Residential Fire Sprinklers
NFPA 13, 13R, and 13D
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Presented by the American Fire Sprinkler Association
www.firesprinkler.org

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NEW for 2019

Heading designates new or revised requirement from the 2016 edition of the standard

Seminar Agenda

- NFPA 13D Single/Two Family and Manufactured Homes
- NFPA 13R Low-Rise Residential Occupancies
- NFPA 13 Residential Occupancies
NFPA 13D 2019 Edition

NFPA 13D Table of Contents

- Chapter 1 – Administration
- Chapter 2 – Referenced Standards
- Chapter 3 – Definitions
- Chapter 4 – General Requirements
- Chapter 5 – System Components
- Chapter 6 – Water Supply
- Chapter 7 – Installation

NFPA 13D Table of Contents

- Chapter 8 – Sprinkler Position & Location
- Chapter 9 – Protection from Freezing
- Chapter 10 – Discharge and Hydraulic Calculations
- Chapter 11 – System Acceptance
- Chapter 12 – Inspection, Testing and Maintenance
- Annex A – Explanatory Material
- Annex B – Informational References
Chapter 1 Administration

- Scope
- Purpose
- Retroactivity
- Equivalency
- New technology

Scope of the Standard

- Covers the design, installation, and maintenance for fires in one and two-family dwellings and manufactured homes
- Water-mist system are not considered a fire sprinkler system and are not included in NFPA 13D
- Protection criteria is based on a single fire ignition location

Purpose of the Standard

- Aids in the detection of residential fires
- Aids in the control of residential fires
- Provides improved protection against injury and fire loss
- Keep fire in room of origin
- Prevent flashover long enough for occupants to escape
Retroactivity

- It is not intended for new requirements to be applied to existing properties.
- Exceptions include an unacceptable risk or impractical (decision made by AHJ).

Equivalency

- It is not intended to prevent the use of any system, methods, or devices that are equivalent or better than those required by the standard.
- Technical documentation must be supplied.
- System, method, or device must be approved.

New Technology

- Nothing is intended to restrict new technology or alternate arrangements.
- Anything not designated by the standard must be used in accordance with its listing.
Chapter 3 Definitions

Definitions

- **Approved**
  - Acceptable to the authority having jurisdiction

- **Authority Having Jurisdiction**
  - Any organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, installations, or procedures

Definitions

- **Listed**
  - Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection or production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose
Definitions

- **Shall** – a mandatory requirement.
- **Should** – a recommendation or that which is advised but not required.

NEW for 2019

**Bathroom**

- Located within a dwelling unit
- Contains a lavatory, water closet, or shower or tub or any combination
- Annex states that a room is still a bathroom if it contains just a toilet and that two bathrooms adjacent to each or are considered separate rooms or compartments

Definitions

**Compartment**

- A space completely enclosed by walls and a ceiling.
- Any wall openings to an adjoining space must have a minimum lintel depth of 8 in. and the total width of the openings in a single wall cannot exceed 8 ft.
- One opening of 36 in. or less with no lintel is permitted as long as there are no other openings to adjoining spaces.
How many compartments are there in this sketch?

Two
Three
Four

Why

Definitions

Dwelling
- Any detached building
- Any part of a townhouse structure that is separated from the remainder of the townhouse with fire assemblies in accordance with building codes.
- Separated part may contain no more than two dwelling units.

Definitions

Shadow Area
- The dry floor area inside the protection area of a sprinkler created by sprinkler discharge that is blocked by a wall or partition.

Annex Information:
- Water is not required to fall on every square inch of floor space of the occupancy...
- Where small shadowed areas are formed on the floor, they are purely on paper and do not take into account the dynamic variables of sprinkler discharge.
Definitions

- Automatic Sprinkler
- Residential Sprinkler
- Multipurpose Piping System
- Network System

Multipurpose Piping System Example #1

Figure A.3.3.12.3(a)
Multi-purpose Piping System (Tree System)—Example 1

Multipurpose Piping System Example #2

Figure A.3.3.12.3(b)
Multi-purpose Piping System (Looped System)—Example 2
Multipurpose Piping System
Example #3

Figure A.3.3.12.3(b)
Multi-purpose Piping System – Example 3 (Network System)

Definitions

- Check Valve
- Control Valve
- Waterflow Alarm
- Waterflow Detector

Chapter 4 – General Requirements
General Requirements

- Sprinkler Temperature Ratings:
  - Ordinary Temperature 135°F to 170°F
  - Intermediate Temperature 175°F to 225°F
  - High Temperature 250°F to 300°F
- Listed or Labeled:
  - Follow listing or labeling or manufacturer’s requirements, unless allowed otherwise by NFPA 13D

New for 2019

- Documentation:
  - Must be able to show adequate water supply, listed devices, and sprinkler coverage and provided upon request
- Qualifications:
  - Layout, calculations and installation by those knowledgeable and trained
Chapter 5 – System Components

System Components

General

- Only new sprinklers can be installed in sprinkler systems.
- Sprinklers cannot be removed and reinstalled except for dry sprinklers.

System Components

General

- Devices and materials used in 13D sprinkler systems must be listed:
- Some notable exceptions:
- Water supply piping, tanks, expansion tanks, pumps, hangers, waterflow detection devices, valves, and gauges do not require listing.
System Components

- **Nonmetallic Pipe**
  - Not equipped with a fire department connection
  - Working pressure of not less than 130 psi at 120°F
  - Pressure-reducing valves and pressure relief valves

- **Nonmetallic Fittings**
  - Not equipped with a fire department connection
  - Working pressure of not less than 130 psi at 120°F
  - Pressure-reducing valves and pressure relief valves

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System Components

**Table 5.2.2 Pipe or Tube Material and Dimensions**

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System Components

**Table 5.2.3.2 Specifically Listed Pipe of Tube Materials and Dimensions**
A.5.2.3.2 – Warning!
Chemical compatibility of non-metallic with other construction products & materials must be verified prior to use in automatic fire sprinkler systems. Among those items:
- Thread sealants
- Firestops
- Spray foams
- Termicidies
- Antifreeze
- Communication cables
- Flux
- Leak detectors
- Insulations
- Cutting oils
- Insecticides
- Coupling lubes
- Wires
- Solder

A.5.2.9.2 – Warning!
Compatible thread sealant OR Teflon tape can be used in a CPVC head adapter. The combination of the two cannot be used together.

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New for 2019
- Underground Pipe.
- Any type of pipe or tube acceptable by the applicable plumbing code for aboveground or underground supply pipe is acceptable.
- Between the point of connection and water supply source.
- Between a remote system riser and the dwelling.
Chapter 6 – Water Supplies

Water Supplies

- At least one automatic water supply
- Minimum stored quantity must provide 10 minutes of water at the system’s calculated flow rate
- Minimum stored quantity 7 minutes at the highest calculated flow rate if units are:
  1. One story in height and
  2. Less than 2000 ft² in area

New for 2019

- Stored water is permitted to be a combination of the water in a storage tank plus the refill rate if the refill is automatic.
Water Supplies

- Water supply sources considered acceptable by this standard:
  1. Reliable waterworks system with or without a pump
  2. An elevated tank
  3. A pressure tank

Water Supplies

- A stored water source with an automatically operated pump
- A well with a pump of sufficient capacity and pressure to meet the sprinkler system demand.

Water Supplies

- Where a pump is the sole source of water for the sprinkler system and is NOT a part of the domestic system, it must meet the following criteria:
  - A test connection must be provided downstream of the pump equal to the flow of smallest sprinkler
  - Pump motors using AC power must connect to a 240V normal circuit and wired in accordance with NEC
  - The disconnect for the pump must be approved
  - Pump cannot be located less than 1.5 inches off the floor
Where a pump and tank is the sole source of water for the sprinkler system and is **NOT** a part of the domestic system, it must meet the following criteria:
- All the previous criteria and:
- The test connection must return water to the tank
- A method for refilling the tank must be piped to the tank
- A means provided to determine water level without opening tank

Figure A.6.2(a) Minimum Requirements for a Stand-Alone System

Figure A.6.2(b) Acceptable Arrangement for Stand-Alone Systems – Option 1
Water Supplies

Figure A.6.2.(c) Acceptable Arrangement for Stand-Alone Piping System -- Option 2

Water Supplies

Figure A.6.2.(d) Acceptable Arrangement for Stand-Alone Piping Systems -- Option 3

Water Supplies – Multiple units served with one water supply
New for 2019 (Simplified)

Annex states that there must be a way to isolate the sprinkler system in one unit without having to enter another. This way, if one unit has a fire and cannot be occupied, the other units can remain occupied with a functioning sprinkler system.

Water Supplies (Multipurpose Piping System)

A sign must be affixed adjacent to the main shutoff valve with minimum ¼” letters:

Warning: the water system for this home supplies fire sprinklers that require certain flows and pressures to fight a fire. Devices that restrict the flow or decrease the pressure or automatically shut off the water to the fire sprinkler system, such as water softeners, filtration systems, and automatic shutoff valves, shall not be added to this system without a review of the fire sprinkler system by a fire protection specialist. Do not remove this sign.
Water Supplies (Common Supply Pipes)

- When serving more than 1 dwelling unit, 5 gpm is added to system demand for sizing common piping

(Not needed if there is a provision for preventing flow to the domestic system upon activation of sprinkler system)

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Water Supplies (Common Supply Pipes)

Figure A.6.3(d) Common Water Supply Connection Serving More Than One Dwelling Unit

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Water Supplies (Water Treatment)
Water Supplies (Water Treatment)

- The flow restriction and pressure loss must be included with the hydraulic calculations.
- An automatic bypass must be installed around the equipment to direct water directly into sprinkler system.

Chapter 7 - Installation

Installation (Valves)
Installation (Valves)

- Preferred valve arrangement:
  A single control valve that shuts off both domestic and sprinkler system water supplies.
- Permitted valve arrangement:
  Separate control valve is permitted for sprinkler system if it is supervised.

Installation (Valves)

- A backflow prevention assembly which includes a shutoff valve can be considered the system control valve.

Installation (Drains and Test Connections)

- Drains and Test Connections
  - Minimum ½” drain on system side of control valve
  - Valve must be installed in drain piping
  - Test connection required where waterflow alarms are installed
  - Orifice equal or smaller than smallest sprinkler K-Factor installed in system
New for 2019

In multipurpose systems, a plumbing fixture on the system side of the system control valve can serve as the drain.

Installation (Pressure Gauges)

- Air pressure for dry systems
- Pressure tanks used for water supply
- Pressure regulating or reducing valve installed with stand-alone system.

Installation (pipe support)

(Courtesy Lubrizol Advanced Materials, Inc.)
New for 2019

Sprinkler piping that is exposed to the protected area must be supported with metal hangers or hangers made of the same material as the structure.

Annex states that wood attached or fastened to the structure as a part of a trapeze hanger is considered an extension of the structure and acceptable for hanging piping.

Installation (Sprinklers)

Installation

- Listed residential sprinklers required
- Residential sprinklers permitted with wet pipe systems only unless specifically listed for use with the other system type
- Listed dry sprinklers can be extended into unheated areas not intended for living purposes
- Quick-response sprinklers permitted to be used in mechanical closets, saunas, or steam rooms
Installation (Sprinkler Temperature Ratings)

Table 7.5.6.3 Minimum Distances for Ordinary and Intermediate Temperature Residential Sprinklers

Installation (Painting and Escutcheons)
Installation (Sprinklers)

Where solvent cement is used sprinklers cannot be installed in the fittings prior to the fittings being cemented in place.

Installation (Alarms)

- Waterflow detection device and local alarm not required to be listed
- Intended as a single alarm audible from outside the building
- Interconnection to smoke alarms or remote monitoring may improve notification, however it is not mandated
- Central station monitoring or fire alarm systems not required by NFPA 13D.
Sprinkler Position and Location

Sprinkler Coverage

- Residential sprinklers to be installed per their listing where the ceiling configuration is part of the listing.

- Where construction features or other conditions exist outside the scope of the listings, listed sprinklers are permitted to be installed beyond listing limitations.

Sprinkler installation

- Sprinklers other than residential shall be installed per coverage criteria from NFPA 13.
New for 2019

If a physical barrier exists that prevents sprinklers from directly spraying on each other, this is no minimum distance between sprinklers.

Sprinkler Operating Pressure

Figure 8.2.1.2(a) Position of Sprinkler Under a Beam
New for 2019

Figure 8.2.1.2(b) Position of Sprinkler Adjacent to a Beam

Basements without Ceilings

Obstructions

**Pendent Sprinklers**

- Pendent sprinklers must be located at least 3'-0" away from obstructions such as ceiling fans and light fixtures unless continuous obstruction requirements are met.
- The distance is measured from the center of the sprinkler to the center of the obstruction.
- Where the sprinkler cannot be located 3'-0" away from the center of the obstruction, an additional sprinkler must be located on the other side of the obstruction.
Table and Figure 8.2.5.3.2 Positioning of Sprinklers to Avoid Obstruction to Discharge (Residential Upright and Pendent Spray Sprinklers)
Obstructions

Figure 8.2.5.3.3(a) Positioning of Sprinkler to Avoid Obstruction Against Walls (Residential Upright and Pendent Spray Sprinklers)

Obstructions

Table and Figure 8.2.5.4.2(a) Positioning of Sprinklers to Avoid Obstruction (Residential Sidewall Sprinklers)

Obstructions

Table and Figure 8.2.5.4.2(b) Positioning of Sprinkler to Avoid Obstruction Along Wall (Residential Sidewall Sprinklers)
Obstructions

- Where soffits exceed 8 in. in width or projection from the wall, sprinklers are required under the soffit.
- Sidewall can be installed in the face of a soffit located directly over cabinets, without additional sprinklers below the soffit or cabinets, as long as the soffit does not project more than 12 in. from the wall.
- Where sidewall sprinklers are more than 3 ft above the top of cabinets, sprinklers can be installed on the wall above the cabinets as long as the cabinets are no more than 12 in. from the wall.

Shadow Areas

Fig. A.8.2.5.7(a) Example of Shadow Areas (SSU/SSP)

Fig. A.8.2.5.7(b) Example of Shadow Areas (HSW)
Installation

Location of Sprinklers

- Sprinklers are required in all areas except:
  - Bathrooms 55 ft² or less
  - Clothes closets, linen closets, or pantries not larger than 24 ft² and the walls and ceilings have non or limited combustible surfaces
  - Garages
  - Open attached porches, carports, and similar structures

Location of Sprinklers

- Attics
- Penthouse equipment rooms
- Elevator machine rooms
- Any concealed space not used or intended for living purposes
Location of Sprinklers

- Where fuel-fired equipment is above the occupied areas of the dwelling unit, no sprinkler protection shall be required in the concealed space.
- Where fuel-fired equipment is below or on the same level as occupied areas of the dwelling unit, a quick response intermediate temperature sprinkler must be installed above the equipment or at the wall separating the space with the fuel-fired equipment from the occupied space.

Sprinklers shall not be required in covered unheated projections of the building at entrances/exits as long as the dwelling unit has another means of egress.

Ceiling Pockets

100 ft³ maximum

10 ft Min

Ceiling Pocket or Sky Light

Entire floor under unprotected ceiling pockets protected by sprinklers at the lower ceiling elevation.
Location of Sprinklers

- Sprinklers are not required in closets in garages or exterior closets located on exterior balconies, exterior breezeways/corridors or accessed from outdoors as long as the closet has no doors or unprotected penetrations directly into the dwelling unit.
- Sprinklers are required in any closet used for heating and/or air-conditioning equipment, washers and/or dryers, or water heaters except as allowed by the above.

Chapter 9 - Protection from Freezing

- Wet pipe permitted in areas not subject to freezing including areas properly insulated to maintain a minimum of 40° F.
- In other areas dry pipe, preaction, or antifreeze systems may be used
- Heat tracing systems (must be listed if used on branch lines.)
- Listed residential dry-pendent or dry-sidewall may be used from heated to unheated areas.
Protection from Freezing

Figure A.9.1.1(a) Insulation Recommendations—Arrangement 1

Protection from Freezing

Figure A.9.1.1(b) Insulation Recommendations—Arrangement 2

Protection from Freezing

Figure A.9.1.1(c) Insulation Recommendations—Arrangement 3
Protection from Freezing

Figure A.9.1.1(d) Insulation Recommendations—Arrangement 4

Protection from Freezing

Figure A.9.1.1(e) Insulation Recommendations—Arrangement 5
Protection from Freezing

Existing Systems
- Maximum 50 percent solution for glycerine
- Maximum 40 percent solution for propylene glycol

Protection From Freezing

Specific areas of Dwelling units
- Maximum 48 percent solution for glycerine
- Maximum 38 percent solution for propylene glycol

Protection from Freezing

Table 9.3.3.1 Water Delivery Time for Dry and Double Interlock Preaction Systems
Hydraulic Calculations

- Sprinklers must flow at least 0.05 gpm/ft² or the listed discharge, whichever is greater
- Piping can be looped, gridded (except for dry or double interlock preaction) or straight run, or any combination.

Compartments

Figure A.10.2(a) Sprinkler Design Areas for Typical Residential Occupancy—With Lintel Between Adjoining Spaces: Dining Room and Hall
Compartments

Figure A.10.2(b) Sprinkler Design Areas for Typical Residential Occupancy—Without Lintel Between Dining Room, With Lintel Between Hall

Hydraulic Calculations

All sprinklers in a compartment to a maximum of (2), under the following conditions:

1. Smooth, flat, horizontal ceiling, no beams, maximum height 24 ft above the floor
2. Flat horizontal ceiling, maximum height 24 ft beams up to 14 in. deep, with pendent sprinklers under the beams
   a) Maximum compartment size 600 ft²
   b) Highest sprinkler in compartment must be above all openings

3. Smooth, flat, sloped ceiling, no beams, maximum slope of 8:12, highest portion of ceiling maximum 24 ft above the floor, highest sprinkler in compartment must be above all openings
Hydraulic Calculations

4. Sloped ceiling, beams up to 14 in. deep, with pendent sprinklers under the beams
   a) Maximum compartment size 600 ft²
   b) Slope greater than 2:12, not more than 8:12
   c) Highest portion of ceiling not more than 24 ft above the floor
   d) Highest sprinkler in compartment must be above all openings

Hydraulic Calculations

5. Sloped ceiling, beams up of any depth, with sidewall or pendent sprinklers in each pocket formed by beams
   a) Maximum compartment size 600 ft²
   b) Slope greater than 2:12, not more than 8:12
   c) Highest portion of ceiling not more than 24 ft above the floor

Hydraulic Calculations

For other conditions, the number of sprinklers in design area is determined in consultation with the AHJ as may be appropriate for the conditions.
Hydraulic Calculations

- Minimum pipe size for steel pipe 1 in.
- Minimum pipe size for other than steel shall be ¾ in. except for smaller sizes permitted by network systems.
- With listed special fittings, ½ in. non-metallic and copper pipe may be used **only in network systems**, under the following conditions
  1. Minimum three paths to each sprinkler
  2. Calculations must indicate paths creating path
  3. Pipe supplying a sprinkler shall not terminate in a dead end.

Network Systems

Figure A.6.3(c) Multipurpose Piping System – Example 3 (Network System)

Network Systems

- With listed special fittings, ½ in. non-metallic and copper pipe may be used **only in network systems**, under the following conditions
  1. Minimum three paths to each sprinkler
  2. Calculations must indicate paths creating path
  3. Pipe supplying a sprinkler shall not terminate in a dead end.
Network Systems

4. Calculations shall be prepared for each sprinkler flowing individually, and for each pair of sprinklers in the same compartment.
5. Location of the most demanding single and pair of sprinklers to be indicated on plan review documents.
6. System to be hydraulically calculated per provisions of NFPA 13.
7. Method of joining pipe to fittings or other pipe shall be in accordance with applicable plumbing code.

Network Systems

8. A maximum of one (1) insert tee shall be permitted in each pipe section to serve only domestic fixtures.
9. When insert fittings are installed, each sprinkler will have four separate paths from the water supply.
10. The piping supplying only plumbing fixtures shall be in accordance with the local plumbing code.

Hydraulic Calculations

Options:
- Simplified Method (Straight run with minimum 4 in. city water main)
- Prescriptive Method
- NFPA 13 Calculation Method
- Manufacturer’s Listed Installation Instructions
New for 2019

- When water supply is from public or private main that is 4 in. diameter or larger, only the static pressure measured at the main is needed for hydraulic calculations.

General (Simplified) Method

1. The system flow rate is established and determined that the water meter meets or exceeds the system demand and that the total demand flow does not exceed the maximum flow allowed by the piping system components.
2. Determine the water pressure in the street.
3. Select pipe sizes

General Method

4. Determine the pressure loss for the water meter, if used, and deduct the pressure using one of the following:
   a) Table 10.4.3(a) which can used, even if the sprinkler flow exceeds the meter’s rated flow.
   b) Higher pressure losses specified by a manufacturer must be used in lieu of those specified in Table 10.4.3(a).
   c) Lower pressure losses can be used where provided by the meter manufacturer
General Method

Table 10.4.4(a)  Pressure Losses in psi in Water Meters

5. Deduct elevation pressure loss using the building height above street (in ft) \( \times 0.433 \) = pressure loss (in psi)

6. Deduct pressure losses from the city main to the inside control valve by multiplying the pressure loss associated with the pipe material by the total length(s) of the pipe in feet.

7. Deduct pressure loss for piping within the building by multiplying the pressure loss associated with the pipe material by the total length(s) of pipe in feet.

General Method

8. Deduct pressure loss for valves and fittings using the following:
   a) Count the valves and fittings from the control valve to the farthest sprinkler.
   b) Determine and add equivalent length for each valve and fitting as shown in Tables 10.4.3(b); 10.4.3(c); 10.4.3(d), or 10.4.3(e) to obtain the total equivalent length for each pipe size.
   c) Multiply the equivalent length for each size by the pressure loss associated with the pipe materials and total the values.
General Method

9. In multilevel buildings, repeat the steps to size piping for each floor.
10. If the remaining pressure is less than the operating pressure established by the testing laboratory for the sprinkler being used, the sprinkler system must be redesigned.
11. If the remaining pressure is higher than required, smaller piping can be used if justified by additional calculations.
12. The remaining piping must be sized the same as the piping up to and including the farthest sprinkler unless smaller pipe sizes are justified by calculations.

Prescriptive Method

Step 1 – Obtain static water supply pressure
Step 2 – Using Table 10.4.9.2(a) determine pressure loss in water service
Step 3 – Using Table 10.4.4(a) determine meter pressure loss
Step 4 – Determine device(s) pressure loss
Step 5 – Using Table 10.4.9.2(b) determine elevation loss
Step 6 – Determine maximum sprinkler operating pressure
Step 7 – Calculate the available pressure for friction loss
Step 8 – Determine maximum pipe length using Tables 10.4.9.2 (c) through (h).
Prescriptive Method Exercise

A home is being designed with sprinklers spaced at 18" on center, in a flat ceiling. Water purveyor tells us there is 51 psi available at the street, and that no backflow preventer is required. The flow rate per sprinkler is 17 gpm each. There is a 1" water meter & 1" water service of approximately 20'. Pad is approximately 6' below the street. Underground piping of PVC runs approximately 40' to the building, and inside the building there is 106' of CPVC sprinkler piping. What size must the inside piping be to meet NFPA 13D requirements?

\[
PT = P_{SUP} - P_{SVC} - P_{M} - P_{D} - P_{E} - P_{SP}
\]

34 gpm flowing from 2 sprinklers

Hydraulic Calculations

\[
P_{SUP} = 58 \text{ (from water purveyor)}
\]

\[
P_{SVC} = -21.7 \text{ from Table 10.3.9.2(a)}
\]

\[
P_{M} = -6.0 \text{ psi Table 10.4.3(e)}
\]

\[
P_{D} = 0 \text{ (no backflow valve)}
\]

\[
P_{E} = +2.6 \text{ psi (0.433 x 6')}\]

\[
P_{SP} = -12.0 \text{ psi}
\]

\[
PT = 20.9 \text{ psi}
\]

How much pipe of 1" CPVC is allowed?

Table 10.4.9.2(f) Allowable Length for 1 in. CPVC Pipe
Chapter 11
Systems Acceptance

Systems Acceptance

- Hydrostatic testing with no pumper connection to be at normal system pressure
- When pumper connection is present hydrostatic testing to be per NFPA 13
- Evidence of leakage is determined by a drop in pressure at a gauge over a 2-hour period, or visually inspecting the system for leaks.

Systems Acceptance

- Waterflow devices, if installed, shall be flow tested using the inspector’s test connection, resulting in an alarm audible on the premises.
- Preaction systems to be operationally tested per manufacturer’s instructions
- Dry pipe and Double Interlock Preaction Systems to be tested for water delivery time to trip the valve, and water discharge at the inspector’s test connection, per the manufacturer’s instructions
- Test times measured from point inspector’s test is fully open.
Chapter 12 – Inspection, Testing & Maintenance

Inspection, Testing & Maintenance

- Installer to provide owner with instructions on ITM
  - Including necessary ITM activities required by NFPA 13D
  - Manufacturer’s installation, care and maintenance instructions for any installed components
  - Name, address, phone of installing contractor
  - Name, address, phone of a fire sprinkler system service company if different from the installing contractor.

System should be inspected and tested periodically to verify good working order.

- Monthly inspection to ensure valves are open
- Monthly inspection of tanks, if any, to confirm they are full
- Monthly testing of pumps, if any, to verify they operate properly, and do not trip circuit breaker upon starting
- Testing of waterflow devices, if any, every 6 months
  - Verify monitoring service if any is notified prior to test
- Ongoing visual inspection of sprinklers to verify unobstructed, undamaged, not corroded, painted, or covered with foreign materials, no signs of leakage, and no decorations are attached.
Inspection, Testing & Maintenance

System *should* be inspected and tested periodically to verify good working order

- Annual operation of the inspector’s test connection downstream of any pressure reducing or regulating valve, verify gauge reads a reasonable value
- Inspections should be conducted by individuals knowledgeable and trained in such systems when the ownership changes.

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Sprinkler system shall be properly maintained

- Damaged, operated, corroded, painted, covered with foreign materials, or leaking sprinkler should be replaced
  - Replacement sprinkler to have the same k-factor, temperature class, and positioning requirements as original

Only manufacturer’s paint to be allowed

- Sprinklers painted outside of the factory to be replaced with a new listed sprinkler.

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Wet pipe systems to be maintained above 40°F at all times, including areas insulated to maintain that temp.

- Antifreeze solutions shall be tested by qualified individuals on an annual basis to:
  - Verify the solution is in compliance with requirements
  - Verify the solution provides the necessary freeze protection
  - Samples taken at beginning and end of draining process, at highest and lowest practical elevations.
  - Riser tag to indicate date the solution was tested
New for 2019

- Inactive Systems
  - Drain system if subject to freezing
  - Drops 4 in. or less in length do not need to be drained
  - Systems must be placed back into service prior to occupancy
  - System pressurized and inspected for leaks
  - Inspected and tested per standard

IRC System Requirements

- P2904.1 General. Where installed, residential fire sprinkler systems, or portions thereof, shall be in accordance with NFPA 13D or Section P2904, which shall be considered equivalent to NFPA 13D.
  - Section P2904 shall apply to stand-alone and multipurpose wet pipe sprinkler systems that do not include the use of antifreeze. A multipurpose fire sprinkler system shall provide domestic water to both fire sprinklers and plumbing fixtures. A stand-alone sprinkler system shall be separate and independent from the water distribution system. A backflow flow preventer shall not be required to separate a stand-alone sprinkler system from the water distribution system.
  - P2904.1.1 Required sprinkler locations. Sprinklers shall be installed to protect all areas of a dwelling unit.

- P2904.3.2 Shutoff valves prohibited. With the exception of shutoff valves for the entire water distribution system, valves shall not be installed in any location where the valve would isolate piping serving one or more sprinklers.

- P2904.3.3 Single dwelling limit. Piping beyond the service valve located at the beginning of the water distribution system shall not serve more than one dwelling.
NFPA 13R
Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies

NFPA 13R

More like NFPA 13:
- Listed Materials
- Listed Pumps – Must conform to NFPA 20!
- Maintenance, Testing & Inspection per NFPA 25!
- Water Supply Duration – 30 minutes
- Up to 4-flowing sprinkler calculations within dwelling units
- Detailed Plans required
- FDC required
- Hydrostatic testing

NFPA 13R

- Chapter 1 – Administration
- Chapter 2 – Referenced Publications
- Chapter 3 – Definitions
- Chapter 4 – General Requirements
- Chapter 5 – System Components
- Chapter 6 – Installation Requirements
- Chapter 7 – Discharge Criteria
- Chapter 8 – Plans and Calculations
- Chapter 9 – Water Supplies
- Chapter 10 – System Acceptance
- Chapter 11 – Care and Maintenance
- Annex A and B
Chapter 1 Scope and Purpose

- NFPA 13R covers the design and installation of automatic sprinkler systems for protection against fire hazards in residential occupancies up to and including four stories in height in buildings not exceeding 60 ft in height.
- The sprinkler system is designed to protect against a fire originating from a single ignition location.
- To prevent flashover in the room of origin, where sprinklered, to allow occupants to escape.

Chapter 3 Definitions

- Dwelling Unit
- Grade Plane
- Residential Occupancies
- Sprinkler System

Chapter 4 General Requirements

In townhouse-style buildings protected in accordance with this standard, each dwelling unit shall have its own dedicated sprinkler system or the control valve for the sprinkler system in the building shall be located outside the dwelling units or in a common area.
Chapter 5 System Components

New for 2019

- Pipe listed for light hazard occupancies can be installed exposed when permitted by the listing (rooms that do not exceed 400 ft²)

New for 2019

- Pipe listed for light hazard occupancies can be installed above any size ordinary hazard room where concealed behind a minimum of one layer of 3/8 in. gypsum wallboard or 1/2 in. thick plywood
Chapter 6 Installation

Use of sprinklers

- Inside dwelling unit
  - Residential sprinklers
  - Listed quick response permitted where no more than 4 sprinklers are located in the dwelling unit and is one compartment
  - Quick response sprinklers must deliver a minimum of \(0.1 \text{gpm/ft}^2\) over entire dwelling unit

Use of Sprinklers

- Outside dwelling units
  - Sprinklers outside of the dwelling units must be quick-response
  - Residential sprinklers are permitted in all light hazard areas
  - Residential sprinklers are permitted in garages that are accessible only from and directly connected to a single dwelling unit
New for 2019

Standard response sprinklers can be installed in garages where they are accessible by people from more than one dwelling unit.

New for 2019

- Temperature ratings
- Sprinklers in closets with ventless clothes dryers must be intermediate or higher temperature classification
- All sprinklers in a compartment must be same temperature rating unless different rating is required for a specific location.

Shadow Area

Figure 6.4.6.3.3.2 Shadow Areas Behind Sidewall Sprinklers in Corridors
Location of Sprinklers

- Sprinklers are not required in:
  - Bathrooms where the area does not exceed 55 ft²
  - Clothes closets, linen closets, and pantries within dwelling units, where:
    - Area does not exceed 24 ft²
    - The walls and ceilings are surfaced with noncombustible or limited combustible materials.
  - Porches, Balconies, Corridors, Garages and Stairs which are open and attached, except as noted below:
    - Where a roof deck is provided above, sprinklers shall be installed to protect attached exterior balconies, attached exterior decks and ground floor patios, serving dwelling units of Type V construction.

Location of Sprinklers

- Sprinklers are not required in:
  - Attics (not used for storage)
  - Penthouse equipment rooms
  - Elevator Machine Rooms
  - Concealed spaces containing only dwelling unit ventilation equipment
  - Crawl spaces
  - Floor/ceiling spaces
  - Noncombustible elevator shafts where cars comply with ANSI A17.1
  - Other concealed spaces not intended for living purposes or storage, containing no fuel-fired equipment.

Location of Sprinklers

- When fuel-fired equipment is present, at least one quick response, intermediate temperature sprinkler must be installed above the equipment.
Location of Sprinklers

Sprinklers are not required in closets (regardless of size) on exterior balconies and exterior breezeways/corridors, as long as there are no doors or unprotected penetrations from the closet directly into the dwelling unit.

New for 2019

Floor control valves are not required in multistory buildings unless the sprinklers are part of a combined standpipe arrangement.

Mixed-use buildings can be served with a single FDC.

Chapter 7 Design Criteria
Discharge Criteria

4 sprinklers

- Smooth flat horizontal ceilings
- 14 inch beams
- Slope up to 8 in 12 with no beams
- Slopes with 14 inch beams
- Beams forming pockets

Discharge Criteria

- Sprinklers can be installed in conditions that are covered by their listing.
- For other conditions, the number of sprinklers in design area to be determined in consultation with Authority Having Jurisdiction, as may be appropriate for the conditions

Discharge Criteria

- For areas outside dwelling units protected with quick response sprinklers, the design discharge and design area is per NFPA 13
- For compartments 500 ft² or less that meet all of the following the design area is limited to all the sprinklers in the compartment to a maximum of four.
  1) Area is protected with 30-minute construction
  2) Sprinklers maximum 225 ft² for Light Hazard, 130 ft² for Ordinary Hazard, or in accordance with their listing
  3) Openings have lintel depth of at least 8 in.
  4) Total area of openings does not exceed 50 ft²
  5) Discharge densities are per NFPA 13
Discharge Criteria

- For areas outside dwelling units protected with residential sprinklers in ordinary hazard areas, the design discharge and design area is per NFPA 13

- For compartments 500 ft² or less that meet all of the following the design area is limited to all the sprinklers in the compartment to a maximum of four.
  1) Area is protected with 30-minute construction
  2) Sprinklers maximum area of 130 ft²
  3) Openings have lintel depth of at least 8 in.
  4) Total area of openings does not exceed 50 ft²
  5) Discharge densities per NFPA 13 ordinary hazard

Discharge Criteria

- The number of design sprinklers for a corridor or breezeway outside the dwelling units must include the four most demanding adjacent sprinklers
New for 2019

- Garages that serve a single dwelling unit are considered a part of the dwelling unit.

New for 2019

- Attics
  - Attics with storage or intended to be occupied must be calculated per Chapter 7
  - Attics that are not intended to be used for storage or occupied can be protected per NFPA 13 design criteria or with residential sprinklers listed for attic protection.

Chapter 8 Plans and Calculations
Chemical compatibility of non-metallic with other construction products and materials must be verified prior to use in automatic fire sprinkler systems. Among those items:

- thread sealants
- leak detectors
- firestoppers
- insulation
- spray foams
- cutting oils
- termiteicides
- insecticides
- antifreeze
- coupling tubes
- communication cables
- wires
- flux
- solder
- mastic
- PVC coated floor clamps
- pipe tapes
- grease
- cutting oils
- rubber and plasticizers
- antimicrobial coatings
Residential sprinklers are permitted in dwelling units and their adjoining corridors, provided they are installed in conformance with their listing. Residential sprinklers can only be used only in wet systems unless specifically listed for use in dry systems or pre-action systems. Where residential sprinklers are installed in a compartment, all sprinklers within the compartment must be residential sprinklers.

- Maximum distances between sprinklers to be measured along the slope
- Sidewall sprinklers to have deflectors within 4 in. to 6 in. from ceiling above, unless listing allows greater distance
- Soffits used for installation of sidewalls, which exceed 8 in. in width or projection from the wall, require sprinklers below the soffit
- Sprinkler obstruction rules
Dwelling Unit Sprinklers

- Sprinklers are not be required in bathrooms located in dwelling units that do not exceed 55 ft² in area, and have walls and ceilings of noncombustible or limited-combustible materials with a 15-minute thermal barrier rating, including the walls and ceilings behind any shower enclosure or tub.
- Sprinklers are not required in clothes closets, linen closets, and pantries within dwelling units in hotels and motels where the area of the space does not exceed 24 ft² and the walls and ceilings are surfaced with noncombustible or limited-combustible materials.

Discharge

- The design area is the area that includes the four adjacent sprinklers that produce the greatest hydraulic demand.
- New buildings having unsprinklered combustible concealed spaces, the minimum design area shall be eight sprinklers.
- The minimum required discharge from each of the four hydraulically most demanding sprinklers must be the greater of the following:
  - The minimum flow rates indicated in individual listings
  - Calculated to deliver a minimum of 0.1 gpm/ft² over the design area
Discharge

- For modifications or additions to existing systems equipped with residential sprinklers, the listed discharge criteria less than 0.1 gpm/ft² is permitted.

- Where areas such as attics, basements, or other types of occupancies are outside of dwelling units but within the same structure, these areas shall be protected as a separate design basis.

- Hose stream allowance and water supply duration requirements shall be in accordance with those for light hazard occupancies.

Conclusion

- Questions and Answers
- Evaluations
- Certificates
- Additional Resources:
  - wwwfiresprinkler.org
  - www.SprinklerECampus.com

This seminar and its contents is not a formal interpretation issued pursuant to NFPA regulations. Any opinions expressed is the personal opinion of the instructor and does not necessarily present the official position of the NFPA and its Technical Committees.