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

TechNotes

Editor - Roland Asp, CET | #449 | 10/13/2020

Best of September 2020

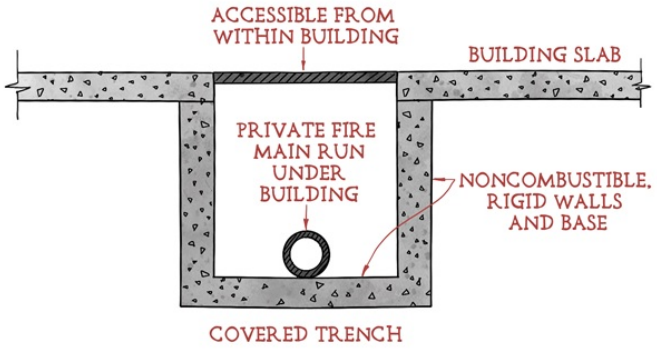
The following are a dozen questions answered by the NFSA's Codes, Standards, and Public Fire Protection staff as part of the Expert of the Day (EOD) member assistance program during the month of September 2020 This information is being brought forward as the "Best of September 2020." If you have a question 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 – Sprinkler Piping under Buildings

Is there guidance in the NFPA standards regarding running piping under buildings?

Yes, Section 10.4.3 of the 2019 edition of NFPA 24 (similar requirements in the 2016 edition) does provide guidance on installing pipe under buildings. It must be noted that these provisions are extracted into NFPA 13 in Chapter 10 of the 2016 edition and Chapter 6 of the 2019 edition.



PRIVATE FIRE MAIN RUN UNDER BUILDING

NFPA 24 does not permit underground piping to be run under a building slab except under some very specific conditions.
Section 10.4.3 states: Private fire service mains are not permitted to be run under buildings. There are two exceptions however:

- Section 10.4.3.1 does allow the underground pipe to extend a maximum of 10 ft under the building. This is simply so the underground can connect to the sprinkler riser within the building. This exception would not apply in the situation that you have described.

- Section 10.4.3.2.1 (and subsections) only allows a main to be run more than 10 ft under a building when the piping is run in a covered trench. Some of the requirements for this trench include the following:

    - The trench must be accessible from within the building
    - The trench shall be noncombustible and have a rigid base and walls
    - The trench must have provisions for draining
    - Pipe in trench may be underground type or aboveground type
    - Underground Piping (if used) must be restrained
    - A valve is required where the piping enters the trench
    - The piping must be protected from freezing

It must be noted that the specific requirements listed above were added to NFPA 24 in the 2016 and 2019 edition, however the general provision that prohibits underground piping from being run under building except when in covered trenches is not new and is part of earlier editions of NFPA 24 as well.

Question #2 – Flooded Sprinkler System

A building with a sprinkler system has flooded and the entire sprinkler system on the lower level has been submerged. What steps are recommended to return this system to service?

It is difficult to make a specific judgement call, not knowing the impact of the flooding, the duration, the exact water quality, how long the components were exposed, etc. Without specifics, there are at least four concerns for sprinkler systems that are submerged in a flood:

1. The electric or electronic portions of the system are damaged or are suspected to have unseen or future issues with operating effectively. Replace or consult with the manufacturer for guidance.
2. Sprinklers submerged in water is not a huge concern, however, the water quality and mechanical damage from objects flowing or floating by may be cause for replacement. This may need a special investigation, testing, or cleaning (as permitted) for each individual sprinkler if left in place. Consult with the manufacturer for guidelines.
3. Escutcheons, cover plates, guards, hangers, etc. are probably more susceptible to corrosion and debris. Floating debris can lodge a cover

plate closed. Point corrosion can occur where water lays or where pieces contact each other. Replace or consult with the manufacturer for guidance.

4. Flood water quality may contain chemicals that are excessively corrosive to steel piping or be incompatible to non-metallic piping. Replace piping or consult with the manufacturer for guidance.

The NFPA 13, NFPA 25, or model fire codes do not address the remediation of the effects of the actual flood, however, the flooding and exposure will trigger replacement and repairs through NFPA 25 and the fire codes when corrosion, discoloration, rust, deformation, etc. start to appear on the piping, coupling, sprinklers and other equipment.

Question #3 – Copper Joints in Fire Pump Sensing Lines

Section 7.5.4 of the 2019 Edition of NFPA 13 deals with the requirements for joining copper tube (soldered and brazed). This section is specific to copper sprinkler system piping and specifies that exposed copper joints in an ordinary hazard occupancy must be brazed. Do these requirements also apply to copper tubing used on fire pump controller pressure sensing lines?

No, the scope of NFPA 13 does not allow it to apply to portions of the fire pump assembly.

The correct standard to reference regarding sensing line assembly is NFPA 20. Specifically, the 2019 edition of NFPA 20, in Section 4.32, allows copper tube but does not regulate the joining technique that is used for the sensing line.

The reason that NFPA 13 does not allow soldering of exposed copper tube in a sprinkler system for example, in an ordinary hazard occupancy, is that the sprinkler system piping is at risk from coming apart during a fire and not allowing water to flow past the point where it comes apart. This is a concern for a sprinkler system, but not a fire pump sensing line. If a fire in a pump room does cause the sensing line to come apart, the pressure will be lost in the sensing line, which will cause the pump to start. This is the end result anyway when there is a fire in a pump room, so there is no significant problem created by the soldered joint.

Question #4 – Calculating Sprinklers under a Conveyor

Is there a section in NFPA that will explain how to hydraulically

calculate the sprinklers under the conveyer belts? Is there a minimum psi / per head calculation or is it a 1,500 sq ft calc?

There is no section specific for the calculation for sprinkler under conveyors in NFPA 13, assuming there is a ceiling level sprinkler system that is calculated separately. If the sprinklers under the conveyors are to be calculated as a separate design area and the sprinklers under the conveyor consist of a single line of sprinklers, then Section 19.3.3.4.2 titled Special Design Areas of the 2019 edition of NFPA 13 would be appropriate and the design area would include all sprinklers up to a maximum of seven sprinklers. This section is also present in earlier edition of the standard – (see section 11.2.3.4.2 in the 2016 edition).

Question #5 – Sprinkler Position Below Duct

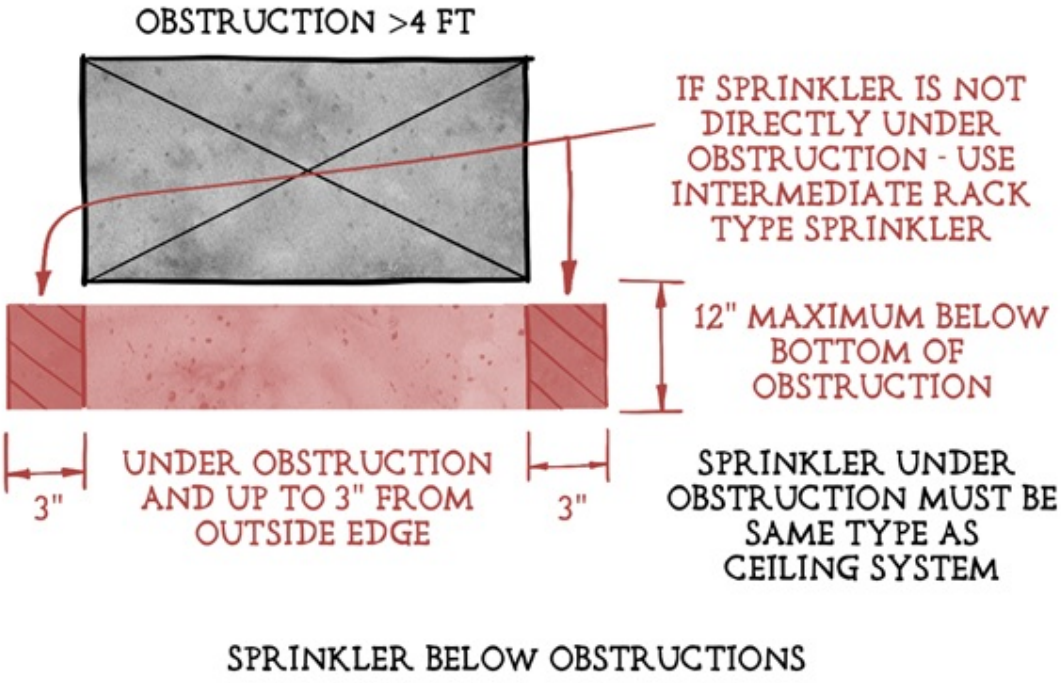
There is a 5-ft duct that requires sprinkler protection underneath. I was told that the sprinkler is permitted to be located next to the duct and not directly under it. Does NFPA 13 require sprinkler below obstructions to be located directly below the obstruction?

No, beginning in the 2016 edition of NFPA 13, the sprinkler protecting under an obstruction is not required to be located directly underneath the obstruction but permits the sprinkler to be located up to 3 inches outside the edge of the obstruction.

In the 2013 edition of NFPA 13, Section 8.5.5.3.1 simply indicates sprinklers shall be installed under fixed obstructions.

In the 2016 edition of NFPA 13 in Section 8.5.5.3.1.1 language was added that would allow sprinklers to be located below the obstruction and not more than 3 in. from the outside edge of the obstruction.

The 2019 edition of NFPA 13 added an annex figure to clarify this requirement. It must be noted that if the sprinkler is not located directly under the obstruction, intermediate rack type sprinklers must be used to prevent the discharge from the ceiling sprinklers from cold soldering the sprinklers below.



Question #6 - Diesel Fire Pump Room Sprinklers

The 2013 edition of NFPA 20, in Section 11.3.3 states a diesel fire pump room must be protected with fire sprinklers in accordance with NFPA 13 as an extra hazard group 2 space. Do the K-factor requirements of NFPA 13 Section 12.6 apply?

No, the K-factor requirements of Section 12.6 are specific to storage and would not apply to protection of a fire pump room. Section 12.6 is in Chapter 12 for general storage requirements and clearly indicates that this requirement is for general storage applications, rack storage, rubber tire storage, roll paper storage, and baled cotton storage. A diesel fire pump room is not a storage application. It is always good practice to increase the K-factor for higher design densities, but this is not required by Section 12.6 for a fire pump room.

Question #7 NFPA 13D Antifreeze Darcy-Weisbach Equation

NFPA 13 requires that the Darcy-Weisbach equation be used for the hydraulic calculations of antifreeze systems larger than 40 gallons. Are we required to use this equation for antifreeze systems over 40 gallons for an NFPA 13D system?

It needs to be pointed out that NFPA 13D (2016) does not recommend the use of antifreeze for systems exceeding 40 gallons. This recommendation is found in the Annex Section A.9.2.1. As this is annex language, this is not a rule but rather a recommendation.

The answer to the specific question is “yes”. When performing hydraulic calculations to size the piping for a NFPA 13D antifreeze system exceeding 40 gallons in size, the Darcy-Weisbach formula needs to be used, NFPA 13D, in Section 10.4.3 gives four options when sizing the pipe. Option (3) is the hydraulic calculation procedure for NFPA 13. When using this method, the procedures highlighted in NFPA 13 are required to be followed and Section 23.4.2.3 of the 2016 edition of NFPA 13 states that:

23.4.2.1.3 For antifreeze systems greater than 40 gal (150 L) in size, the friction loss shall also be calculated using the Darcy–Weisbach formula By using the word “also”, this section states that these systems should be calculated using both the Hazen-Williams and the Darcy-Weisbach methods of hydraulic calculations.

Another pipe sizing option found in 10.4.3 is option (4) which states use the manufacturer’s listed installation instructions. The data sheets for the listed antifreeze solutions on the market and confirmed that the Darcy-Weisbach method is required for system antifreeze systems exceeding 40 gallons in capacity.

The other two acceptable pipe sizing methods: simplified calculation method of 10.4.4 and the prescriptive pipe sizing method of 10.4.9 do not have any language pertaining to antifreeze solutions but is my opinion that these methods were intended for a water only system.

Question #8 - Concrete Waffle Pan Ceiling

In a building with a concrete waffle ceiling that is 16" deep sidewall sprinklers that are listed to be installed 18 inches below the ceiling are contemplated. Sidewall sprinklers can only be used if the ceiling is considered “smooth”. The 2016 edition of NFPA 13 in Annex Section A.3.7.2 (3) (a) suggests that “Flat slab, pan-type reinforced concrete” ceilings are considered a smooth ceiling. Is a waffle type ceiling considered to be a type of smooth ceiling?

No, most waffle type ceilings are considered obstructed construction and NOT a flat smooth ceiling. The annex note that was referenced does seem to create some confusion. A public comment was submitted to NFPA 13 during the 2013 revision cycle seeking clarity on this very issue. The committee stated that waffle construction could be “considered obstructed construction” and stated that flat slab, Pan type ceiling is considered

smooth ceiling but also stated that “Pan type construction is not waffle construction”.

Question #9 – Acceptance Test vs Annual ITM

On a fire sprinkler system, does the acceptance test performed upon completion of installation qualify as that year’s annual NFPA 25 ITM requirement?

No, the acceptance testing is for verifying the system is operating as it is meant to and is required by the installation standards such as NFPA 13 and NFPA 14. The requirements of NFPA 25 begin when the system is officially turned over to the building owner, typically when a use and occupancy permit is issued. This includes all frequency requirements such as daily, weekly, and monthly.

Question #10 – Room Design Method and Rating of Doors

We are using the room design method for several small ordinary hazard rooms. These rooms are enclosed by 1-hour rated walls with self-closing 45-minute rated doors to adjoining rooms. Since the doors are only rated for 45-minute (does not meet the minimum duration in Table 11.2.3.1.2) do I need calculate up to (2) sprinklers in the adjoining corridor?

Section 11.2.3.3.3 and Table 11.2.3.1.2 require the wall (just the wall) to be a minimum one-hour fire resistance rated. Section 11.2.3.3.5 indicates the opening (door in this case) is required to have the appropriate fire resistance rating for the enclosure. It may be appropriate per IBC, 2018 edition, section 716 for a one hour rated wall to have a 45-minute rated door for protection of the opening. This would meet the requirements of the standard and allow for the use of the room design method.

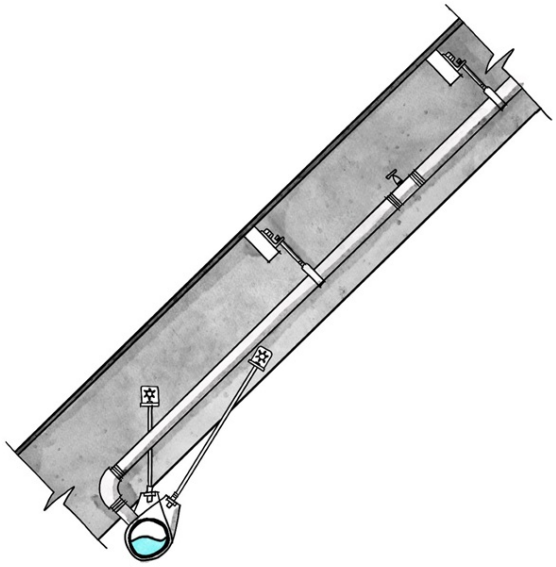
Question #11 – Threaded rod installed at an angle

On a project with a sloped ceiling, the branch lines are run up the slope and are supported by all thread rod installed perpendicular to the slope. Will the load cause the hanger rod to bend?

The hangers as described could be problematic if not installed properly especially without additional hangers and braces. The lateral loads imposed on the rods as they are installed could cause bending over time. NFPA 13 does have some guidance for situations such as this where the

pitch of the branch line is 6 in 12 or greater. Section 16.2.1.3 in the 2019 edition states that for branch lines exceeding 6 in 12 in pitch, the lateral load must be reduced by one of the following methods:

1. An additional hanger installed on the main (see figure below)
2. Lateral sway braces installed on the main
3. Branch line hangers using articulating structural attachments
4. Equivalent means to support the branch lines.



HANGERS AND BRANCH LINE HANGERS BELOW STEEP SLOPE

This section shows that the concerns are valid and if the branch line is installed at a steep enough pitch some means would need to be taken in order to reduce the nonaxial loads on the threaded rod hangers.

Question #12 – Mixed Use System Size

Can an area including that includes both extra hazard and ordinary hazard use be over 40,000 square feet in size?

Yes. NFPA 13, 2016 edition, Section 8.2.3 indicates, "where single systems protect extra hazard, high-piled storage, or storage covered by other NFPA standards, and ordinary or light hazard areas, the extra hazard or storage area coverage shall not exceed the floor area specified for that hazard and the total area coverage shall not exceed 52,000 sq ft."

A single sprinkler system can have an extra hazard area of 30,910 sq ft with an additional 11,000 sq ft of light or ordinary hazard space for a total system area of 41,910 sq ft. Both areas can be supplied from the same sprinkler system riser.

Join the NFSA Team

We are searching for a Fire Protection Engineer to join Team NFSA!

This position supports the mission by providing technical services including representation on committees, research of sprinkler system performance, preparing written reports and developing and teaching

seminars. Please view the entire position description and apply here: **Fire Protection Engineer Position**

New EOD Process

Starting on July 15, 2020, the NFSA has a new EOD process where members can submit questions, track the progress, and view their EOD cases. The step by step process is detailed in TechNotes #442.

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