

SECTION 13930

WET-PIPE FIRE SPRINKLER SYSTEMS

PART 1 GENERAL

1.01. SECTION INCLUDES

- A. Underground fire service mains
- B. Wet-pipe sprinkler systems
- C. System design, installation, and certification

1.02. RELATED SECTIONS

- A. Section 13851 Fire Alarm System
- B. The conditions of the Contract, including the General Conditions and Supplementary Conditions, and Division 1 - General Requirements, apply to work covered by this Section.
- C. Comply with Division 2, 13, 15, and 16 Sections, as applicable. Refer to other Divisions for coordination of work.

1.03. DEFINITIONS

- A. Equipment and materials shall be approved for their designed use and performance. The term "approved" shall mean Factory Mutual (FM) approved and/or Underwriters Laboratories (UL) listed and acceptable to the approval authorities.
- B. Approval authorities shall include Rooms To Go (Owner), authorized representative Telgian Corporation (Engineer), the General Contractor, and the local fire/code official(s), where applicable, (Authorities Having Jurisdiction).
- C. The term "Contractor" as used within this specification refers to the private underground fire service mains and/or fire sprinkler system subcontractor(s).

1.04. REFERENCES

- A. International Code Council (ICC)
 - 1. 2018 North Carolina Building Code
 - 2. 2018 North Carolina Fire Code
- B. National Fire Protection Association (NFPA)
 - 1. NFPA 13 - Installation of Sprinkler Systems

2. NFPA 20 - Installation of Centrifugal Fire Pumps
 3. NFPA 24 - Private Fire Service Mains and Their Appurtenances
 4. NFPA 25 - Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
 5. NFPA 70 - National Electrical Code
 6. NFPA 72 - National Fire Alarm Code
 7. NFPA 101 - Life Safety Code
 8. NFPA 1963 - Fire Hose Connections
- C. Underwriters Laboratories, Inc. (UL)
1. Fire Protection Equipment Directory
 2. Building Materials Directory
 3. Electrical Construction Materials Directory
- D. Factory Mutual System (FM)
1. FM Approval Guide (Latest Edition)
 2. Property Loss Prevention Data Sheet 2-0
- E. American National Standards Institute (ANSI)
1. ANSI/ASME B1.20.1 - Pipe Threads, General Purpose
 2. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
 3. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300
 4. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250
 5. ANSI/ASME B16.5 - Steel Pipe Flanges and Flanged Fittings
 6. ANSI/ASME B16.9 - Factory-made Wrought Steel Buttweld Fittings
 7. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welded and Threaded
 8. ANSI/ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
 9. ANSI/ASME B16.25 - Buttwelded Ends for Pipe, Valves, Flanges, and Fittings
 10. ANSI/ASME B36.10M - Wrought Steel Pipe
- F. American Society for Testing and Materials (ASTM)
1. ASTM A53 - Welded and Seamless Steel Pipe

2. ASTM A126 - Gray Iron Castings for Valves, Flanges, Pipe Fittings
 3. ASTM A135 - Electric-Resistance-Welded Steel Pipe
 4. ASTM A183 - Carbon Steel Track Bolts and Nuts
 5. ASTM A193 - Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
 6. ASTM A194 - Carbon and Alloy Steel Nuts and Bolts for High Pressure and High Temperature Service
 7. ASTM A197 - Cupola Malleable Iron
 8. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
 9. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 10. ASTM F436 - Hardened Steel Washers
 11. ASTM A536 - Ductile Iron Castings
 12. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
- G. American Welding Society (AWS)
1. AWS D10.9 - Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
- H. American Water Works Association (AWWA)
1. AWWA C104 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
 2. AWWA C110 - Ductile Iron and Gray Iron Fittings, 3-inch Through 48-inch, for Water and Other Liquids
 3. AWWA C111 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
 4. AWWA C115 - Flanged Ductile Iron Pipe and Threaded Flanges
 5. AWWA C150 - Thickness Design of Ductile Iron Pipe
 6. AWWA C151 - Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
 7. AWWA C153 - Ductile Iron Compact Fittings, 3-inch through 12-inch, for Water and Other Liquids
 8. AWWA C502 - Dry-Barrel Fire Hydrants

9. AWWA C509 - Resilient-Seated Gate Valves for Water and Sewerage Systems
10. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances
11. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
12. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch Through 12-inch, for Water or Other Liquids

1.05. SYSTEM DESCRIPTION

A. Underground Fire Service Mains

1. Private fire service water mains shall be provided for distribution of water to fire hydrants and fire suppression systems as indicated on the fire protection and civil drawings, and in accordance with this specification.
2. Post indicator valves (PIV) shall be provided as indicated on the fire protection and civil drawings. Each PIV shall be equipped with a valve supervisory tamper switch to be connected to the fire alarm system by others.
3. Where underground mains pass through building walls, or require a vertical rise or drop, the pipe shall be cement-lined ductile iron. Other underground piping shall be either cement-lined ductile iron or polyvinyl chloride (PVC) as indicated on the civil drawings.
4. The top of all underground mains shall have a minimum depth of cover of 36-inches below earth grade, or as required by local Authority Having Jurisdiction, or NFPA 24, whichever is greater.
5. All underground piping on the discharge side of the fire pump shall be rated with a working pressure not less than 175 psi.
6. Underground mains shall be mechanically restrained or have concrete thrust blocks installed at all changes in direction, behind tees, hydrants and dead end lines or capped tees. Mechanical joint restraints and/or thrust blocks shall be designed and installed in accordance with NFPA 24 based upon the soil resistance determined by the Soils Engineer for a minimum internal static pressure of 225 psi using a 1.5 safety factor. All stub-ins (risers and pump house) shall be mechanically restrained and have concrete thrust blocks. All rods, nuts, bolts and washers shall be painted with asphaltum paint. Corrosion protection must meet requirements of NFPA 24.

7. Guard posts shall be provided around all above ground on-site hydrants and post indicator valves subject to vehicular damage. Coordinate with drawings. The posts shall be a minimum of 6-inch Schedule 40 pipe filled with concrete. The top of each post shall be 4-feet above grade level and shall extend a minimum of 3- feet below grade. Posts shall be anchored in concrete. A minimum clear space of 3-feet shall be provided between each post and the component being protected.

B. Sprinkler Systems

1. Provide as indicated on the fire protection drawings.
2. Control Valves: Each sprinkler system riser shall be controlled by an indicating OS&Y or butterfly valve.
3. Inside Hose Stations: Provide interior fire hose connections (no hose) throughout the warehouse in accordance with the requirements of the Authorities Having Jurisdiction. Hose connections shall be protected from physical impact and permanently labeled for the system they are connected to. *Confirm locations of hose stations with owner prior to installation.*

C. Hydraulic Design Requirements

1. Sprinkler Discharge Area: The discharge area for each system shall be the hydraulically most remote area as defined in NFPA 13. The design area, for systems based on density/area design method, shall be a rectangular area having a dimension parallel to the branch lines at least 1.2 times the square root of the minimum area of operation specified.
2. Friction Losses: Losses in pipe shall be calculated in accordance with the Hazen- Williams formula with "C" values in accordance with NFPA 13.
3. Hose Stream Allowances: Include an allowance for hose streams as required by NFPA 13. Inside hose stream allowances shall be taken at the base of the riser. Outside hose stream allowances shall be taken at the nearest hydrant or connection of the sprinkler system lead-in to the underground private fire service main.
4. A minimum 10 psi cushion or safety margin between the available water supply residual pressure and the calculated system demand pressure of the hydraulically most remote system shall be incorporated into all hydraulic calculations.

D. Water Supply:

1. Hydraulic calculations shall be based on the available water supply from the water tank and fire pump being constructed adjacent to the site, as

indicated on the civil drawings. The Contractor shall conduct a flow test on this system, and submit the results of the flow test to the Engineer for review and approval prior to the preparation of the shop drawings and hydraulic calculations.

E. Location of Sprinklers

1. Location of sprinklers in relation to the ceiling and the spacing of sprinklers shall not exceed that permitted by NFPA 13 and the listing of each sprinkler. Pendent sprinklers located beneath suspended ceiling tiles shall be positioned on a center-tile basis. The spacing of sprinklers on the branch lines for open areas shall be essentially uniform. ESFR sprinklers shall be located in strict conformance to FM Loss Prevention Data Sheet 2-0.

F. Alarm and Supervisory Devices

1. Provide and install the following alarm and supervisory switches, which shall be connected to the building fire alarm control panel (FACP) by the fire alarm contractor.
 - a. Tamper Supervisory Switches: All valves directly controlling water to fire sprinklers, and the valve controlling the fire pump test header, shall be provided with tamper supervisory devices. An off-normal signal shall be initiated during the first two revolutions of a hand wheel or when the stem of the valve has moved one-fifth of the distance from its normal position, whichever is less. Each tamper supervisory device shall initiate a distinct supervisory indication.
 - b. Water Flow Switches: Each sprinkler system shall be provided with a vane- type water flow device. Water flow signals shall be priority signals and shall identify the activated flow device.

G. System Drainage

1. Drain pipes and valves shall be installed on each system to allow drainage. Each system shall drain to the maximum extent possible through the main drain valve. Discharge from drain pipes shall be to the building exterior, directed away from the building and stairs. The discharge from each drain pipe shall be piped to within 84-inch of grade. Splash blocks under each drain outlet shall be provided where necessary to prevent soil erosion.

H. Cleaning and Painting

1. All finished pipe installation shall be thoroughly cleaned of rust and in condition for painting.

2. All interior aboveground sprinkler system pipe and trim shall be painted red from the finished floor to 25 feet above the finished floor level.
 3. All outside drain pipes shall be painted to match the exterior paint color at the location of the pipe.
- I. Wet-Pipe Systems Operating Sequence
1. When a sprinkler is opened by heat from a fire, water flows to the open sprinkler.
 2. A single supervisory signal shall be generated for each individual system control valve with transmission to the FACP for tamper switch activation.
 3. A water flow signal shall be generated for transmission to the FACP upon water flow in each system equal to or greater than any one sprinkler. The flow switch shall be set for an alarm signal transmission delay of 60 seconds.
- J. Work Not Included
1. Installation of portable fire extinguishers
 2. The wiring and monitoring of alarm switches and supervisory signaling system
 3. All electrical installations

1.06. SUBMITTALS

- A. Shop Drawings
1. Prepare and submit a minimum of five (5) complete sets of detailed shop drawings indicating the proposed layout of equipment, fire service mains, risers, hangers, pipes and sprinklers. Prepare working drawings not smaller than a scale of 3/32-inch = 1-foot, on 30-inch x 42-inch drawing sheets, in accordance with all requirements for "Working Drawings (Plans)" as specified in NFPA 13. Shop drawings shall clearly indicate the locations and dimensions (to scale) of all potential obstructions or other interference to the ESFR sprinkler systems, including (but not limited to): bar joists, bottom chord bridging, x-bracing, lighting fixtures, draft curtains, duct work, powered roof exhaust ventilators, automatic smoke and heat vents, skylights, conduits, pipes, fans, etc. Submittal must be approved in writing by the Engineer and the Authority Having Jurisdiction prior to starting work.
- B. Product Data
1. Submit five (5) complete sets of descriptive data annotated to show the specific model, type and size of each item proposed. Full descriptive data

shall be submitted for all components essential to proper installation, including, but not limited to: sprinklers, pipe, fittings, gate valves, butterfly valves, check valves, hangers, flow switches, tamper switches, post indicators, underground pipe, devices, materials and associated equipment. Submittal must be approved in writing by the Engineer and the Authority Having Jurisdiction prior to starting work.

C. Hydraulic Calculations

1. Prepare and submit a minimum of five (5) complete sets of hydraulic calculations. A separate hydraulic calculation must be submitted for each sprinkler system unless otherwise pre-approved by the Engineer. Nodes or reference points for each system must be included on the shop drawings. Submittal must be approved in writing by the Engineer and the Authority Having Jurisdiction prior to starting work.

D. Submittals to the Authority Having Jurisdiction

1. Submit shop drawings, product data, and hydraulic calculations directly to the Fire Marshal's office for approval. Do not commence work until approval is obtained. Provide proof of approval to Owner. Coordinate with the local authorities' field inspecting representatives and make all adjustments or changes required to obtain approval without added cost to the contract.

E. Project Record Documents

1. Sprinkler Contractor's Superintendent shall prepare and maintain on-site, on a daily basis, red-lined shop drawings to record as-built conditions. Make red-lines available during construction for reference by the Engineer *and Owner* for construction site visits. Submit completed red-line drawings to the Engineer at project completion.
2. Prepare and submit record shop drawings, product data, and hydraulic calculations reflecting final as-built conditions at completion of project, but before final acceptance of the work. These documents shall be prepared in accordance with the requirements for the initial submittal. Freehand sketches or mark-up documents are not acceptable.

F. Operations and Maintenance Data

1. Furnish ~~two (2)~~ *three (3)* hardcopy sets *and electronic set* of instruction manuals containing complete operation and maintenance instructions for the specific make and model of fire pump, pump controller, check valves, control valves, water flow and pressure switches, valve supervisory switches and other components supplied. Include maintenance data relative to components of system, servicing requirements, inspection data,

replacement part numbers and availability, and location and numbers of service depot.

G. Contractor's Material and Test Certificates

1. Upon completion of required testing, submit completed and signed Contractor's Material and Test Certificates, for aboveground and underground piping, certifying systems meet or exceed the specified requirements.

1.07. QUALITY ASSURANCE

A. Qualifications

1. Contractor shall be certified by the material/equipment manufacturer as trained in, and as knowledgeable of, the manufacturer's standard practices and procedures relating to installation of sprinkler systems and fire pumps. The Contractor shall be certified and licensed by the state and local jurisdictions, as applicable.
2. Contractor shall be a firm specializing in performing work of this Section with a minimum of three years' experience and must be regularly engaged in making such installations.
3. Contractor shall have successfully installed automatic fire sprinkler systems of the same type and design as specified herein. The Contractor shall provide evidence of such qualifications. The data shall include names and locations of at least three installations where the Contractor has installed such systems. The Contractor shall indicate the type and design of each system and certify each system has performed satisfactorily in the manner intended for a period of not less than 18 months. The Contractor shall submit a copy of a valid state sprinkler contractor certificate and license, as applicable.
4. Contractor shall provide workers normally employed in the field and as otherwise specified in NFPA 13 and local ordinances. All material shall be new and in good condition, free of defects, scratches, corrosion and contamination. Used equipment shall not be allowed.

B. Equipment and components shall bear the UL and/or FM label or marking.

C. Regulatory Requirements

1. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 13, to other applicable NFPA standards, Local, State and Federal codes; and to all other requirements specified herein. The advisory provisions (Appendices) of the NFPA publications referred to herein shall be

considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. If there are any conflicts between these specifications and the referenced standards and publications, the most stringent requirement shall apply, as determined by the Engineer.

2. Shop drawings, product data, and hydraulic calculations shall bear the stamp of approval of Authorities Having Jurisdiction, including the Engineer and the Fire Marshal's office.
3. Deviations from the contract documents and the contractor's approved submittal documents will not be permitted without written consent from the Engineer.
4. Compliance with the contract documents shall not relieve the Contractor from any specification section including strict compliance with NFPA 13, NFPA 24, FM Data Sheet 2-0, local, state, or federal requirements, and the requirements of the Authority Having Jurisdiction.

1.08. DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place. Maintain in place until installation.
- B. Provide temporary protective coating on cast iron and steel valves.

1.09. SEQUENCING

- A. The underground fire service mains and hydrants shall be fully functional prior to the start of combustible construction.
- B. Flushing of the underground mains and lead-ins must be completed, and witnessed by the Engineer *and Owner* before connection is made to aboveground sprinkler system piping.

1.10. GUARANTEE

- A. The Contractor, in addition to other warranties or guarantees required by the contract documents, shall guarantee workmanship on all piping, devices, and related materials for a period of one year from the date of the Engineer's final acceptance of the work. All defects shall be promptly corrected at no cost to the Owner.
- B. The Contractor is responsible for providing a system that has been coordinated with the contract documents and approved by all concerns referenced in this document including, but not limited to, the Owner, local authorities, and the Owner's representatives.

1.11. EXTRA MATERIALS

- A. Provide spare sprinklers under provisions of NFPA 13. The quantity of each type of extra sprinkler shall be as specified in NFPA 13.
- B. Provide suitable wrenches for each type of sprinkler.
- C. Provide metal cabinets for storage of spare sprinklers and sprinkler wrenches. Cabinets shall be of sufficient size to permit spare sprinklers to fit upright and reasonably secured within the cabinets. Cabinets sized such that spare sprinklers must be laid on their sides within the cabinets shall not be accepted. Cabinets shall be located at sprinkler system risers, unless otherwise indicated.

1.12. HYDRAULIC DESIGN INFORMATION SIGN

- A. Provide a permanently marked, weatherproof metal or rigid plastic sign, with the following information inscribed thereon:
 - 1. Location of the design area or areas
 - 2. Discharge densities over the design area or areas, or number and discharge pressure of calculated sprinklers, as applicable
 - 3. Required flow and residual pressure demand at the base of the riser
 - 4. Occupancy classification or commodity classification and maximum permitted storage height and configuration.
 - 5. Hose stream demand included in addition to the sprinkler demand.
- B. The lettering on the sign shall be engraved or otherwise typeset. Handwritten signs shall not be accepted.
- C. Signs shall be permanently secured to the system riser with corrosion resistant wire, chain, or other approved means.

PART 2 PRODUCTS

2.01. GENERAL

- A. All equipment supplied under this specification shall be new, and shall be UL-listed and/or FM-approved for fire protection service and installed and used as intended by the listing.

2.02. UNDERGROUND FIRE SERVICE MAINS

- A. Underground pipe shall be UL-listed or FM-approved for fire protection service and shall be Ductile Iron pipe meeting AWWA C150 and AWWA C151,

cement-mortar lined per AWWA C104, and laid per AWWA C600, or high pressure PVC pipe meeting AWWA C900 and laid per AWWA C605.

- B. The pressure class of the pipe, joints, fittings, valves and hydrants shall not be less than the maximum working pressure of the system under non-emergency (no-flow) conditions. In no case shall the pressure class be less than 175-psi.
- C. Ductile iron pipe shall be joined by mechanical or push-on joints meeting AWWA C111, cast iron flanges meeting ANSI B16.1, ductile iron flanges meeting AWWA C115, or other approved means.
- D. Fittings shall be cast iron meeting ANSI B16.1 or ductile iron meeting AWWA C110.
- E. Fire hydrants shall be high-pressure type, meeting the requirements of AWWA C502 and the Authority Having Jurisdiction. Hose threads shall have the NH standard external thread as specified in NFPA 1963, unless another thread is required by the authority having jurisdiction.
- F. Fire department connection (FDC) shall be either a Storz-type connection with location to be coordinated with local AHJ.
- G. Backflow Prevention Device: To be provided by the city.

2.03. ABOVEGROUND PIPING SYSTEMS

- A. Inspect, test and approve piping before covering, or concealing. Provide fittings for changes in direction of piping and for all connections.
- B. Welding shall be performed in the shop; field welding will not be permitted.
- C. Conceal piping, fittings, fixtures, hangers and supports in areas with suspended ceilings and finished areas.
- D. Sprinkler pipe shall be per NFPA 13, and shall be steel conforming to ASTM A-53, A-135, or A-795. Piping joined by welding or rolled-groove method shall have a minimum nominal wall thickness in accordance with Schedule 10 for sizes less than 8-inch (200 mm), 0.134-inch (3.40 mm) for 6-inch (150 mm), and 0.188-inch (4.78 mm) for 8-inch (200 mm). Piping joined by threaded methods shall be Schedule 40 for sizes less than 8-inch (200 mm) and Schedule 30 for sizes 8-inch (200 mm) and larger. Wall thicknesses less than those described above may be used if the pipe is specifically listed and has a Corrosion Resistance Ratio of at least 1.0, including when joined.
- E. Pipe shall be joined by threaded, rolled-groove, welded or flanged methods. Welding methods shall comply with all requirements of AWS D10.9, threads shall be cut to ANSI/ASME B 1.20.1, and groove dimensions shall be compatible with the listings of the couplings and fittings used. Flange gaskets

shall be red rubber sheet, 1/16-inch thick, conform to ASTM D-2000. Gaskets for grooved couplings shall be EPDM, grade E, conforming to ASTM D-2000. Grooved couplings and fittings shall be of the same manufacturer.

- F. Fittings shall be cast iron conforming to ANSI B16.1 or ANSI B16.4, malleable iron conforming to ANSI B16.3, or steel conforming to ANSI B16.5, ANSI B16.9, ANSI B16.11, ANSI B16.25, or ASTM A234.
- G. Grooved couplings and fittings shall be of the same manufacturer.

2.04. SPRINKLERS

- A. ESFR sprinklers be pendent sprinklers and shall have a nominal K-factor of ~~46.8~~ **22.4** and nominal temperature rating of 165 F. All other sprinklers shall have nominal 17/32-inch or 1/2-inch orifice and a release element of ordinary temperature rating except where a higher temperature rating is necessary for individual sprinkler locations.
- B. Sprinklers (other than ESFR) in warehouse areas without suspended ceilings shall be standard- response, brass and upright type unless otherwise specified.
- C. Sprinklers in office areas with suspended ceilings shall be quick-response, ordinary temperature-rated 1/2-inch orifice recessed pendent sprinklers with chrome finish.

2.05. PIPING SPECIALTIES

- A. Wet-pipe Sprinkler System Riser Valve: Provide Riser Swing Check Valve controlled by an OS&Y or butterfly valve equipped with 2-inch main drain valve piped to exterior and inlet and outlet pressure gauges for each individual sprinkler system. Trim to include a vane-type water flow switch. Trim shall also include an Inspector's Test Connection (ITC) and grid relief valve with the discharge piped to the exterior.
- B. Water Flow Switches: Provide a paddle-type water flow switch above the sprinkler system riser valve on each individual sprinkler system. The switch shall have sensitivity setting to signal any flow of water that equals or exceeds the discharge from any one sprinkler. Water flow switch mechanisms shall incorporate a retard element, adjustable up to two minutes, which shall be set between 20 and 30 seconds. Assembly shall be rated at 175-psi cold water pressure. Switches shall be compatible with the fire alarm system and NFPA 72.
- C. Valve Supervisory Switches: Provide each sprinkler control valve, including yard post indicator valves and the two OS&Y valves on the backflow preventer in the vault, with an approved circuit supervisory (tamper) switch. The switch shall be designed to transmit a supervisory alarm signal to the

building fire alarm system. The supervisory signal shall be obtained during the first two revolutions of the hand wheel or operating crank. The switch shall not interfere with the operation of the valve, nor obstruct the view of its indicator. The trouble signal shall be obtained during abnormal interconnecting circuit conditions. Devices shall be compatible with the fire alarm system and the requirements of NFPA 72. All switches shall be suitable for installation of end-of-line devices.

- D. Pressure Gauges: Pressure gauges shall be the Bourdon-tube type with a metal corrosion-resistant case, flat glass window, 3-1/2-inch diameter with background dial with black markings, and a 0-300 psig range. Gauge accuracy shall be 3-2-3% of full range. A shutoff valve shall be provided with each gauge connection.

2.06. VALVES

- A. Provide valves as required by NFPA 13 and of types approved for fire service. Sprinkler control valves shall open by counterclockwise rotation and be of the type compatible with wall-mounted indicator posts or butterfly type. Valves 2-inch and smaller shall be bronze. Valves 2-1/2-inch and larger shall be iron bodies, bronze mounted. Valves 2-inch and smaller shall be bronze.
- B. Gate Valves
 - 1. Up to and including 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc.
 - 2. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, resilient- seated.
 - 3. Provide inside screw-type valves where wall-type indicator valve operators are provided.
- C. Globe Valves
 - 1. Up to 2 Inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, with backseating capacity repackable under pressure.
 - 2. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, renewable seat and disc.
- D. Ball Valves
 - 1. Up to and including 2 Inches: Bronze one-piece body, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops.
 - 2. Over 2 Inches: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged.

E. Butterfly Valves

1. Bronze body, stainless steel disc, resilient replaceable seat, threaded ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch compatible with the fire alarm system.
2. Cast or ductile iron body, chrome plated ductile iron disc, resilient replaceable EPDM seat, extended neck, handwheel and gear drive and integral indicating device and built-in tamper proof switch compatible with the fire alarm system.

2.07. PIPE HANGERS

- A. Pipe hangers, braces and supports shall be provided in accordance with NFPA 13.
- B. Hangers for support of piping and equipment shall be types approved for fire protection service. Supports including all threaded rods shall not interfere with access to operating areas or contact building services equipment.

2.08. PIPE SLEEVES

- A. For sleeves in masonry concrete *tilt-up* walls, floors, roofs provide ASTM A53, Schedule 40 or standard weight, hot-dip galvanized steel pipe sleeves.

2.09. PIPE ESCUTCHEON PLATES

- A. Provide approved one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed areas. Provide chromium-painted finish on plates in finished areas. Securely anchor plates in place with set screws or other approved means.

PART 3 EXECUTION

3.01. PREPARATION

- A. Coordinate work of this Section with other affected work.
- B. The Contractor shall take any necessary measures to prevent damage to the facilities and equipment, and shall take any necessary measures to keep the premises dry at all times. Damage resulting from the work and testing under this section, whether intentional or not, shall be repaired by the Contractor at no cost to the Owner.
- C. Prior to the operation (opening or closing) of any valve controlling water to the domestic or fire system, notification shall be given to, and approval obtained from, the Building Owner's Representative.

- D. Neither the A/E, Developer nor Owner shall be responsible for providing a safe working place for the Contractor, subcontractors, or their employees, or any individual responsible to them for the work. The responsibility rests with the Contractor.
- E. Ream pipe and tube ends. Remove burrs.
- F. Prepare piping connections to equipment with flanges or unions.
- G. All excess oil, dirt, pipe joint compound, rust and mill scale shall be removed from piping and equipment. All dirt, debris and excess cutting oil shall be removed from the interior of all piping and equipment before it is erected.
- H. *A pre-install meeting shall take place prior to any work commencing.*

3.02. INSTALLATION

- A. All equipment shall be installed in an aesthetic and skilled manner in accordance with NFPA Standards and other applicable standards referenced by this document. Final appearance of all systems and equipment shall be neat and clean. All piping in areas with finished ceilings shall be concealed. All wiring shall be in metal conduit.
- B. Inspect, test and approve piping before covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in pipe sizes through tapered reducing pipe fittings; the use of bushings will not be permitted. Welding shall be performed in the shop; field welding will not be permitted. Conceal piping, fittings, fixtures, hangers and supports in areas with suspended ceilings and finished areas.
- C. Install equipment in accordance with manufacturer's instructions.
- D. Use proper lubricant on ends of piping or gaskets where required by pipe fitting or coupling manufacturer. The manufacturer's recommended lubricant shall be used.
- E. Where required by manufacturer, properly torque bolts to manufacturer's specifications using a torque wrench.
- F. All sprinklers shall be installed after the piping has been installed at ceiling level, and not while the piping is on ground level. There shall be no exceptions.
- G. Place pipe runs to minimize obstruction to other work.
- H. Insulate connection between pipe, fittings, hangers or dissimilar metal against direct contact. Use dielectric insulating flanges and units.
- I. Support all sprinkler piping as specified in applicable NFPA Standards.

- J. Provide minimum 1-1/4-inch diameter, 84-inch long nipple, cap and ball valve at ends of all cross mains for flushing connections.
- K. The Contractor shall coordinate and install equipment, piping and hangers so that it will not interfere with or be obstructed by piping, lighting, electrical conduit and wiring, structural members, air- conditioning equipment, and ceiling construction. If any such interference or obstruction exists or occurs, the Contractor shall make the necessary adjustment and/or additions to permit satisfactory installation of the system with no additional cost to the owner, architect, or engineer.
- L. Sprinkler installation shall be coordinated with the installed mechanical and electrical work and the ceiling grid/layout. Where sprinklers are to be installed on modular ceiling panels (lay-in acoustical tile), sprinklers shall be located in the center of the ceiling panel, or located in other symmetrical pattern acceptable to the Building Owner's Representative and in accordance with referenced standards and design drawings. The Contractor shall furnish additional sprinklers, which may be required for coordinated ceiling pattern without additional cost to the Owner, even though number of sprinklers may exceed minimum code requirements.
- M. The Contractor shall install the piping and equipment in accordance with approved shop drawings.
- N. Main and Auxiliary Drains
 - 1. Each system shall be furnished with a main drain capable of draining the majority of the system to drain. Drainage to floor is not permitted.
 - 2. Auxiliary drains shall be provided to drain any sections of piping that trap water or are not capable of being drained by the main drain in accordance with NFPA 13. Auxiliary drains shall discharge to the exterior unless otherwise approved by the Owner and/or Engineer.
 - 3. All outside exposed sprinkler system piping shall be galvanized pipe, and drains terminating outside shall be piped to within 4-inch of finished grade. Concrete splash blocks shall be provided at grade level beneath all outside drains to preclude soil erosion where necessary.
- O. Install piping to conserve building space, and not interfere with use of space and other work. Piping must be installed above bottom chord of joists.
- P. Group piping whenever practical at common elevations. Obstructions created by grouped piping shall be provided with additional protection as required.
- Q. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

- R. Coordinate location and method of hanging of sprinkler piping 4 in. and larger with the structural design; provide additional structural bracing where necessary. *Do not penetrate structural members without prior approval.*
- S. Tapping or drilling of load-bearing structural members is not permitted. Attachments may be made to steel or concrete structures with approved clamps and hangers designed in accordance with NFPA 13 and local standards. Any beam penetrations shall be coordinated with the structural engineer and must obtain approval from structural engineer.
- T. Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Grout sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide clearance between exterior of piping and interior of sleeve in accordance with NFPA 13. Firmly pack space with noncombustible insulation and caulk at both ends of the sleeve with plastic waterproof cement, which will dry to a firm but pliable mass, or provide a segmented elastomeric seal. In fire-resistive rated assemblies (walls, floors, ceiling and partitions), pack space with approved firestopping materials. Installation of materials shall result in fire resistance rating equal to or greater than the assembly rating, unless otherwise indicated. Extend sleeves in floor slabs 3-inch above the finished floor.
- U. Die cut screw joints with full cut standard taper pipe threads with red lead and linseed oil or other non- toxic joint compound applied to male threads only.
- V. Install valves with stems upright or horizontal as required, not inverted. Remove protective coatings after installation.
- W. The Contractor is responsible for coordination of system requirements with all conditions of the building and site including, but not limited to, blind spaces, shelving, lights, grilles and diffusers, piping, duct work, doors, windows, equipment platforms, walls (fire-rated and non-fire-rated), beams, joists, columns, HVAC equipment, electrical panels and equipment, ceilings, areas without ceilings, wall construction, floors and all construction, equipment and building appurtenances. Contractor shall coordinate the layout of equipment, piping and materials to assure sufficient space and openings to accommodate the entire installation, and accessibility for maintenance and replacements, if necessary.
- X. Equipment, devices, apparatus, and accessories requiring normal servicing, operation and maintenance shall be made easily accessible.
- Y. Provisions shall be made by the Contractor to protect piping, sprinklers and other components of the sprinkler systems from extreme climatic conditions including freezing and high temperature.

Z. Pipe Hangers:

1. Provide a hanger, designed to prevent upward pipe movement, within 12-inch of a pendent sprinkler located at the end of a branch-line or on armovers over 12-inch in length in areas with suspended ceilings.
2. Provide a minimum of two (2) hangers per grooved pipe section greater than 6 ft. in length.
3. Hangers shall be positioned such that they are connected to pipe segments only and not to fittings.

AA. Identification signs shall be provided. Attach properly lettered approved metal signs conforming to NFPA 13 to each valve and alarm device. Permanently affix hydraulic design data nameplates to the riser of each system. Provide signs on the sprinkler control valve of each system. The sign shall identify the area of coverage controlled by the valve. Hydraulic design data nameplate information shall not be handwritten.

BB. Provide an inspector's test connection (ITC) for each sprinkler system and locate the ITC above the riser check valve. Each ITC terminating outside shall be piped to within 8-inch of finished grade. Concrete splash blocks shall be provided at grade level beneath each discharge to preclude soil erosion where necessary.

CC. Thrust Blocks

1. The trench in the area of each fitting shall be cut to provide a thrust block bearing surface on undisturbed soil.
2. Concrete shall be poured to fit snugly against as much of the fitting as possible without interfering with access to fitting joints.
3. The concrete shall be allowed a minimum curing time of five days.

3.03. ESFR SPRINKLERS (PENDENT TYPE)

- A. The sprinkler contractor shall be responsible for proper consideration of all obstructions and other installed equipment which may have an impact on the operation of ESFR sprinklers.
- B. Prior to the start of construction, the sprinkler contractor shall closely coordinate with all other trades—including, but not limited to, structural steel, mechanical, electrical, plumbing, data processing, and material handling—to ensure the water discharge from ESFR sprinklers will not be obstructed from reaching burning commodities at high volume and high momentum.
- C. The standard to be utilized in identifying ESFR sprinkler placement and obstruction issues shall be the latest version of FM Global Property Loss

Prevention Data Sheet 2-0. Any obstruction issue identified during the course of construction or acceptance inspections shall be corrected to meet the requirements of this standard at no additional cost to the Owner, architect, or engineer.

- D. Vertical duct work supplying unit heaters, if provided, shall be centered between ESFR sprinklers. The fire sprinkler contractor shall advise the general and mechanical contractors of this requirements as part of the fire sprinkler system coordination.
- E. Powered roof-top ventilators less than or equal to 4 ft. in diameter shall be positioned such that there is an ESFR sprinkler centered directly beneath the opening. If this sprinkler is less than 8 ft. from adjacent ESFR sprinklers, baffles shall be provided and installed at no additional cost.
- F. The contractor shall space ESFR sprinklers with consideration of the location of all skylights and/or roof vents so that an ESFR sprinkler is not located directly underneath a skylight or roof vent. Spacing shall take into consideration the location of any HVLS fans as necessary. Refer to architectural *and mechanical* drawings for the locations of skylights, roof vents and HVLS fans.

3.04. TESTING

- A. The system shall be subject to inspection and acceptance by the Engineer and the Authorities Having Jurisdiction for the purpose of determining the system is in accordance with federal, state, local and specification requirements and applicable standards of the NFPA and other related codes.
- B. The Contractor shall be responsible for performing and certifying requisite inspection and tests in accordance with applicable codes and standards for all equipment furnished under this specification.
- C. Inspection and testing procedures shall be submitted to the Engineer for approval prior to use.
- D. All underground piping shall be completely flushed in accordance with NFPA 13 and NFPA 24 in the presence of the Engineer. Two weeks advance notification shall be given the Engineer. Flushing procedures are subject to the approval of the Engineer and the Authorities Having Jurisdiction.
- E. All underground piping shall be hydrostatically tested at not less than 200-psi or 50 psi in excess of the maximum working pressure of the system (whichever is greater) for not less than two hours in accordance with NFPA 24. Before testing, the trench shall be backfilled between joints. All joints shall be left exposed during the test.

- F. Each hydrant shall be fully opened and closed under full system pressure, and checked for proper drainage.
- G. All interior system piping shall be hydrostatically tested at not less than 200-psi or 50 psi in excess of the maximum working pressure of the system (whichever is greater) for not less than two hours in accordance with NFPA 13. After testing and acceptance, all systems shall be returned to service and left operational.
- H. All operating parts, including electrical equipment, shall be fully tested to ensure their proper operation. All control valves shall be fully closed and opened under full system pressure.
- I. All field tests performed by the Contractor shall be conducted in the presence of the Engineer and other representatives at the Owner's option. Contractor shall provide written notification to all persons concerned two (2) weeks in advance of the tests in order to arrange attendance.
- J. The Contractor shall perform supplemental tests and shall render additional services in connection with the sprinkler system, as directed. The cost, if any, will be negotiated prior to the test. The effect of additional tests, if any, on the delivery schedule shall be determined prior to undertaking the test.

END OF SECTION 13930

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