by the University Project Manager.
 - g. Provide a separate zone on each floor for buildings exceeding 3 floor levels including the basement.
 - 2. Wet Pipe Systems:
 - a. Use wet pipe systems for the majority of system applications.
 - b. Use electronic vane type water flow detectors except for the following:
 - 1) Alarm check valve assemblies may be used for systems installed in buildings if there is no approved fire alarm control panel installed and the system protects only one zone.
 - 3. Antifreeze Systems:
 - a. Do not install antifreeze systems unless specifically approved in writing by the University Project Manager.
 - b. If these systems are proposed, only use them for incidental areas susceptible to freezing, as required.

- c. Determine the feasibility and advantages of using other approved methods for protection of piping against freezing.
 - d. Include procedure in specifications for flow testing antifreeze systems without reducing antifreeze concentration.
- 4. Dry Pipe Systems:
 - a. Provide dry pipe systems in areas susceptible to freezing. Dry pipe systems are preferred over antifreeze systems. Condensate collector drain valve shall be full-port ball valve type.
 - b. Maintain air pressure by a nitrogen system or automatic air compressor powered from a dedicated circuit supplied from the building emergency circuit, where available. Use of a reliable plant air supply, in lieu of or in addition to an air compressor, is acceptable.
 - c. Monitor piping for low air pressure.
- 5. Pre-action Systems:
 - a. Provide pre-action systems as directed by the University Project Manager.
 - b. Supervise pre-action piping by an approved method.
 - c. Electronically release pre-action valve assemblies through an approved releasing panel. Coordinate the panel with Division 26 work.
 - d. Activate pre-action valve by means of automatic fire detection with manual release capability.
 - e. Space automatic fire detection devices according to NFPA 72. Detection method shall be by one or more of the following, as determined by the Engineer on specific project requirements:
 - 1) Smoke Detectors
 - 2) Heat Detectors
 - 3) Loss of Air Pressure
 - 4) Manual
 - f. Coordinate system activation method and sequencing with Division 26. Sequence of operation for valve actuation shall follow one or a combination of the following as determined by the Engineer:
 - 1) Automatic Detector Signal
 - 2) Cross-zoned or verified Automatic Detector Signals
 - 3) Automatic Detector Signals and Loss of Air
 - 4) Manual
- 6. Deluge Systems:
 - a. Provide deluge valve assembly, including valve, trim packages, and actuation system approved by Factory Mutual, as a complete assembly.
 - b. Detection systems can be pilot line or electronic as determined by the
 - c. Engineer.
 - d. Provide a dedicated air supply system if pneumatic detection is incorporated into the design.
 - e. Space hydraulic or pneumatic heat detectors spaced according to NFPA 13 and manufacturer's requirements.
 - f. Space fire detection in accordance with NFPA 72.
 - g. Provide approved agent releasing panel if deluge valve actuation is by electronic means.
- 7. Exposure Protection Systems:
 - a. Provide exposure sprinkler system with an independent supply from the vertical or main riser, prior to any other sectional controls, with a supervised control valve and distinctive flow detection.
 - b. Control systems incorporating open sprinklers by the operation of detection devices designed for the specific application.
- 8. Standpipe Systems:
 - a. Design system as required by current State of Colorado approved version of the NFPA and IBC.
 - b. Locate hose valves within the building stairway enclosures with additional corridor locations as required, unless alternative locations are approved by the University Project Manager in writing.

- c. Provide approved roof manifolds where required by current State of Colorado approved building codes or by the University CBO. Roof manifolds shall be 4 inches in diameter, with two 2-1/2-inch gated outlets. The interior control valve shall be operable from the roof location. Provide accessible manual drains and automatic drip.
 - d. Hydraulically calculate standpipe systems.
- 9. Elevator and Electrical Equipment:
 - a. Comply with the requirements of ANSI A17.1 for the installation of sprinkler systems in elevator machine rooms and shafts.
 - b. Where elevator equipment is provided with Phase I emergency service, provide sprinkler protection in the elevator shaft and elevator machine room. Sprinkler protection serving these areas shall be as follows.
 - 1) Provide 286 degree F. sprinkler with guards, in elevator machine rooms and hoistways.
 - 2) Provide control valve with tamper switch outside elevator machine rooms and shafts.
 - 3) Provide one smoke detector in the vicinity of each sprinkler for elevator recall. Coordinate between Divisions 21, 22, 23 and 26 for proper detector and sprinkler locations.
 - 4) Provide one 190-degree F. fixed temperature non-resetting heat detector adjacent to each sprinkler. Heat detectors shall automatically disconnect power to the elevator machinery and the elevator controller.
 - 5) Design elevator machine room and hoistway sprinkler system as a separate zone with its own valves, flow switch and tamper switch.
 - 6) Protect each bank of elevators and associated equipment rooms by an independent system unless determined otherwise by the Engineer and approved by the University Project Manager.
 - 7) Protect transformer rooms by a pre-action sprinkler system. Other systems may be approved on a case by case basis as determined by the Engineer and approved by the University Project Manager.
- 10. Protection for Mechanical Shafts:
 - a. Sprinklers are required in all shafts where shaft construction or contents are combustible or where the shaft is accessible by personnel. Sprinklers are not required for shafts housing a single duct which occupies the entire area of the shaft.
 - b. Install sprinklers in shafts accessible for inspection, maintenance, or repair and replacement.
 - c. Place sprinklers at the top of all shafts requiring protection. Additional protection may be required if the shafts have offsets.
- 11. Protection for Shafts Housing Hazardous Exhaust System:
 - a. Provide sprinklers for protection of all shafts serving a special hazard exhaust system. Coverage is not required if the shaft is dedicated to special hazard exhaust systems, and the shaft is not accessible by personnel and is of fire resistive non-combustible construction and ductwork is completely non-combustible.
 - b. Consult the University Project Manager in all situations.
 - c. Refer to the appropriate NFPA standards for the design of sprinkler systems for special hazard exhaust systems such as paint spray operations or cooking exhaust.

1.3 SUBMITTALS

- A. Submittals for the following shall be made in accordance with Section 230000.
 - 1. Submit sample of each type and finish of sprinkler and escutcheon plate to be installed.
 - 2. Submit shop drawings showing all details as defined by NFPA 13. Show pipe routing and coordination of all building components.
 - 3. Submit hydraulic calculations including summary sheet, detailed work sheets, graph sheet, and water supply information as outlined in NFPA 13. Designer shall seal and sign hydraulic calculations, drawings, and work sheets.
 - 4. Submit a copy of NFPA 25.

5. Submit copies of Contractor's Material and Test Certificates similar to those in NFPA 13.

1.4 QUALITY ASSURANCE

- A. Design shall be performed by a NICET Level III or IV Technician, Registered Fire Protection Engineer, or Registered Professional Engineer with experience in fire protection design and registered for the design and installation for fire protection systems in the State of Colorado.
- B. Installer shall have a minimum of five years of experience in the design and installation of automatic fire sprinkler systems and employ workmen experienced and skilled in this trade.
- C. Installer shall have the capability of providing a full service maintenance, testing, and inspection program in accordance with NFPA standards and where applicable, be certified to perform these services.
- D. Installer shall have an emergency service capability for response to emergency conditions and shall be capable of responding within four hours or receiving notification with 24 hour service capability.
- E. Qualifications for Welding Processes and Operators: Comply with the requirements of AWS D10.9, Specifications of Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3.
- F. Regulatory Requirements: Comply with the following codes:
 1. NFPA 13 - Standard for the installation of sprinkler System.
 2. FPA 14 - Standard for the Installation of Standpipe and Hose Systems.
 3. NFPA 24 - Installation of Private Fire Service Mains and their applications.
 4. NFPA 1963 - Screw threads and Gaskets for Fire Hose Connections.
 5. UL Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled for the application anticipated.
 6. National Electrical Code.
 - 7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Gate Valves:
 - a. Nibco Inc.
 - b. Mueller
 - c. Grinnell
 2. Butterfly and Ball Valves:
 - a. Mueller
 - b. Victaulic
 - c. Nibco Inc.
 3. Grooved Mechanical Couplings:
 - a. Victaulic Company of America
 - b. Gruvlok
 - c. Or approved equal per Division 1 requirements.
 4. Sprinklers:
 - a. Reliable
 - b. Viking Corp.
 - c. Grinnel
 5. Fire Protection Specialties:
 - a. Croker-Standard Div.,; Fire-End & Croker Corp.
 - b. Elkhart Brass Mfg. Co., Inc.
 - c. Guardian Fire Equipment, Inc.

6. Backflow Preventers:
 - a. Febco
 - b. Watts
 - c. Hersey
7. Check Valves:
 - a. Central Sprinkler Corp.
 - b. Mueller
 - c. Viking Corp
8. Fire Protection Specialty Valves (Dry, Pre-action, Deluge):
 - a. Viking Corp.
 - b. Viking
 - c. Victaulic
 - d. Reliable
9. Air Compressors:
 - a. Emglo Products Corp.
 - b. Gast
 - c. Viking Corp.
10. Alarm, Flow, and Tamper Switches:
 - a. Potter Electric Signal Corp.
 - b. System Sensor
 - c. Victaulic
11. Fire Department Connection:
 - a. Croker
 - b. Potter Roemer
 - c. Elkhart
 - d. Guardian Fire Equipment, Inc.
12. Inspector's Test and Drain Module:
 - a. Victaulic
 - b. A.G.F.
 - c. Grinnell/Gem

2.2 MATERIALS, GENERAL

- A. Piping:
 1. Black steel pipe for wet pipe systems and standpipes. Hot dipped galvanized pipe for dry pipe, pre-action and deluge systems.
 2. Schedule 40 for pipe 2-inch and smaller and joined with threaded or cut grooved fittings.
 3. Schedule 10 for pipe sizes up to 5 inch and 0.134 inches for 6 inch pipe for pipe joined by welding or roll grooved fittings.
 4. Other pipe thickness is acceptable provided the pipe UL corrosion resistance ratio (CRR) exceeds 1.00. Schedule 40 black steel has a CRR of 1.0
 5. Fittings:
 - a. Provide hot dipped galvanized fittings for dry pipe, pre-action, and deluge systems. Threaded fittings are preferred in architecturally exposed or sensitive areas.
 - b. Flexible sprinkler drops shall not exceed 3'0" in length.
 6. Do not use Copper pipe or fittings
- B. General: Equipment shall bear the UL listing for the intended use.
- C. Valves:
 1. General Requirements
 - a. Suitable for a minimum of 175 psi. working pressure unless the project requirements demand higher pressures.
 - b. Riser and Sectional Control Valves: Provide indicating type suitable for supervisory contact switch.

- D. Check Valves:
 - 1. 1-1/2 inch and smaller: All bronze with screwed ends.
 - 2. 1 inch and larger: Iron or brass body.
 - 3. Alarm Check Valve: Same size as riser. Provide with a retarding device.
- E. Miscellaneous Valves:
 - 1. Ball Drip Valves: Brass with 1/2 inch NPT.
 - 2. Main and Sectional Drain Valves: Bronze gate valve.
 - 3. Gauge Assembly Valves: 1/4 inch globe or angle 3-way valves with screwed bonnet and renewable composition disc.
 - 4. Combination Test/Drain Valve: UL listed approved.
- F. Dry Pipe Valve:
 - 1. Differential or latching differential type, sized by hydraulic calculations and supplied by pipe of equal or greater size.
 - 2. Positive latching clapper.
 - 3. Trim, accelerators, and exhausters provided by same manufacturer as dry pipe valve.
- G. Pre-action and Deluge Valves:
 - 1. UL listed approved as a complete assembly, including valve, trim packages and actuation system.
 - 2. Sized by hydraulic calculations and supplied by pipe of equal or greater size.. Valve trim includes manual control/activation capability, drain and test provision with trim for automatic operation via a 24-volt solenoid.
 - 3. Valve wired normally closed.
- H. Solenoid Release Valves:
 - 1. Specifically listed and approved for fire protection systems and compatible with pre-action valve and fire alarm control panel.
- I. Gauges:
 - 1. Water Pressure: Brass bourdon tube with 3-1/2 inch diameter case rated for 300 psi water pressure in 5 pound increments. Equip with 1/4-inch shut-off valve.
 - 2. Air Pressure: Brass bourdon tube with 3-1/2 inch diameter case rated for 100 psi air pressure in 1 psi increments. Equip with 1/4-inch shut-off valve.
- J. Fire Department Connections:
 - 1. Siamese connection, double 2-1/2 inch clapper, swivel plugs, and chain, threads matching local fire district equipment, and bronze escutcheon plate identifying system.
 - 2. Single 2-1/2 inch, threads matching local fire district equipment. Use if the riser is less than 3-inches.
 - 3. Interconnect multiple fire department connections so the entire sprinkler system is fed by each fire department connection.
- K. Backflow Preventers:
 - 1. General: Provide assemblies complete with manufacturer's installed OS & Y control valves with indentation for monitoring and strainer on inlet. Pressure loss shall be 5 psig maximum through middle third of flow range.
 - 2. Reduced pressure type: Use for fire suppression systems when chemical additives such as antifreeze are present or when untreated water may be pumped into the system.
 - 3. Double check valve assembly type: Install on each automatic sprinkler and standpipe system at the base of the system riser downstream of the domestic water supply tap.
- L. Fire Department Hose Valves for Standpipes:
 - 1. Standpipes are NOT to have hoses and must be Class III, with 2 1/2 inch and 1 1/2 inch reducer (per NFPA 14, Section 3-3.3, exception 2).
 - 2. Thread to conform to local fire department standard.

3. Stairwell standpipe connections are to be made on the intermediate landing, unless a vestibule is designed, in which case, place the connection in the vestibule
 - a. Per Aurora Fire Dept. Contact Campus Fire and Life Safety Officer if questions
 - b. Verify locations with Denver Fire Dept
- M. Sprinklers:
 1. Nominal 1/2 inch orifice for “ordinary temperature classification except where higher temperature heads are required or shown.
 2. Use quick response sprinklers where allowed by NFPA 13 and suitable for the specific project.
 3. Finished Areas: Use standard spray, semi-recessed, chrome finish sprinklers. Coordinate with Architect and University Project Manager.
 4. Corrosive Atmospheres: Coated sprinklers to prevent deterioration.
 5. Non-finished areas: Brass finish, ordinary temperature rating.
 6. Mechanical rooms/attics: Brass finish, intermediate temperature rating.
 7. Localized areas with potential for freezing: Dry pendant or dry pendant sidewall sprinklers.
 8. Metal Cabinet and Spare Sprinklers: Refer to Section 01 78 46 – Extra Stock Materials.
 9. Guards: Provide on sprinklers subject to damage or located within 7 feet of the floor, or as otherwise indicated for special conditions.
 10. Spare Parts: Refer to Section 01 78 46 – Extra Stock Materials.
- N. Electrical Equipment:
 1. General: Electrical equipment, tamper switches, and devices must be compatible with the fire alarm system.
 2. Supervisory Switches: Weatherproof switch housing, and cover with tamper resistant screws, automatic reset capabilities, and capable of being wired in normally open/closed position.
 3. Water Flow Detectors: Electronic vane type or pressure activated, with field adjustable built-in retard device, tamper resistant screws. Switch to activate when flow of 10 gallons per minute or more occurs.
 4. Low Pressure Supervisory Switches: Provide for dry pipe or supervised pre-action sprinkler systems. 1/2 inch NPT enclosure, field adjustable between 20 psi and 175 psi, weatherproof housing and cover with tamper proof screws.
 5. Exterior Alarm Signals: Exterior electric bell with flashing strobe, minimum 6-inch diameter, and audible level of 85 dBA at ten feet. Mount above fire department connection at a height of ten to fifteen feet above grade.
- O. Air Compressor:
 1. UL listed and sized to replenish the system in 30 minutes. Provide with 20 gallon tank, air filters, safety relief valve, check valve, and pressure switch. Compressor rated for 90 psi. Obtain power from a dedicated circuit wired to the building’s emergency power system.
 2. Piping: galvanized or copper.
- P. Air Maintenance Device:
 1. UL listed and approved for fire protection use.
- Q. Fire Pump Bypass Flow Measuring System
 1. Victaulic Style 735 Fire Pump Test Meter
 2. Or approved.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Pipe inspectors test valve discharge to a wastewater drain. Pipe main drain to a wastewater drain.

- B. Coordinate the installation of fire protection materials and equipment above and below ceilings with suspension system, light fixtures, and other building components.
- C. Where mounting heights are not detailed or dimensioned, install overhead fire protection services and equipment to provide maximum headroom possible. Install a minimum 1-1/4 inch threaded capped connection on the end of each cross main to facilitate flushing.
- D. Do not attach the system riser to the supply connection until the underground piping is flushed, tested, and accepted by the Authority having Jurisdiction.
- E. Conceal piping in all areas except mechanical rooms and areas noted on the drawings.
- F. Install fire department hose valves no lower than 42 inches above the finished floor and no higher than 60 inches above the finished floor.
- G. Install sight glasses on inspector's test connections where discharge cannot be seen while valves are operated.
- H. Terminate inspector's test connection at a 45 degree elbow with a sprinkler which has the frame and strut assembly removed. Orifice size to be same as the smallest sprinkler installed on the system.
- I. Pipe 2-inch main drain to safe location to allow for full flow testing.
- J. Install a concrete splash block with a minimum length of 4 feet to direct the drain or test discharge water away from the building.
- K. Install tamper switches on all system shutoff valves.
- L. Identification:
 - 1. Valves: identify and label all sprinkler valves. Attach caution signs to all valves controlling water to sprinkler systems in accordance with NFPA 13.
 - 2. Miscellaneous Fire Lines: Label inspector's test drain lines, main drain, and fire lines.
 - 3. Nameplate: Mount hydraulic designed information nameplate at alarm valve and include information in accordance with NFPA 13.

3.2 TESTING, CLEANING, AND CERTIFICATION

- A. Record inspections and testing on a copy of Material and Test Certificates as shown in NFPA 13.
- B. Prior to any test on sprinkler/standpipe systems, flush piping to remove any foreign matter.
- C. Hydrostatically test all systems, including fire department connection, to not less than 200 psi for 2 hours. Read test pressure from gauge located at low point of system.
- D. Additionally, test dry-pipe and pre-action systems with an air pressure of 40 psi which is allowed to stand 24 hours. Stop all leaks that allow a loss of pressure over 1-1/2 psi over 24 hours.
- E. Correct leaks immediately. On threaded pipe, tighten joints. If necessary, dismantle and replace section. Caulking, preening, or stop-leak compounds are not permitted.
- F. Test backflow preventer in accordance with state requirements by certified tester.
- G. Function Trip Test:
 - 1. Wet Pipe System: Functionally trip test system components and alarms by opening the inspector's test connection.

2. Dry Pipe and Pre-action Systems: Functionally trip test system components and alarms by opening the inspector's test connection. Maximum dry valve trip test time shall be 15 seconds from the time the inspector's test valve is completely open. Maximum water delivery time to the inspector's test shall be 60 seconds from the time the inspector's test valve is completely open.

- H. Provide backflow preventer state test certification.

3.3 COMMISSIONING (DEMONSTRATION)

- A. Provide 4 hours of instruction to the University Facilities Operations personnel. Include valve and drain locations, pipe routing, maintenance and testing procedures.

END OF SECTION 21 05 00