

## Best of February 2023

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 February 2023. This information is being brought forward as the "Best of February 2023." 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 recently published edition of the standard referenced was used.

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### Question #1 – Through vs Membrane Penetrations

**A sprinkler drop is penetrating a two-hour rated ceiling assembly consisting of metal channel sandwiched between four layers of drywall.**

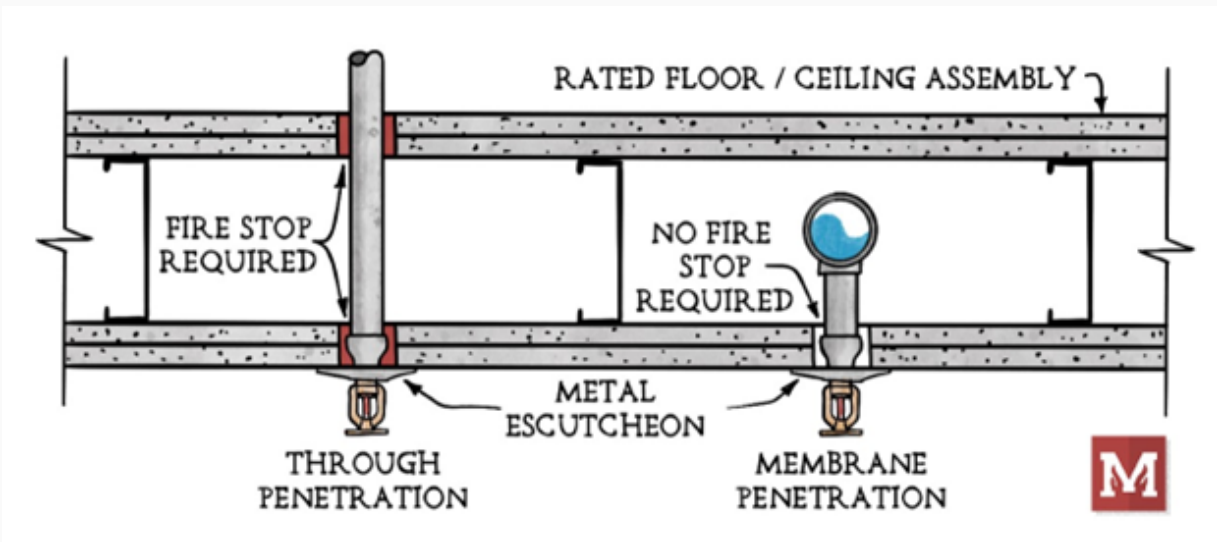
**Is it required to seal this penetration with fire stop material?**

The answer would depend upon if the penetration is considered a through penetration or a membrane penetration. The International Building Code (IBC), 2018 edition, Section 714.5 highlights the requirements for through penetrations vs. membrane penetrations as defined in Chapter 2 for horizontal assemblies such as a floor ceiling assembly.

A membrane penetration is a breach in one side of the floor-ceiling assembly and a through penetration is a breach in both sides of the floor ceiling assembly. For horizontal assemblies (floor/ceiling):

- Membrane penetrations: Section 714.5.2 provides the requirements for membrane penetrations and exception 5 allows for the annular space created by the penetration of a fire sprinkler with a metal escutcheon with no fire stopping required.

- Through penetrations: Section 714.5.1 provides the requirements for through penetrations and requires fire stopping.



## Question #2 – Mezzanine Level and Standpipe Requirement

A project consists of a three-story building where the floor level of the uppermost floor is less than 30 feet above the level of fire department access; however, there is a mezzanine present which exceeds that 30 feet threshold. This mezzanine satisfies the requirements of Section 505.2 of the 2021 edition of the *International Building Code* (IBC).

The IBC requires standpipes where the highest story exceeds 30 feet above the lowest level of fire department access.

**Is a standpipe system required as the mezzanine level is 30 feet above fire department access?**

No, the mezzanine described in your example would not trigger the requirement for a standpipe system, as it is not considered a standalone story or meet the threshold for height found in the IBC, Section 905 requiring a standpipe system.

A single mezzanine meeting the requirements of IBC Section 505, by definition is considered part of the floor below and not a separate story or an occupiable floor.

The requirement in 905.3.1 would only require a standpipe if the building is four or more stories or has an occupiable floor 30 feet above/below the level of fire department vehicle access.

The 2021 IBC defines a mezzanine as an intermediate level or levels between the floor and ceiling of any story and in accordance with Section 505.

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## **Question #3 – Two Buildings served by a Single Remote Fire Department Connection**

**A project consists of adding a building to a lot where there is an existing sprinklered building. The original building is served by an underground fire main with an existing remote fire department connection (FDC).**

**It is proposed that the new building be served with a new lead-in from the existing underground fire main and the new building will be served by the existing FDC.**

**It is understood that both NFPA 13 and NFPA 24 states that multiple systems can be served by a single FDC, however, the authority having jurisdiction (AHJ) is concerned with this arrangement, specifically due to the fact that the only way to isolate each building will be to shut down water at the fire riser within each building.**

**Is it allowed to serve two buildings with one remote FDC?**

Yes, as you have indicated both NFPA 13 and NFPA 24 permit a single fire department connection to serve fire sprinklers systems in multiple buildings. The thinking is that the sprinkler system is protecting for a single fire at a time. The standard does not anticipate protecting for multiple fires at the same time.

The 2016 edition of NFPA 13, Sections 8.17.2.4.3 - 8.17.2.4.4 makes it clear that a remote FDC can serve multiple systems. Section 8.17.2.4.3 states that for multiple systems the FDC must be connected between the supply control valves and system control valves. Section 8.17.2.4.4 goes on to state that the requirements of 8.17.2.4.3 for multiple systems does not apply where the FDC is connected to the underground piping.

As the FDC as described is to be connected to the underground, the appropriate document would be NFPA 24.

This arrangement is addressed in the 2016 edition of NFPA 24, Section 5.9, on remote fire department connections. The concept of a remote FDC serving multiple buildings is discussed in Section 5.9.5.7. This section states that where an FDC is serving multiple buildings or locations, a sign must be provided indicating what buildings are being served.

It must be noted that the use of a remote FDC is subject to the requirement or approval of the AHJ as noted in NFPA 24. Also, NFPA 13, Section 8.17.2.4.6 establishes the FDC must be located at the nearest point of fire department access or at a location approved by the AHJ.

As for the concern that “the only way to isolate each building will be to shut down water at the fire riser within each building,” there is no need to isolate an individual building when charging the FDC in a fire event of the other building. As the non-fire building sprinkler system will not be operating and is a closed system, the additional pressure from the FDC will not impact the non-fire building.

Additionally, as noted in NFPA 13, Section A.17.2.3, the purpose of the FDC on a sprinkler system is to simply supplement the pressure of the sprinkler system and not to provide any particular flow/pressure or to meet system demand.



## **Question #4 – Fire Alarm required for a NFPA 13D System**

**Is a fire alarm required when installing an NFPA 13D fire sprinkler for a one- and two-family residence?**

No, a fire alarm system is not required as part of a NFPA 13D sprinkler system. Section 7.6 in the 2016 edition of NFPA 13D does state that local waterflow alarms (which is not quite a fire alarm) are required in homes that are not equipped with smoke alarms/detectors in accordance with NFPA 13D. The annex to this section makes it clear that the local waterflow alarm mentioned in this section is not intended to be a listed fire alarm or connected to a central station or fire alarm system.

However, the residential building codes do require all homes to be equipped with smoke alarms, as does NFPA 13D. Section 4.4 of the 2016 edition of NFPA 13D specifically states that smoke alarms in accordance with NFPA 72 are required. The result of this is that since all homes are required to have smoke alarms, there are few instances where NFPA 13D requires this local alarm.

This is not to say that a local alarm or even a fire alarm is not permitted, but they are not required. As one of the intents of NFPA 13D is to keep costs reasonable, NFPA 13D does not mandate their use.

One caveat that must be noted is: It is possible that the contract or a locally adopted mandate would include a requirement for a NFPA 13D system to include a local waterflow alarm or a fire alarm.

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## **Question #5 - Area Limitations and the Total Square Footage of a 2-story Building**

**A project consists of a two-story building that has a total square footage of 56,000 square feet. The first floor is 46,000 square feet and the second floor is 10,000 square feet. The building is classified as a light hazard occupancy.**

**Can this building be protected by a single sprinkler system and are floor control valve assemblies required in accordance with the 2019 edition of NFPA 13?**

Yes, the two-story building as described can be protected by a single sprinkler system.

Section 4.5.1 titled System Protection Area Limitations reads: *“The maximum floor area on any one floor...”* protected by a single sprinkler system riser cannot exceed 52,000 square feet for a light or ordinary hazard occupancy.

By using the term “on any one floor” this section is not limiting the cumulative area of all floors but rather the maximum area of a single floor.

In the case described, no single floor exceeds 52,000 square feet and thus a single sprinkler system is permitted.

Additionally, floor control valve assemblies would not be required as Section 16.9.11.1 only requires floor control valve assemblies on multistory buildings exceeding two stories in height.

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## **Question #6 - Greenhouse Sprinklers**

**Are sprinklers required in a permanent greenhouse attached to an education occupancy?**

Yes, the greenhouse would be required to be protected with sprinklers. This is assuming the existing educational building is equipped with sprinkler protection and the greenhouse addition is not a separate building by code.

If the greenhouse is being added to the existing building, and the building is sprinkler protected, there is no exception in the International Building Code (IBC) or NFPA 13 to omit sprinkler protection from the greenhouse. NFPA 13, 2022 edition, Section 4.1.1 for the level of protection indicates a building, where protected by an automatic sprinkler system installation, shall be provided with sprinklers in all areas except where specific sections of this standard permit the omission of sprinklers. There is no exception in NFPA 13 to permit sprinklers to be omitted from a greenhouse.

If the greenhouse is constructed as a separate building, the applicable sections of the IBC Chapter 9 and Section 903 would be used to determine if automatic sprinkler protection is required.



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## **Question #7 – Idle Wood Pallet Storage - Dry Pipe System Water Delivery**

A cold dock is being protected with a dry pipe sprinkler system in accordance with the 2016 edition of NFPA 13. The water delivery time is being calculated with a listed calculation program and must meet the water delivery times listed in Table 7.2.3.6.1. This table lists the maximum calculated water delivery times for light hazard, ordinary hazard, extra hazard and high-piled storage.

There is a single rack that will be used to store a maximum of 11 feet idle wood pallets. Since this does not meet the definition of high-piled storage, what is the maximum water delivery time needed from Table 7.2.3.6.1?

The maximum water delivery time would be 40 seconds with 4 remote sprinklers open.

Table 7.2.3.6.1 lists water delivery times based on the protection criteria provided, and the delivery time gets shorter as the hazard increases.

It is true that idle pallet storage 12 feet high does not meet the definition of high-piled storage, which is defined as storage in excess of 12 feet high; however, the criteria for idle pallet storage is within the general storage requirements.

In addition, the storage of idle pallets poses a significant risk, and produces high heat and fast flame spread in a fire event. The design criteria for pallet storage in some arrangements result in a higher flow than most high-piled commodity storage arrangements including Group A plastics. With this in mind the delivery time for idle pallet must meet the requirements for high-piled storage at minimum.

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## **Question #8 – Minimum Required Discharge for Small Buildings**

**A project consists of an 800 square foot stand-alone building with non-rated wall construction and is being equipped with an extra hazard sprinkler system in accordance with the 2022 edition of NFPA 13.**

**The requirements of 28.2.4.2.4 and 28.2.4.2.5 make sense for a small area of higher hazard occupancy located within a larger lower hazard building. The high hazard occupancy could be expanded in the future, and the extra flow allows for future system modifications. However, when applied to a small area building with a high hazard occupancy, the application of 28.2.4.2.5 causes a significant impact in the hydraulics.**

**Is the additional flow from Section 28.2.4.2.5 required in the hydraulic calculations for this small standalone building?**

Based upon the language of NFPA 13, there are two possible paths to avoid adding the additional flow required by 28.2.4.2.5. This additional flow is often called phantom flow.

Using the density area method, use the provisions of 28.2.4.2.4 to calculate only the sprinklers in the available design area (in this case all sprinklers within the 800 square foot building.) Next, you would need to get agreement from the authority having jurisdiction (AHJ) that the provisions of the next Section 28.2.4.2.5 do not need to be applied to this circumstance as the building is small and there is no additional area that would require an additional sprinkler flow to be added. These are separate sections, and it should be noted that during the first draft for the development of the 2025 edition of the standard, the existing annex note A.28.2.4.2.4 (which described the method for adding the flow required by 28.2.4.2.5) was relocated to A.28.2.4.2.5 (See FR- 1254), this preliminary action indicates that the committee believes that these are separate ideas and may bolster your case when discussing with the AHJ. Based upon the wording of these sections, this may be a tough sell. It should be noted that if the building and the sprinkler system are added to in the future, permits would need to be obtained and proof that the sprinkler system is hydraulically capable of protecting the added area.

The second method would be to apply the room design method. As 28.2.4.2.5 is in the Density/Area method section it would not apply to the room design method. Although it was noted that the stand-alone building has non-rated wall construction, the room design method does not require

exterior walls to have a fire resistance rating. Section 19.2.3.3.4 requires “all interior walls enclosing the room shall have a fire resistance rating equal to the water supply duration.”

There is no requirement for the exterior walls to have any rating and the charging statement for the room design method found in Section 19.2.3.3.1 would be met. This section reads:

The water supply requirements for sprinklers only shall be based upon the room that creates the greatest demand.

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## Question #9 – Testing After Replacing Sprinkler Due to Fire

**A fire occurred in an existing sprinklered building and 10 sprinklers activated and need to be replaced. After replacing the sprinklers at what pressure does the sprinkler system need to be tested?**

System working pressure. This is based upon language found in NFPA 25, 2020 edition. Table 5.5.1 titled *Summary of Component Action Requirements* states that when replacing “Sprinklers, regardless of number” the required action is “Inspect for leaks at system working pressure.” This table also states that if the pipe and fittings are repaired or replaced and 20 or less sprinklers are affected, then the piping systems need to be inspected for leaks at system working pressure. If more than 20 sprinklers are affected, then a hydrostatic test in accordance with NFPA 13 needs to be performed.

This concept is supported by Section 29.7 of the 2019 edition of NFPA 13. Although this section deals more with modifications to existing systems (and the piping) and not specifically on replacement of sprinklers, this section states:

- 29.7.1 – Modification to existing piping systems test at: System working pressure
- 29.7.2 – When more than 20 sprinklers are affected test at: 200 psi for 2 hours (As this project states 10 sprinklers – this section would not apply)
- 29.7.3 – When modifications cannot be isolated, test at: System working pressure (when simply replacing sprinklers on an existing system, the sprinklers cannot be isolated so this section would apply)

It should also be noted that NFPA 25 (2020) in annex Section A.5.2 does give suggestion to dealing with post-fire situations. This annex section suggests:

- Inspect all sprinklers in fire area.
- Small fire (controlled by one or two sprinklers): Replacing just the activated sprinkler may be adequate.
- Soot covered sprinklers should be replaced.



- Substantial fire: Consideration should be given to replacing the first ring of sprinklers surrounding two operated sprinklers as the heat from the fire could have weakened the response mechanism.

It must also be noted that the annex section is not part of the requirements of the standard and due consideration of the site-specific conditions must be considered.



## Question #10 – Vertical Openings

**A fully sprinklered building includes an opening that connects the 1st and 2nd floor only. The 2015 edition of the International Building Code (IBC) in Section 712.9 appears to allow this two-story opening without an enclosure.**

**Are closely spaced sprinklers and draft stops required in accordance with Section 8.15.4 of the 2013 edition of NFPA 13?**

No, as stated in Section 8.15.4.1 closely spaced sprinklers and draft stops are required for unenclosed openings where “sprinkler protection is serving as the alternative to enclosure of the vertical opening.” As this opening is not required to be enclosed per Section 719.1.9 the provisions of Section 8.15.4.1 would not be applicable.

## Question #11 – Non-Combustible Canopy with Combustible Finish

**A 6 foot wide exterior canopy is structurally constructed of non-combustible materials. However, the face of the bottom side of the canopy has a non-structural tongue and groove cedar finish that is 3/4 inch in depth.**

**As Section 8.15.7.2 of the 2010 edition of NFPA 13 states that sprinklers may be omitted from exterior projections constructed of materials that are noncombustible, can sprinklers be omitted from under this canopy?**

No, sprinklers cannot be omitted below the canopy described.

Section 8.15.7.2 in the 2010 edition of NFPA 13 specifically states sprinklers shall be permitted to be omitted where the canopies, roofs, porte-cocheres, balconies, decks, or similar projections are constructed with materials that are non-combustible, limited-combustible, or fire retardant-treated

wood as defined in NFPA 703, *Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials*.

The requirement for noncombustible materials does not only apply to the structural members, it also applies to the canopy finish.

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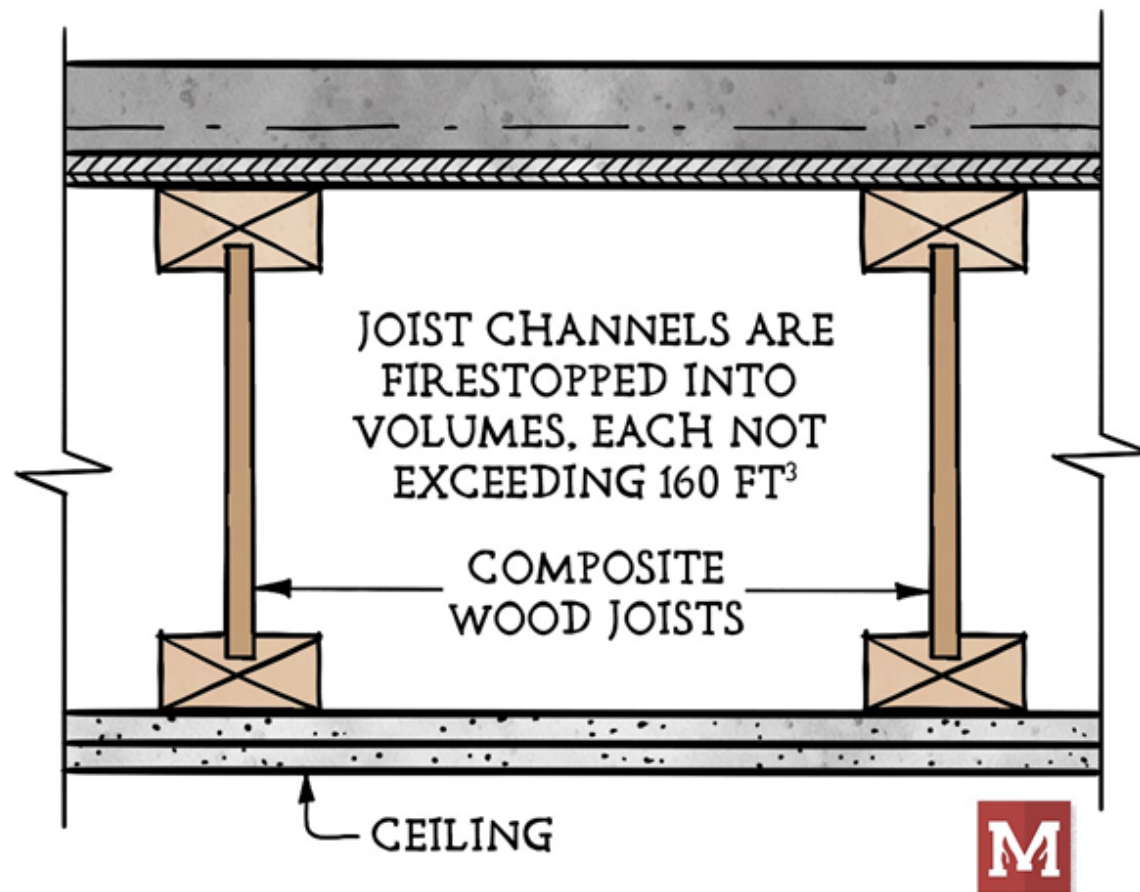
## **Question #12 – Concealed Space with Composite Wood Joists**

**The 2016 edition of NFPA 13 in Section 8.15.1.2.6 allows sprinklers to be omitted from concealed spaces consisting of composite wood joists with a gypsum board ceiling directly attached as long as the joist channels are fire stopped into 160 cubic foot volumes.**

**Is the firestopping mentioned required to be installed perpendicular to the composite wood joists or are the composite wood joists required to be encompassed or “sheathed” in order to omit sprinklers?**

In order to omit sprinkler protection in accordance with Section 8.15.1.2.6, the joist channels need to be fire stopped with materials equivalent to the web construction of the composite wood joist. This means the material would be installed perpendicular to the joist to limit fire spread through the joist channel. In order to apply this section, there is no need to sheath the entire composite wood joist. This is made clear by the requirement to use a “material equivalent to the web construction.

Also note that if the ceiling is installed using metal channels (1 inch max), 3 ½ inch batt insulation needs to be installed at the bottom of the joist panels.



As stated, the requirements of 8.15.1.2.6 are only specific to whether sprinklers can be omitted from a combustibile concealed space. Section 11.2.3.1.5 must also be considered. This section requires the adjacent area of sprinkler operation to be 3,000 square feet unless one of the exceptions found in 11.2.3.1.5.2 are met.

Section 11.2.3.1.5 has nothing to do with sprinklers being permitted to be omitted but rather to compensate for a potentially larger fire that may originate in an unprotected space. If a fire is not contained in the unprotected space, a larger design area is mandated to compensate for the larger fire when it does break through to a sprinklered area.

In order to avoid increasing the design area, the conditions are more stringent. Section 11.2.3.1.5.2(10) is specific that the composite wood joist construction is specific that “adjacent joist channels” need to be fire stopped into volumes not exceeding 160 cubic feet using materials equivalent to 1/2 inch gypsum board.

This differs then the requirements of 8.15.1.2.6 in two ways:

1. 8.15.1.2.6 requires the firestop materials to be equivalent to the web construction while 11.2.3.1.5.2(10) requires the firestop materials to be equivalent to 1/2 inch gypsum board.

2. 8.15.1.2.6 requires each individual joist channels to be fire stopped into volumns of 160 cubic feet while 11.2.3.1.5.2(10) requires “adjacent joist channels” to be fire stopped into 160 cubic feet volumes which may require the fire stopping to be installed between joist channels.



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