



FIRE SPRINKLER SYSTEM

These guidelines are to be followed when an automatic fire sprinkler system within the City of Rockwall is to be installed or modified. These guidelines are not to be interpreted as containing all data required for proper design, installation, or approval.

All Fire Sprinkler Systems shall conform to the 2015 International Fire Code, as adopted and amended by the City of Rockwall, current edition of NFPA 13 and NFPA 14. These guidelines are not intended to replace, nor supersede any codes and/or ordinances adopted by the City of Rockwall, or determinations and positions of the Rockwall Fire Department.

Design

- 1) Sprinkler systems for all strip retail centers, multiple tenant buildings, speculative warehouses, or any other multiple tenant building, regardless of ceiling height, shall be designed to provide a minimum of Ordinary Hazard Group 2 for Class IV commodities. **A minimum of 1" outlets shall be provided on all branch lines. A hexagonal bushing to accommodate sprinklers attached directly to branch lines is permitted.**
- 2) Double Check/Backflow Preventer is required and shall be installed inside the building. **A meter is not required.**
- 3) A means shall be provided downstream of backflow prevention assembly for full-forward flow tests at system demand.
- 4) The system shall be designed with a 5 psi safety factor at 20 psi residual on City mains.
- 5) The water supply test used for design of the sprinkler systems shall be witnessed by the Rockwall Fire Department. The results of the flow test shall be within one year of the sprinkler plan submittal. The exact location of the static/residual hydrant and the flow hydrant shall be indicated on the design drawings. All fire protection plan submittals shall be accompanied by a water flow test report provided by the Rockwall Fire Marshal Division.
- 6) All risers for building requiring multiple risers shall be centrally located.
- 7) Sprinkler system risers providing protection for buildings with multiple tenant spaces must be located in a ground floor room directly accessible from the exterior. The door must be labeled as the riser room.
- 8) Riser room shall be large enough to accommodate maintenance, provided with lighting hard-wired to the building electrical system, emergency lighting, and hardwired permanent heat.

NFPA 13R Systems:

- 9) Balconies, decks and open-ended corridors shall be protected in accordance with the 2015 International Fire Code.
- 10) Sprinkler protection is required in attic spaces of such buildings three or more stories in height, in accordance with NFPA 13 and or NFPA 13R requirements, and attached garages.

Installation

- 11) Inspector test connections, drains, and ball-drips shall be piped directly to the exterior.
- 12) At least one inspection test valve shall be located at the remote system area.
- 13) Sprinkler and Standpipe system water-flow detectors shall be provided for each floor tap to the sprinkler system and shall cause an alarm upon detection of water flow for more than 45 seconds. All control valves in the sprinkler and standpipe system except for fire department hose connection valves shall be electrically supervised to initiate a supervisory signal at the central station upon tampering.



- 14) Dry-system air compressors shall be hard wired and shall have a listed air maintenance device connected to the compressor with a minimum 1/2" connection.
- 15) Pre-action system solenoids shall be wired for alarm activation upon current loss.
- 16) All systems with a chemical additive or antifreeze shall be provided with a reduced pressure principle backflow prevention assembly or a reduced pressure principle fire protection backflow prevention assembly. Where only added to a portion of a system, the device shall be permitted to be located so as to isolate only that portion of the system. (IPC 608.16.4.1)

Standpipes

- 17) In buildings exceeding 10,000 square feet in area per story, Class I automatic wet or manual wet standpipes shall be provided where any portion of the building's interior area is more than 200 feet of travel, vertically and/or horizontally, from the nearest point of fire department vehicle access.

Exceptions:

- (1) Automatic dry and semi-automatic dry standpipes are allowed as provided for in NFPA 14.
 - (2) R-2 occupancies of four stories or less in height having no interior corridors.
- 18) Standpipe systems shall be installed in accordance with this section and NFPA 14. Manual dry standpipe systems shall be supervised with a minimum of 10 psig and a maximum of 40 psig air pressure with a high/low alarm.
 - 19) When a roof-top hose connection is required, the hose connection shall be two-way.
 - 20) When standpipes are required, connections shall be placed at two hundred feet (200') intervals along major corridors thereafter.
 - 21) National Standard Thread (NST) shall be provided.

Fire Department Connection

- 22) FDC's for automatic sprinkler systems and/or standpipe systems for new buildings shall be equipped with a 2 1/2" Siamese connection. (See Figure 1).
- 23) All FDC connections shall be equipped with a locking Knox FDC Cap. Knox products may be ordered online at www.knoxbox.com.
- 24) Check valves shall be accessible for 5-year inspection. If located underground, shall be installed within a meter can/valve box large enough to access the valve.
- 25) FDC shall be facing and visible from the fire lane.
- 26) FDC must be within 100-feet of a fire hydrant.
- 27) The FDC shall be clear and unobstructed with a minimum of a 5-foot clear all-weather path from fire lane access
- 28) The FDC shall be installed 18-48 inches above grade.
- 29) Fire hose threads used shall be national standard hose thread.
- 30) The FDC shall discharge into the system on the discharge side of the pump if a pump is present. *See Underground Fire Lines guidelines for details on Remote Fire Department Connections (FDC)*

Inspection Requirements

- 31) **Do not stack the riser until the underground flushing has been completed.** Check Fire Sprinkler Underground permit for verification of completion.
- 32) Visual: All overhead piping and joints must be uncovered and exposed, with labeling of the pipe legible from the floor. All hangers will be visually inspected and must be uncovered and exposed to the floor.



- 33) Overhead Hydrostatic Test: Overhead piping will be visually inspected with all joints exposed and labeling of the pipe turned downward. The test will be at 200 psi for a minimum of two hours. No pressure drop or gain allowed.
- 34) A hydrostatic test is required for all new installations.
- 35) A hydrostatic test is required for all modifications/tenant finish-out with twenty or more sprinkler heads added and/or relocated.
- 36) 24-hour air test: The test will be conducted at 40 psi of air for 24-hours with less than 1.5-psi loss.
- 37) Trip Test: Operational test of the dry-pipe valve is performed and the quick opening device (500+ gallon systems) is tested, 750+ gallon systems must trip within 60 seconds.
- 38) Compressor Test: Dry system compressor fills the system within 30 minutes.
- 39) Riser Main Flush: Upon completion of the overhead hydrostatic test, the overhead piping will be drained and witnessed by the Fire Department.
- 40) Riser Room: Verify riser room requirements, including floor drain for fire pumps, heat, light, markings, spare sprinkler head box and wrench, etc.
- 41) Hydraulic Design Information Sign (Hydraulic Data Nameplate). The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion-resistant wire, chain, or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve, or deluge valve supplying the corresponding hydraulically designed area. The sign shall include the following information:
 - a) Location of the design area or areas
 - b) Size (area) of or number of sprinklers in the design area
 - c) Discharge densities over the design area or areas
 - d) Required flow and residual pressure demand at the base of the riser or fire pump where applicable
 - e) Occupancy classification or commodity classification and maximum permitted storage height and configuration
 - f) Hose stream allowance included in addition to the sprinkler demand
 - g) Name of the installing contractor
- 42) General Information Sign. The installing contractor shall provide a general information sign used to determine system design basis and information relevant to the inspection, testing, and maintenance requirements required by NFPA 25. Such general information shall be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other acceptable means. Such signs shall be placed at each system control riser, antifreeze loop, and auxiliary system control valve. The sign shall include the following information:
 - a) Name and location of the facility protected
 - b) Occupancy classification
 - c) Commodity classification
 - d) Presence of high-piled and/or rack storage
 - e) Maximum height of storage planned
 - f) Aisle width planned
 - g) Encapsulation of pallet loads
 - h) Presence of solid shelving
 - i) Flow test data
 - j) Presence of flammable/combustible liquids
 - k) Presence of hazardous materials
 - l) Presence of other special storage



- m) Location of venting valve
 - n) Location of auxiliary drains and low point drains on dry pipe and preaction systems
 - o) Original results of main drain flow test
 - p) Original results of dry pipe and double interlock preaction valve test
 - q) Name of installing contractor or designer
 - r) Indication of presence and location of antifreeze or other auxiliary systems
 - s) Where injection systems are installed to treat MIC or corrosion, the type of chemical, concentration of the chemical, and where information can be found as to the proper disposal of the chemical
- 43) Combination hydraulic design information and general information are permitted. The sign shall include the following information:
- a) Location of the design area or areas
 - b) Size (area) of or number of sprinklers in the design area
 - c) Discharge densities over the design area or areas
 - d) Required flow and residual pressure demand at the base of the riser
 - e) Occupancy classification or commodity classification and maximum permitted storage height and configuration
 - f) Hose stream allowance included in addition to the sprinkler demand
 - g) Name of the installing contractor
- 44) Standpipe and Fire Department Connection (FDC): Hydrostatic testing if not already done, the test will be at 200 psi for a minimum of two hours. No pressure drop or gain allowed. A flow test at hydraulically most remote standpipe through FDC to verify required pressure and flow.
- 45) Fire Pump: Hydrostatic testing (if not already done, the test will be at 200 psi for a minimum of two hours, no pressure drop or gain allowed.), all piping flushed, pump room requirements verified, and operational test conducted by manufacturer witnessed by the fire department.
- 46) Standpipe: Acceptance test in compliance with NFPA 14.
- 47) Fire Sprinkler Final: Final sign-off at completion of all inspections and the receipt of all State require paperwork and a complete and signed appropriate contractor's material and test certificate(s). The inspection shall be conducted when all sheet rock and millwork is completed.

Plan submittal is only required for alterations/modifications involving 20 or more sprinkler heads, alterations/modifications to the system risers, and/or special applications (i.e. water curtains).

Minor fire sprinkler system modifications (such as adding fewer than 20 heads) do not require plan submittal. Work not requiring plans submittal: Contractors shall install a white service tag indicating location (i.e. Suite #) and scope of work.

Submittal Requirements

Prior to fire sprinkler system submittal, the underground fire line plans must have been submitted and approved. Underground plans must be included as a reference for hydraulic calculations.

Working Plans

- 48) Working plans shall be drawn to an indicated scale, on sheets of uniform size, with a plan of each floor, and shall show those items from the following list that pertain to the design of the system:
- a) Name of owner and occupant.
 - b) Location, including street address.



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- c) Point of compass.
- d) Full height cross section or schematic diagram, including structural member information if required for clarity and including ceiling construction and method of protection for nonmetallic piping.
- e) Ceiling/roof heights and slopes not shown in the full height cross section.
- f) Location of partitions.
- g) Location of fire walls.
- h) Occupancy class of each area or room.
- i) Location and size of concealed spaces, closets, attics, and bathrooms.
- j) Any small enclosures in which no sprinklers are to be installed.
- k) Size of city main in street and whether dead end or circulating; if dead end, direction and distance to nearest circulating main; and city main test results and system elevation relative to test hydrant.
- l) Other sources of water supply, with pressure or elevation.
- m) Make, type, model, and nominal K-factor of sprinklers, including sprinkler identification number.
- n) Temperature rating and location of high-temperature sprinklers.
- o) Total area protected by each system on each floor.
- p) Number of sprinklers on each riser per floor.
- q) Total number of sprinklers on each dry pipe system, preaction system, combined dry pipe–preaction system, or deluge system.
- r) Approximate capacity in gallons of each dry pipe system.
- s) Pipe type and schedule of wall thickness.
- t) Nominal pipe size and cutting lengths of pipe (or center-to-center dimensions). Where typical branch lines prevail, it shall be necessary to size only one typical line.
- u) Location and size of riser nipples.
- v) Type of fittings and joints and location of all welds and bends. The contractor shall specify on drawing any sections to be shop welded and the type of fittings or formations to be used.
- w) Type and locations of hangers, sleeves, braces, and methods of securing sprinklers when applicable.
- x) All control valves, check valves, drain pipes, and test connections.
- y) Make, type, model, and size of backflow prevention assembly, and means to forward flow test at system demand.
- z) Make, type, model, and size of alarm or dry pipe valve.
- aa) Make, type, model, and size of preaction or deluge valve.
- bb) Kind and location of alarm bells.
- cc) Size and location of standpipe risers, hose outlets, hand hose, monitor nozzles, and related equipment.
- dd) Private fire service main sizes, lengths, locations, weights, materials, point of connection to city main; the sizes, types and locations of valves, valve indicators, regulators, meters, and valve pits; and the depth that the top of the pipe is laid below grade.
- ee) Piping provisions for flushing.
- ff) Where the equipment is to be installed as an addition to an existing system, enough of the existing system indicated on the plans to make all conditions clear.
- gg) For hydraulically designed systems, the information on the hydraulic data nameplate.
- hh) A graphic representation of the scale used on all plans.
- ii) Name, address, and phone number(s) of contractor.



- jj) Hydraulic reference points shown on the plan that correspond with comparable reference points on the hydraulic calculation sheets.
- kk) The minimum rate of water application (density or flow or discharge pressure), the design area of water application, in-rack sprinkler demand, and the water required for hose streams both inside and outside.
- ll) The total quantity of water and the pressure required noted at a common reference point for each system.
- mm) Relative elevations of sprinklers, junction points, and supply or reference points.
- nn) If room design method is used, all unprotected wall openings throughout the floor protected.
- oo) Calculation of loads for sizing and details of sway bracing.
- pp) Zones of influence used in calculations for seismic bracing indicated on plans.
- qq) The setting for pressure-reducing valves.
- rr) Information about listed antifreeze solution used (type and amount).
- ss) Size and location of hydrants showing size and number of outlets and if outlets are to be equipped with independent gate valves. Whether hose houses and equipment are to be provided, and by whom, shall be indicated. Static and residual hydrants that were used in flow tests shall be shown.
- tt) Size, location, and piping arrangement of fire department connections.
- uu) Edition year of NFPA 13 to which the sprinkler system is designed.

Hydraulic Calculations

- 49) Hydraulic calculations shall be prepared on form sheets that include a summary sheet, a graph sheet, a water supply analysis, a node analysis, and detailed worksheets.

Summary Sheet

- 50) The summary sheet as shown in Figure 27.4.5.1.2(a) shall contain the following information, where applicable:
 - a) Project name and date
 - b) Location (including street address)
 - c) Owner or expected occupant of space being designed
 - d) Name, address, and phone number of installing contractor
 - e) Name and phone number of designer
 - f) Authority having jurisdiction
 - g) Standard or document system is being designed to, including the edition of the document
 - h) Design area number and location
 - i) Drawing or sheet number where design area is located
 - j) Occupancy or commodity classification and information
 - k) For storage applications (including miscellaneous), additional information including storage height, ceiling height, storage configuration, aisle width, orientation of upright or pendent, sprinkler K-factor and sprinkler temperature, and the table and or curve utilized in the design
 - l) System type, including the system volume with type of protection system indicated in the notes
 - m) Sprinkler type, including coverage and response type
 - n) Slope of roof or ceiling within the design area
 - o) System design requirements, as follows:
 - i) Design area of application, ft² (m²)
 - ii) Minimum rate of water application (density), gpm/ft² (mm/min)
 - iii) Area per sprinkler, ft² (m²)



- iv) Number of sprinklers calculated
- p) Total water requirements as calculated, including allowance for inside hose, outside hydrants, water curtain, and exposure sprinklers, and allowance for in-rack sprinklers, gpm (L/min)
- q) Ceiling height if used for quick response sprinkler reduction
- r) Elevation of highest calculated sprinkler
- s) Water supply information, including the following:
 - i) Date and time of test
 - ii) Location of the test and flow hydrant(s)
 - iii) Source of the water for the flow test
 - iv) Elevation of the test hydrant relative to the finished floor
 - v) Size of fire pump, gpm @ psi
 - vi) Size of on-site water tank
- t) Notes that include peaking information for calculations performed by a computer program, type of preaction system, limitations (dimension, flow, and pressure) on extended-coverage or other listed special sprinklers, system type, including the system volume

Graph Sheet

- 51) A graphic representation of the complete hydraulic calculation shall be plotted on semiexponential graph paper (Q1.85) as shown in NFPA 13 Figure 27.4.5.1.2(b) and shall include the following:
- a) Water supply curve
 - b) Sprinkler system demand
 - c) Hose demand (where applicable)
 - d) In-rack sprinkler demand (where applicable)
 - e) Additional pressures supplied by a fire pump or other source (when applicable)

Supply Analysis

- 52) Information summarized from the graph sheet as shown in NFPA 13 Figure 27.4.5.1.2(c) shall include the following:
- a) Node tag at the source
 - b) Static pressure [psi (bar)] available at the source
 - c) Residual pressure [psi (bar)] available at the source
 - d) Total flow [gpm (L/min)] available at the source
 - e) Available pressure [psi (bar)] at the source when the total calculated demand is flowing
 - f) Total calculated demand [gpm (L/min)] at the source
 - g) Required pressure [psi (bar)] when flowing total calculated demand

Node Analysis

- 53) Organized information as shown in NFPA 13 Figure 27.4.5.1.2(c) regarding the node tags given to each hydraulic reference point on the system as indicated on the shop drawings shall include the following information:
- a) Node tag for each specific point on the system used in the hydraulic calculations
 - b) Elevation in ft (m) of each node tag
 - c) K-factor of flowing nodes (such as sprinklers)
 - d) Hose allowance in gpm (L/min) requirements for the node tag
 - e) Pressure in psi (bar) at the node
 - f) Discharge in gpm (L/min) calculated at the node
 - g) Notes that indicate any special requirements for the node



Detailed Worksheets

- 54) Detailed worksheets as shown in NFPA 13 Figure 27.4.5.1.2(d) or computer printout sheets shall contain the following information:
- a) Sheet number
 - b) Hydraulic reference points used in each step
 - c) Elevation in ft (m) at each hydraulic reference point
 - d) Sprinkler description and discharge constant (K) for the flowing reference point
 - e) Flow in gpm (L/min) for the flowing reference point (when applicable)
 - f) Total flow in gpm (L/min) through each step
 - g) Nominal pipe size in in. (mm)
 - h) Actual internal diameter of pipe in in. (mm)
 - i) Quantity and length in ft (m) of each type of fitting and device
 - j) Pipe lengths in ft (m), center-to-center of fittings
 - k) Equivalent pipe lengths in ft (m) of fittings and devices for the step
 - l) Total equivalent length in ft (m) of pipes and fitting for the step
 - m) C-factor used in each step
 - n) Friction loss in psi/ft (bar/m) of pipe
 - o) Sum of the pressures from the previous step (starting pressure at beginning)
 - p) Elevation head in psi (bar) between reference points
 - q) Total friction loss in psi (bar) between reference points
 - r) Required pressure in psi (bar) at each reference point
 - s) Notes and other information shall include the following:
 - i) Velocity pressure and normal pressure if included in calculations
 - ii) In-rack sprinkler demand balanced to ceiling demand
 - iii) Notes to indicate starting points or reference to other sheets or to clarify data shown
 - iv) Diagram to accompany gridded system calculations to indicate flow quantities and directions for lines with sprinklers operating in the remote area
 - v) Combined K-factor calculations for sprinklers on drops, armovers, or sprigs where calculations do not begin at the sprinkler
 - vi) The pressure [psi/(bar)] loss assigned the backflow device when included on a system
 - vii) Friction factor and Reynolds number when the Darcy–Weisbach equation is used
- 55) Please upload the following documents when submitting your permit online:
- (1) Working plans
 - (2) Hydraulic calculations forms, where systems are required to be calculated
 - (3) Data sheets for the system components
 - (4) Signed owner's certificate
 - (5) Third Party Review Letter
 - (6) State License(s)



Figure 1: Fire Department Connection Detail

