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

TechNotes

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Best of January 2020

Following are a dozen questions answered by the engineering staff as part of the NFSA's Expert of the Day (EOD) member assistance program during the month of January 2020. This information is being brought forward as the "Best of January 2020." 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 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 - Class III Standpipes

What is the minimum design pressure required in NFPA 14-2010 for a Class III standpipe in a ten-story building protected by an automatic sprinkler system utilizing both a 2-1/2 in. hose connection and 1-1/2 in. hose station?

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February 18, 2020

2019 NFPA 14, Standard for the Installation of Standpipe and Hose Systems Updates

Presented by Terin Hopkins, Public Fire Protection Specialist

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Answer: A Class III standpipe shall be designed to meet both the requirements of the 2½ in. (Class I) 100psi residual pressure and that of the 1½ in. reducer (class II) of 65psi residual pressure at the outlet of the connection. Therefore, the design pressure minimum would be 100psi, satisfying both requirements per NFPA 14-2010 Section 7.8:

> ***7.8 Minimum and Maximum Pressure Limits***
>
> ***7.8.1 Minimum Design Pressure for Hydraulically Designed Systems.*** *Hydraulically designed standpipe systems shall be designed to provide the water flow rate required by Section 7.10 at a minimum residual pressure of 100 psi (6.9 bar) at the hydraulically most remote 2½ in. (65mm) hose connection and 65 psi (4.5 bar) at the outlet of the hydraulically most remote 1½ in. (40 mm) hose connection.*

It should also be noted that the AHJ may permit the hose station to be omitted in lieu of a 2 ½ in. x 1 ½ in. reducer & cap installed on the 2-1/2 in. outlet:

> ***5.3.3.2*** *Where a building is protected throughout by an approved automatic sprinkler system, Class II hose stations for the use by trained personnel shall not be required , subject to the approval of the AHJ, provided that each Class I hose connection is 2 ½ in. and is equipped with a 2 ½ in. x 1 ½ in. reducer and a cap attached with a chain.*

Question #2 - Residential Booster Pumps

Is a residential booster pump installed in a garage as part of an NFPA 13D system required to be installed 18 in. above the finished floor per the 2018 IRC Section M1307.3, G2408.2, G2408.2.1, or UPC 507.3?

Answer: The answer to your question is "no." While it is true that Section M1307.3 of the IRC states, "Appliances having an ignition source shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor in garages," Section M1307.3 would not apply to a pump motor due to the scoping language in 2018 IRC Section M1201.1. This section states, "The provisions of Chapters 12 through 24 shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and used to control environmental conditions within buildings." Basically, these chapters are discussing the heating and cooling equipment of the house.

A pump motor for a sprinkler system does not control

the environmental conditions within a building, thus is not subject to the requirements of Chapter 13, Section M1307.1. As stated in this scoping language, Chapter 12 through Chapter 24 are in reference to mechanical equipment controlling environmental conditions and would not apply to the residential sprinklers system components such as the booster pump.

Also, Sections G2408.2, G2408.2.1, UPC 507.3 were used as evidence to enforce the elevating of the pump. However, G2401.1 states that the applicability of Chapter 24 only applies to, "fuel gas piping systems, fuel-gas appliances and related accessories, venting systems and combustion air configurations." Additionally, Chapter 5 of the UPC only applies to water heaters. Therefore, Chapter 24 of the IRC and Chapter 5 of the UPC, would not apply to electric fire pumps either.

Question #3 - Antifreeze Loops and Backflow Prevention

The NFPA 13-2010 Handbook discusses that there are concerns regarding the additional elevation and possible dilution to the antifreeze solution based on the migration of the water into a second floor antifreeze piping. Is there any documentation that supports the requirement for a backflow device versus continuing with the traditional antifreeze loop?

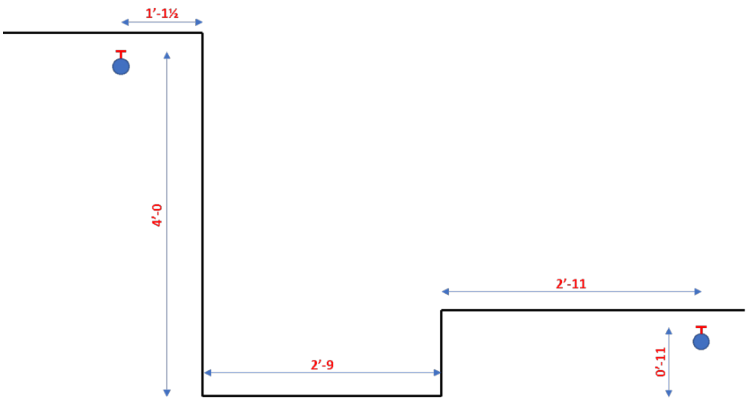
Answer: The use of a backflow preventor versus a loop is at the discretion of the designer as long as the requirements of NFPA 13-2010 and issued TIA's are met.

Per NFPA 13-2010 a backflow preventor would not be required when the requirements of Section 7.6.3.1 and Figure 7.6.3.1 are met.

As explained in the annex note to Section 7.6.3.1, antifreeze solutions have a higher density than water and the installation of the loop will ensure that water does not diffuse into the unheated space. Because the level of the sprinklers is above the antifreeze loop, a check valve with a 1/32 in. hole would need to be installed at the bottom of the loop.

Question #4 - ESFR Sprinkler Obstructions

Per the sketch below, can a project utilizing ESFR sprinklers omit the sprinkler below the 2 ft. 9 in. soffit if sprinklers are located on either side of the obstruction per NFPA 13-2016 sections 8.8.5.1.2(2) and 8.8.5.2.1.4?



Answer: The answer to your question is "yes." Sprinklers may be omitted below the lower soffit if sprinklers are located on either side of this obstruction per NFPA 13-2016 sections 8.8.5.1.2(2) and 8.8.5.2.1.4, and the spacing between the two sprinklers does not exceed the maximum allowable distance per NFPA 13-2016. The fact that that the distance from the sprinkler deflector on one side exceeds 18 inches does not change this allowance. The sections referenced in Chapter 8 do not contain any language limiting the distance from the bottom of the soffit to the sprinkler deflector at the upper ceiling.

In further support of this concept, refer to Figure 8.8.5.1.2(c) which is, in essence, half of the situation described. Figure 8.8.5.1.2(c) does not have an 18-inch limitation from the bottom of the soffit to the sprinkler deflector at the upper ceiling, and this concept should apply to this situation.

Question #5 - Pressure Relief Valves

Why would it be better to use pressure reducing valves or pressure regulating valves instead of pressure relief valves for systems with working pressures in excess of 175 psi?

Answer: Prior to 1999, pressure relief valves were commonly used in systems with pumps to protect against overpressure, but several factors caused the NFPA 20 Committee to rethink this requirement. First, NFPA 20 was changed to allow pump manufacturers to produce split case horizontal pumps that produced up to 140 percent of their rated pressure at churn, instead of the prior 120 percent. This resulted in higher churn pressures for listed pumps. At around the same time, and mainly as a result of the One Meridian fire in Philadelphia, a study of standpipe practices led the NFPA 14 committee to increase the minimum pressure at the top of a standpipe to 100 psi instead of the prior 65 psi. And finally, certain new technology sprinklers created the demand for higher pressures and flows.

The end result of these factors was that more systems

with pumps were being designed with reliance on pressure relief valves, such that the overpressure would be controlled through a large waste of water.

The rules of NFPA 20 were changed to require that pumps be sized such that the maximum static supply pressure plus maximum churn pressure did not exceed the working pressure of downstream components, adjusted for elevation (Section 4.7.7.1 in NFPA 20-2016 and -2019). This created a greater need for pressure-reducing valves and pressure control valves.

Additionally, Section 4.7.7.2, immediately following that requirement, rules out the use of pressure relief valves for this purpose and Section 4.19.1.1 in the 2016 edition and 4.20.1.1 in the 2019 edition state that pressure relief valves can be used only where specifically permitted by the standard.

The subsections that follow that section still require relief valves for diesel pumps where 121 percent of churn pressure plus the static supply pressure, adjusted for elevation, exceeds the rating of components, but do not void the requirement of Section 4.7.7.1. NFPA 20 also calls for the use of pressure relief valves for variable speed pumps under some conditions.

Question #6 - Exposed CPVC

Can exposed CPVC pipe be installed without sprinklers through a closet meeting the conditions of NFPA 13R, or would sprinklers be required to protect the exposed CPVC pipe?

Answer: The CPVCmay be run exposed in the closet where sprinklers are permitted to be omitted and not installed. From the time that nonmetallic piping was first listed for use in sprinkler systems (prior to any listings for exposed nonmetallic piping) Underwriters Laboratories took the position that such piping needed to be protected from the fire until it was backed within a space not required to be protected with sprinklers. This is the basis by which CPVC and other nonmetallic piping can be placed within nonsprinklered joist channels.

Question #7 - Small Room Rule

Can one standard spray sprinkler protect a room less than 225 sq. ft if the dimensions are 16 ft-10 in x 11 ft 10 in.?

Answer: The answer to your question is "no." With the sprinkler placed the maximum 9 ft from one wall as allowed under the rule, the distance from the opposite wall would be 7 ft 10 in., exceeding the maximum 7 ft 6 in. that represents half the normal allowable distance

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between sprinklers. The extra distance is permitted only for a single wall.

The rule was intended to accommodate avoidance of center-of-room obstructions, commonly light fixtures, and was not intended to indicate that sprinklers can generally be used beyond their listed capabilities.

Question #8 - FM Global vs. NFPA

In a situation where the FM data sheets are less stringent than NFPA 13 requirements, can just the FM Data Sheets be followed?

Answer: While FM criteria is typically more stringent, the design scheme provided by FM could be accepted over NFPA as long as the Authority Having Jurisdiction recognizes the FM Data Sheets as being equivalent to the NFPA standards or an "alternate arrangement" to the NFPA standards under Sections 1.5 or 1.6 of NFPA 13 (similar sections in other NFPA standards) the use of the FM criteria would be acceptable.

It really just comes down to whether the local AHJ agrees that the FM Data Sheets have the same overall goals and objectives (or higher). Many AHJ's do agree with this and allow the FM Data Sheets to be used instead of the NFPA prescriptive requirements. But we can't speak for all of them. What we do usually warn people about with these discussions is that if you are going to go down this road, you have to use the FM Data Sheets in their entirety. You can't pick a few rules out of the FM Data Sheets and then use NFPA standards for the rest.

Question #9 - Panel Construction

A structure consists of I-Beams supporting a corrugated metal roof deck resulting in gaps between the top of the beam and the roof deck. Do these gaps disqualify this construction from being considered panel construction?

Answer: The answer to your question is "yes." The advantage of panel construction is that panel construction (300 sq. ft maximum) is capable of trapping heat and thus sprinklers located per the obstructed construction criteria (sprinkler deflectors installed up to 22 inches below the ceiling deck) will activated in a timely manner. Unfilled penetrations such as you have indicated may compromise this heat trapping capability and would not generally be allowed in panel construction.

In order to consider this ceiling configuration as panel construction these gaps could be filled. Another possibility is that an engineer could prove to the AHJ that the gaps would not compromise the heat trapping

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capability of this construction, it is possible that this could be considered panel construction.

Question #10 - Storage Exceeding 10 ft Clearance

If the storage level to ceiling distance exceeds 10 feet (due to warehouses not always being full), can NPFA 13-2016 Figure 17.2.1.2(b) Note 2 still be utilized, or would a level of in rack sprinklers be required per section 12.1.3.4.5 in addition to the ceiling sprinklers?

Answer: For storage with a clearance in excess of 10 ft., the system would have to be designed to protect a storage height that correlates to 10 ft clearance or one level of in-rack sprinklers must be provided beneath the top tier of storage in accordance with NFPA 13-2016 section 12.1.3.4.5.

> ***12.1.3.4.5*** *Where the clearance to ceiling exceeds 10 ft for section 16.3 or section 17.2, protection shall be based upon the storage height that would result in a clearance to ceiling of 10 ft or providing one level of supplemental, quick-response in-rack sprinklers located directly below the top tier of storage and at every flue space intersection*

In this case, the density provided by Figure 17.2.1.2.1(b) would be appropriate for all storage of Group A plastics stored per section 17.2.1.2.1 up to 15 ft. The design density used should be the one prescribed by this figure (0.60 gpm/ft2 over 2,000 sq. ft) with the additional installation restrictions for extra hazard occupancies followed.

Question #11 - Surface Rust

Many sprinkler systems are installed prior to conditioned air being fully functional in a building. Is there cause for concern if surface rust develops on the steel pipe and cast-iron fittings over time before the building is closed in?

Answer: The answer to your question is "no." Any steel or iron components exposed to air having greater than 60% humidity (or air and water) will corrode. Corrosion rates are greater with high temperatures and higher levels of humidity. However, the corrosion you described would not be of grave concern. Typically, this type of corrosion is referred to as "general" or "uniform" corrosion which is a general thinning of the material over time. This is very different from pitting or crevice corrosion which would deteriorate the metal at an accelerated rate. The observed corrosion (as described) would be more of an aesthetic issue than cause for concern about material performance or corrosion damage.

Question #12 - Flushing

Debris (stones) was recently discovered during a fire pump test and now flushing is required to clear the line. If the pump feed is 6-inch, but the lead-in to the building is 8-inch, what flushing criteria should be used?

Answer: NFPA 24-2019 Table 10.10.2.1.3 contains flushing criteria for underground piping (the same as NFPA 13-2019 Table 6.10.2.1.3) and bases its minimum flow rates on the need to achieve a velocity of 10 ft/sec within the piping. This would suggest that the criteria for the 8-inch main, 1,560 gpm, as that is where the debris would originate; however, if 150% of the rated flow of the pump exceeds 1,560 gpm, then that value should be used. Flushing the system at a higher volume than future pump tests would mitigate the risk of churning up any additional debris in the underground main.