

DIVISION 21 FIRE SUPPRESSION

Section 21 10 00 – Water Based Fire Suppression Systems

PART 1: GENERAL

1.01 Scope of Standard

- A. This standard provides general guidance concerning the specific preferences of Texas State University-San Marcos for automatic fire sprinkler and standpipe systems.
- B. The design guidelines contained herein include the requirements for systems, materials, fittings and valves utilized for fire protection systems at Texas State University-San Marcos. It is the intention of this document to provide a minimum standard for fire protection systems at Texas State University-San Marcos so as to provide the highest level of fire safety possible; it is not intended to be a guide specification.

1.02 Scope of Work

- A. All new and renovated buildings at Texas State University-San Marcos shall have a fire sprinkler system.
- B. Provide all design and materials required to provide a complete fire protection system to protect the specified building areas in accordance with design requirements. Antifreeze loops are not permitted. The preference of Texas State University-San Marcos is to provide automatic fire sprinkler systems that do not contain alarm valves, and if possible, do not require a fire pump.
- C. Provide a complete automatic sprinkler system as defined by the National Fire Protection Association (NFPA) Standard 13. Wet pipe systems are the standard design at Texas State University-San Marcos Campus. Preaction systems may be a requirement for special occupancies such as special collections, computer rooms, etc. but such systems shall be authorized by the Owner prior to design.
- D. Required standpipe systems shall be Class I in all cases regardless of minimum code requirements.
- E. The work addressed in this section consists of a fire protection system, which may include, and at least will be coordinated with all of the following:
 - 1. Fire Alarm Systems
 - 2. Wet Chemical Extinguishing systems
 - 3. HVAC and smoke control systems and fire, smoke, and combination fire/smoke dampers
 - 4. Emergency power systems
 - 5. Security Systems

6. Elevator installation. See the Texas State University-San Marcos Elevator Construction Standards 14 20 00 and 14 24 00.
 7. Central control and monitoring system.
- F. Reference Standards: NFPA 13, NFPA 14, NFPA 20, NFPA 24, NFPA 25, NFPA 72, NFPA 101. See also Section 16720, Fire Detection and Alarm Systems.

1.03 Related Work: References/Quality Assurance:

- A. Industrial Risk Insurers (IRI) standards, the International Building Code, International Conference of Building Officials, and National Fire Codes as published by the National Fire Protection Agency (NFPA) and San Marcos, the State of Texas Fire Marshall's requirements contain fire protection criteria and requirements for the design of all fire suppression systems. The contractor shall conform to the following:
1. Conform to a minimum of NFPA 13 for sprinkler systems. IRI or Owner requirements may require design in excess of NFPA 13.
 2. Conform to minimum of NFPA 14 for standpipe systems. IRI or Owner requirements may require design in excess of NFPA 14.
 3. All materials and performance shall meet the appropriate ANSI, ASME and ASTM Codes.
 4. All design shall conform to requirements of Industrial Risk Insurers (IRI).
 5. Welding Materials and Procedures shall conform to the ASME Code.
 6. Only welders certified in accordance with ANSI/ASME Section 9 shall be employed.
- B. Each item of equipment shall be capable of performing its function over an extended period of time with a minimum of attention and maintenance. All equipment shall be constructed using new materials designs and built in accordance with the best practices of the industry.
- C. Each item of equipment shall be listed by Underwriters Laboratories (UL) or approved by Factory Mutual (FM). Each major item of equipment shall bear the manufacturer's name or trademark; serial number, and UL or FM label.
- D. Reference Publications: NFPA 13, NFPA 14, NFPA 20, NFPA 24, NFPA 25, NFPA 72, NFPA 101.

1.04 Submittals:

- A. Texas State University-San Marcos Project Representative shall review and distribute all submittals for approval by IRI, the San Marcos, the State of Texas Fire Marshal, A&E Services, and others as appropriate.
- B. The State of Texas Fire Marshall has final authority of approval of the Sprinkler System.
- C. All product data shall be submitted under provisions of Division 00.
- D. Manufacturer's data sheets shall be provided for all materials and equipment for approval before purchase or installation. Data sheets shall describe the type of material, capacities,

manufacturer, and part numbers of equipment and give information necessary for checking equipment approval.

- E. The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 13, NFPA 14, NFPA 20 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 reflective ceiling layout and have been coordinated with other trades prior to submittal.
- F. Hydraulic calculations shall comply with NFPA 13 and shall include comprehensive hydraulic data sheets. Verification of the adequacy of water pressure and other pertinent water supply data shall be the responsibility of the design engineer. The design engineer shall immediately notify the State of Texas Fire Marshal and Architectural and Engineering Services (A&E Services) of the need for supplemental water supply or fire pump or the need for any special considerations required. The engineer shall provide the record data at the point of the new utility connection as follows:
 - 1. Building Name and flange elevator (ft):
 - 2. Test hydrants (hydrant number and location and hydrant elevation (ft)
 - 3. Flow rate (gpm), static pressure (psi), and residual pressure (psi)
- G. No work shall be performed until the shop drawings, calculations and data sheets have been approved by Architectural and Engineering Services. The contractor is solely liable for any work performed prior to this approval.

PART 2: PRODUCTS

2.01 Piping

- A. All piping shall be a minimum schedule 40 steel pipe. All exposed pipe shall be painted (unless prohibited by code).

Mechanical Grooved Couplings:
Malleable iron housing clamps: ASTM A47; UL labeled; engage and lock, designed to permit some angular deflection, contraction, and expansion, galvanized couplings for galvanized pipe.

 - 1. "C" shaped composition-sealing gasket: ASTM D2000.
 - 2. Steel bolts, nuts and washers: ASTM A183 heat-treated with a minimum tensile strength of 110,000 psi.
 - 3. Connection shall be made to Texas State University-San Marcos Campus on-site water system unless the Owner agrees to an alternate arrangement. The connection between system piping and underground piping shall be made with a cast iron flanged piece, properly fastened.
- B. Piping shall be concealed in areas with drop ceilings. Sprinklers shall generally be centered in ceiling tiles.

- C. Piping shall be installed in a craftsman like manner and shall not interfere in the complete function of other systems such as cable trays, access panels, or pedestrian passageways. Installation of all piping shall be in coordination with duct, light fixture, and any other work that may obstruct sprinklers. The contractor shall coordinate with all trades having materials in above ceiling spaces prior to commencement of any work.
- D. All piping installed outside or otherwise exposed to freezing weather, shall be externally galvanized. Antifreeze loops are not permitted. Piping shall be painted red, and the galvanized surface shall be properly prepped prior to painting to insure bonding.

2.02 Valves

- A. Unless specified otherwise, all valves shall be UL listed or FM approved and be suitable for the anticipated pressures or a minimum of 175 psi working pressure, whichever is greater
- B. All valves on connections to water supply to sprinklers shall be UL listed butterfly type indicating valves except for the following which shall be O.S.& Y:
 - 1. All indicating valves on the supply side of the backflow preventer;
 - 2. The indicating valve immediately adjacent to the backflow preventer on the system side.
 - 3. All indicating valves on the suction side of a fire pump.
 - 4. Where indicated on the contract drawings.
- C. All butterfly valves shall have a built in tamper resistant switch for supervision of the open position. The switch shall be contained within a NEMA Type 1, general purpose indoor rated housing. Either unauthorized removal of the switch housing (when the valve is open) or closing the valve, shall cause the switch contacts to change position. The switch shall have four conductors to accommodate connections to Style 4 or Style 6 signaling line circuit devices.
- D. Where OS&Y indicating valves are installed, the following shall apply:
 - 1. Valves 2-1/2 inches and larger shall be iron body, except seats, discs, and stems which shall be brass. Valves 2 inches and smaller shall be brass body and brass stem seat.
- E. A check valve shall be installed between each floor (isolation) control valve and the floor drain valve to permit draining of only the floor (area) affected. Check valves shall comply with the following:
 - 1. Check valves 2-1/2 inches and larger shall be iron body swing check with cast brass hinge, rod, and brass faced discs.
 - 2. Check valves 2 inches and smaller shall be UL listed brass body and all brass fitted.
- F. Ball valves shall be constructed of forged brass with Teflon seats and shall be provided with a vinyl-covered handle.
- G. Post Indicator Valve - Gate valve on incoming water service shall be operable by a UL listed post indicator valve.

- H. All valves controlling water supply for sprinklers shall be readily accessible for use by emergency and maintenance personnel.
- I. All accessible valves controlling water supply for sprinklers shall be supervised by the fire alarm system. All valves controlling water supply for sprinklers shall be red in color.
- J. A valve shall be installed at the base of each riser.

2.03 Piping Accessories

- A. All hanger components other than all thread shall be UL listed or FM approved. No sprinkler piping is to be supported from any mechanical or electrical devices and/or equipment (ducts, lights, etc.). Hanger assemblies installed outside, or otherwise exposed to weather, shall be externally galvanized.
- B. Install iron pipe sleeves of ample diameter at all points where pipes penetrate beams, floors or walls. Size and install so that sprinkler pipes are not stressed.
- C. Sleeves shall be installed prior to construction of walls or pouring of concrete. Install sleeves flush with all surfaces.
- D. Sleeves for underground pipe shall have mechanical rubber seals and be watertight.
- E. Floor, wall and ceiling plates shall be pressed steel or cast iron split plates, chromium plated.
- F. Pressure gauges shall be UL listed or FM approved for fire service.

2.04 Sprinkler

- A. Sprinklers shall be UL listed or FM approved. Any sprinkler that incurs damage, is painted, or is sprayed with any obstructive material shall be replaced at no cost to the Owner. Installation of sprinklers shall be coordinated with other work including duct and electric fixture installation to prevent sprinkler obstructions.
- B. Sprinklers that may be subject to mechanical damage shall be provided with guards listed by UL and IRI approved for the model of sprinkler used.
- C. Quick response sprinklers are required throughout all light hazard occupancies and encouraged throughout ordinary hazard occupancies.

2.05 Fire Department Connections

- A. Each fire department connection shall be the flush type. Freestanding type fire department connections shall only be installed when approved by A&E Services and the San Marcos, Texas Fire Marshal. Each fire department connection shall be two (2) 2-1/2 inches, equipped with UL listed screw caps with pin lugs and chains. The fire department connection shall be labeled "AUTOMATIC SPRINKLER" with raised letters at least one inch in size and cast on plate. The fire department connections shall be not less than two feet and not more than 3 feet 6 inches in elevation, measured from the ground level to the centerline of the inlets.
- B. A bypass with a normally closed valve shall be installed around the check valve in the fire department connection piping, to permit flow testing of the backflow prevention assembly.

C. Locations of Hose Connections:

1. Hose connections and hose stations shall be unobstructed and shall be located not less than 0.9 m (3 ft) or more than 1.5 m (5 ft) above the floor.
2. Class I systems shall be provided with 65-mm (2.5-in.) hose connections in the following locations:
 - a. At each intermediate landing between floor levels in every required exit stairway.
 - b. At the highest landing of stairways with stairway access to a roof and on the roof where stairways do not access the roof.

D. Reference Standards: NFPA 14.

2.06 Identification Tags

Identification signs shall be porcelain enameled 18 gauge and shall be affixed securely by brass chain to all valves. The signs shall be red in color.

- A. Provide an approved laminated valve chart in frame and plexiglass cover showing location and use of each valve. The chart shall be secured in a visible location acceptable to Texas State University-San Marcos near the system riser.
- B. The main drain sign shall be labeled "MAIN DRAIN". Riser drains shall be labeled "RISER DRAIN" or "DRAIN".
- C. Auxiliary drain signs shall be labeled "AUXILIARY DRAIN".
- D. Inspector's Test signs shall be labeled "INSPECTOR'S TEST".
- E. All water supply control valves shall have a standard sign identifying the portion of the system controlled, noting that the valve shall be kept open, and leaving a blank space for notification information.
- F. All isolation valves shall be marked "normally open" (NO) or "normally closed" (NC).

2.07 Drains and Test Piping (including Dry Pipe Systems)

- A. All risers, including the alarm check valve, shall be equipped with drains with sizes as specified in NFPA 13. The alarm checks valve drain ("main drain") shall be piped to the sanitary sewer system.
- B. Every waterflow switch shall have an-inspector's test connection piped in accordance with item 2.10C of this Standard.
- C. All drains and test piping shall be piped to the sanitary sewer system.

2.08 Backflow Prevented

- A. A double check backflow prevention assembly with AS&Y valves shall be installed in the water supply to each automatic fire protection system.

2.09 Dry Pipe System

- A. Dry Pipe systems shall only be installed when adequate heat can not be provided to prevent sprinkler piping from freezing.
- B. In areas subject to freezing that cannot be protected by dry sprinklers on a wet sprinkler system, a dry pipe system shall be installed. Antifreeze loops are not permitted.
- C. All piping & fittings for Dry Pipe Systems shall be hot-dipped galvanized.

2.10 Fire Pump, Motor and Controller

- A. A fire pump shall only be installed when the existing water supply is not adequate to meet the required sprinkler demand, or when the building height is greater than 75 feet as measured from the lowest level of the fire department access.
- B. The pump furnished for fire protection service shall be supplied with a driver, controller and pump accessory items specified by the pump manufacturer.
- C. The pump and controller shall be UL listed and approved for fire service, per NFPA 20.
- D. The fire pump shall be capable of delivering not less than 10% excess capacity of the rated flow at not less than 100% of the rated head. The shut off (no flow) head shall not exceed 120% of rated head.
- E. The fire pump shall be a horizontal split case, single stage, centrifugal pump specifically labeled for fire service. Limited service fire pump controllers will not be accepted unless specified by A&E services or the Fire Marshals Office.
- F. The pump and motor shall be mounted on a common base plate of formed steel.
- G. The pump casing shall be cast iron with 6 inch 125 pound rated suction and inch 250 pound rated discharge flanges machined to American National Standards Institute (ANSI) dimensions
- H. The pump shall be hydrostatically tested and run tested prior to shipment. The pump shall be hydrostatically tested at a pressure of not less than one and one-half times the no flow (shut off) head of the pump's maximum diameter impeller plus the maximum allowable suction head, but in no case less than 250 psi.
- I. Fittings
The pump manufacturer shall furnish piping accessory items for the pump installation which will adapt the pump connections to the fire protection system and' test connection as follows:
Fittings subjected to pump discharge pressure shall be ANSI 250 psi rated. Fittings subjected to suction pressure shall be 125 psi rated.
- J. Flow Meter
An IRI approved flow meter shall be provided and installed in accordance with NFPA 20 to test the pump.
- K. Fire Pump, Motor, and Controller
 - 1. The main fire pump controller shall be a factory assembled, wired, and tested unit.

2. The controller shall be of the combined manual and automatic type designed for across-the-line type starting.
3. The minimum withstand rating of the controller shall not be less than 30,000 Amps RMS Symmetrical at 480 volts.
4. The controller shall include a motor rated combination disconnect switch/circuit breaker, mechanically interlocked and operated with a single externally mounted handle. When moving the handle from “OFF” to “ON” the interlocking mechanism shall sequence the isolating disconnect switch “ON” first and then the circuit breaker. When the handle is moved from “ON” to “OFF” the interlocking mechanism shall sequence the circuit breaker open first, and then the isolating disconnect switch.
5. The controller shall have externally mounted, individual, visible indicators for “Power Available”, “Phase Failure”, “Phase Reversal”, “Pump Running”, and “Run Time On”
6. The controller shall be wired so that the fire pump can only be shut down manually, per Fire Marshall Requirements.
7. Individual “Phase Failure”, “Phase Reversal” and “Pump Operating” alarm contacts shall be wired for connection to the Main Fire Alarm Control Panel, and the FCMS.
8. The manufacturer shall test the entire controller assembly prior to shipment. This test shall include each function the controller may be required to perform. The manufacturer shall test the circuit breaker at 300% full load, 600% load, and short circuit current settings. The manufacturer shall perform a high potential test on the controller power circuits at not less than two times the rated voltage plus 1000 Volts. Documentation of the above listed tests shall be submitted before the fire pump acceptance test.

L. Field Acceptance

1. Upon completion of the pump and sprinkler piping installation, a field acceptance test shall be conducted to 110% of the design capacity. All acceptance testing outlined in NFPA 20 shall be conducted by installing contractor in the presence of a representative of Texas State University-San Marcos Fire Marshal. Documentation of all factory and field tests shall be submitted at the conclusion of the field acceptance test. A&E will not approve any equipment prior to receipt and review of these test results.
2. Fire pump testing shall be of the recirculation type using a venturi.
3. The first flush must be filtered either by:
 - a. Directing the water to a large area of pervious cover capable of absorbing all of the discharge without causing erosion or damage to the existing landscape; or,
 - b. Directing the water to a cleaned area of impervious cover where the discharged water would enter a storm drain inlet protected by filtration (e.g. hay bales secured by sand bags).

4. If the total water volume is to exceed 1,000 gallons, the discharged water must be de-chlorinated before it enters the storm sewer system either by directing water into a small area where sodium metabisulfite (1 cup or 250 mgs per 5 gallons of chlorinated water) can be dripped in slowly to remove all chlorinate or, by directing the water through an obstacle course that is designed to remove the chlorine through aeration of the water. Contractors must use a chlorine test kit and test chlorine levels to ensure chlorine levels of discharged water are less than .1 mg/L residual chlorine before it enters other water bodies.

2.11 Pressure Maintenance Pump and Motor Controller

- A. The contractor shall furnish and install a pressure maintenance pump with a rated capacity of 10 GPM, against a total head of 250 feet coupled to a motor rated for the required pump, not to exceed 5 HP (Maximum), 480 volts, 60 HZ, 3 phase.
- B. The pressure maintenance pump shall be installed in accordance with NFPA 20.
- C. The control valves to and from the pressure maintenance pump shall be supervised butterfly valves installed in accordance with item 2.02.A of this specification.
- D. Pressure maintenance Pump Controller
 1. The pressure maintenance pump controller shall be factory assembled, wired and tested, and specifically designed for this type of service.
 2. The pressure maintenance pump controller shall be UL listed.
 3. The pressure switch shall have a range of 0-300 psi and have independent high and low pressure settings. The pressure switch shall be mounted inside the controller. The piping connection for the pressure switch shall be installed as shown in NFPA 20Appendix A. The pressure switch set points shall be set as shown in NFPA 20 Appendix A.
 4. The controller shall have a running period timer to be set to keep the motor in operation for at least one minute.
 5. The controller manufacturer, prior to shipment, shall hook up and test the pressure maintenance pump controller as a completed assembly. This test shall include each function the controller may be required to perform. The manufacturer shall perform a high potential test of the controller power circuits are not less than two times the rated voltage plus 1000 volts. Documentation of the above listed tests shall submit prior to the pump acceptance test.
- E. Field Acceptance Test

A field acceptance test of the pressure maintenance pump and controller shall be performed by the contractor at the same time as the main fire pump acceptance test. The acceptance test shall include each function the controller may be required to perform including manual start-stop, automatic start-stop, and minimum run timing.

2.12 Standpipe Systems

- A. The Standpipe and hose cabinet shall be reviewed and approved by State of Texas Fire Marshall, as well as, the City of San Marcos Fire Marshall.
- B. Wet standpipe systems shall be the manual-wet type and Class 1 as defined by NFPA 13.
- C. Each standpipe shall be installed with a UL listed 2-1/2 inch NST fire department hose connection with screw caps on each floor in an accessible, protected; and readily visible location in accordance with NFPA 13.
- D. Each standpipe shall have a drain sized and located in accordance with NFPA 13. Each drain shall be discharged to sanitary sewer.
- E. All dry piping shall be installed so that the entire system may be drained. The number of auxiliary drains shall be kept to a minimum.
- F. All dry piping, hangers and fittings shall be galvanized.
- G. Each dry standpipe shall be provided with an air and vacuum valve installed at the top of each riser. The air and vacuum valve shall be a 1 inch APCO Series 140 air and vacuum valve, manufactured by Valve and Primer Corporation or approved equal.
- H. One Standpipe Valve and Hose are to be located:
 - 1. Inside each required exit stairwell, on the intermediate landing, (not at flooring landing), of the Building.
 - 2. At the highest landing of stairway to roof access.
 - 3. On roofs where stairway does not access roof.

Approved Product or equal: Larsen, F50-3232, solid door, lettering black, horizontal, stainless steel, satin finish.

PART 3: EXECUTION

3.01 Guarantee

The Contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of three (3) years after the date of final acceptance by the Engineer, ordinary wear and tear excepted. Contractor shall be responsible for, and pay for, any damages caused by, or resulting from defects in his work.

3.02 Qualifications

System design and installation shall be supervised by a licensed NICET Level III sprinkler system technician or fire protection engineer with not less than five (5) years experience with sprinkler systems. Shop drawings shall be prepared and engineered. Accurate As-Built drawings shall be required in the form of three hard copies and two copies on CD in the specified format. The signature of the RME or engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system

conforming to applicable state laws and recognized good engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler system technician.

3.03 Certification

- A. Fire system is to be certified to the State Fire Marshall by the installing licensed fire alarm firms.
- B. Copy of certification shall be included in fire alarm panel and owner's manual.
- C. Proof of transmitting certificate to State Fire Marshall shall be provided to owner and A/E. Contractor shall transmit via Certified Mail Return Receipt and shall include original copy of receipt to owner's proof of submission as part of the Final Owners Operating and Maintenance Manuals.

END OF SECTION 21 10 00