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## Div. 21 Fire Suppression

The design guidelines contain herein include the requirements for systems, materials, fittings, valves, and pumps utilized for the fire protection systems at Mississippi State University. It is the intention of this document to provide a minimum standard for fire protection materials, fittings, valves and pumps at the university so as to provide the highest level of fire and life safety possible. Professionals shall verify that all applicable portions of the standard are incorporated into the final construction documents and adhered to during the construction of the project. Variances from these standards by the professional and or the contractor during the planning, design and construction of the project shall be submitted to the Office of Planning, Design and Construction Administration for approval. All requests for variance shall be submitted on the Office of Planning Design and Construction Administration's standard Request for Variance form.

### Section 21 10 00: Water-Based Fire-Suppression Systems

The design and installation of the fire suppression system will be in accordance with current additions of the following codes, standards and guidelines:

- NFPA 13 Standard for Installation of Sprinkler Systems
- NFPA 14 Standard for Installation of Standpipe and Hose Systems
- NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 24 Installation of Private Fire Service Mains and their Appurtenances
- NFPA 25 Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems
- NFPA 45 Standard on Fire Protection for Laboratories Using Chemicals
- NFPA 72 National Fire Alarm Signaling Code

Provide a complete automatic sprinkler system as defined by the latest edition of NFPA 13. All fire sprinkler systems installed 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 that cannot be maintained above 40 degrees F, will require a dry pipe system to be installed. **Antifreeze systems of any size are not permitted on campus. Heat tape or heating cables are not permitted for use as a freeze protection on fire suppression systems.**

All fire protection systems shall be monitored by a fire alarm system as established in Division 28 Electronic Safety and Security.

#### Quality Assurance:

The contractor shall conform to the following:

- All materials and performance shall meet the appropriate ANSI, ASME and ASTM Codes
- Welding Materials and Procedures shall conform to the ASME Code.



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- Only welders certified in accordance with ANSI/ASME Section 9 shall be employed.

Each item of the equipment shall be new, UL Listed and FM Approved. Each major item of equipment shall bear the manufacturer's name or trademark, serial number, UL stamp and FM label.

### Submittals:

Refer to provisions established in Division 01 General Requirements, Section 01 34 0- Shop Drawings, Product Data and Samples.

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

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 reflected ceiling layout and shall be coordinated with other trades prior to submittal. Shop drawings shall be submitted with a minimum (1/8") scale and all details at a minimum (1/4") scale.

Hydraulic calculations for standpipe 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 standpipe system hydraulic calculations.

Provide hydraulic calculations for automatic standpipes, where required per NFPA 14, to provide 100 psi when flowing 500 gpm at the most remote standpipe outlet at 250 gpm at each additional standpipe. Provide hydraulic calculations for manual standpipes to demonstrate the pressure available at the top of each standpipe while flowing the demand required per NFPA 14 utilizing both the available water supply and the nominal City of Starkville fire truck pumper through the fire department connection (FDC).

Prior to preparing shop drawings and hydraulic calculations, the design engineer is required to verify the adequacy of water pressure and other pertinent water supply data. The engineer shall provide the record data at the point of the new utility connection as follows:

1. Building name
2. Test hydrant (hydrant numbers and locations) and hydrant elevation
3. Flow rate (gpm), static pressure (psi), and residual pressure (psi)

No work shall be performed until the State Fire Marshal's office has approved the shop drawings, calculations, and data sheets.

Any modifications to shop drawings previously approved by the State Fire Marshal's office, will need to be submitted as a revision to the State Fire Marshal's office for approval before changes can be made on the project. A current copy of shop drawings, approved by the State Fire Marshal, shall be kept on the jobsite at all times during construction.



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### Fire-Suppression Sprinkler System Piping and Equipment:

#### Pipe:

1. Above ground pipe
  - a. All wet sprinkler system piping shall be a minimum of schedule 40 black steel piping with cast or malleable iron threaded or steel grooved end fittings.
  - b. BlazeMaster, CPVC, PB and other plastic piping shall **not** be specified or approved for use on MSU projects.
  - c. All concealed pipe and exposed pipe that is not painted red is required to be marked "Fire Protection." Pipe markers must be wrap around type with white letters at a minimum of 1" in height. Spacing and location as follows:
    - i. Above ceiling corridors: Every 20' for mains. One on each branch line.
    - ii. Above rooms with ceilings: Every 20' for mains (at least one in each room). One in every room on each branch line.
    - iii. Exposed area non-painted pipe: Every 20' for mains and branch lines (at least one on each branch line) and in each room.
    - iv. Exposed areas painted pipe: Pipe markers not required (as long as pipe is painted red – any other to follow above).
2. Underground pipe
  - a. Any changes in underground piping direction shall be provided with a thrust block or joint restraint as required per NFPA 13 (10.8.2) and NFPA 24 (10.8.2 and A10.8.2). Changes in direction where entering buildings shall be provided with thrust blocks and joint restraint.
  - b. Underground pipe shall be installed by either a fire sprinkler contractor or an underground contractor licensed to install fire service mains.
  - c. No underground pipe shall be covered until a joint inspection by the State Fire Marshal's office and design professionals.

#### Mechanical Grooved Couplings:

1. When grooved couplings are used, rolled-grooved joints are required with fittings and couplings designed for working pressure of 300 psi. Malleable iron housing clamps: ASTM A47; UL listed; engage and lock, designed to permit some angular deflection, contraction and expansion.
2. Galvanized couplings are required for galvanized pipe.
3. "C" shaped composition sealing gasket: ASTM D2000.
4. Steel bolts, nuts and washers: ASTM A183 heat treated with a minimum tensile strength of 110,000 psi.



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### Valves:

1. Unless specified otherwise, all valves shall be FM approved and UL Listed and be suitable for the maximum anticipated system pressure or a minimum of 175 psi working pressure, whichever is greater.
2. All valves in the sprinkler system shall be FM approved and UL Listed butterfly type indicating valves except for the following, which should be gate valves:
  - a. All indicating valves on the suction side of a fire pump
  - b. Where indicated on contract drawings
3. All butterfly valves shall have a built in tamper resistant switch for supervision of the open position. The switch shall be contained in a NEMA type 1, general purpose indoor rated housing. Closing the valve shall cause the switch contacts to change position.
4. Where OS&Y valves are installed , the following shall apply:
  - a. Valves 2-1/2 inches and larger shall be iron body with brass seats, discs and stems. Include tamper switches listed for use with OS&Y valves
  - b. Valves 2 inches and smaller shall be brass body, stem, and seat. Include tamper switches listed for use with OS&Y valves.
5. Check valves shall comply with the following:
  - a. Check valves 2-1/2 inches and larger shall be iron body swing check with cast brass hinge, rod, and brass faced discs.
  - b. Check valve 2 inches and smaller shall be UL listed and FM Approved brass body and all brass fitted.
  - c. Check valves shall be accessible for inspection and testing.
6. Ball valves shall be constructed of forged brass with Teflon seats and shall be provided with a vinyl-covered handle.
7. Post Indicator Valve
  - a. Gate valves on incoming water service shall be operable by a UL listed and FM Approved post indicator valve with tamper switch monitored by the associated building fire alarm control panel.
  - b. Wall mounted post indicator valves are not permitted.
8. All valves controlling water supply for sprinklers shall be accessible for use by emergency and maintenance personnel.



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9. Except for underground water supply valves located in roadway boxes, all valves controlling water supply to sprinklers shall be supervised by the fire alarm system.
10. A control valve shall be located at the base of each riser.

### Piping Accessories:

1. All hanger components other than all thread shall be UL listed and FM approved. No sprinkler piping is to be supported by any mechanical or electrical devices and/or equipment (ducts, lights, etc). Hanger assemblies installed outside, or otherwise exposed to weather, shall be externally galvanized.
2. Provide sleeves where pipes penetrate beams, floors or walls and install prior to construction of walls or pouring of concrete. Install sleeves flush with all surfaces.
3. Sleeves for underground pipe shall have mechanical rubber seals and be watertight.
4. Floor, wall and ceiling plates shall be pressed steel or cast iron split plates, chromium plated. Floor, wall and ceiling plates shall not be used in lieu of appropriate methods for maintaining the rating integrity of a firewall.
5. Pressure gauges shall be UL listed and FM approved for fire service.

### Drains and Test Piping:

1. All portions of the system shall be equipped with drains of the size specified in NFPA 13. All drains including auxiliary drains shall be piped to the sanitary sewer system designed to handle full flow from the drain.

### Sprinklers:

1. Sprinklers shall be UL listed and FM approved and shall not include O-ring 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 electrical fixture installation, to prevent obstructions.
2. 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.
3. All flexible hose assemblies shall be composed of UL listed and FM approved braided hoses. Corrugated flexible assemblies will **not** be accepted.



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### **Dry Pipe System:**

1. Dry pipe systems shall be installed where the area being protected cannot be maintained above 40 degrees F, as required per NFPA 13.
2. Pitch dry pipe system piping a minimum of ¼ inch per 10 feet for dry system mains and minimum of ½ inch per 10 feet for dry system branch lines.
3. All sprinklers that are not upright heads shall be full length dry pendent sprinklers that connect directly to the dry system branch line tee fittings.
4. Provide a tank or riser-mounted air compressor listed for fire protection use and sized to refill the entire dry pipe system within 30 minutes as required per NFPA 13.
5. Utilize the compressor manufacturer's listed air maintenance device and supervisory air pressure switch to maintain and monitor the dry pipe system air pressure.
6. All dry pipe valves must be externally resettable.

### **Guarantee:**

1. The contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional costs to the owner, any part thereof, which may become defective within the period of one (1) year 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.

### **Qualifications:**

1. 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 of experience with sprinkler systems. Accurate As-Built drawings shall be required in the form of three hard copies and two copies on CD in the specified AUTOCAD 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 recognize good engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler system technician.

### **Training:**

1. Contractor shall provide services to instruct Owner's personnel in operation and maintenance of system for a minimum of two 4 hour sessions.



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### **Section 21 30 00: Fire Pumps**

Provide a complete fire pump system as defined by the latest edition of NFPA 20. The design and installation will be in accordance with current additions of the following codes, standards and Guidelines:

- NFPA 13 Standard for the Installation of Sprinkler Systems
- NFPA 14 Standard for the Installation of Standpipe and Hose Systems
- NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 24 Installation of Private Fire Service Mains and their Appurtenances
- NFPA 25 Standard for Inspection, Testing and Maintenance of Water Based Fire Protection Systems
- NFPA 72 National Fire Alarm Signaling Code
- IFC International Fire Code
- IBC International Building Code

The work addressed in this section consists of a fire pump system which will be coordinated with all of the following:

- Fire Alarm System
- Emergency Power System
- Water Based Fire Suppression System

#### Quality Assurance:

Each item of the equipment shall be new and approved by FM Global. Each major item of equipment shall bear the manufacturer's name or trademark, serial number, and FM Label.

#### Submittals:

Refer to provisions established in Division 01 General Requirements, Section 01 34 0- Shop Drawings, Product Data and Samples.

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

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 reflected ceiling layout and shall be coordinated with other trades prior to submittal. Shop drawings shall be submitted with a minimum (1/8") scale and all details at a minimum (1/4") scale.



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Hydraulic calculations for standpipe 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 standpipe system hydraulic calculations.

Provide hydraulic calculations for automatic standpipes, where required per NFPA 14, to provide 100 psi when flowing 500 gpm at the most remote standpipe outlet at 250 gpm at each additional standpipe. Provide hydraulic calculations for manual standpipes to demonstrate the pressure available at the top of each standpipe while flowing the demand required per NFPA 14 utilizing both the available water supply and the nominal City of Starkville fire truck pumper through the fire department connection (FDC).

Prior to preparing shop drawings and hydraulic calculations, the design engineer is required to verify the adequacy of water pressure and other pertinent water supply data. The engineer shall provide the record data at the point of the new utility connection as follows:

1. Building name
2. Test hydrant (hydrant numbers and locations) and hydrant elevation
3. Flow rate (gpm), static pressure (psi), and residual pressure (psi)

No work shall be performed until the State Fire Marshal's office has approved the shop drawings, calculations, and data sheets. The contractor is solely liable for any work performed before this approval.

Any modifications to drawings approved by the State Fire Marshal's office, will need to be submitted as a revision to the State Fire Marshal's office for approval before changes can be made on the project.

### Products:

Fire Pump, Motor and Controller:

1. The pump furnished for the fire protection service shall be equipped with a driver, controller and pump accessory items specified by the pump manufacturer.
2. The pump and controller shall be UL Listed and FM approved for fire service, per NFPA 20.
3. The fire pump shall be SINGLE stage, centrifugal **horizontal** split-case pump specifically labeled for fire service. The power source shall be electricity.
4. The pump and motor shall be mounted on a common baseplate of formed steel.
5. The pump casing shall be cast iron with 125 pound rated suction, unless the maximum pressure at the suction side of the pump exceeds 125psi, and 250 pound rated discharge flanges machined to American National Standards Institute (ANSI) dimensions.





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6. 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 not less than 250 psi.
7. The main fire pump controller shall be a factory assembled, wired, and tested unit.
8. The controller shall be of the combined manual and automatic type designed for across-the-line starting. Variable Frequency Drive controllers are not acceptable.
9. The minimum withstand rating of the controller shall not be less than 30,000 Amps RMS Symmetrical at 480 volts.
10. 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.
11. The controller shall have externally mounted, individual, visible indicators for "Power Available", "Phase Reversal" and "Pump Running".
12. The controller shall be furnished from the factory with the auto run timer disabled.
13. Individual "Power Failure", "Phase Reversal" and "Pump Running" shall be wired for connection to the Main Fire Alarm Control Panel.
14. Where required by NFPA 20, the controller shall be equipped with an automatic transfer switch. Power to the transfer switch shall be supplied by one of the NFPA 20 power sources.
15. The manufacturer shall test the entire controller assembly prior to shipment. The 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 no less than two times the rated voltage plus 1000volts. Documentation of the above listed tests shall be submitted before the fire pump acceptance test.
16. Provide an automatic transfer switch on all fire pump controllers.



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### **Fittings:**

1. The pump manufacturer shall furnish piping accessory items for the pump installation which will adapt the pump connection to the fire protection system and test connections as follows:
  - a. Fittings subject to pump discharge pressure shall be ANSI 250 psi rated.
  - b. Fittings subject to suction pressure shall be ANSI 125 psi rated, unless the maximum pressure at the suction side of the pump exceeds 125 psi.

### **Jockey Pump and Motor Controller:**

1. The contractor shall furnish and install a jockey pump coupled to a motor rated for the required pump, not to exceed 5 HP (Maximum), 480 volts, 60 HZ, 3 phase.
2. The jockey pump shall be installed in accordance with NFPA 20.
3. The control valves to and from the jockey pump shall be supervised butterfly valves installed in accordance with this standard.

### **Jockey Pump Controller:**

1. The jockey pump controller shall be factory assembled, wired and tested, and specifically designed for this type of service.
2. The jockey pump controller shall be UL Listed and FM approved.
3. The pressure 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 pressure set points shall be in accordance with NFPA 20 Appendix A.
4. The controller manufacturer, prior to shipment, shall hook up and test the jockey pump controller as a complete assembly. This test shall include each function the controller may be required to perform. The manufacturer perform a high potential test of the controller power circuits at not less than two times the rated voltage plus 1000 volts. Documentation of the above tests shall be submitted prior to the pump acceptance test.
5. All jockey pumps shall be served by emergency power circuits.

### **Field Acceptance:**

Upon completion of the fire pump and sprinkler piping installation, a field acceptance test shall be conducted at a minimum, rated and peak loads of the fire pump by controlling the quantity of water discharged through an approved test device. All acceptance testing outlined in NFPA 20 shall be conducted by the installing contractor in the presence of a Mississippi State University representative



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(FM Alarm Services). Documentation of all factory and field tests shall be submitted at the conclusion of the field acceptance test.

A field acceptance test of the jockey pump and controller shall be performed 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 and automatic start-stop.

### Guarantee:

The Contractor shall guarantee all workmanship and materials to be as represented by him, and shall repair or replace, at no additional costs to the Owner, any part thereof, which may become defective within the one year period after the date of final acceptance by the Engineer.

### Warranty:

Warranty for all system components, equipment and labor must be good for one year after final acceptance.