NFSA The Voice of the Fire Sprinkler Industry TechNotes

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Best of April 2016

Following are a dozen questions answered by the engineering staff as part of the NFSA's Expert of the Day (EOD) member assistance program being brought forward as the "Best of April 2016." If you have a question for the NFSA EOD (and you are an NFSA member), send your question to eod@nfsa.org and the EOD will get back to you.

It should be noted that the following are the opinions of the NFSA Engineering Department staff, generated as members of the relevant NFPA 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 and should therefore not be considered, nor relied upon, as the official positions of the NFPA or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used.

Question 1 – Building Height for Requiring Standpipe Systems
A building has a mechanical penthouse on top of the roof. Without including the penthouse, the third (and top) floor of the building is 28 feet 8 inches above finished floor. If the penthouse height is included in the height of the building, then a standpipe system would be needed. Specifically, you have asked if the mechanical penthouse is supposed to be included in the standpipe height requirements for the building.

Answer: The answer depends on if the penthouse is considered a story under the building code. Section 1510.2 in the International Building Code (IBC), 2015 Edition, states, "*Penthouses in compliance with Section 1510.2.1 through 1510.2.5 shall be considered as a portion of the story directly below the roof deck on which such penthouses are located. All other penthouses shall be considered as an additional story of the building.*" The referenced sections include requirements such as area limitations, use restrictions, weather protection, and types of construction. If these guidelines are met, then the height of the penthouse would not need to be included in the determination of adding a standpipe system for the protection of the building.

There is no specific language in the IBC differentiating between occupied and unoccupied floors when determining the height of a building for standpipe requirements.

Question 2 – Long Riser Nipples
Riser nipples in a fire sprinkler system are 4 feet 6 inches long. There is discussion of the ability to transfer the load from the branch line through the riser nipple and to the main and its sway braces. Specifically, has this has been addressed in NFPA 13?

Answer: Yes. The Committee has been looking at longer riser nipples and how much load can be transferred through the connection without damage to the connections in the last few revision cycles of NFPA 13. Language was first added in the 2013 Edition and further refined in the 2016 Edition. Section 9.3.5.9.6.1 now reads, "When riser nipples are provided in systems requiring seismic protection, they shall satisfy the following equation, unless one of the following conditions is met:

(1) Where riser nipples are 4 ft (1.2 m) or less in length and Cp is 0.50 or less
(2) Where riser nipples are 3 ft (900 mm) or less in length and Cp is less than 0.67
(3) Where riser nipples are 2 ft (600 mm) in length or less and Cp is less than is 1.0

$$\frac{(H_r \cdot W_p \cdot C_p)}{S} \geq F_y$$

where:

H_r= length of riser nipple piping (in inches)
W_p= tributary weight (in pounds) for the branch line or portion of branch line within the zone of influence including the riser nipple
C_p= seismic coefficient
S= sectional modulus of the riser nipple pipe
F_y= allowable yield strength of 30,000 psi (2070 bar) for steel, 30,000 psi for copper (soldered), 8000 psi (550 bar) for CPVC"

As the length of the riser nipple in your example is more than 4 ft, the calculation would be necessary. Section 9.3.5.9.6.2 goes on to say, "If the calculated value is equal to or greater than the yield strength of the riser nipple, the longitudinal seismic load of each line shall be evaluated individually, and branch lines shall be provided with longitudinal sway bracing per 9.3.5.6." This means that if the load from the branch line is too much, then the branch line would have to have longitudinal bracing. This would mean that the line would not be included in the zone of influence for the lateral sway braces on the connected main(s).

Question 3 – Converting Dry Pipe System to Wet Pipe System

A building owner wants to convert a dry pipe sprinkler system over to a wet system. You have mentioned the typical corrosion found in dry pipe sprinkler systems over time. In light of an aging dry system, can this dry system be converted into a wet system according to NFPA 13?

Answer: Yes. This would not be a unique circumstance where a dry pipe system was converted into a wet system. In fact, Section A.7.2 in the annex of NFPA 13, 2016 Edition, states in the first paragraph, "…Dry pipe systems should be converted to wet pipe systems when they become unnecessary because adequate heat is provided..." (similar language exists in earlier editions.) This indicates that the practice is acceptable within the standard.

In addition, you have asked if there are recommended practices for this conversion. As long as the system has been maintained in accordance with NFPA 25, which has inspection, testing and maintenance requirements, then the materials should be viable without additional concerns. NFPA 25 has internal inspection requirements and may trigger periodic flushing requirements depending on what is found. The flushing is intended to remove any scale that has occurred.

Question 4 – Distance from a Baffle
Referencing NFPA 13, it has been noted that a pendent sprinkler will be installed near a baffle. What is the minimum distance that pendent sprinkler needs to be from the baffle?

Answer: The pendent sprinkler should be installed 4 inches away from the baffle. This is identified in Section 8.6.3.3 of NFPA 13, 2016 Edition (with similar text in earlier editions). Although the standard calls out spacing from walls the same would apply to a baffle, which acts like a partition dividing the sprinkler from neighboring sprinklers. The main reason for the distance is to be able to have space to inspect the sprinkler and remove it (if necessary) over the lifetime of the system.

Question 5 – End of Branch Line Piping
The end of a branch line will be supported with the last hanger 45 ½ inches from the last sprinkler. It is 1 ¼-inch steel pipe. The plans show a coupling in the unsupported length. Section 9.2.3.4.1 in NFPA 13 states, "For steel pipe, the unsupported horizontal length between the end sprinkler and the last hanger on the line shall not be greater than 36 in. (900 mm) for 1 in. (25 mm) pipe, 48 in. (1.2 m) for 1 ¼ in. (32 mm) pipe, and 60 in. (1.5 m) for 1 ½ in. (40 mm) or larger pipe." Is it permissible to have a coupling in the unsupported length?

Answer: No, the unsupported length requirements were written with the assumption that the distance was a single length of pipe that did not contain couplings. Although the requirements of Section 9.2.3.4.1 are technically satisfied, this arrangement violates Section 9.2.3.2.1, which states, "…there shall not be less than one hanger for each section of pipe." While it would be permissible for a rigid length of pipe to be cantilevered in this way, the load imposed on the coupling in this arrangement would not be acceptable.

Question 6 – Sprinkler Guards
Section 6.2.8 has been referenced from NFPA 13. It states, "Sprinklers subject to mechanical injury shall be protected with listed guards." Are there other locations in the codes or standards that indicate locations where guards are required on the sprinklers?

Answer: No, NFPA 13 does not provide specific locations for sprinklers that need guards nor do the model building codes. The decision to provide sprinkler guards typically is left to the user's judgement. Typical locations where guards have been installed include gymnasiums, in-rack sprinklers, and on sprinklers mounted lower than standard door heights.

Question 7 – IFC Fire Flows
It has been asked if the fire flow requirements of the International Fire Code (IFC) supersede the hose demand found in NFPA 13 for fire sprinkler systems.

Answer: No. The two calculations are separate and distinct. The fire flow from the IFC is an estimation of how much water the fire department will need to fight a fire, whereas the hose demand is the amount of the available water the fire department will use when fighting a fire while the sprinkler system is flowing. The two documents do not correlate and do not function together and should not be used in that manner. It is important to note the 2012 IFC Commentary text on Appendix B:

> "This appendix was developed independent of the sprinkler standards NFPA 13, 13R and 13D. These standards sometimes have requirements for inside and outside hose streams that are independent of the fire flow requirements."

The fire department could ask for the fire sprinkler demand with hose demand compared to the required fire flow and the greater of the two is then compared to the actual water supply. This is actually a new section in the 2015 IFC, Section B105.3.

Question 8 – Forward Flow Test for Backflow Preventers

There has been much discussion about testing backflow preventers recently. What is the purpose of the forward flow test in NFPA 13 Section 8.17.4.5.1 (cited below)?

> **8.17.4.5.1* Backflow Prevention Valves.** Means shall be provided downstream of all backflow prevention valves for forward flow tests at a minimum flow rate of the system demand including hose allowance where applicable.
> **A.8.17.4.5.1** System demand refers to flow rate and pressure. This test is only concerned with testing at the proper flow rate.
> The full flow test of the backflow prevention valve can be performed with a test header or other connection downstream of the valve. A bypass around the check valve in the fire department connector line with a control valve in the normally closed position can be an acceptable arrangement. When flow to a visible drain cannot be accomplished, closed loop flow can be acceptable if a flowmeter or site glass is incorporated into the system to ensure flow. When a backflow prevention device is retroactively installed on a pipe schedule system, the revised hydraulic calculation still follows the pipe schedule method of 11.2.2 with the inclusion of friction loss for the device.

Answer: The forward flow test is to ensure that the check valves in the backflow assembly open completely to permit the system demand to flow as intended by design. The full forward flow test referenced in NFPA 13 and NFPA 25 serves an entirely different purpose than the tests performed by water purveyors to test the primary function of the backflow assembly.

When water purveyors test backflow assemblies, they are ensuring that the backflow assembly does not allow water from the system side to pass back through to the supply side. That is the sole purpose for which the backflow assembly is required by the water purveyor. When a full forward flow test is performed on a sprinkler system, it is to ensure that the check valves in the backflow assembly are capable of opening sufficiently to allow the required system demand flow to pass from the supply side to the system side. Maintenance test events such as inspector's tests and main drain tests do not normally require the system to flow the entire design demand. This means that the check valves in the backflow preventer are only required to open partially during those tests. Requiring periodic full forward flow tests both provides "exercise" for the check valves to keep them from binding in the closed or partially closed position and it may also give indications of impairment if the full forward test is conducted and water flow is visibly less than anticipated.

This requirement has appeared in NFPA 13 since at least the 2002 edition. The 2016 edition adds language clarifying the required flow rate.

Question 9 – Sprinklers below a Mesh Ceiling
Sprinklers are sometimes required to be installed below obstructions that have openings such as a mesh or grid with openings. Why are heat collectors not permitted or used in situations where there is not a solid ceiling?

Answer: NFPA 13 is a prescriptive standard for the installation of fire sprinklers and does not address every situation. In situations where there is an open mesh ceiling and sprinklers are installed above and below, it is because the mesh ceiling is obstructing the spray pattern or discharge of the fire sprinklers above. When dealing with any obstruction, NFPA 13 allows specific sprinkler spacing requirements to avoid obstructions or the option to install additional sprinklers. The primary reason sprinkles are installed below a mesh ceiling is when the spacing requirements could not be met for the type of sprinkler being used and its obstruction criteria. The standard would require these sprinklers to be of a shielded type or have another means of protection from the above head sprinklers to prevent cold soldering, but NFPA 13 does not require heat collectors, nor permit heat collectors in this situation.

Question 10 – Removing a Water Motor Gong
There is an existing sprinkler system that includes both a mechanical water gong and a water flow switch connected to the building fire alarm system. It has been indicated that the water motor gong was the original alarm for the system with the fire alarm system being added later. The water motor gong does not currently function although the fire alarm system does work properly. Can the water motor gong be removed and the pipe capped off, or does it have to be repaired since it is already in place?

Answer: The non-functioning water motor gong should be able to be removed as the system is also monitored by the fire alarm system. NFPA 13 simply requires that the system be equipped with a water flow alarm that will sound within 5 minutes of water flow (see section 6.8.1 in the 2016 edition of NFPA 13 or section 6.9.1 in the 2013 edition). The fire alarm system connected to a water flow switch can serve this purpose. Although traditionally the audible alarm has been installed on the outside of the building, the annex section A.6.8.3.1 states that:

> *"Outside alarms might not be necessary where the sprinkler system is used as part of a central station, auxiliary, remote station, or proprietary signaling fire alarm system, utilizing listed audible inside alarm devices."*

As this water motor gong is an existing component of the system, the AHJ should be consulted prior to removing it.

Question 11 – Obstruction in Front of Sidewall Sprinkler
The obstruction criteria for spacing residential sidewall sprinklers has been referenced. In regards to obstructions to the sprinkler spray pattern development, does the area four inches above a residential sidewall sprinkler have to remain clear of obstructions for a minimum of 8 feet?

Answer: Yes. The area 4 inches above the residential sidewall sprinkler deflector has to be clear based on the allowable distance given by Table 8.10.7.1.3. Therefore, based on Table 8.10.7.1.3, if the sprinkler deflector is 1 inch above the bottom of the obstruction, this obstruction in question would need to be a minimum of 8 feet away from the sprinkler. This 8-foot span would also need to be clear of obstructions within 4 inches above the sprinkler deflector. This is because residential sprinkler spray pattern is projected in an arc to ensure the throw of the spray discharge meets the coverage area. This language is new for the 2016 edtion and applies to residential as well as extended coverage sprinklers because of the distribution pattern of these types of sprinklers.

Question 12 – Harsh Environments for Sprinklers

There is a building that has open truck dock doors down both sides of the building and an approximate overhang of 7ft. The overhang is protected with a sidewall sprinkler from inside the building. NFPA 25 requires testing of sprinklers and the annex gives examples of a harsh environment one of those being areas exposed to outside weather. Is any outside application considered a "harsh" environment and would it apply to a trucking dock terminal?

Answer: In regards to harsh environments, unfortunately, there really is no clear answer. NFPA 25 provides some guidance in the form of annex language on what the technical committee considers to be harsh. By reviewing the list (A.5.3.1.1.2), the sprinklers described are certainly "exposed to outside weather" in terms of temperature fluctuation, etc. But in that list, it gives examples such as tanneries, galvanizing rooms and other environments. Harsh often refers to spaces where there are chemicals present in addition to air exposure and outdoor conditions.

In these cases, it is generally best to work with the owner and the AHJ to come up with a solution that is acceptable to the AHJ whose job it is, ultimately, to enforce the requirements of the standard.