

## Best of August 2022

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 August 2022. This information is being brought forward as the "Best of August 2022." If you have a question for the NFSA EOD submit your question online through the "My EOD" portal.

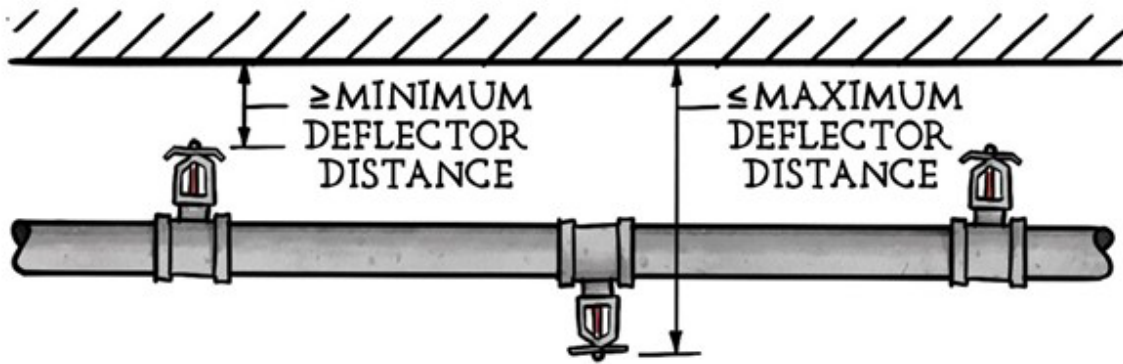
It should be noted that the following are the opinions of the NFSA Engineering, Codes, and Standards staff, generated as members of the relevant NFPA and ICC technical committees and through our general experience in writing and interpreting codes and standards. They have not been processed as formal 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.

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### Question #1 – Pendent and Upright Sprinklers on Same Branch Line

**Do all the sprinklers on a branch line need to be of the same orientation (i.e., all upright or all pendent)?**

No, there is no requirement to have all the sprinklers on a branch line in the same orientation. NFPA 13 only requires that the installation of the installed sprinklers meet the installation requirements and manufacturer's listing requirements. In this case, upright and pendent sprinklers are permitted to be installed on the same branch line as long as rules, such as deflector distance below the ceiling, are met for each sprinkler type.



## PENDENT & UPRIGHT SPRINKLERS ON SAME BRANCHLINE



### Question #2 – NFPA 13R and Standard Response Sprinklers

NFPA 13R typically requires the use of residential or quick response sprinklers. However, trash rooms are typically classified as ordinary hazard areas. There is a trash room that would be best covered by an extended coverage sprinkler.

**Can standard response sprinklers be used in the trash room of a NFPA 13R system?**

No, standard response sprinklers may not be used outside a dwelling unit in an NFPA 13R system.

NFPA 13R, 2016 edition, Section 6.2.2 for areas outside the dwelling unit, such as the common trash room, requires sprinklers be quick response, except as permitted by 6.2.2.2. Section 6.2.2.2 provides areas where residential sprinklers may be used outside the dwelling units. Item (6) in this section indicates ordinary hazard areas may use residential sprinklers in accordance with 7.2.4.1.

Section 7.2.4.1 indicates residential sprinklers are permitted to be used in ordinary hazard areas that meet the following conditions:

- The area is compartmented into 500 sq ft or less with 30-minute fire-rated construction.
- The sprinklers are spaced 130 sq ft per sprinkler.
- Openings have a lintel at least 8 in.
- The total area of openings, not including overhead garage doors that open to the exterior, does not exceed 50 sq ft for each compartment.
- Discharge densities are in accordance with NFPA 13 for ordinary hazard.

## Question #3 – Water Supply Control Valve Requirement

**Is it a requirement of the 2016 edition of NFPA 13 to have a water supply control valve at the system riser (at service entrance)?**

No, there is no requirement that the control valve be located at the building entry. Section 3.5.13 in the 2016 edition of NFPA 13 defines a system riser and states that a control valve can be located on a system riser either directly or within its supply pipe. As long as there is a primary control valve and it is accessible, it is not required that the control valve be located on the riser at the point of entry.

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## Question #4 – Open-Top Containers and Solid Piled Storage

**It is understood that Open-top containers are not permitted with ESFR sprinklers. How does the 2016 edition of NFPA 13 address open top containers that are not stored on racks and are protected with CMDA or CMSA sprinklers?**

Solid-piled storage consisting of open-top containers protected by CMDA or CMSA sprinklers would need to follow the general requirements of Chapter 14, Chapter 15 (and Chapter 12) of the 2016 edition of NFPA 13. There are no specific restrictions pertaining to open-top containers for palletized, solid piled, bin box, shelf, or back-to-back shelf storage in these chapters where protected by CMDA or CMSA sprinklers.

The concern with open-top containers (which includes the possibility of rack or flue collapse due to the collection of water in the container) is of greater concern with rack storage. This is why chapter 16 and chapter 17 both include statements that the protection of open-top container is outside the scope of these chapters. There is no similar language in chapters 14 and 15 for solid piled storage arrangements protected by CMDA or CMSA sprinklers.

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## Question #5 - Hose Stream Allowance for Special Design Areas

**It is not clear if it is required to include a hose stream allowance in systems that are calculated in accordance with Special Design Areas identified by Section 11.2.3.4 of the 2016 edition of NFPA 13.**

**As an example, if the system being calculated is a separate riser supplying a building service chute in accordance with 11.2.3.4.1, is there a hose stream allowance required to be included within the calculations?**

Yes, a hose stream allowance is required to be included for special design areas identified in NFPA 13, 2016 edition, Section 11.2.3.4.

Section 11.1.4 for design approach and water demand indicates the water demand requirements shall be determined from the following:

1. The occupancy hazard fire control approach and special design approaches found in Chapter 11.
2. The Storage design approaches found in Chapter 12 through Chapter 20.
3. The Special occupancy approaches found in Chapter 22.

Section 11.1.4.2 indicates the minimum water demand requirements for a sprinkler system is determined by adding the hose stream allowance to the water demand for sprinklers. The associated annex section explains the importance of having an adequate water supply available for fire department use. Hose stream demand is to provide the fire department with the additional water to conduct mop-up operations and final extinguishment of a fire.

Section 11.1.6 for hose allowance indicates for systems with multiple classifications, the hose stream allowance and water supply duration need to be in accordance with one of the following:

1. The water supply requirements for the highest hazard classification within the system.
2. The water supply requirements for each individual hazard classification are used in the calculations for the design area for that hazard.
3. For systems with multiple hazard classifications where the higher classification only lies within single rooms of 400 ft<sup>2</sup> or less and with no similar adjacent rooms, the water supply requirements for the primary occupancy shall be used.

In the case described, a separate riser supplying sprinklers in a building service chute in accordance with Section 11.2.3.4.1, the hose stream allowance would be included in the calculations and based upon the occupancy classification of the space the service chute serves. For example, if the service chute serves a light hazard residential occupancy, the hose allowance would be 100 gpm. While Section 11.2.3.4.1 provides special design approaches, it does not eliminate the hose allowance for the type of occupancy.

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## **Question #6 – Residential Sprinklers - Shadow Area and Soffits**

**NFPA 13 permits up to 15 sq ft. as the shadow area for residential sprinklers. However, soffits greater than 8 inches require a sprinkler below.**

**Can the “soffit rule” be ignored if the floor area below a soffit is a maximum of 15 sq ft.?**

No. The shadow area allowance for residential sprinklers is limited to “blocked” areas caused by walls and partitions and is not intended to take place of any of the existing obstruction rules. It must be noted that the 2016 edition of NFPA was referenced in this EOD request, however in 2016 edition, the shadow area concept was not in NFPA 13 but was limited to NFPA 13D and NFPA 13R. This concept was added to Chapter 12 (residential sprinklers) in the 2019 edition of NFPA 13.

The 2016 edition of NFPA 13R defined shadow areas in Section 3.3.10 as the dry floor area that is within the protection area of a sprinkler created by the portion of sprinkler discharge that is blocked by a wall or partition.

Based upon this definition, shadow areas do not apply to all obstruction but rather are limited to the area that is “obstructed” by a wall or partition.

Further the annex language to “this section specifically states that the purpose of the shadow area is *“not to replace any existing obstruction requirements. Instead, the shadow area concept has been added to the standard to provide clarity to specific situations in which walls form non-rectangular shaped rooms.”*

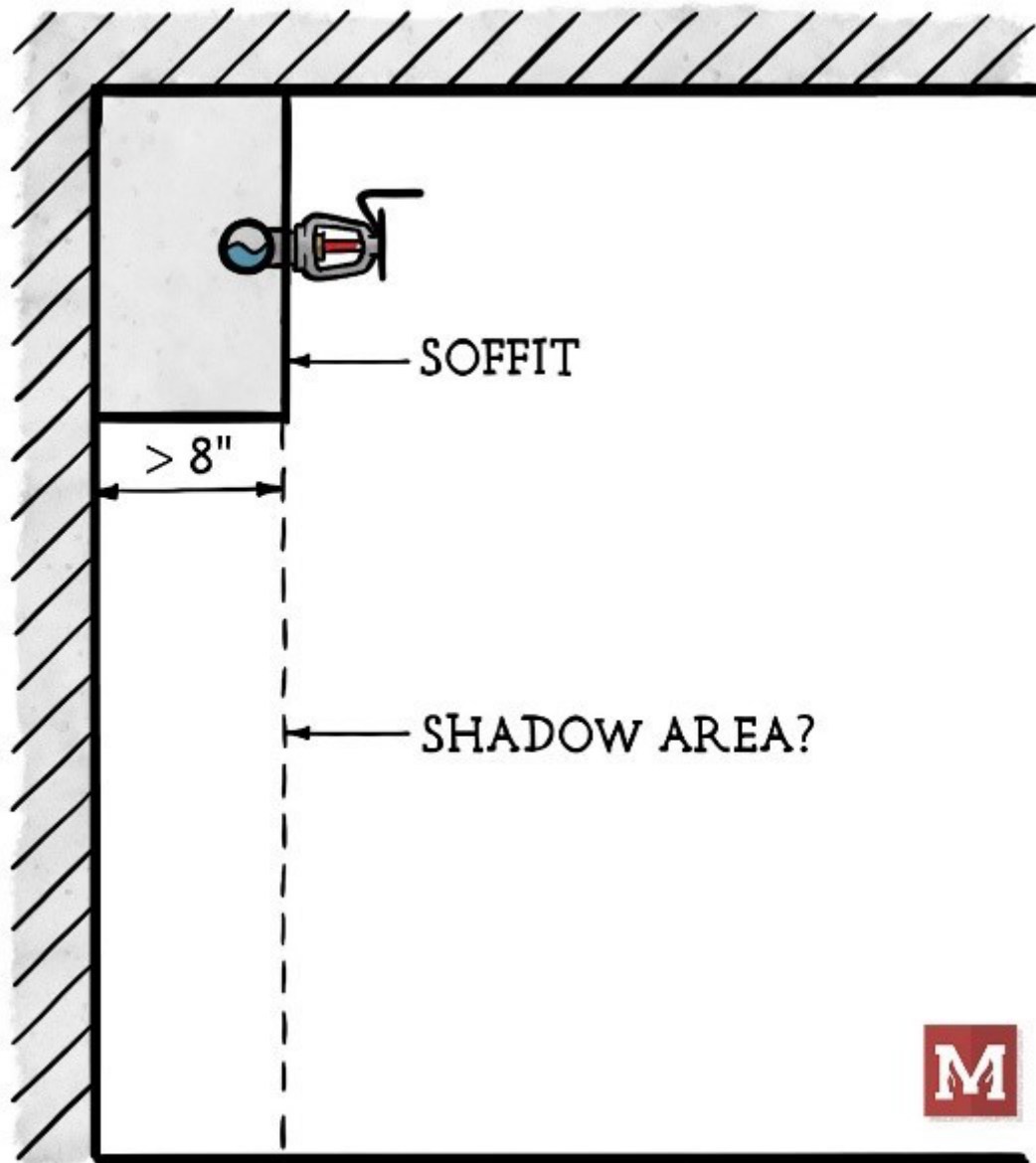
Based upon this reasoning, it is not the intent to override the “soffit rule” based upon the shadow area allowance for residential sprinklers.

As noted above the shadow area concept was first added to NFPA 13 for residential sprinklers only in the 2019 edition and was further refined in the 2022 edition with the addition of a definition found in Section 3.3.195. This definition did modify the NFPA 13R definition by adding the term “or other obstruction” to the definition from NFPA 13R. The NFPA 13 definition reads:

*The floor area within the protection area of a sprinkler created by the portion of sprinkler discharge that is blocked by a wall, partition, or other obstruction.*

The addition of “or other obstruction” does, can confuse this concept, however the annex note stating that the shadow area concept is not intended to replace the existing obstruction requirements has been retained. Further section 12.1.10.2.3 does limit the application of the shadow area concept to blocked areas “create by walls and partitions”

Based upon this, the above answer does not change, and the shadow area allowance is not intended to override the soffit rules.



## Question #7 – Water Heater in Garage of Single-Family Home

Section 8.3.8 of the 2016 edition of NFPA 13D states that sprinklers are not required in garage closets and Section 8.3.9 states that sprinklers are required in closets with heating equipment except if that closet is in a garage.

Is sprinkler protection required for a water heater in a garage that is not in a closet?

No. NFPA 13D, 2016 edition, does not require sprinkler protection in a garage even if there is a water heater located in the garage. Section 8.3.4 indicates sprinklers are not required in garages, open attached porches, carports, and similar structures. There is no exception to this allowance to

omit sprinkler protection from a garage even for items such as fuel fired equipment. The handbook commentary on this section indicates that garages are not required to be sprinkler protected due to few deadly fires starting in garages (see Table A.1.2(a)), cost benefit of sprinkler protection for unheated spaces, and that the garage is separated (usually 1 hour rated per the building code) from the remainder of the home.

Sections 8.3.8 and 8.3.9 are specific to closets only and would not be applicable to a garage that is exempt from sprinkler protection by Section 8.3.4 as noted above.

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## **Question #8 – Sway Bracing to Block/Masonry Wall**

**It is understood that pipe can not be braced to sections of the building that will move differently. However, does the 2022 edition of NFPA 13 specifically prohibit attaching sway bracing to a block wall?**

There is no section in NFPA 13 that prohibits attachment to any building structure, including block walls. However, there are restrictions on the types of products that may be used to attach to the structure. The capacity of the structure is always the responsibility of the structural engineer.

The building structure and the anchors that attach the brace assembly to the building structure should be reviewed by the structural engineer to confirm that the anchors and structure are strong enough to resist the seismic forces.

NFPA 13 provides load ratings for wedge anchors and cast-in-place anchors in concrete, screws in wood, and bolt through steel. However, NFPA 13 does not provide any anchor information for a block wall. This means that the fire protection designer would need to find an anchor, determine its shear, and tension capacity at each brace angle based on the block construction, and then find its maximum allowable load rating at each angle range while accounting for the prying factors of the seismic swivel attachment. They then need to confirm that their seismic forces on the brace do not exceed the capacity of the anchor in that orientation and angle. Then the calculations need to be reviewed by a registered professional engineer per Section 18.5.12.2. This information then needs to be provided to the structural engineer to confirm that the shear and tension loads applied are acceptable for that structure.

Differential movement, as described in Section 18.5.13, should be reviewed if the hangers attach to a different structure than the braces. However, this needs to be determined by the structural engineer because differential movement can be a result of thermal expansion, vibration in the building, wind loads, snow loads, seismic loads, etc. These forces would be unknown to the fire sprinkler designer.

Essentially, this all falls back to the structural engineer and no one else should be making decisions about the structure, its capacity, and what the structure can be used for. If the fire sprinkler designer has all their loads reviewed and accepted by a registered professional engineer and a structural engineer, then the installation should be acceptable in accordance with NFPA 13.

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## Question #9 – Predominantly Flat Roof Deck

A sprinkler system is being designed for a building with a flat roof/ceiling. However, there is a small portion of sloped ceiling leading to skylights (sawtooth construction). There is sprinkler protection at the skylight section.

As the small roof area with skylights has a pitch greater than 2 in 12 does the remote area need to be increased by 30%?

No, the arrangement described does not appear to require a 30% increase in the design area. The increase in design area as dictated by section 11.2.3.2.4 of NFPA 13 (2016 edition) is intended to be applied to the overall roof pitch, not the slope of a skylight that is a small portion of the ceiling itself. The slope in question is the slope of the skylight, not the ceiling itself. The purpose of the increase is to account for the heat collecting at the peak of the ceiling in the event the fire is at a lower point of the ceiling which would cause sprinklers higher in the peak to activate and may be outside of the anticipated design area. Since the ceiling is mostly flat this is not a concern.

The NFPA 13 handbook provides clarification stating that the slope ceiling increase is intended where the roof is continuously sloped and is not meant to apply to *"sawtooth roofs or similar situations in which the extent of the slope is small relative to the sprinkler design area."*

## Question #10 – Devices in Fire Pump Suction Piping

It is being requested that a flow switch be installed in the suction piping to a fire pump.

Is a flow switch allowed to be installed in fire pump suction piping?

No, a flow switch is not specifically addressed by the standard for installation in the fire pump suction piping.

NFPA 20, 2019 edition, Section 4.16.1.1 defines the fire pump suction piping as all pipe, valves, and fittings from the pump suction flange to the connection to the public or private water service main, storage tank, or reservoir, and so forth, that feeds water to the pump.

Section 4.16.9.1 indicates no device or assembly, unless identified in 4.16.9.2, that will stop, restrict the starting of, or restrict the discharge of a fire pump or pump driver shall be installed in the suction piping. Section 4.16.9.2 does not address the installation of a flow switch in the fire pump suction piping.



This section is to ensure devices in the suction piping will not stop, restrict the starting of, or restrict the discharge of the pump. A paddle type flow switch has a maximum water velocity rating and could restrict the discharge of the pump if the paddle is broken off or causes excessive friction loss or turbulence. The maximum velocity for the flow switch should be evaluated and compared to the maximum velocity created by the fire pump at 150% rated capacity.

The installation of a flow switch in the suction piping would be outside the prescriptive requirements of the standard as it is not specifically addressed. The engineer of record and AHJ should review and approve the installation of a flow switch in the fire pump suction piping.

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## **Question #11 – Expansion Tank for Antifreeze System**

**Are expansion chambers for antifreeze systems required to be listed for fire protection in accordance with the 2016 edition of NFPA 13?**

Yes, the expansion chamber, where used in a NFPA 13 system, needs to be listed for fire protection.

The reason that the technical committee responsible for NFPA 13 wants the chamber to be listed for fire protection is that the bladder inside can possibly fail. If the bladder fails, the tank will not work properly. Unlisted tanks are typically only rated for 80 psi and may not stand up to the pressures expected in sprinkler systems.

NFPA 13 gives several installation choices for antifreeze systems and an expansion tank is not required with all options. However, where used, the expansion tanks need to be listed for fire protection for the reasons articulated above. This is why section 7.6.3.3 of NFPA 13 that deals with expansion tanks identify them as “*a listed expansion chamber.*”

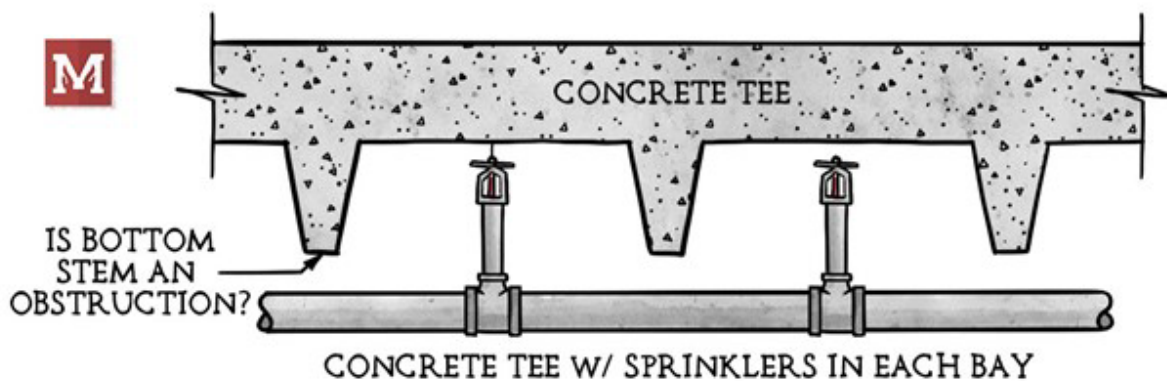
It should also be noted that for NFPA 13D applications, expansion tanks are not required to be listed as stated in NFPA 13D (2016) in Section 5.1.2.1.

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## **Question #12 – ESFR's in Concrete Tee Construction**

**ESFR sprinklers are installed in each channel of concrete tee construction. Is the bottom stem of the concrete tee considered for obstruction purposes?**

No, the bottom of the concrete tee is not an obstruction if it is less than 24 inches wide and sprinklers are provided on both sides. NFPA 13, 2022 edition, Section 14.2.11.1.2 indicates the requirements of 14.2.11.1.1 (the beam rule) shall not apply where sprinklers are spaced on opposite sides of obstructions less than 24 inches (600 mm) wide, provided the distance from the centerline on the obstructions to the sprinklers does not exceed one-half the allowable distance between sprinklers.



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