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

TechNotes

Editor - Roland Asp, CET #517 08/08/2023

Best of July 2023

The following are a dozen questions answered by the NFSA's Codes, Standards, Public Fire Protection and Engineering staff as part of the Expert of the Day (EOD) member assistance program during July 2023. This information is being brought forward as the "Best of July 2023." If you have a question for the NFSA (National Fire Sprinkler Association) 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 (National Fire Protection Association) and ICC (International Code Council) 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 recently published edition of the standard referenced was used.

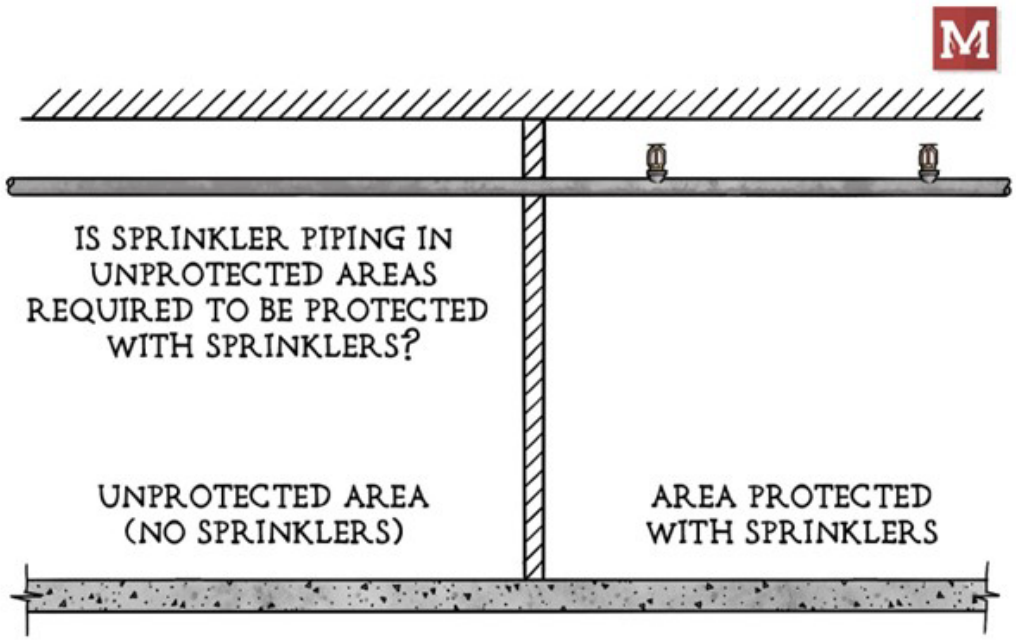
Question #1 – Main Pipe in an Unsprinklered Space

An existing unsprinklered building is being renovated and received a variance to only protect two small residential areas using the 2010 edition of NFPA 13R. The water is going to be brought into the building over 300 feet from the areas to be protected.

Are the unprotected areas that the sprinkler main be running through considered "hazardous" and are sprinklers required to protect this piping?

It depends. Section 8.16.4.3 in the 2010 edition of NFPA 13R says that private service main aboveground piping is permitted to be in a hazardous area when protected by an automatic sprinkler system. Note that this section only applies to situations where the pipe is being run through hazardous areas. If the piping passes through a "hazardous area" at any point along the unprotected area, the space needs to be protected with an automatic sprinkler system. NFPA 13 contains the same criteria, and the annex language in 13 says that any "area or a structure or building that poses a degree of hazard greater than that normal to the general occupancy of the building or structure. Those areas include flammables, toxics, noxious or corrosive materials, and heat-producing appliances."

The sprinkler piping still needs to be protected from mechanical damage, but there is no requirement to protect it from fire with sprinklers if the piping does not pass through a hazardous area. If the space does not contain sprinklers, then someone has already concluded that a fire in the space is not intended to be controlled with sprinklers. The worst-case scenario for a fire starting in this space is that it causes the main to fail and water gets discharged on the fire anyway.



Question #2 – Darcy-Weisbach and Listed Antifreeze

NFPA 13 states for antifreeze systems greater than 40 gallons, the Darcy-Weisbach Formula is required to be used. However, the new UL (Underwriters Laboratory) listed antifreeze cutsheets make it seem like the Darcy-Weisbach Formula should be used always regardless of size.

When using the newly listed antifreeze solutions, is it required to calculate using the Darcy-Weisbach method if the total capacity of the antifreeze is less than 40 gallons?

Yes. There are four listed antifreeze products currently available on the market: Tyco LFP, Tyco LFP+, Noble Eliminator 1330, and Lubrizol Freezemaster. The product sheets are nearly identical in regard to hydraulic calculations, stating the antifreeze friction loss is obtained using the Darcy-Weisbach formula regardless of system size.

NFPA 13 does have language exempting systems under 40 gallons of antifreeze. However, when the listing of the antifreeze product says to use the Darcy-Weisbach formula for friction loss, without a volume requirement, it becomes mandatory, regardless of what the installation standard allows. Therefore, the requirement to use Darcy-Weisbach for all systems is part of the UL Listing requirements. The products need to be used in accordance with the listing requirements and therefore, in this instance, override the requirements of NFPA 13

Question #3 – NFPA 13R vs NFPA 13D System Multipurpose Piping System

A fire sprinkler system is to be provided in a two-story residential building consisting of nine apartments. The facility will be designed in accordance with the 2018 International Residential Code (IRC).
Two questions have been asked which will be answered separately:

Question 3A: Can a fire code official give a waiver from a 13R system to a 13D system for the described building?

Question 3B: Are Multipurpose Piping Systems permitted in NFPA 13R?

Answer 3A: Based upon the information given, the answer is no. The building in question is a two-story residential apartment with nine – 1-bedroom apartments.
This building falls outside the scope of NFPA 13D which is limited to "one- and two-family dwellings and manufactured homes." The multi-family building described does not appear to meet this requirement.

Additionally, it was stated that this facility will be designed in accordance with 2018 International Residential Code, however, based upon the description, this building does not appear to be within the scope of the residential code (See R101.2)

The 2018 International Building Code does state in Section 903.2.8 that NFPA 13D systems are permitted in Group R-3, Group R-4, Condition 1 and in small care facilities. There is not enough information to determine if these classifications are appropriate for the building in question.

Answer 3B: No. Multipurpose systems are only found in NFPA 13D. NFPA 13R does not mention this system type and while not specifically prohibited by NFPA 13R, multipurpose systems are not contemplated by this standard. It should be noted that common domestic/fire mains are permitted as indicated in Section 9.6 of the 2016 edition of NFPA 13R.

Question #4 – 2-Hour Rated Enclosure

In a 2-hour rated room, would an extra hazard group 1 (EH1) ceiling sprinkler system provide the 2-hour rating for the roof/ceiling?

No, a sprinkler system designed to extra hazard group 1 would not be considered an alternative to a 2-hour fire resistive assembly. The building code requires fire resistive assemblies to be tested in accordance with ASTM (American Society for Testing and Materials) E119. The ASTM E119 standard specifies types of materials that make up a 1-hour, 2-hour, 3-hour, etc. fire rated assembly. For example, one layer of 5/8 inch Type X gypsum meets a 1-hour fire resistive assembly based on the ASTM E119 test.

The building code often grants a 1-hour reduction in the hourly fire resistive rating (2-hour down to 1-hour, for example) when sprinklers are present. But the presence of a fire sprinkler system designed to EH1 does not correlate to a 2-hour horizontal fire barrier (or fire wall) rating.

Question #5 – Air Testing of Deluge Systems

NFPA 25 requires deluge systems to have a full flow trip test performed annually.

Is it permissible to perform an air test in place of the wet test mandated by NFPA 13?

No, an air test is not an acceptable test in lieu of conducting a full flow trip test on deluge systems. NFPA 25 specifically requires a full flow trip test of deluge systems annually in accordance with Section 13.4.4.2.3. Section 13.4.4.2.3.1 allows for other testing methods

when there could be damage caused by water, but Section 13.4.4.2.3.3 states a full flow trip test shall not exceed 3 years.

The reason for conducting full flow trip tests of deluge systems more frequently than preaction and dry systems is because of the environments that deluge systems are typically protecting. The likelihood of debris entering the system through the open sprinklers or nozzles increases the potential for blockages.

When testing a deluge system, a gauge must be placed at the most remote nozzle or sprinkler to compare pressures with the gauge at the deluge system. This is to determine if there are blockages in the system and allows the technician to verify that the nozzles or sprinklers are properly aligned. This cannot be properly completed using only air.

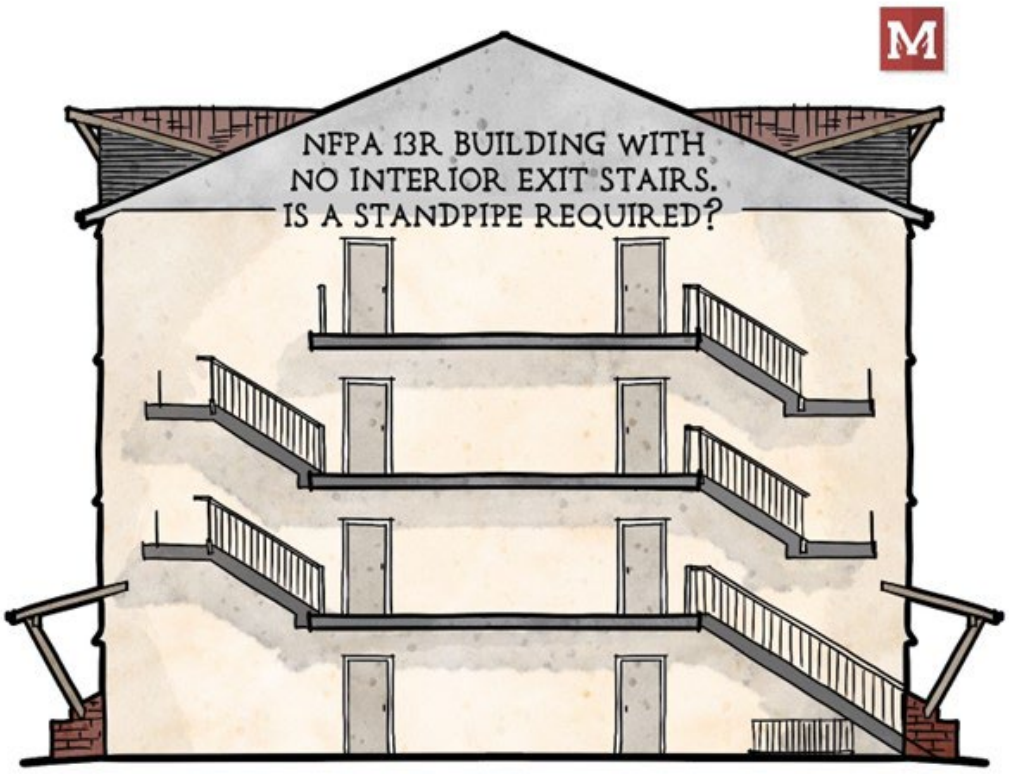
Question #6 - Standpipes for 13R Building with Only Exterior Stairs

The 2018 edition of the International Building Code (IBC) states standpipes are required for buildings that are 4 stories or more in height. IBC Section 905.4 lists the required hose valve locations for a Class 1 standpipe.

Does a NFPA 13R building with only exterior exit stairs, no interior exit stairs and no other required hose valve locations, still require a standpipe?

No. The requirement for standpipe hose connection locations comes from the International Building Code (IBC). The 2018 IBC requires standpipe hose connections in all interior exit stairways, which is a defined term in the building code. The 2018 differentiated an interior exit stairway (enclosure) from an exterior exit stairway, by definition, and only requires standpipes on interior exit stairways per Section 905.4. This change was unintentional and exists in the 2018 and 2021 IBC, with the requirement coming back for interior and exterior exit stairs in the 2024 IBC edition.

In every case, with the 2018 and 2021 editions of the IBC, the exterior stairs are exempt from hose connections but be sure to check the remainder of the section for other hose connection locations. Be sure to check for local ordinances for modifications to Section 905.4 that could require hose connections.



Question #7 – Maximum Ceiling Height

Is there a maximum ceiling height for light hazard that would allow the omission of sprinklers? Could not find a specific section in NFPA 13 or NFPA 13R.

No, there is not a maximum ceiling height or allowing sprinklers to be omitted in a light hazard occupancy. There is a 55-foot ceiling height threshold in the International Building Code (IBC) to exempt sprinklers when over 55 feet in an atrium ceiling (Section 404.3). This height is due to the maximum height in the labs that test and list sprinklers. Check the listing of the sprinklers for any height limitations.

However, the next edition of NFPA 13 may include additional requirements for high ceilings. Proposals have been submitted to the 2025 edition of NFPA 13 that would specify new requirements regarding density requirements and minimum K factors for ceilings over 30 feet in height. These proposed changes do not, however, apply to light hazard systems. As the next edition of NFPA 13 is still in the revision cycle, there are no accepted changes at this point.

Since the question does reference NFPA 13R, this standard does limit ceiling height to 24 feet for residential sprinklers in Section 7.1.1.3.1. However, quick response sprinklers are permitted in NFPA 13R when installed per NFPA 13. If the building had an atrium, and the height of the ceiling was over 55 feet, then sprinklers could be eliminated at the ceiling. The

55-foot height limitation is not applied anywhere else in the sprinkler standard or building codes.

Question #8 – Remote Controlled Valves

Domestic water systems can be equipped with a water shut-off that can be controlled remotely. Is this allowed with fire sprinkler systems?

Does NFPA 13 permit the use of remote-controlled valves?

Until the 2019 edition of NFPA 13, control valves that can be controlled from a remote location were not specifically addressed in NFPA 13. Previous editions of NFPA 13 simply required control valves to be listed and must not be closed in less than 5 seconds.

Beginning in the 2019 edition (see Section 16.9.4) and continuing in the 2022 edition (see Section 7.6.2) automated control valves were addressed. This section, along with the related subsections, states that a listed automated water control valve assembly with a reliable position indication connected to a remote supervisory station is permitted, and (Section 7.6.2.2) that the automated water control valve must be capable of being operated manually as well as automatically.

Question #9 – Deflector Distance for Obstructions with Concealed Sprinklers

When using concealed sprinklers, is the maximum deflector distance above the bottom of an obstruction taken from the ceiling (before the deflector drops) or from the bottom of the deflector (after the deflector drops)?

The deflector distances dictated by the obstruction rules are intended to ensure the spray pattern is not obstructed, therefore, the distances are based on the deflector distance in the spraying position, not when it is positioned above the concealer plate. The maximum allowable distance should be measured from the deflector without the cover plate in place.

Question #10 – Plastic Storage 2016 vs 2022 NFPA-13 standards

A warehouse that has a 35-foot ceiling and will be storing Group A exposed unexpanded plastic on floor to 20 feet in height. Based upon the 2016 and 2019 edition, an acceptable sprinkler design for this arrangement was 12 K-16.8 pendent ESFR (early suppression fast response) (12 at 52psi). However, the 2022 edition of NFPA 13 does not allow for this.

Does this mean they completed tests that show his criteria (12 at 52 K-16.8) will not work?

Yes, the 2022 edition of NFPA 13 did remove the ESFR K16.8 12 sprinklers at 52 psi criteria from Table 23.3.1 for this storage arrangement. The NFPA 13 discharge committee reason found that "...Testing at FM (Factory Mutual) Global has demonstrated that the K16.8 pendent ESFR sprinkler is not capable of protecting exposed nonexpanded Group A plastics

with a design of 12 sprinklers at 52 psi when the ceiling is more than 30 feet high. Since the K14.0 pendent ESFR sprinkler has the same design, this change also applies to it as well."

Question #11 – Monitoring of NFPA 13 Systems

Does NFPA 13 require electrical monitoring of sprinkler systems? A project only has a water motor gong, but it is in a rural area.

NFPA 13 does not require electrical supervision of sprinkler systems, but the building or life safety code does.

Monitoring or supervision consists of two main aspects of the system: Waterflow alarms and supervision of valves.

For waterflow alarms, NFPA 13 simply requires a local alarm. The referenced water motor gong would meet this requirement. Section 17.1.1 of the 2016 edition of NFPA 13 is the applicable section for this requirement.

The NFPA 13 requirements for supervision of control valve is found in Section 8.16.1.1.2. This section states that all valves serving the sprinkler system must be supervised by one of the following four methods:

1. Central Station alarm.
2. An audible signal in a constantly attended location.
3. Locked in an open position.
4. Sealed in a fenced enclosure and inspected weekly.

However, as stated above, the building and life safety codes typically have more stringent monitoring and supervision requirements than does NFPA 13 and the more stringent requirements of the building codes must be adhered with.

For example, the International Building Code (2018) in Section 903.4 requires all valves and waterflow switches be "electrically supervised by a listed fire alarm control unit".

Section 903.4.2 for alarms, requires an approved audible device on the exterior of the building. This section goes on to say: "Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system."

Question #12 – Refrigerated Areas at 38 Degrees

We have been requested to install standard wet drops through the roof of an IMP ceiling [similar to Figure A.8.4.9.1(b) - 2016 edition of NFPA 13]. The temperature inside the room will be controlled maintained at 38 degrees. The engineer of record for the project reasons that the heads should not freeze based on heat conducted from the supply piping installed in the interstitial space above the IMP ceiling.

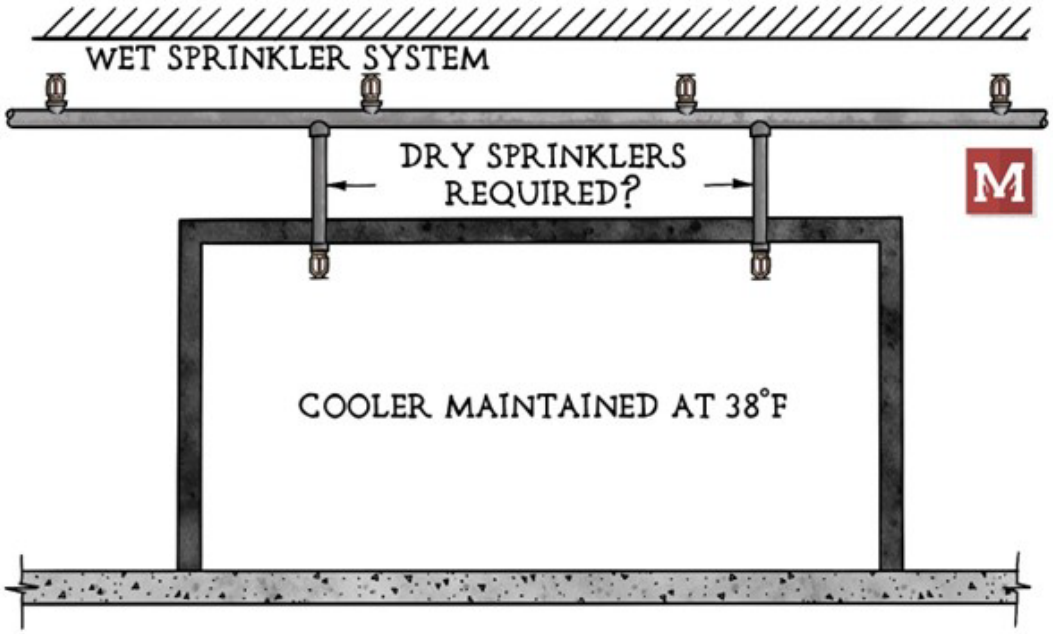
Will we technically be violating Table 8.4.9.1(a) if we install wet drops in the IMP ceilings?

No, this would not be a violation of Table 8.4.9.1(a) as the charging section (Section 8.4.9.1) starts off with the following language: "Where dry sprinklers are connected to wet pipe systems…" As dry sprinklers are not being utilized, this section would not apply.

However, Section 8.16.4.1 titled "Protection of Piping Against Freezing" must be reviewed. This section states then where the system is subject to freezing and temperatures cannot be

maintained at 40 degrees or greater, then a dry system needs to be installed (Section 8.16.4.1.1). However, this section goes on to highlight various exceptions to this requirement. In this case, Section 8.16.4.1.5 may be applicable. This section states that wet systems can be installed in areas less than 40 degrees F where “heat loss calculations performed by a professional engineer verify that the system will not freeze.”

If the engineer of record has performed these heat loss calculations and verified that the piping will not freeze, there is no violation of the standard. It would be prudent to get this statement in writing.



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