

Best of September 2021

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 2021. This information is being brought forward as the "Best of September 2021." 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 – In-Rack Sprinklers – Quick Response or Standard Response

A project includes solid racks that require in-rack sprinklers with an ESFR system at the ceiling installed in accordance with the 2016 edition of NFPA 13.

Are the in-rack sprinklers required to be quick response or are standard response sprinklers acceptable?

The in-rack sprinklers with an ESFR ceiling design are required to be quick response unless a specific design criteria is being used that permits the use of standard response in-rack sprinklers.

NFPA 13, 2016 edition, Section 8.3.3 titled Thermal Sensitivity provides the general requirements. Section 8.3.3.2 states that where quick-response sprinklers are installed, all sprinklers within a compartment shall be quick-response unless otherwise permitted in 8.3.3.3, 8.3.3.4, or 8.3.3.5. However, Section 8.3.3.4 indicates the provisions of 8.3.3.2 shall not apply to in-rack sprinklers.

In the case of in-rack sprinklers, the requirements including the thermal sensitivity are provided with the selected design approach in storage chapters (Chapter 12-21.) This decision would be dependent on the commodity classification, storage arrangement, and type of protection (CMDA, CMSA, ESFR) selected.

As an example, if the project consists of rack storage of plastic commodities up and including 25 ft. in height with ESFR ceiling protection, Section 17.2.3.4.2 requires the in-rack sprinklers be K-8.0 or K-11.2 quick-response, ordinary-temperature sprinklers. The handbook commentary on this section goes on to indicate the only time in rack sprinklers are required to be quick response is when the ceiling sprinklers are ESFR. Where ESFR sprinklers are at the ceiling, the in-rack sprinklers should have a comparable sensitivity so that fire control by the in-rack sprinklers begins before ESFR sprinklers remote from the fire activate.

If project consists of rack storage of plastic commodities over 25 ft. in height with ESFR ceiling protection, Section 17.3.3.1.1.1 requires where solid shelves are used, in-rack sprinklers shall be installed in every level below the highest solid shelf. Section 17.3.3.4 goes on to indicate where required by Table 17.3.3.1, one level of K-8.0 or K-11.2 quick-response, ordinary-temperature in-rack sprinklers shall be installed at the tier level closest to but not exceeding one-half of the maximum storage height.

Sections 16.2.3.6 and 16.3.3 for in-rack sprinklers requirements for rack storage of Class I through Class IV commodities where ESFR sprinklers are being used at the ceiling provide the same requirement for in-rack sprinklers to be quick response.

Question #2 – Private yard mains

A project consists of a large building that is to be equipped with an ESFR fire sprinkler system. There is a 12-inch underground service from the city water main which will feed a fire pump within the building. The fire pump, in turn, will feed a 12-inch underground loop. This yard loop will feed both the sprinkler lead-ins and private fire hydrants. See Figure below.

Is this arrangement acceptable?

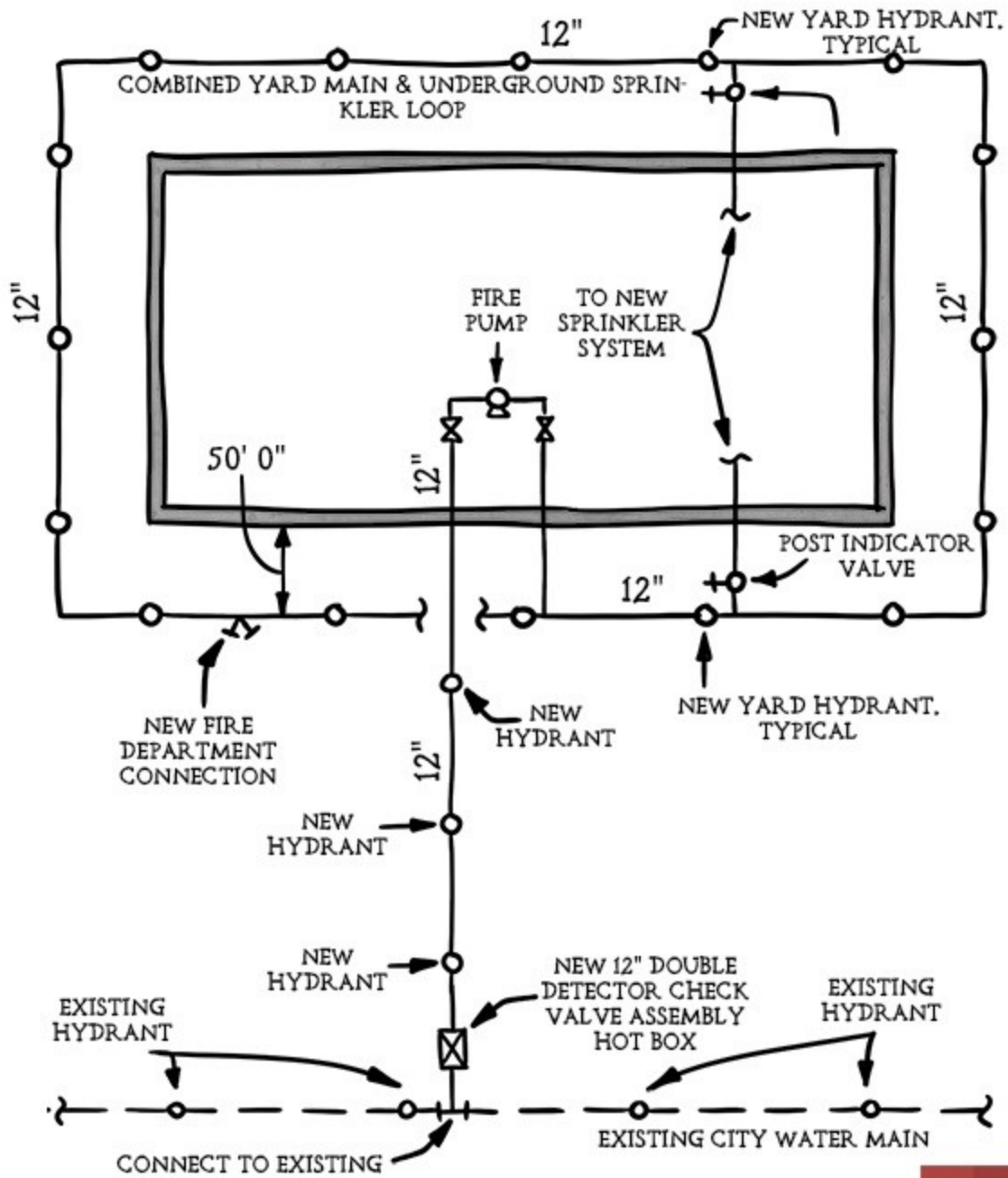
Yes, the applicable standard for this private fire main would be NFPA 24, Standard for the installation of Private Fire Service Mains and Their Appurtenances. NFPA 24 allows the underground loop to be fed from a fire pump. This is made clear in Section 5.6 of the 2022 edition of NFPA 24 (identical language in earlier editions) which states that fire pump units installed in accordance with NFPA 20 shall be considered an acceptable water source. The annex to this Section (A.5.6) makes clear that the arrangement described is acceptable. This annex to this section states that a fire pump and suction supply “makes an acceptable supply” as long as it is of

adequate capacity, reliability and is properly located.

The piping being on the discharge side of the fire pump must be rated for the pressures they will experience.

Additionally, sectional valves in accordance with Section 6.6 must be provided. This section states that sectional valves must be provided so that the number of fire protection connections between sectional valves does not exceed six. As noted in annex Section A.6.6.1, this requirement is to limit the number of connections that would be impaired due to a pipe break or during repairs to the system. This annex note also defines fire protection connections as “sprinkler system lead-ins, hydrants, or other fire protection connections.”

It should be noted that there was a change to this section (6.6.1) in the 2022 edition which limits this requirement to looped systems only. Previous editions did not specify that this requirement was limited to looped systems. However, regardless of which edition is being enforced, the requirement for sectional valves for this project would apply.



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Question #3 – Paint Booth with exterior exhaust

Sprinklers are being installed in a paint spray booth in accordance with the 2013 edition of NFPA 13. The exhaust duct from the booth runs up the exterior of the building.

Is it required to provide protection for the exterior portion of the exhaust duct?

Yes, sprinkler protection is required in the exhaust duct and this requirement includes the exterior portions of the duct.

The 2011 edition of NFPA 33 (which is referenced by the 2013 edition of NFPA 13), in Section 9.1 states that spray areas shall be protected with an approved automatic fire protection system. This section specifically states that the spray area includes “any associated exhaust plenums and exhaust ductwork.”

The spray area is defined by NFPA 33, in Section 3.3.2.3 which states that a spray area includes:

1. Areas in direct path of spray application process
2. Interior of the spray booth
3. Interior of exhaust plenum
4. Interior of exhaust duct
5. Interior of the air recirculation filter
6. Solvent recovery or concentration unit

This definition goes on to highlight areas that are not part of the spray area (and would not require protection). These areas include:

1. Fresh air make-up units
2. Air supply ducts and plenums
3. Re-circulation air supply ducts that are downstream of secondary filters
4. Exhaust ducts from solvent concentrator units.

Based upon this definition, the exhaust duct is part of the spray area and sprinkler protection is required. NFPA 33 does not state that exhaust ducts at the exterior of a building are excluded.

The 2011 edition of NFPA 33 in Section 9.4.6 states that sprinklers protecting ducts or stacks “shall be spaced no more than 12 ft apart”.

In the 2011 edition there was no difference in sprinkler spacing between vertical and horizontal ducts; however, this section was revised in the 2016 edition. Section 9.4.6(1) in the 2016 edition indicates that “one sprinkler shall be located at the top of each vertical riser and at the midpoint of each riser.” Additional heads shall be spaced on 7.3 m (24 ft) centers if the rise is greater than 7.3 m (24 ft). Section 9.4.6 (2) states that in the horizontal portion of the ducts, the sprinklers are required to be spaced at 12 ft on center beginning no more than 6 ft from the duct entrance.

Question #4 – Cloud ceilings and hydraulic calculations

A project includes cloud ceilings; however, sprinklers are required to be installed both

above and below the ceiling clouds as the clouds do not meet the requirements to omit sprinklers above in accordance with 8.15.24.1 of the 2016 edition of NFPA 13.

When determining the hydraulically remote area, is the calculation required to include the sprinklers above and below the clouds?

No, the sprinklers in the ceiling clouds are only installed there because the clouds are obstructions to the sprinklers above. Section 23.4.4.7.3.1 specifically allows the sprinklers under obstructions to be omitted from the ceiling sprinkler calculations. The general thought here is that the sprinklers at the higher ceiling are designed to handle the problem below. If the sprinklers under the clouds operate, they are just that much closer to the fire and therefore will help prevent a similar number of sprinklers at the ceiling from operating.

Note that, using this philosophy, the higher ceiling sprinklers must be designed taking the distance from the floor to this higher ceiling into account. So, if using quick response sprinklers to reduce the design area, the reduction must be based on the height of the higher ceiling sprinklers, not the cloud ceiling sprinklers.



Question #5 Minimum size for a combined standpipe

It appears that Section 7.6.3 of the 2013 edition of NFPA 14 requires that combined sprinkle/standpipe risers be at least 6 in. in size.

Is there an exception to use 4 in. if the standpipe calcs work hydraulically?

Yes, the standpipe pipe size can be 4 in. if the hydraulic calculations support the design when sprinklers are provided throughout the building. Section 7.6.3 allows a building that is protected throughout by a NFPA 13 or 13R system to have a minimum 4 in. standpipe pipe when hydraulically designed in accordance with Section 7.8.1.

Minimum standpipe pipe size is 4 in. as stated in Section 7.6.1, and all standpipes that are part of a combined system in partially sprinklered buildings must have a minimum 6 in. pipe as noted in Section 7.6.2.

The technical committee attempted to better address this in the 2016 edition by adding “where only a portion of the building has sprinkler protection” to Section 7.6.2 and clarifying the exception in Section 7.6.2.1, allowing the 4 in. pipe for systems hydraulically designed in accordance with Section 7.8.1. The substantiation for this public comment was that it reduces confusion on when a riser must be 6 in., and better correlates the relationship between Sections 7.6.2 and 7.6.3.

In the 2019 edition of the standard, the technical committee continued to clarify this issue by again making sub-section 7.6.2.1 a stand-alone requirement in Section 7.6.3. The committee statement justifying the change was that “AHJs still don’t believe that a standpipe can be 4 in. when the building is sprinklered throughout. Since this falls under 7.6.2.1, AHJs are not allowing the standpipe to be 4 in. even though the building is sprinklered throughout”. This change was approved by unanimous decision of the committee.

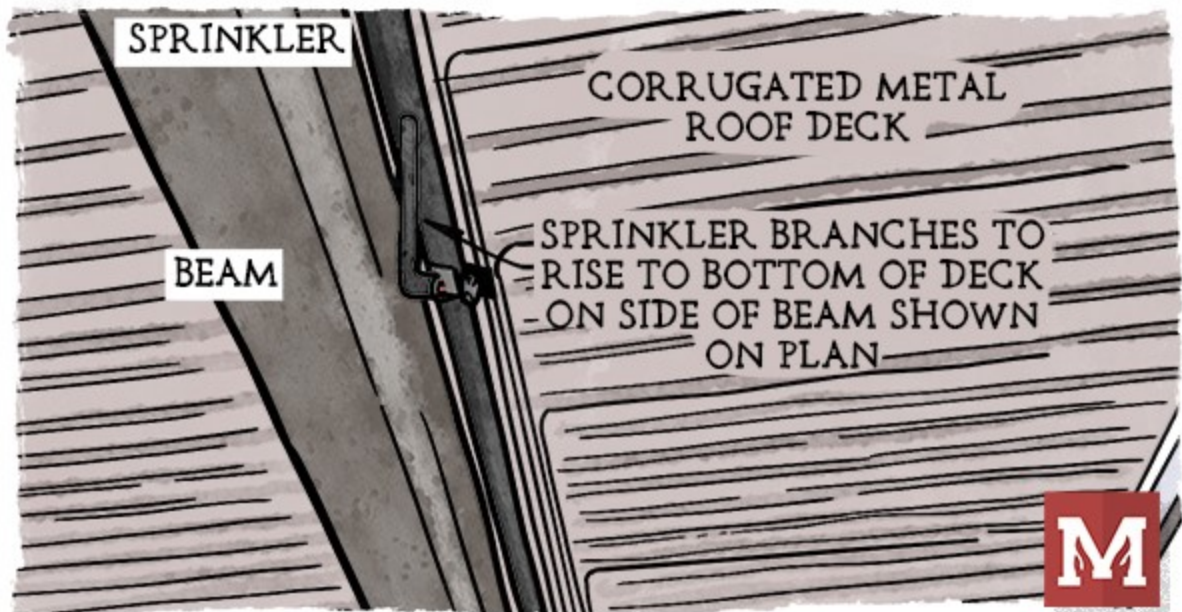
Question #6 – Sidewall sprinklers and corrugated ceilings

For aesthetic reasons, the architect is wanting to install rows of horizontal sidewall sprinklers parallel and tight to the structural beams in the new shop. The ceiling between the structural beams consists of 3 in. corrugated metal. The referenced edition of NFPA 13 is the 2016 edition.

Is the ceiling considered to be smooth flat as per the listing of the sidewall sprinkler?

Yes, the ceiling between the beams is considered smooth and flat. The 3 in. corrugations do not change the smooth designation as defined in Section 3.3.5.5 which states that a smooth ceiling is “free from significant irregularities, lumps, or indentations”. A reasonable argument can be made that corrugations up to and including 3 inches in depth should be considered smooth based on the distinction made in Section 8.5.4.1.2 regarding the measurement of deflector to ceiling distances.

This is further supported by the 2022 edition of NFPA 13. For the current edition of the standard, the definition of a smooth ceiling (section 3.3.28.4) was revised to state that a smooth ceiling is “free from significant irregularities, lumps, or indentations greater than 4 in. in depth”. Additionally, section 10.3.2.1 now states that “corrugated metal decks with channel depths up to 3 in. shall be considered as smooth ceilings.”



Question #7 – In-rack sprinkler calculations

In a warehouse project, protected in accordance with the 2013 edition of NFPA 13, there are in-rack sprinklers in a portion of the building. The most hydraulically remote area for the ceiling sprinkler does not coincide with the area with in-rack sprinklers. Section 23.8.2 states that the water demand for in-rack sprinklers must be added to the ceiling demand at the point of connection.

Is it required to provide calculations for the overhead systems most remote area without in-rack demand added (no racks below), as well as additional calculations with overhead design area adjusted to be above the most hydraulically demanding in-rack sprinklers?

Yes. The in-rack sprinkler demand is only required to be added and balanced with the ceiling sprinkler demand in the same area as the in-rack sprinklers. As the hydraulically most demanding area (remote area) in this case does not include in-rack sprinklers, the in-rack demand would not be required to be added and balanced to this ceiling demand.

However, an additional calculation would need to be performed for the area with the in-rack sprinklers. This calculation would consist of the most demanding area of the ceiling sprinkler over

the in-rack sprinklers which would be added and balanced to the in-rack demand below. This concept is described in the 2013 edition of the *Automatic Sprinkler System Handbook* in the commentary to Section 23.8.2.

Question #8 – Ceiling Pockets along a wall

There is a project that includes a ceiling pocket along a wall with a lower ceiling on one side only. This pocket meets the criteria of Section 8.6.7.2 in the 2016 edition of NFPA 13 to allow the omission of sprinklers from within the pocket.

Does this section allow sprinklers to be omitted from pockets along a wall where sprinklers are only spaced on one side?

Yes. Section 8.6.7.2 has a list of six criteria, when all six are followed, it eliminates sprinklers inside the ceiling pocket. Where ceiling pockets are along a wall, sprinklers are exempt in the pocket as long as the lower sprinkler covers the floor area under the unprotected pocket.



Question #9 – Sprinklers under obstructions

Section 8.5.5.3.1.1 in the 2016 edition of NFPA 13 allows sprinklers below obstructions to be located up to 3 in. from the outside edge of the obstruction.

Does this section apply to all sprinkler types (Standard Spray, CMSA and ESFR)?

Yes, Section 8.5.5.3.1.1 applies to all sprinkler types. This is made clear by Section 8.5.1.3 which states that Sections 8.5.2 through Section 8.5.7 applies to all sprinkler types unless Section 8.6 through Section 8.12 have more restrictive rules.

Additionally, Section 8.5.5.3.3 states that sprinklers under obstructions shall be the same as the sprinklers at the ceiling and specifically identifies spray, CMSA, ESFR, and residential except as permitted by Section 8.5.5.3.3.1 which states that spray sprinklers can be used under overhead

doors.

Question #10 – Sprinklers below obstructions in sound stages

A project includes sound stages which in accordance with Section 22.19.2.2 in the 2016 edition of NFPA 13 is being designed as extra hazard group 2. It is our interpretation, that this higher design density is to avoid sprinkler heads below temporary sets/ceilings that occurs within a studio sound stage. It has been stated that this same section can be used to avoid installing sprinklers below permanent obstructions like ductwork and catwalk over 4 ft wide.

If a soundstage is designed to an Extra Hazard Group 2 per Section 22.19.2.2, can sprinklers be omitted from below permanent obstructions like ductwork and catwalk over 4 ft wide?

No, Section 22.19.2.2 does state that the requirements of NFPA 13 prohibiting obstructions to sprinkler discharge are not applicable if the building sprinkler system meets the design criteria for Extra Hazard, Group 2. However, this alternative design criteria is provided to account for construction of props and sets that change often where it is impractical to protect all the obstructions for each change in set. This section should only be applied to obstructions that meet those criteria. The fixed obstructions provided by the structure and permanent equipment should be protected as required by Chapter 8.

This criterion was extracted from 2013 edition of NFPA 140: *Standard on Motion Picture and television Production Studio Soundstages, approved production facilities, and Production Locations*. It is recommended all protection criteria provided in NFPA 140 be reviewed, specifically Section A.4.11.1.3.1 which provides a detailed description as to why this alternative design criteria are provided.

The image is a horizontal banner. On the left, there is a black rectangle with a yellow diagonal shape and the text "POTTER ROEMER" in white, bold, sans-serif font. To the right of this is a photograph of a red fire department valve mounted on a brick wall. Further right is a yellow rectangle containing the text "75+ Years of excellence", "Premium Fire Protection Products or every environment", "Large Inventory ships fast", and "potterroemer.com" in black font.

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Question #11 – Sprinklers below “sawtooth” roof

A project includes an area 32 ft x 11 ft with a sawtooth pattern raised ceiling, sort of like a skylight. This ceiling jumps up approximately 5 ft on one side to allow vertical windows and then the ceiling slopes back down to the original 9 ft high ceiling which surrounds this area.

Since this area is over 32 sq ft, it cannot be treated like an unprotected skylight. And since it is over 36 inches tall on one side, it cannot be treated as an unprotected ceiling pocket.

In this scenario, would it be acceptable to have sidewall sprinklers approximately 4 ft-6 in down from the peak, spraying horizontally straight across this ceiling?

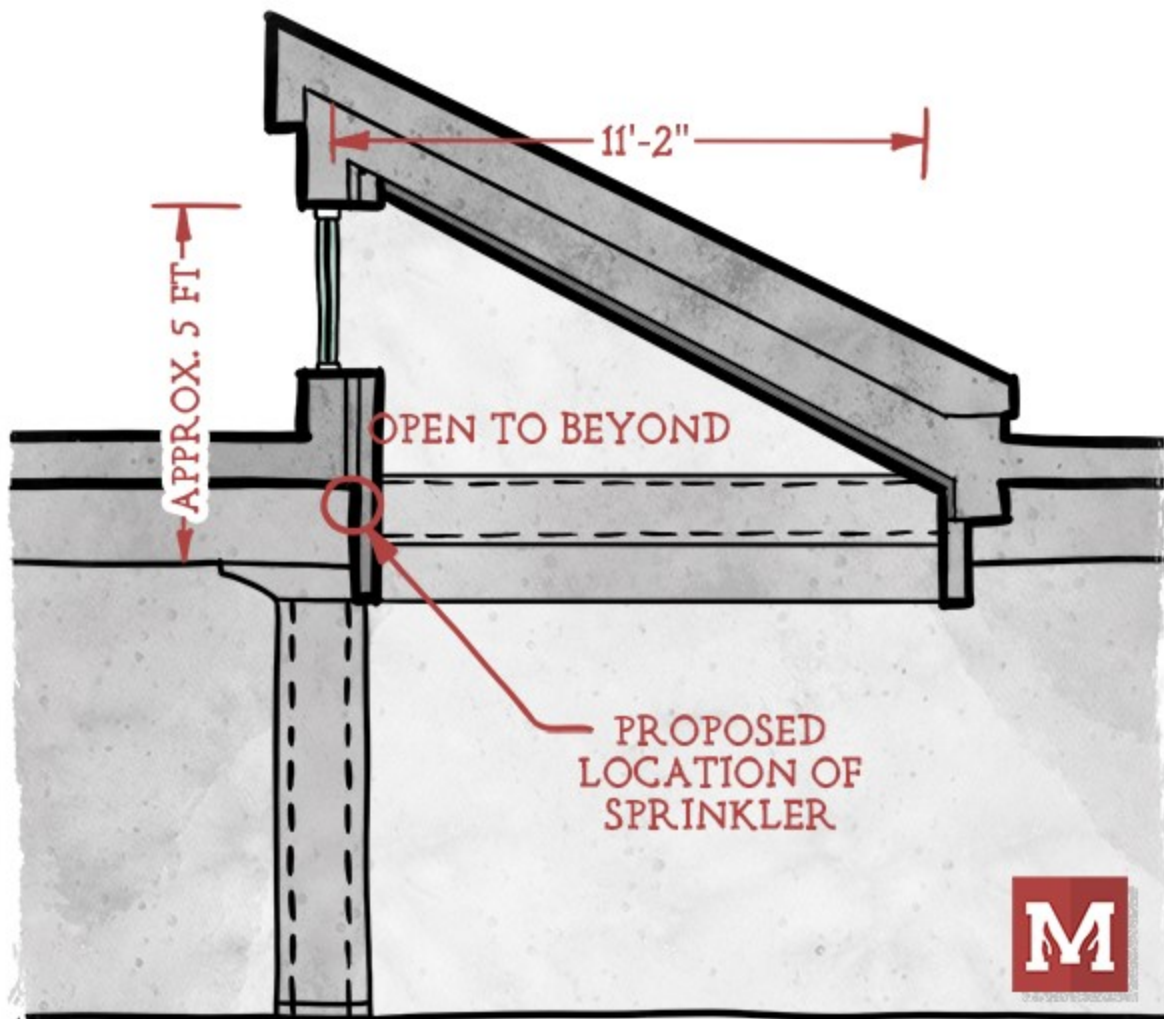
No, NFPA 13 does not have a prescriptive method that would permit a sidewall sprinkler to be installed with a deflector distance of 4 ft–6 in below the highpoint of the ceiling. As noted in section 8.7.4.1.1, sidewall sprinklers are to be installed with the deflector located no more than 6 in. below the ceiling (may be up to 18 in. when listed for such use).

Additionally, section 8.7.4.2.1 requires that the deflector be installed parallel to the ceiling. Finally, Section 8.7.4.2.2 states that for sloped ceilings (such as described) the sidewall sprinkler needs to be located at the “highpoint of the slope and positioned to discharge downward along the slope.”

You are correct that the scenario described would not permit the skylight omission (8.5.7) as the area exceeds 32 sq ft or the ceiling pocket omission rule (8.6.7) as the depth of this “pocket” exceeds 36 in.

It appears that this scenario is limited to the following options:

1. Install sprinkler(s) within this “pocket” adhering to the prescribed deflector distances. It should be noted that a pendent or upright sprinkler may be installed up to 36 inches below the high point as noted in Section 8.6.4.1.3.1 or, Section 8.6.4.1.3.2 for saw-toothed roofs.
2. Provide calculations in accordance with Section 8.1.1(6) that will demonstrate that the sprinklers installed with a greater deflector distance than prescribed, will still activate in a timely manner and perform comparable to sprinklers installed in conformance with the rules of NFPA 13.



Question #12 – New school building adjacent to existing

Can a new 17,000 sq ft autobody tech shop be built against an existing school without sprinkler protection?

No. The autobody tech shop is required to be sprinklered because it exceeds the 12,000-sf threshold whether it is considered an E occupancy (Section 903.2.3 of the 2018 edition of the IBC) or an S-1 occupancy (Section 903.2.9.1). The sprinkler requirements would follow even if the building was standalone or separated by a fire wall per IBC, Section 706. This addition to an existing building would not trigger sprinklers throughout the entire existing building, only the new addition. The requirement for sprinkler protection applies to just the fire area for E and S-1 occupancies. This means, just the addition fire area is required to be sprinklered, but there are fire area separation requirements that also need to be followed. Fire areas are separated by fire barriers (IBC, Section 707) and IBC, Section 707.3.10 requires a 2-hr. fire barrier to separate the new from the existing. With the 2-hr. fire barrier separating the new addition from the existing, it creates a fire area that the sprinkler system protects without extending into the existing building.

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Whether you use NFPA 13, NFPA 14, NFPA 20, NFPA 25, and the International Fire Code (IFC) daily or during a plan review, the EOD Handbook is a valuable resource that taps the extensive knowledge of the NFSA experts.

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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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