

Best of May 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 May 2022. This information is being brought forward as the "Best of May 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.

Question #1 – “Bucket Test” in lieu of Hydraulic Calculations

An existing system was installed in 2016 and includes an auxiliary antifreeze system protecting unheated garages. Although a backflow preventer was shown on the accepted plans, isolating the antifreeze system, the backflow preventer was never installed, and the original hydraulic calculations do not include the friction loss for the backflow preventer. The local jurisdiction is requiring the backflow preventer be installed, per the original plans; however, including the friction loss for this device means that the hydraulic calculations will not work. Also note that the existing antifreeze is a noncompliant “food-grade” solution which will be replaced with a listed antifreeze solution.

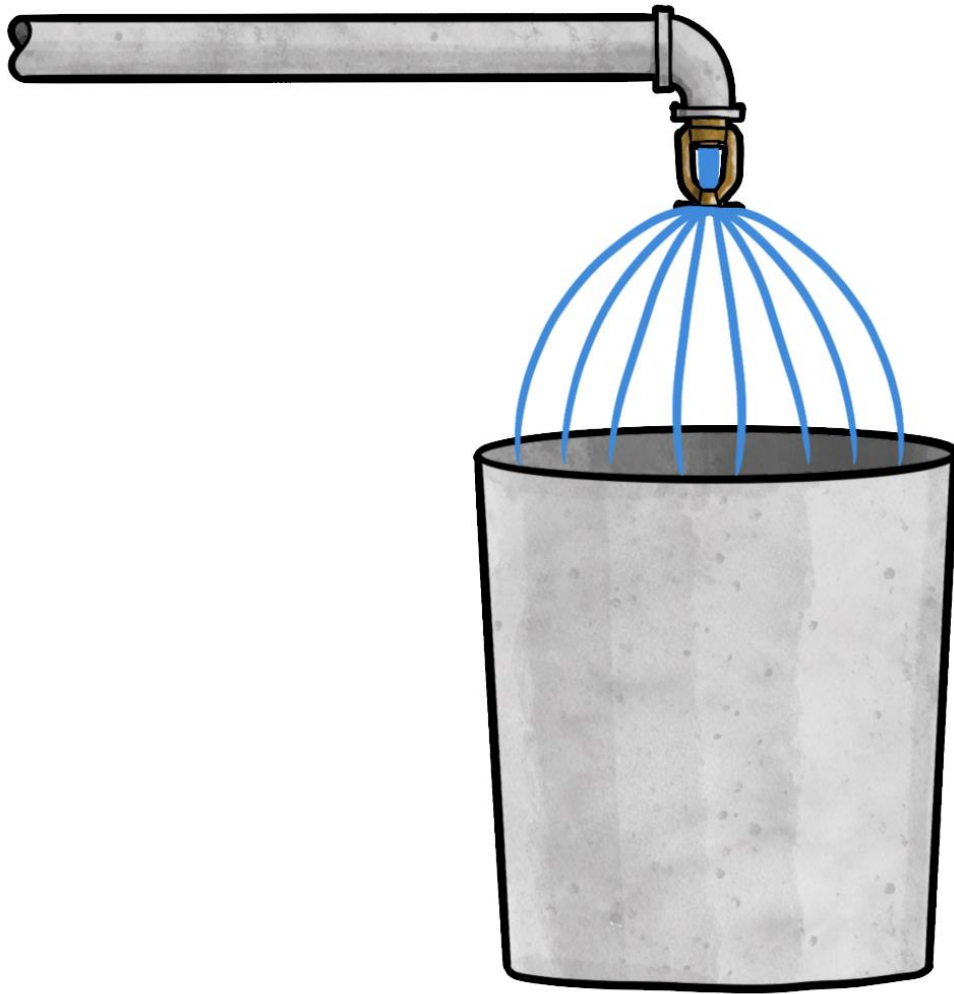
As the hydraulic calculation will not work with a backflow installed, is it permissible to simply flow the sprinklers in these garages into a barrel to determine if the garage sprinkler system will work?

No. What you described, flowing sprinkler(s) into a barrel, is commonly called a “bucket test.” Bucket tests are not recognized by NFPA 13, or any other NFPA installation standard, and cannot be used to circumvent the required hydraulic calculation requirements of NFPA 13. When retrofitting a backflow preventer into an existing sprinkler system, NFPA 13 is clear. The 2019 edition of NFPA 13, Section 29.1.3 in the 2019 edition with similar language in earlier editions, states that when a backflow preventer is being retroactively installed in an existing sprinkler system, “a thorough hydraulic analysis must be performed.” This analysis includes:

- Revised hydraulic calculations
- New fire flow data
- Any modifications to the existing system to accommodate the additional friction loss due to the new backflow preventer.

A bucket test cannot be used in lieu of the above requirements. A hydraulic analysis as described above must be completed. If the existing arrangement cannot be made to work with the added friction loss of the backflow preventer, then the system will need to be modified. It should be noted that the full hydraulic analysis required by this section pertains to the system being affected (garage systems) and it is not the intent to provide a full hydraulic analysis of the entire existing system but to simply verify that the additional friction loss through the backflow prevention device can be supported. An annex section is being proposed to the 2025 edition of NFPA 13 to state this concept.

It should also be noted that NFPA 13 does not require the use of a backflow preventer with antifreeze solutions, although the water authority or other health codes may. Depending on the overall arrangement of the system, an antifreeze loop as illustrated in Figure 8.6.3.1 of the 2019 edition of NFPA 13 may be acceptable. Earlier editions of NFPA 13 have similar requirements pertaining to antifreeze loops.



Question #2 – Hose Allowance and Strainer Requirements in NFPA 15

A project calls for a water spray system with open spray nozzles fed from an 8-inch deluge valve. The applicable standard is the 2012 edition of NFPA 15.

Is a hose stream allowance needed and is it required to add a strainer on the main feed pipeline after the deluge valve?

Because spray systems protect a wide range of equipment and types of equipment, NFPA 15 does not provide hazard classifications like NFPA 13. Typically, NFPA 15 is applied when required by another standards, codes, or project specifications. Often times spray systems are a result of a

Hazard Analysis/Risk assessment. Because the applications vary greatly, the density along with the hose stream allowance is often specified in those standards or specifications.

Based on the requirements dictated in the other standards or specifications the system design objectives would be one of the following:

- Extinguishment
- Control of Burning
- Exposure Protection
- Flammable Vapor Mitigation

There are only two instances where NFPA 15 directly specifies a required hose allowance. The first being protection of Belt Conveyors under the extinguishment objective, where a 250-gpm hose allowance is required. The other instance is for the protection of transformers which also requires a 250-gpm hose allowance.

In this case if a hose stream was required it would need to be specified by the project specifications or the standard in which is being applied that requires the spray system to be installed.

As for the strainer question, NFPA 15 Section 6.4.6.1 requires main pipeline strainers when the system utilizes nozzles with waterways less than 3/8 in. and for any system where the water is likely to contain obstructive material. Individual strainers are required at each nozzle with water ways less than 3/16 in.

It is common practice to install strainers when the water supply is grey water or a raw water source. NFPA 15 does not dictate the location of the strainer; however, if the water source is a raw water source it is good practice to install it upstream of the deluge valve.

Question #3 – Pendent Sprinklers vs. Upright Sprinklers

A new sprinkler system was recently installed in a dining area with a sloped ceiling and exposed wood deck. The installed sprinkler system consists of exposed branch lines with upright sprinklers.

The use of upright sprinklers is being questioned with the statement that pendent sprinklers will provide “better coverage.”

Is there a valid reason to change the sprinkler heads to pendant orientation?

No. In this case, unobstructed construction, sloped ceiling, exposed steel piping, exposed wood deck in an assembly space (dining hall), the NFPA 13, building code, and fire code would not mandate or prefer a pendent over the currently installed upright sprinkler.

Section 8.4.1.1 of the 2016 edition of NFPA 13 allows upright sprinklers or pendent sprinklers, Section 8.6 provides the same coverage, and dozens of other sections lump upright and pendent sprinkler rules and criteria together.

In short, there is no technical justification, design rule, or hydraulic benefit to rotate the current upright sprinkler into the pendent position.



Question #4 – Manual Dry Standpipe and Supervisory Air

Chapter 5 of the 2016 edition appears too ambiguous as to if it is a requirement to include supervisory air on a manual dry standpipe.

Does NFPA 14 require supervisory air in manual dry standpipes?

No, the 2016 edition of NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, does not require supervisory air on manual dry standpipes. The requirements found in Chapter 5 are extracted from NFPA 13, *Standard for the Installation of Sprinklers*, and are for dry valves installed on standpipe systems. These requirements have been very confusing for several cycles of the standard and the technical committee is looking to address this issue in the 2023 edition of NFPA 14.

NFPA 14 second draft is concluding this week with new requirements for supervisory air on all dry systems. This was a unanimous decision from the technical committee and if passes ballot, the next edition of NFPA 14 will require all manual dry standpipe to be supervised with air.

Note: There are requirements in NFPA 241, *Standard for the Safeguarding of Construction, Alteration, and the Demolition Operations*, for temporary supervisory air on dry system.

Question #5 Existing Systems Modifications

On a project which the scope of work includes to relocate sprinkler heads, it is being requested that the working plans include all 47 items included in Section 27.1.3 of the 2019 edition of NFPA 13. This is the section pertaining to required information to be included on the plans. Many of these items are not applicable to this small renovation project.

Is the intent of NFPA 13 to require all items in the list of 27.1.3 for sprinkler renovation projects?

No, NFPA 13, 2019 edition, does not require all the items in Section 27.1.3 be submitted for shop drawing review. Only those items from the list that pertain to the design are required by the standard.

Section 27.1.3 indicates working plans shall be drawn to an indicated scale, on sheets of uniform size, with a plan of each floor, and shall show those items from the following list that pertain to the design of the system. There would be many items from this list that do not pertain to the design of a renovation project on an existing sprinkler system that simply involves relocating existing sprinkler locations.

Chapter 29 is specific to modifications to existing systems. Both Section 29.1.2 and Section 29.6.1 indicate where additions or modifications are made to an existing system, enough of the existing system shall be indicated on the plans to make all conditions clear.

These items are subject to interpretation by the AHJ. However, it is the intent of the standard that enough information is shown to accurately depict the work being conducted and the associated compliance with the standard.

Question #6 – Earthquake Bracing

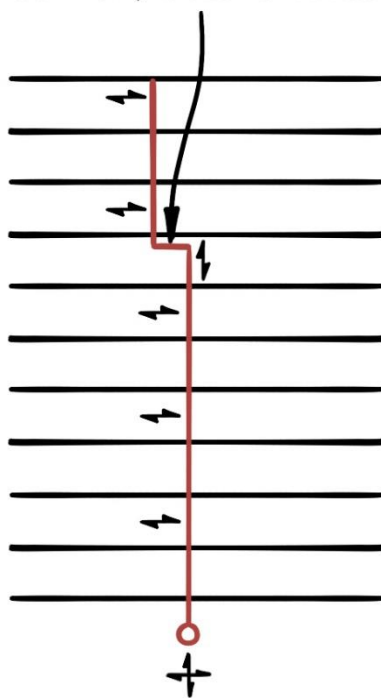
Section 18.5.7 of the 2019 edition of NFPA 13 speaks about runs of pipe between changes in direction but Figure A.18.5.7.2 shows the longitudinal bracing on the last piece of main.

In this figure which pipe is more than 12 feet?

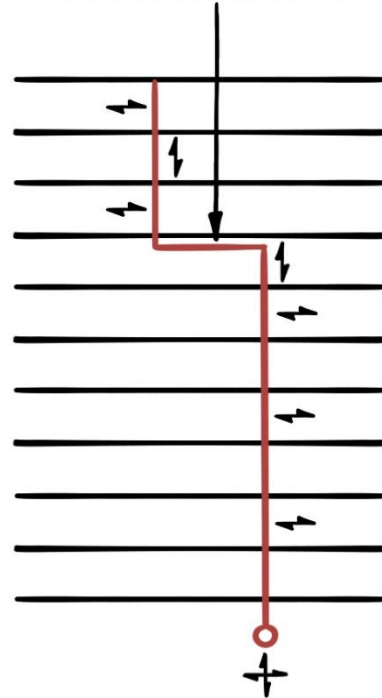
In Figure A.18.5.7.2, the pipe that is more than 12 feet is the perpendicular span or run between the two changes in direction. As noted in the main section (18.5.7.2), where this span is more than 12 feet, it is included in the linear length to apply bracing. Where it is less than 12 feet, the span between the changes in direction is not counted or applied.

The figure in the annex (Figure A.18.5.7.2) does a poor job of visually showing the difference between the two scenarios. The figure is very limited in size and details and is not intended to be a scaled representation. The longitudinal brace does appear where it does, but the user is left without dimensions and details to fully understand the scenario. However, all the figure is trying to point out is where the 12 feet change is greater, then, additional bracing will be included. The specific location of the longitudinal brace in the figure is insignificant.

RUNS <12' CAN BE SUPPORTED BY BRACES ON ADJACENT PIPES



RUNS >12' INCLUDED IN SWAY BRACE DISTANCE MEASUREMENT



Question #7 – ICC-ES Evaluation Reports and Requirements for Pre-Fab “Pods”

The ICC Evaluation Services (ICC-ES) created a report (ESR-4445) that supports the omission of sprinklers in light and ordinary (group 1) occupancies for prefabricated enclosed booths or pods installed in otherwise fully sprinklered building.

Can this report be used to omit sprinklers within the booth or pod without a specific omission in NFPA 13?

No. ICC-ES Evaluation Reports (ESR) are not considered by any of the NFPA 13 technical committees when published by the ICC. An ESR has no authority to modify or apply exceptions to the standards (NFPA 13) referenced by the model codes (IBC, IFC). This means an ESR cannot grant an exception to NFPA 13.

Specifically, to ESR-4445, as an enclosed booth that serves as room, it directs the user to NFPA 13 for occupancy classifications and the building official to Section 903.3 for compliance with NFPA 13. ESR-4445 Section 5.5 appears to grant a building official discretion to omit sprinklers in this space with an engineering analysis. This wording in the ESR is unclear on whether an explicit exception exists, but it would be very difficult to justify an unsprinklered booth or room in a sprinklered building when the building official is directed to go to NFPA 13 to classify the space as light hazard or ordinary hazard. The reference to Section 903.3 also directs the building official to follow the referenced standard, where no exception exists for such booth or room. The building official may point to Section 903.3.1.1.1 for exempt locations, but the booth is not justified in this section, unless #2 is used and approved by the fire code official.

The 2022 edition of NFPA 13, Section 9.2.10 does allow small temporary occupied enclosures (booth) without sprinklers that do not extend to the ceiling and are under 24 square feet. The booths in this ESR appear to be complying with the height exception but not the area exception. In summary, the NFPA 13 technical committees did address sprinkler protection of these booths. It is important to note a fully sprinklered building per Section 903.3 is required by the IBC in order for all tradeoffs to apply.

Question #8 – Extra high ceilings and Density Increase

A project consists of 53 ft. ceilings over injection molding and the sprinkler criteria is proposed to be Extra Hazard Group 1 (EH1). Additionally, there are areas of solid pile plastic storage to approximately 20 ft.

Should the density be adjusted beyond EH1 to account for extra high ceiling protection over EH occupancy? It appears the roof/ceiling height is restricted to 35 ft. in accordance with the 2019 edition of NFPA 13

Currently there are no requirements to increase the design criteria for high ceilings for non-storage applications. The maximum ceiling height is listed as 35 feet for density area criteria of high-piled group a plastic storage (See Table 21.3.3(a)); however, the Extra Hazard Group 1 criteria applied to the non-storage areas does not have a maximum ceiling height. Throughout the development of sprinkler criteria there have been many successful tests that indicate that sprinklers are effective and will perform as design at ceiling heights up to 60 feet; however, recent testing has shown different results. Publicly available reports are available which show test results for sprinkler application of non-storage occupancies with high ceilings. These tests suggest that an increase in density may be warranted at certain ceiling heights.

While NFPA 13 currently does not require this adjustment, these findings are being discussed in the development of the 2025 edition of NFPA 13.

A summary of the tests and results can be found by following this link

<https://www.nfpa.org/-/media/Files/News-and-Research/Resources/Research-Foundation/Symposia/2014-supdet/2014-papers/SUPDET2014Thomas.ashx?la=en>



Question #9 – Minimum distance from FDC Check Valve to Exterior

The 2016 edition of NFPA 13 specifies that for drains subject to freezing, there is a required minimum distance of 4 ft. of exposed pipe between the drain valve and the exterior.

Is there a similar requirement for a minimum distance for a FDC line from the check valve to the exterior?

No. There is no minimum prescriptive distance specified for a minimum distance between the check valve and FDC. NFPA 13 does have an annex note (A.8.17.2.4) that states that the check valve (in a FDC line) should be located to “minimize freezing potential.” Further Section 8.17.2.6 does require an automatic drain valve to be installed in the piping between the check valve and FDC in areas subject to freezing.

The standard is purposefully vague about the requirement, recognizing that the demands of climate and freeze protection change from one area to another.

Question #10 – Fire Department Connections – Siamese vs Single Inlet

Typically, fire department connections (FDC) for a sprinkler system consist of 2 – 2 ½ inlets (Siamese). On a recent project, a single system with a 2 ½ inch riser was shown with a single inlet fire department connection. We understand that Section 8.17.2.3 does allow hydraulically calculated systems to have an FDC size equal to the largest riser.

Is it a requirement of the 2016 edition of NFPA 13 to have a Siamese type fire department connection?

No, an FDC connected to a single system with a 2 ½ inch riser is not required to have 2-2 ½ inch outlets.

Section 6.7.1.3 states that single-outlet fire department connections are permitted where piped to a 3 inch or smaller riser.

Question #11 – Means to Perform a Forward Flow Test for a Backflow prevention Device.

It is understood that NFPA 13 requires a “means to perform a forward flow test.” NFPA 13, however, does not seem to have a lot of information on how to size the forward flow test connection.

How should this means be sized?

NFPA 13, in the past did not specifically state a size for the test and only stated a means must be provided. It is important to note, however, that NFPA 13 for forward flow tests intends the “means” to be able to flow at the minimum flow rate of system demand including hose stream allowance if applicable.

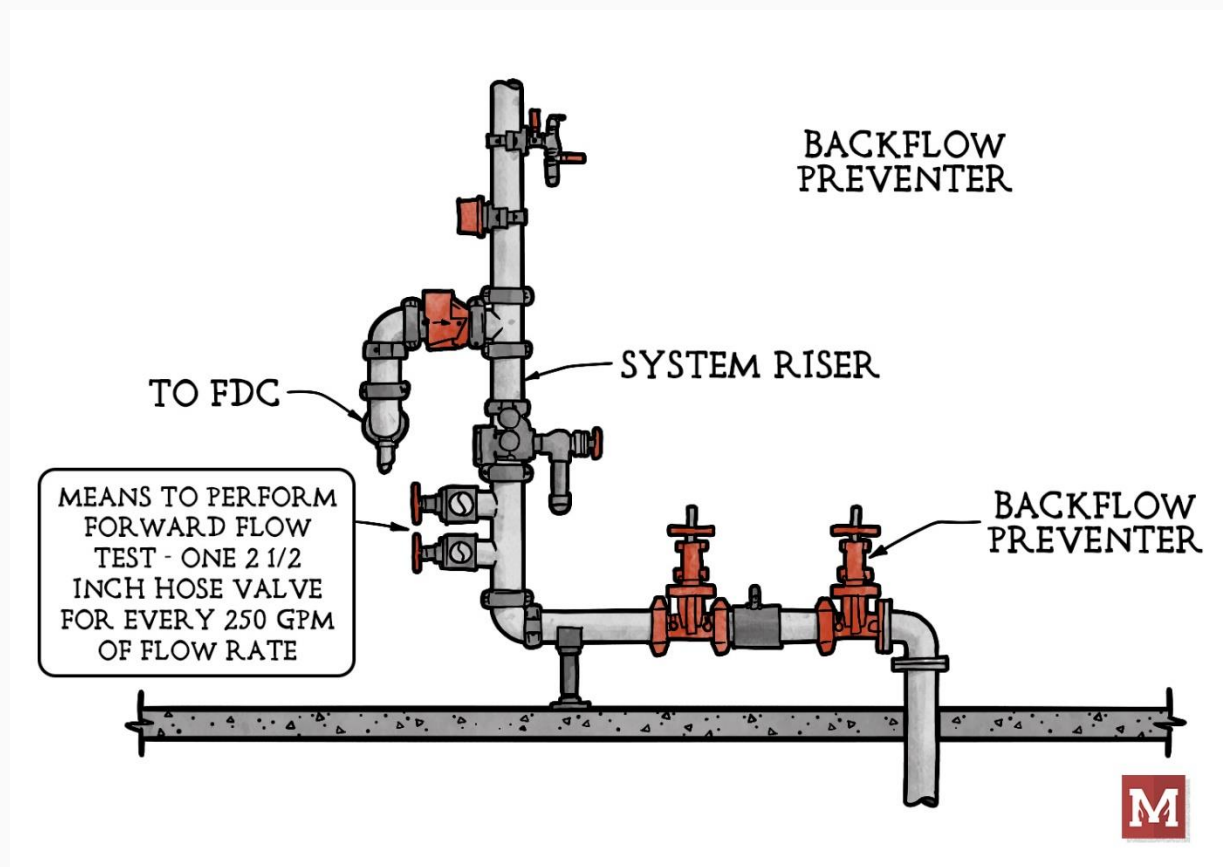
Throughout the years, NFPA 13 has become more specific about the requirements for this test.

Since 1996 NFPA 13 has required a means for conducting the forward flow test and provided an Annex guidance on how to accomplish this including: test headers, bypass around FDC w/ closed valve and closed loop flow w/meter or sight glass.

The 2016 edition of NFPA 13 revised Table 8.16.2.4.2 on the sizing of main drains to allow main drains larger than 2 inches. As noted by the annex to this section, this was to allow the main drain to be sufficient to flow the system demand flow rate as a “practical means for performing the forward flow test of the backflow device.” No sizing guidance was added.

The 2019 edition of NFPA 13 expanded on the text stating that the means must be installed so that the system does not have to be removed from service, to perform the forward flow test. Section 16.14.5.1.1 was added which states that the means to perform the forward flow test must be “serviceable without requiring the owner to modify the system to perform the test.”

The 2022 edition added a requirement to provide a 2 ½ inch hose valve for every 250 gpm of system demand flow rate including hose allowance where applicable (Section 16.14.5.1). This section does also allow other means as long as the flowrate requirement is met, and that the system does not require modification to perform this test.



Question #12 – Water supply for NFPA 13D

A residential fire sprinkler system is being installed in a single-family home in accordance with the 2016 edition of NFPA 13D. The sprinkler system and the plumbing system will be separate but share a common water service.

Is the domestic demand required to be added to the sprinkler demand as they are both served by a common water supply?

Domestic demand is not added to the sprinkler demand as long as the residential sprinkler system serves a single dwelling unit only.

If, however, the sprinkler system serves in more than one dwelling unit (and the sprinkler system and domestic use is served by a common supply pipe) then the provisions of Section 6.5.2 would apply. Section 6.5.2 states that 5 gpm is added to the sprinkler demand to size the common supply piping.

This section goes on to state that the 5 gpm is not required to be added if provisions is made to prevent flow into the domestic water system upon operation of a sprinkler. Also note that a dwelling unit is defined in Section 3.3.4.

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