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

Editor - Roland Asp, CET | #457 | 02/08/2021

Best of January 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 January 2021. This information is being brought forward as the "Best of January 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 – Tent on Top of Building

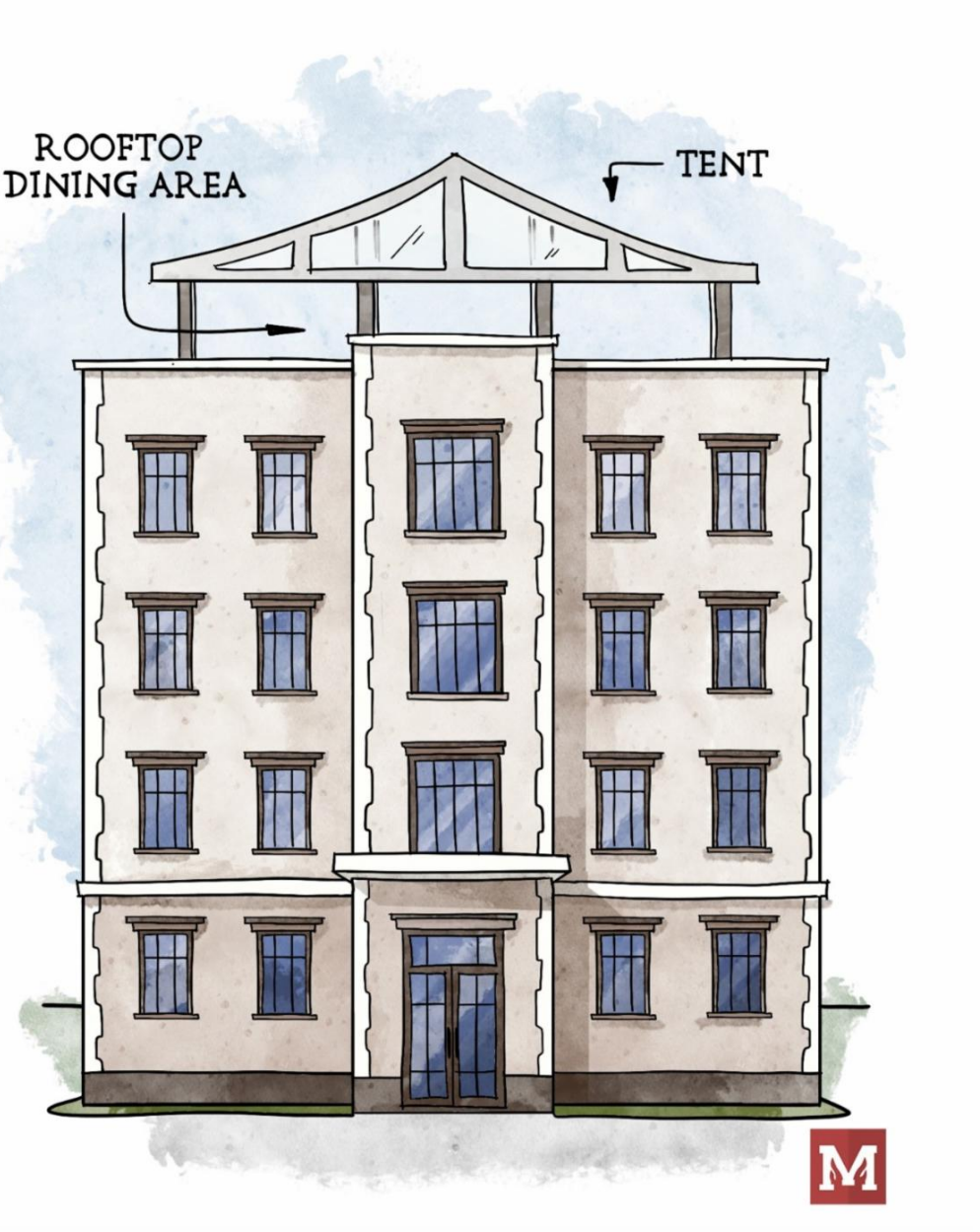
A local restaurant is planning to add a tent to the building's roof top and the tent is being permitted through the building department. The building is fully sprinklered in accordance with NFPA 13.

Will the tent atop the fire sprinklered structure require fire sprinklers?

Yes, fire sprinklers are required in the tent on the roof. NFPA 13 does not have exceptions for this application. Assembly uses on the roof are permitted through the building code, however, structures (tents are structures per the IBC definition) on the roof that permit additional occupancy need to follow the building code for egress, fire protection, etc., as if the tent was permanent construction. The tent creates a floor or story on the roof (per the IBC definition), requiring the extension of the automatic sprinkler system for A-2 through 903.2.1.2. The referenced automatic sprinkler system standard, NFPA 13, does not exempt occupied roof structures, nor does the exempt sprinkler exceptions in IBC/IFC, Section 903.3.1.1.1.

It could be said that the tent is a temporary and this is solely used for mitigating the local COVID restrictions. The fire code and building code have long had rules for tents and temporary structures (IFC, Section 3104 & 3105 – IBC, Section 3103). The applications for tents under the code are

meant for the ground floor with adequate spacing from other buildings. A tent on the roof increases the occupant and fire load where it was probably never considered, therefore, the same life safety considerations apply as if a more permanent structure was added.



Question #2 – Polypropylene Netting Ceiling

There is a walkway located at the ground level of a fully sprinkled building and the walkway has a polypropylene netting "ceiling" located approximately 8-foot above walkway floor. The walkway is not located within the racking area and is protected with ceiling level sprinklers only.

Are sprinklers required under this netting due to the volume of the openings as directed in the "open ceiling" definition?

No, assuming the area is a light or ordinary hazard occupancy and spray sprinklers are used at the upper ceiling, sprinklers are not required below the lower ceiling made of netting (open-grid ceiling).

NFPA 13, 2016 edition, Section 3.6.4.11 defines a spray sprinkler. Section 8.15.14 provides the specific requirements for an open-grid ceilings.

Open-grid ceilings are required to have minimum 1⁄4 in. openings. It appears from the information provided the openings for your open-grid ceiling are 2 in. squares with 1/8 in. cord. The minimum opening size would be 1.94 in.

The thickness or depth of the material does not exceed the least dimension of the opening. The thickness is the 1/8 in. cord which is less than the 1.94 in. least dimension of the opening.

Openings shall constitute 70 percent of the area of the ceiling material. Based on the information and dimensions provided, your open-grid ceiling would be greater than 75 percent open.

Assuming the distance from the open-grid ceiling to the upper ceiling is 48 inch or greater, the sprinkler spacing at the upper ceiling would not be required to be reduced for light or ordinary hazard occupancies.

The installation of open-grid ceilings beneath sprinklers restricts the sideways travel of the sprinkler discharge and can change the character of discharge. This is why the minimum size and area of openings is important, as well as the distance from the sprinkler at the upper ceiling to the lower grid ceiling. This allows the sprinkler pattern to develop and provides sufficient openings for the water to reach the hazard below the open-grid ceiling.

Question #3 – Fire Sprinkler Working Plans

An authority having jurisdiction (AHJ) is requiring ALL the requirements of Section 27.1 of the 2019 edition of NFPA 13 for a small tenant finish project involving the addition and relocation of less than 10% of the existing sprinklers and the work area is not part of the original system remote area.

Section 27.1 of NFPA 13 contains an extensive list of requirements for fire sprinkler shop drawings intended for submittal to the AHJ.

Is ALL of this information REQUIRED for a small tenant finish project?

No, not all of Section 27.1.3 has to be on every shop drawing of every system. NFPA 13 is the standard for all kinds of sprinkler installations, i.e., new systems, revamping existing systems, retrofitting new systems in existing buildings, modifications to existing systems and so on. The standard does not get into specifics or what subsections of Section 27.1.3

apply for each construction project but states in the same section that plans, "…shall show those items…that pertain to the design of the system". The key words here are "pertain to the design of the system".

You describe an existing system that was designed before this edition and was approved and commissioned. A small tenant project that has some new and relocated sprinklers of a similar hazard and water supply does not rise up to the level of a complete set of working plans. What pertains to this system modification needs to be addressed, but only in the affected work areas. For example, for a tenant fit-out or remodel, it should show the appropriate details, i.e., new, and existing piping/equipment, relocated sprinklers, hazard classification, etc. The tenant fit out probably has other permits for the new work, so, architectural plans, and past plans or permits can be referenced for the scope of work and existing content.

Section 27.1.3 is an inclusive list that covers everything and is usually appropriate for new systems in new or existing buildings. Some of the information in this list may be items the sprinkler contractor knows nothing about and would take significant effort and cost to provide information that is already built and in place. It is important to note that Section 1.2, under purpose of this standard, is to provide "…reasonable degree of protection… of design by knowledgeable and experience personnel…" This does not discount the authority of the code official, but the responsibility and liability of the design is upon the licensee. Therefore, the extent of Section 27.1.3, should be reflected where reasonable and necessary to demonstrate the changes to the existing system.

Question #4 – Curved Concrete Ceilings

Do curved concrete ceilings require additional coverage? Basically, these are curved / half barrel ceilings made of concrete which span across the entire ceiling / bottom of deck.

Curved ceilings could possibly add sprinklers but are typically not necessary. Curved ceilings usually have a couple of additional rules to follow.

First, curved or dome ceilings are difficult to space and would depend on the how steep the curvature actually is. For example, very steep curvatures may be treated as vertical walls and domes with a gentler curvature would be more akin to slope ceilings. The key is to ensure that the floor area is properly provided with sprinkler coverage. The 2016 edition of NFPA 13 in Section 8.6.3.2.5 provides special guidance on measuring horizontal distances for sprinkler separation for the installation of standard pendant and upright spray sprinklers under curved surfaces.

Second, a 30% area increase is required by Section 11.2.3.2.4 when performing calculations for curved ceilings. A curved ceiling has a continually changing slope and where the average slope exceeds 1 in 6 (2/12), it is considered a sloped ceiling and the 30% area of operation increase would be applicable. The reason for this increase in the area of operation is to account for the heat from a fire traveling up to the high point

of the ceiling. This would mean that the activation of the sprinklers directly over the fire may be delayed. This would be the case in a sloped ceiling or a curved ceiling.

Question #5 - Sprinkler Riser in Stairwell

Is a sprinkler system riser and its associated components permitted to be installed in a stair shaft? This is the primary riser into the building feeding a sprinkler system and not a standpipe. It is anticipated that the riser will be located under the intermediate landing.

Yes, sprinkler piping and equipment can be located in a stair enclosure. NFPA 13, 2019 edition, Section 16.1.1 simply provides the requirement that the system riser be accessible for operation, inspection, testing, and maintenance.

General building equipment (such as mechanical equipment for heating or ventilation of the building) is prohibited by the International Building Code (IBC) and International Fire Code (IFC) from being installed in the stairwell. Interestingly, the IBC and IFC do not prohibit the equipment itself. Instead, Section 1023.5 prohibits any penetrations of the stairwell for building equipment. The theory is that if the stairwell wall cannot be penetrated, the equipment is not allowed to be installed.

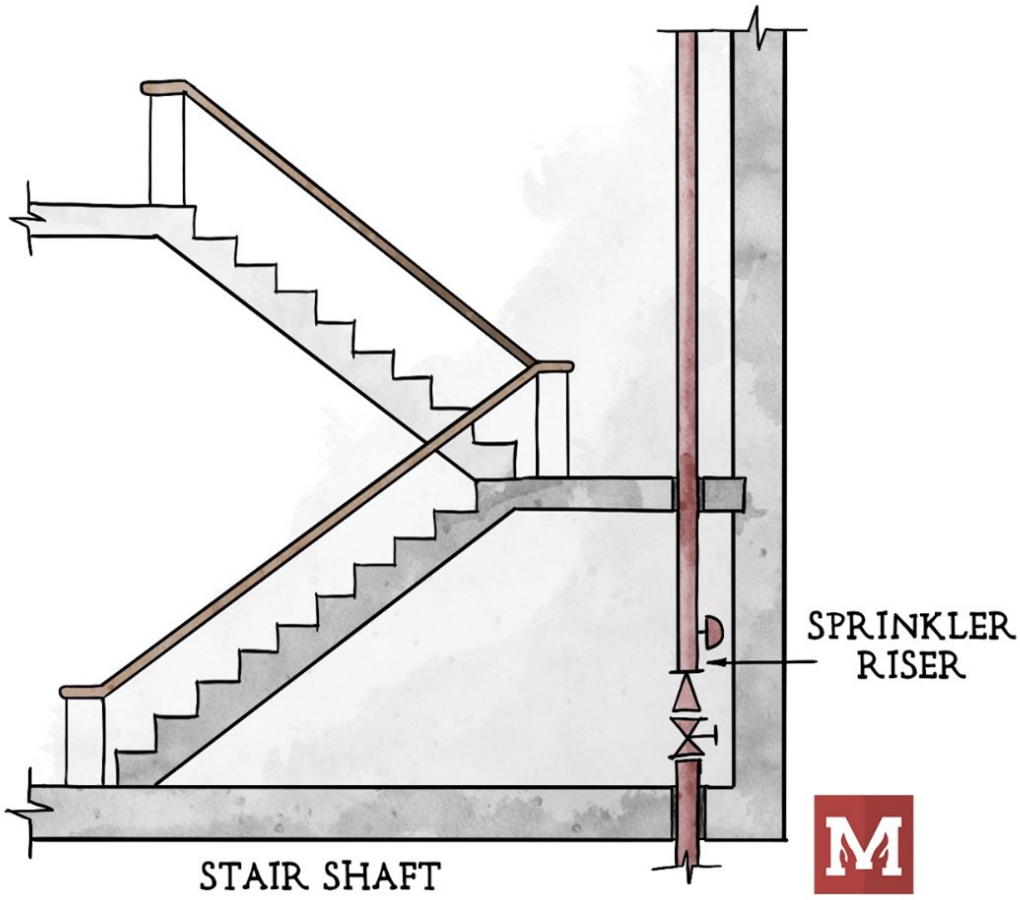
This section in the IBC/IFC contains a specific exception for fire sprinkler and standpipe equipment. Therefore, since fire sprinkler equipment is specifically permitted to penetrate the stairwell wall, the equipment is allowed to be installed in the stairwell and penetrate the wall to protect the rest of the building.

Philosophically, this has been well accepted for wet pipe sprinkler systems and it is very common to see the riser and control equipment for each floor of a building within the stairwell. The fact that this is the main system riser does not change the rules as far as the code is concerned. Section 1023.5 of the IBC/IFC does not specify the kind of sprinkler system piping that is allowed. It says that all sprinkler piping is permitted to penetrate the walls of the stairwell.

Of course, the sprinkler control equipment needs to be clear of any portion of the stairwell necessary for egress or for an area of refuge. As long as egress and area of refuge space requirements are met, there is no problem with the sprinkler control and riser equipment being in the stairwell.

NFPA 101 has the same provisions as the IBC/IFC discussed above in Section 7.1.3.2.1(10)(g).

In conclusion, the IBC, IFC, and NFPA 101 all allow the sprinkler control and riser equipment to be located in the stairwell as long as they are clear of the egress and area of refuge spaces.



Question #6 - Maximum Domestic Demand In NFPA 13R

In a large residential building protected with sprinkler system installed in accordance with the 2016 edition of NFPA 13R, the domestic demand would be over 500 gpm based on the fixture count. Although this flow does not have significant friction loss through the 6-inch combined water main, the domestic demand does use more than half of the available loss, therefore reducing the safety margin.

Is the intent of NFPA 13R to have a maximum domestic demand flow?

No, NFPA 13R does not have a maximum domestic demand flow to be added to the calculations for combined domestic/fire mains. The maximum flow is already part of Table A.9.6(b) Total Estimated Domestic Demand. This table bases the estimated demand on a probability that a certain percentage of available downstream fixtures are being used at a given time.

As you are aware, one process for determining the domestic demand is:

1. Determine the total fixture load value from Table A.9.6(a). The fixture

load units are determined based upon the total number and type of plumbing fixtures.
2. Determine the Total Estimated Domestic Demand by using the total fixture load units in step 1 in Table A.9.6(b)
3. The domestic demand (from step 2) is added to the sprinkler demand at the appropriate point.

It should be noted that the domestic demand criteria were modified and clarified in the 2019 edition of NFPA 13R in Section 9.3. Section 9.3.2 gives additional options for determining the domestic demand as follows:

1. Table 9.3.2(a) and Table 9.3.2(b) – (this method is similar to the 2016 edition method)
2. Method from local plumbing code.
3. Values from the registered design professional.

It should also be noted that the fixture load value table has been updated in the 2019 edition. Table 9.3.2(a) includes new and updated values which are typically less than those found in the 2016 edition Table A.9.6(a).

Question #7 - Room Design Method & Fire Resistance Rating

In order for a room to qualify to use the room design method in a light hazard occupancy with a 30-minute water duration requirement, are 5/8" GYP board walls, with metal studs and a drop ceiling to equal the 30 min fire resistances rating adequate? And do other measures need to be taken such as fire stopping penetrations?

Section 11.2.3.3.3 in the 2016 edition of NFPA 13 states that only the walls need to meet the fire resistance rating. There are many ways to accomplish a particular required fire-resistance rating. There are several different types of materials and configurations that will create a 30-minute fire resistance rating. However, 5/8 inch gypsum board on either side of metal studs would meet the 30-minute fire resistance rating.

A design professional can do the design. Additionally, the Gypsum Association has a fire resistance design manual that provides configurations for gypsum boards.

Finally, the International Building Code (IBC) in Section 722 provides a means to calculate fire resistance. By using this section, you can piece together a custom configuration to meet your custom needs.
It is suggested to use one of these resources to construct the fire resistance rated assembly that is needed.

While NFPA 13 is silent on firestopping penetrations, maintaining the integrity of the wall rating is important. The wall assembly listing may require firestop penetrations and the AHJ may any penetrations are protected.

Question #8 – System Area Limitation in NFPA 13R and NFPA 13

This question relates to multi-floor buildings where the total floor area exceeds 52,000 square feet but each individual floor has a total area under 52,000 feet.

What are the requirements to protect the above building with a single sprinkler system in accordance with NFPA 13R and with NFPA 13?

Additionally, when are floor control valves required per these standards?

The system limitation for a NFPA 13R system would be 52,000 square feet per floor up to four stories or 60 feet in height, whichever limit is reached first. This is found in the scoping of in the 2019 edition of NFPA 13R. Section 1.1 of NFPA 13R states that the standard covers the design and installation of automatic sprinkler systems for protection against fire hazards in residential occupancies up to and including four stories in height that are located in building not exceeding 60 feet in height above grade plane.

NFPA 13 systems are limited to the same 52,000 square feet restriction (higher hazards reduce the maximum floor area, see Section 4.5.1) however, within the scoping there are no height restrictions for these systems. The IBC provides additional guidance. Section 403.3.1 states that in buildings over 420 feet in building height; the building must be supplied by not fewer than two risers and each riser must supply the sprinklers on alternating floors. It is also important to understand that sprinkler risers and standpipe system are limited based on pressure limitation of equipment and components.

In NFPA 13R systems, a floor control valve is not required on every floor. However, NFPA 14 does require a separate floor control valves where a standpipe system serves as the water supply piping for a sprinkler system in the same building. If a building has a standpipe system, and if a common riser is providing sprinkler protection, then control valves would be required at every floor in compliance with NFPA 14.

In the 2019 edition of NFPA 13, Section 16.9.11.1, it states that buildings exceeding two stories in height are required to have floor control valves, check valves, main drain valves, and flow switches. It must be noted that there are some exceptions within this section.

Question #9 – NFPA 25 Inspections

In accordance with NFPA 25, can the owner perform the required daily, monthly, or quarterly inspections or is this something that a sprinkler contractor is required to perform?

There is nothing in the NFPA 25 that states the Inspection, Testing, and Maintenance (ITM) requirements must be completed by a contractor or building owner, NFPA 25 simply requires that the tasks must be completed by a person who is competent through training and experience that is acceptable to the Authority Having Jurisdiction (AHJ).

In many cases there are local or state requirements for specific training or certifications to perform the tasks. If the owner's, the maintenance person has the proper training to conduct the ITM and it is acceptable to the AHJ then NFPA 25 would permit that person to perform these tasks. However, it would be a good idea to verify these requirements with the local AHJ.

Question #10 – 20 psi Minimum Pressure in Sloped Attic

A combustible concealed space with sloped of 5 in 12 with joists spaced 2-feet apart is enclosed with two layers of gypsum board attached to the bottom of the joists. This area will be projected with upright sprinklers spaced 1-foot apart perpendicular to the roof slope. Section 8.6.4.1.4.4 in the 2013 edition requires a minimum pressure of 20 psi.

Does this 20-psi minimum apply in a situation where the combustible members are enclosed with noncombustible sheathing attached to the bottom of the joists?

No, the intent of NFPA 13, 2013 edition, Section 8.6.4.1.4.4 would be to require a minimum sprinkler pressure of 20 psi when the roof or ceiling is of exposed combustible construction. The reason for the increased pressure is to account for the increased fire growth rate associated with the steeply pitched roof and exposed combustible construction above the sprinklers. In your case the steeply pitched roof has two layers of gypsum board attached and does not have exposed combustible construction to contribute to the fire growth rate.

While this specific detail is not addressed by the standard in Section 8.6.4.1.4.4, Section 8.6.4.1.4.5 indicates the requirement of 8.6.4.1.4 shall not apply when the exposed combustible sheathing in the roof or ceiling space are constructed of pressure impregnated fire-retardant treated wood as defined by NFPA 703. Covering the exposed combustible sheathing in the roof or ceiling with gypsum board would in effect accomplish the same performance objective.

With gypsum board attached directly to the bottom of the roof joists, you have in effect created an additional combustible void space above the gypsum board and between the solid roof joists that would not require

additional sprinkler protection as detailed in Section 8.15.1.2.4.

Question #11 – ESFR "One Foot Shift Rule"

A warehouse is protected with ESFR sprinklers and an entire branch line was shifted 1-ft to avoid being too close to a line of open-web girders. This permitted based upon as permitted by Section 8.12.3.1(4) in the 2016 edition of NFPA 13. Based upon various obstructions, it would be beneficial to also shift some individual sprinkler 1 foot along the branch line.

Is there any distance away from a shifted branch line that the shift rule can be utilized in the other direction along the branch line?

NFPA 13, 2016 edition, Section 8.12.3.1.(4)(c) indicates it shall not be permitted to move a branch line where there are moved sprinklers on a branch line that exceed the maximum sprinkler spacing. It appears the intent of this section is to prohibit the use of both the sprinkler shift rule (item 3) and the branch line shift rule (item 4) together in the same area of the system. This would effectively prohibit exceeding the maximum sprinkler spacing in both directions.

If the sprinklers were shifted along the line and the lines were also shifted, exceeding the maximum sprinkler spacing requirement in both directions, the maximum protection area of coverage requirements of Section 14.2.8.2 would be exceeded as well.

By not allowing the lines to be shifted when there are shifted sprinklers, this would also apply in the reverse to not allow shifted sprinklers when there are shifted lines. The 2019 edition appears to be consistent on this issue and I am not aware of any proposed changes to the 2022 edition.

Question #12 – Hose Connection on the Roof

A hose connection is required on the roof per the 2016 edition of NFPA 14, Section 7.3.2.9. The annex shows a diagram showing a PIV style valve that allows operation of the hose connection without going back inside of the building. The climate is such that a valve is necessary to prevent water from freezing in the pipe. Other projects in this area have a valve located in the building so that one must be inside the building to operate the hose connection.

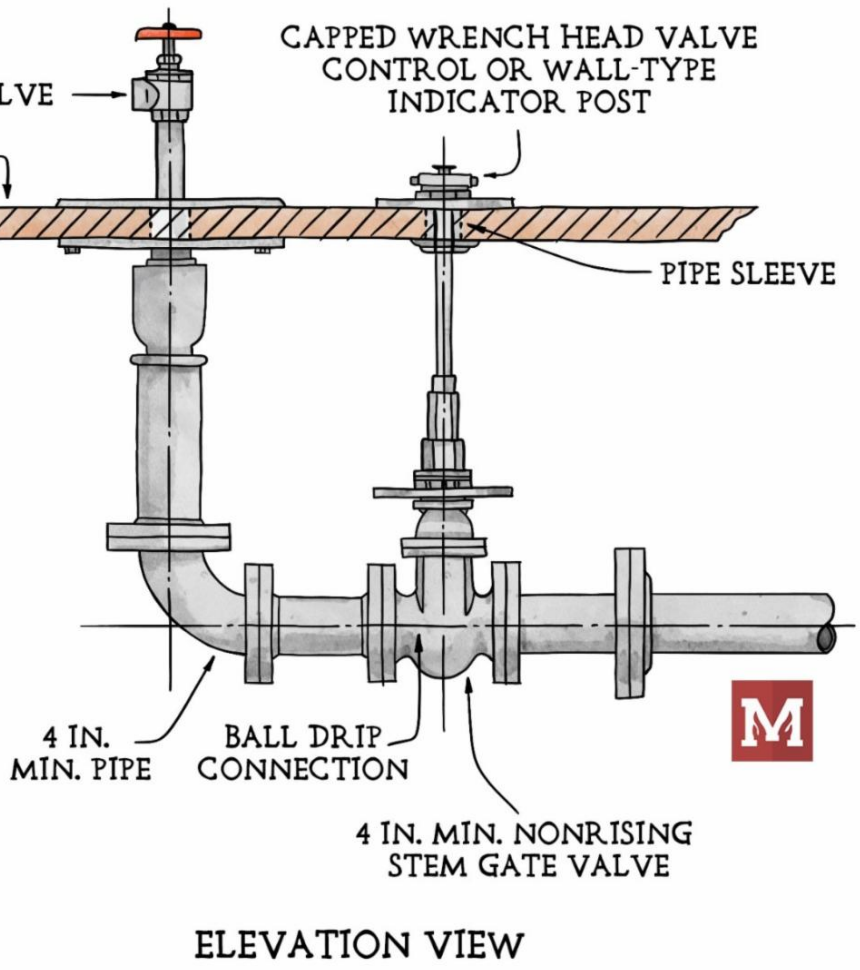
Is it a requirement of NFPA 14 that the control valve to a roof hose connection must be assessable from the roof as indicated in this annex figure?

NFPA 14 does not have requirements for how freeze protection is to be provided for standpipe roof top hose connections. It simply requires that all pipe and any control valve to be protected from temperatures below 40 degrees F or above 120 degrees F.

The Annex Figure A.7.3.2.7 is non-enforceable material and is only meant to provide guidance and to be used as an example of a means for providing

that protection. The use of a control valve accessible or operational from the roof would be beneficial but not required by the standard.

The control valve can be inside the building at the top of the riser, pending AHJ approval as found in Section 7.3.2.11.2.



ITM Hands On Training

This 2-day, hands-on program covers a wide variety of inspection and testing procedures for water-based fire protection systems as outlined in NFPA 25 (2017).

The program includes:

- Main Drain Testing
- Water flow Alarm Device Testing
- Control Valve Testing
- Valve Trip Tests
- Pressure Reducing Valve Test
- And Testing multiple types and components of fire sprinkler systems

Although not included in the hands on practical, hydrant, standpipe and

underground flow testing as well as system pressure reducing valve test will be addressed the classroom setting.

February 25 - 26, 2021
Centennial, CO

Register Here

March 2 - 3, 2021
Exton, PA

Register Here

Top Tech Competition

The 2021 Top Tech Competition will be held in October 2021. The window for testing will open summer 2021. We look forward to your participation. More details will be out soon. Keep studying!

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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