NFSA NATIONAL FIRE SPRINKLER ASSOCIATION
The Voice of the Fire Sprinkler Industry

TechNotes

Editor - Roland Asp, CET #493 08/09/2022

Best of July 2022

The following are a dozen questions answered by the NFSA's Codes, Standards, and Public Fire Protection staff as part of the Expert of the Day (EOD) member assistance program during the month of July 2022. This information is being brought forward as the "Best of July 2022." If you have a question for the NFSA EOD submit your question online through the "My EOD" portal.
It should be noted that the following are the opinions of the NFSA Engineering, Codes, and Standards staff, generated as members of the relevant NFPA and ICC technical committees and through our general experience in writing and interpreting codes and standards. They have not been processed as formal interpretations in accordance with the NFPA Regulations Governing Committee Projects or ICC Council Policy #11 and should therefore not be considered, nor relied upon, as the official positions of the NFSA, NFPA, ICC, or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used.

Question #1 – Return Bends with a Raw Water Source

The 2013 edition of NFPA 13 requires sprinklers that are supplied from a raw water source be installed with a return bend connected to the top of the branch line. The system in question has a branchline that is elevated above the cross main on a riser nipple.

Is a return bend directly to the sprinkler head required if the entire line rises from the main?

Yes. Return bends connected to the top of the branch lines are required where pendent sprinklers are served by a raw water source unless one of the following conditions is met:

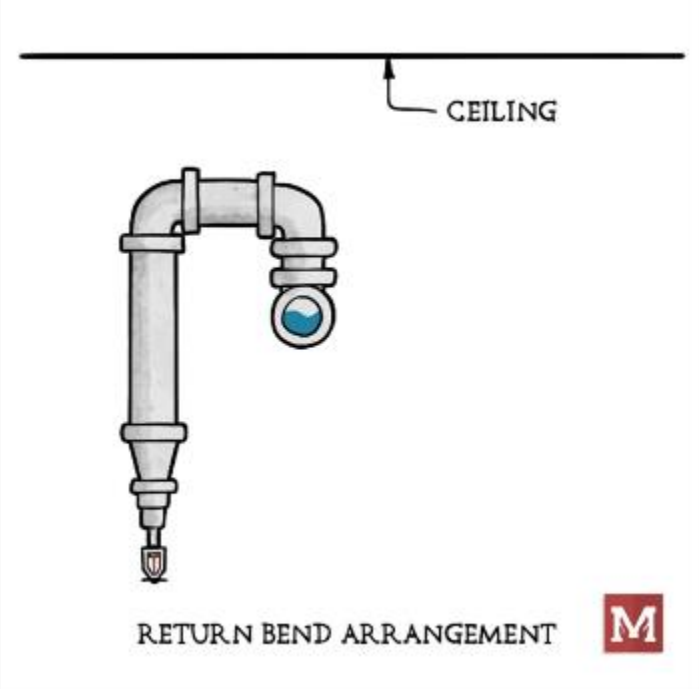
- System is a deluge system
- Dry pendent sprinklers are used
- System is wet system, and the pendent sprinklers have a K-factor of 11.2 or larger

Additionally, return bends are not required when using upright or sidewall sprinklers.

This requirement (found in 8.15.19.1 of the 2013 edition of NFPA 13) is to prevent sediment from the raw water source from settling in the pendent sprinkler orifice or drop nipples.

Raw water sources (such as an open pond, open top reservoir, lakes, streams etc. – see A.3.3.19) may include a variety of sediments in the water. As these sediments may be entrained in the water, simply raising the branch line above the cross main (such as with a riser nipple) would not negate the requirement for the return bend.

While it is not within the prescriptive requirements of the standard, the AHJ may accept a strainer in lieu of the return bend arrangement as permitted by Section 1.5 of NFPA 13. Strainers if accepted, however, must be listed for fire protection use and adds a maintenance issue as the strainer must be kept clear.



Question #2 – Fire Department Inlets and the IBC

An extra hazard system with no standpipes or pumps was designed with two (2) inlets on the FDC and a system demand of about 1600 GPM.

It is being interpreted that a sprinkler system with a 1,600-gpm demand is required to have seven (7) inlets on the FDC (1600 GPM divided by 250 GPM per inlet) because section 912.1 from the 2015 edition of the IBC states that the FDC is to be installed in accordance with the system design as opposed to NFPA 13 which states the FDC is to supplement the system.

Only two, 2 ½ inlets are required in the fire department connection (FDC) for an automatic sprinkler system (with no associated standpipe).

The building code is simply requiring a FDC in accordance with NFPA 13 and Section 912.1 of the 2015 edition of the IBC makes this clear. This section states that a fire department connection must be *"installed in accordance with the NFPA standard applicable to the design and shall comply with Section 912.2 through 912.6."*

By stating in accordance with the "NFPA standard applicable to the design", this section does not state that the FDC must meet the system demand but rather that a FDC must be installed in accordance with NFPA 13.

NFPA 13 requires two 2 ½ inch inlets in the FDC regardless of the system demand or the hazard classification. This requirement is found in Section 6.7.1 of the 2016 edition of NFPA 13. There is no requirement in NFPA 13 for the FDC to meet the system demand or to ever require additional 2 ½ inlets. This concept is made clear in the annex to this Section (A.6.7.1) which states that the purpose of the fire department connection is, *"…to supplement the water supply but not necessarily provide the entire sprinkler system demand. Fire department connections are not intended to deliver a specific volume of water."*

Section 912.1 of the IBC is not changing this requirement. It is simply stating that the FDC must meet the requirements of NFPA 13. By using the phrase *"installed in accordance with the NFPA standard applicable to the design"* the code is simply identifying the appropriate NFPA standard. For all sprinkler systems, this would be NFPA 13. For a standpipe system the applicable NFPA standard would be NFPA 14.

Question #3 – Spacing of Residential Sprinklers in a Small Room

Section 11.3.1.3(3) in the 2016 edition of NFPA 13 states that if a room is 800 sq ft or less, the sprinklers must deliver a density of 0.1 gpm/sq ft "using the area of the room divided by the number of sprinklers in the room."

As the residential design method requires four sprinklers in the design area, does this mean that the individual sprinklers cannot be spaced over 200 sq ft each?

No, it is not the intent of Section 11.3.1.3(3) to limit the spacing of residential sprinklers to 200 sq ft each. It is describing how to calculate the required discharge of the sprinklers in small rooms (800 sq ft or less).

The charging statement (11.3.1.3) states that each residential sprinkler in the design area (which is four sprinklers per section 11.3.1.1) must be the greater of one of the following:

The minimum flow rates from the sprinkler listing (as published by the manufacturer) – 11.3.1.3(1)

For rooms larger than 800 sq ft each of the four sprinklers in the design area must deliver a minimum density of 0.1 gpm/sq ft with the protection area of each sprinkler determined by the S x L rule which is found in Section 8.5.2.1. (11.3.1.3(2)

For rooms 800 sq ft or smaller, each of the four sprinklers in the design area must deliver a minimum density of 0.1 gpm/sq ft but instead of measuring the protection area of each sprinkler by the S x L rule, we are allowed to determine the sprinkler protection area simply by dividing the total area of the room by the number of sprinklers in that room (11.3.1.3(3)).

The Section 11.3.1.3(3) method is similar to the small room rule method found in 8.6.2.1.2.1. Section 11.3.1.3(3); however, does not limit the coverage area of the four sprinklers in the design area to 200 sq ft. This section is not limiting the spacing but is allowing an alternate method of determining the coverage area of each sprinkler to calculate the density requirement.

Section (11.3.1.3(3)) simplifies the method for small rooms by allowing the discharge density to be calculated based upon the average spacing and not the actual spacing.

Question #4 – ESFR Continuous Obstruction

A plumber installed a 2 inch nominal (2-1/8 in.) copper pipe 29 inches below ESFR sprinkler heads. Section 14.2.11.3.1(2) in the 2019 edition of NFPA 13 restricts obstructions to 2 inches or less within 2 feet.

A 2-1/8 inch copper pipe at 29 inches directly below an ESFR sprinkler would seem to be less of an obstruction than a 2 inch pipe 24 inches down.

Does the language of 14.2.11.3.1 really restrict a plumber installing copper pipe as indicated?

Yes, based on the prescriptive requirements of NFPA 13, 2019 edition, Section 14.2.11.3.1 this is not permitted by the standard without additional sprinklers. Additional sprinklers shall not be required where the obstruction is 2 inches or less in width and is located a minimum of 2 feet below the elevation of the sprinkler deflector or is positioned a minimum of 1 foot horizontally from

the sprinkler. In the case described the continuous obstruction is greater than 2 inches in width and not located a minimum of 1 foot horizontally from the sprinkler.

Please note this section was changed in the 2022 edition of the standard. Section 14.2.11.3.1(2) indicates additional sprinklers are not required where the obstruction is 1 1⁄2 inches or less in width and is located a minimum of 12 inches below the elevation of the sprinkler deflector.

ESFR sprinkler obstruction rules are very specific based on the unique nature of their discharge pattern, the type of suppression/control, and the hazards protected. Based on the research, it is not simply a case of determining the projected shadow area from an obstruction.

Question #5 - Figure 10.2.7.1.2(c) - Obstruction against walls

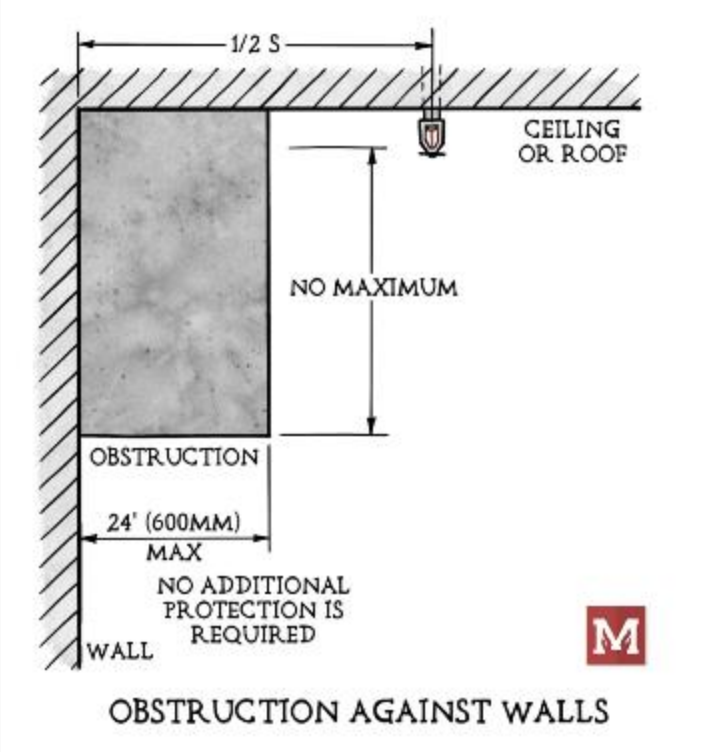
Figure 10.2.7.1.2(c) in the 2019 edition of NFPA 13 shows the dimension ½ S on the top of the figure.

What does ½ S mean?

The intent of the ½ S dimension shown in the figure is to dictate that the sprinkler is spaced to the wall and not the edge of the obstruction even though protection under the obstruction is not required.

This dimension is stating that the maximum distance between the sprinkler and the wall cannot exceed ½ the maximum distance between sprinklers measured in that direction. “S” is the maximum allowable spacing between sprinklers.

For example, the maximum allowable distance between standard spray pendent and upright sprinklers in a light and ordinary hazard occupancy is 15 feet. The ½ S in this figure is stating that the sprinkler must be spaced no more then 7 ½ feet from the wall (not the edge of the obstruction.)



Question #6 - Fire Pump Foundation

A project includes a fire pump installation on the first floor of an existing multistory building. The structural engineer is recommending a steel dunnage foundation in lieu of a concrete pad for the pump foundation to reduce the load on the floor below.

Would this meet the intent of NFPA 20 for "rigid support"?

Yes, as long as the structural engineer and pump supplier ensure the foundation is permanent, rigid, and can maintain pump and motor/engine alignment, this would meet the requirements of NFPA 20, 2016 edition, Section 6.4.4. The standard does not require a concrete base for the fire pump.

Section 6.4.4 requires the foundation be sufficiently substantial to form a permanent and rigid support for the base plate. Section A.6.4.4 explains a substantial foundation is important in maintaining alignment and suggests that the foundation preferably should be made of reinforced concrete. As this is annex language, it is not an enforceable requirement.

Question #7 – ESFR's in Concrete Tee Construction

ESFR sprinklers are located in each channel of concrete tee construction.

Is the bottom stem of the tees considered for obstruction purposes?

No, the bottom of the concrete tee is not an obstruction if it is less than 24 inches wide and sprinklers are provided on both sides. NFPA 13, 2022 edition, Section 14.2.11.1.2 indicates the requirements of 14.2.11.1.1 (the beam rule) shall not apply where sprinklers are spaced on opposite sides of obstructions less than 24 inches wide, provided the distance from the centerline on the obstructions to the sprinklers does not exceed one-half the allowable distance between sprinklers.

Question #8 – Minimum Aisle width for an ESFR System

Is there a minimum aisle width for double-row racks having ESFR protection for a Group A Cartoned Unexpanded Plastics Commodity?

Yes, the ESFR protection schemes in NFPA 13, 2019 edition, Chapter 23 are based on minimum aisle widths. This minimum aisle width is as defined in Chapter 3 for the type of rack storage.

Single row racks are defined as racks that have no longitudinal flue space and that have a depth up to 6 feet with aisles having a width of at least 3 1/2 feet between loads on racks.

Double row racks are defined as racks less than or equal to 12 feet in depth or single-row racks placed back-to-back having an aggregate depth up to 12 feet, with aisles having an aisle width of at least 3 1/2 feet between loads on racks.

Multiple row racks are defined as racks greater than 12 feet in depth or single- or double-row racks separated by aisles less than 3 1/2 feet wide having an overall width greater than 12 feet.

The specific ESFR sprinkler data sheet would also need to be referenced to ensure it does not have an increased minimum aisle width associated with the listing or approval.

Question #9 – Quick Response Reduction and Differing Ceiling Heights

A single compartment has two adjacent ceiling with different heights that fall within the hydraulically most demanding area. Quick response sprinklers are being used and all requirements of Section 11.2.3.2.3.1 (quick response reduction) are met.

What ceiling height should be used in calculating percent reduction to design area of Figure 11.2.3.2.3.1?

When applying the quick response ceiling height reduction found in Section 11.2.3.2.3.1 of the 2016 edition of NFPA 13, the highest point of the ceiling within the design area would be applied (see Figure 11.2.3.2.3.1).

In a case where two adjacent ceiling heights exist within the same design area, the higher of the two ceiling heights would be applied to Figure 11.2.3.2.3.1.

The thought process behind this adjustment is that when using quick response sprinklers, the sprinklers will activate quicker when installed under a lower ceiling. Based upon this concept, where the ceiling heights differs within the same remote area, using the higher height to determine the percentage of reduction of the design area would be required.

Question #10 – Sprinkler Spacing in Bathrooms

It is understood that when determining whether a sprinkler is required based on square footage for a bathroom in accordance with the 2022 edition of NFPA 13R, the area of the tub/shower enclosure must be included to determine the overall square footage of the bathroom.

Is the tub/shower enclosure also included when determining spacing and location of the installed sprinkler?

Yes, the area of the tub/shower is part of the sprinkler coverage and sprinklers are either added or adjusted to cover the entire area of the bathroom

Unless the bathtub is separated from the rest of the bathroom in such a way as to be considered a separate compartment (as defined in Section 3.3.1) the area is included in the spacing of the sprinkler.

Question #11 – NFPA 13 - Mixing Commercial and Residential Sprinklers in a Corridor

In a NFPA 13 project, it would be advantageous to use both quick response sprinklers and residential sprinklers in a corridor.

Is it permitted to mix quick response and residential sprinklers within the same corridor?

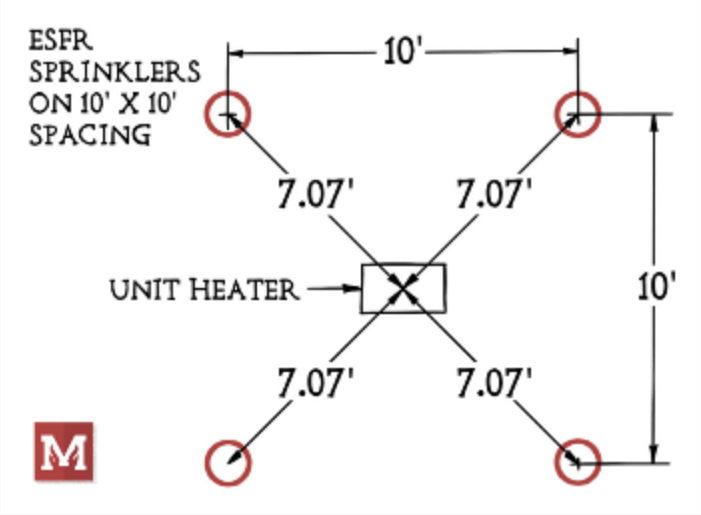
No, installing residential sprinklers and other types of fast response sprinklers within the same compartment is not permitted. A corridor is considered a compartment and Section 12.1.4 of the 2019 edition of NFPA 13 states that when residential sprinklers are installed in a compartment then all sprinklers within that compartment must be residential sprinklers.

Question #12 – ESFR/CMSA Sprinklers near Unit Heater

ESFR & CMSA Sprinklers are not made with high temperature bulbs and are only made in ordinary and intermediate temperatures. Based on Table 8.3.2.5(a) in the 2016 edition of NFPA 13, Intermediate temperature rated sprinklers need to be 7 feet away from unit heaters.

Does this mean that for ESFR sprinklers, the only option is to have a unit heater spaced 7 feet below the sprinkler?

No. The 7 feet measurement for the high temperature zone in NFPA 13, 2016 edition, Figure 8.3.2.5 is measured from the center of the heater. If the heater is placed exactly in the middle of four sprinklers on a 10 feet by 10 feet spacing, the distance from the center of the heater to the sprinkler will be exactly 7.07 feet, which exceeds 7 feet, permitting the use of an ordinary temperature sprinkler, assuming that the heater is not pointed to blow at one of the sprinklers. If the heater is pointed to blow at one of the sprinklers, the sprinkler in question can be changed to intermediate temperature, with the rest of the sprinklers remaining as ordinary temperature.



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