

Best of January 2016

Following are a dozen questions answered by the engineering staff as part of the NFSA's Expert of the Day (EOD) member assistance program being brought forward as the "Best of January 2016." If you have a question for the NFSA EOD (and you are an NFSA member), send your question to eod@nfsa.org and the EOD will get back to you.

It should be noted that the following are the opinions of the NFSA Engineering Department staff, generated as members of the relevant NFPA 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 and should therefore not be considered, nor relied upon, as the official positions of the NFPA or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used.

Question 1 - System Protection Area Limitations

Is a 3-story 60,000 square-foot ordinary hazard building permitted to be protected with a single sprinkler system if each floor area is less than 52,000 square-feet?

Answer: No, not if the enforced code adopts the 2013 or later edition of NFPA 13. The standard only permits a 3-story building to be protected by a single system if the aggregate floor area is 52,000 square feet or less as per **NFPA 13 (2016) 8.2.4.3**. With an aggregate floor area of 60,000 square-feet, at least two systems would be required as per **8.2.4.1***: One serving the first floor and another serving the second and third as permitted by **8.2.4.2**. (This language originally appeared in the 2013 edition as **Section 8.16.1.5**.)

8.2.4 Floor Control Valve Assemblies.

8.2.4.1* Multistory buildings exceeding two stories in height shall be provided with a floor control valve, check valve, main drain valve, and flow switch for isolation, control, and annunciation of water flow on each floor level.

8.2.4.2 The floor control valve, check valve, main drain valve, and flow switch required by 8.2.4.1 shall not be required where sprinklers on the top level of a multistory building are supplied by piping on the floor below.

8.2.4.3 The floor control valve, check valve, main drain valve, and flow switch required by 8.2.4.1 shall not be required where the total area of all floors combined does not exceed the system protection area limitations of 8.2.1.



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8.2.1 The maximum floor area on any one floor to be protected by sprinklers supplied by any one sprinkler system riser or combined system riser shall be as follows:

....

(2) Ordinary hazard - 52,000 ft² (4830 m²)

....

Editions prior to 2013 do not limit the number of floors less than 52,000 square-feet that may be supplied by a single system riser. However, the **NFPA Automatic Sprinkler System Handbook, 2010 Edition**, does suggest that the intent of the 52,000 square-foot limitation is per fire area. If floors are connected by unprotected vertical openings, the aggregate area of the multi-floor fire area protected by a single sprinkler system should be limited to 52,000 square-feet or less.

Question 2 - Performing an Air Test in Lieu of a Hydrostatic Test for System Acceptance

A single interlock preaction system is to be installed in vaults where important paper documents will be stored. The owner requests that no hydrostatic test will be conducted upon completion. Is an air test a permissible alternative to performing a hydrostatic test?

Answer: No. All systems must be hydrostatically tested at 200 psi for 2 hours. There are some exceptions listed in **25.2.1*** of NFPA 13, but in this situation, the only acceptable test is the hydrostatic test. While "pressure is pressure," the effect of that pressure can be different when the pressure is generated by a different source. The key difference is in the ability of air versus water to compress. Air undergoes a substantial volume change when compressed while water does not. If the pressure confinement is suddenly eliminated, through the failure of a section of piping or a fitting, both the air and water go back to their pre-pressurized volumes. For water this is negligible but for air this considerable expansion can result in projectile movement of loose and damaged parts of the system; essentially creating shrapnel. It is for this reason that **NFPA 13** limits air pressure tests to a maximum of 40 psi.

Question 3 - Connecting Sprinkler Drains to Existing Condensate Drain Riser

Is it permissible under **NFPA 13** to connect a sprinkler drain in a high rise building to an existing 2-inch condensate drain riser?

Answer: No, sprinkler risers cannot be directly connected to condensate risers under typical circumstances. If the condensate riser discharges to the sewer, connection is explicitly prohibited by **8.16.2.6.1***.

8.16.2.6.1* Direct interconnections shall not be made between sprinkler drains and sewers.

A.8.16.2.6.1 Where possible, the main sprinkler riser drain should discharge outside the building at a point free from the possibility of causing water damage. Where it is not possible to discharge outside the building wall, the drain should be piped to a sump, which in turn should discharge by gravity or be pumped to a wastewater drain or sewer. The main sprinkler riser drain connection should be of a size sufficient to carry off water from the fully open drain valve while it is discharging under normal water system pressures. Where this is not possible, a supplementary drain of equal size should be provided for test purposes with free discharge, located at or above grade.



While it is conceivable that a situation could exist where it would be possible to connect small auxiliary drains to a condensate drain that is not directly connected to the sewer, the condensate line is unlikely to be sufficient in size to accommodate the full flow of a 2-inch Main Drain discharge under system pressure as required by **8.16.2.4.4** nor sized to comply with **8.16.2.4.8**.

8.16.2.4.4 Drains shall discharge outside or to a drain connection capable of handling the flow of the drain. [See **Figure A.8.17.4.1(b)**.]

8.16.2.4.8 Where drain connections for floor control valves are tied into a common drain riser, the drain riser shall be one pipe size larger downstream of each size drain connection tying into it.

Question 4 - New Sprinklers with Old Manufacturing Dates

With regard to **NFPA 13 Section 5.1.1***, "Only new sprinklers shall be installed in sprinkler systems"; does the standard require "new" sprinklers to bear "new" dates?

Answer: No, the determination that a sprinkler is "new" is not based on its date of manufacture but on whether it has ever been previously installed. The intent of the requirement is to prevent sprinklers from being removed and reinstalled; whether in the same fitting or a different system altogether. The standard only permits "new" (i.e. never previously installed) sprinklers to be used.

It should be noted that, although not explicitly stated in the standard, the presumption is that "new" sprinklers have been properly stored and protected against damage between the time that they are manufactured and installed; for example, in the manufacturer's original packaging or equivalent or in an approved sprinkler cabinet.

Question 5 - Omitting Sprinklers in Noncombustible Vestibule

A building will be protected in accordance with **NFPA 13**. The entry vestibule will be noncombustible construction (with no glass used) and will not be heated. Can sprinklers be omitted from this enclosed space?

Answer: No. **NFPA 13** utilizes the concept that all spaces are protected with fire sprinklers unless a space is permitted to omit the sprinklers. There are no specific allowances to omit the sprinklers for an entry vestibule.

Assuming that the concern is that the space is not heated, one option would be to use a dry sidewall sprinkler to protect the vestibule. If this is not an option, then it is best to consult the authority having jurisdiction (AHJ) to see if there are any alternatives. There have been some scenarios where the footprint of a vestibule or revolving door enclosure have been permitted by the AHJ to omit the sprinkler for practical purposes provided that the floor area is covered by adjacent sprinklers in the adjoining space. However, the standard does not state that allowance so the decision would have to come from the AHJ.

Question 6 - Adjusting Design Areas to Comply with Required Minimums

The design density for an Extra Hazard occupancy building has been determined to be 0.3 gpm/square-foot over a 2000 square-foot design area. High-temperature sprinklers will be used for a 25

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percent area reduction for high temperature sprinklers in Extra Hazard (EH) occupancies as permitted by **NFPA 13 Section 11.2.3.2.6**.

11.2.3.2.6 High-Temperature Sprinklers. Where high temperature sprinklers are used for extra hazard occupancies, the area of sprinkler operation shall be permitted to be reduced by 25 percent without revising the density, but not to less than 2000 ft² (186 m²).

It has been determined that the design area must have a length parallel to the branch lines as per **23.4.4.2.1*** of at least 53.67 feet and requires at least 5 sprinklers per branch. Due to the narrowness of the building, there are only three branch lines across so taking 5 sprinklers on each results in a rectangular area of only about 1500 square-feet.

23.4.4.2.1* Where the design is based on the density/area method, the design area shall be a rectangular area having a dimension parallel to the branch lines at least 1.2 times the square root of the area of sprinkler operation (*A*) used, which shall permit the inclusion of sprinklers on both sides of the cross main.

How should this design area be adjusted to at least 2000 square-feet to comply with the requirements of **NFPA 13**?

Answer: The number of sprinklers on each branch line must be increased to seven to meet both the minimum design area length (53.67 feet) and minimum design area requirement (2000 square-feet)". This will satisfy both **11.2.3.2.6** and **23.4.4.2.1***.

Based on the total required size of the design area and sprinkler coverage shown in the drawing provided, the design area will need to include 21 sprinklers. The standard requires the rectangular area to have a *minimum* dimension parallel to the branch lines of 53.67 feet (5 sprinklers) but, in order to include a total of 21 sprinklers with just 3 branch lines, that dimension must be lengthened to include 7 sprinklers (79.87 feet) satisfying **23.4.4.2.1***. Including all 3 available branch lines will create a design area of 2077 square-feet satisfying **11.2.3.2.6**.

Question 7 - Sprinklers on Covered Patio with Gas Fireplace

It has been determined that a covered patio does not require fire sprinklers. If a gas-fired fireplace is installed on the patio, would the area now require sprinklers according to **NFPA 13**?

Answer: No. **NFPA 13** requires sprinklers for exterior projections over specified widths based primarily on the materials of construction. If there is storage below the projection then sprinklers would be required. However, the presence of a fireplace on the patio would not be classified as storage. If it has been determined that the materials of the projection were such that sprinklers were permitted to be omitted from this space, then the added presence of a fireplace would not be sufficient to require sprinklers.

Question 8 - Sizing Water Tanks Including Refill Rate

Is it acceptable to utilize the refill rate when determining tank size (not a break tank)?

Answer: Yes, the **NFPA** installation documents permit the refill rates from water supplies to meet part of the duration demand. This



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concept is best expressed in the **NFPA 22 Section 4.1.4**. This section, which is new in the 2013 edition, reads as follows:

4.1.4 A tank shall be sized so that the stored supply plus reliable automatic refill shall be sufficient to meet the demand placed upon it for the design duration.

It must be noted that if this tank provides suction to a fire pump it is by definition (in both **NFPA 20** and **NFPA 22**) considered a break tank and the rules for sizing and arranging the refill mechanisms must be followed. These rules can be found in **NFPA 22 Section 14.5.3**.

The following is the definition of a break tank in **NFPA 22**:

3.3.1 Break Tank. A tank providing suction to a fire pump whose capacity is less than the fire protection demand (flow rate times flow duration).

If this tank does not include a fire pump, it would not technically be a break tank but the reliability and arrangement of the refill mechanism must be evaluated to ensure that the required duration of the fire protection system is available.

Question 9 - Concern for Overpressurization in Multipurpose NFPA 13D System

A **NFPA 13D** multipurpose system will be supplied from a common cistern tank fed by a well pump. The sprinkler system (and combined domestic) will include a 2 hp booster pump. Should there be a concern that the domestic fixtures may be overpressurized or that the pump will turn on every time a plumbing fixture is turned on?

Answer: Yes, but a properly set pressure switch will turn on the booster pump to feed the operating sprinkler system but will not turn the pump on upon the flow of the domestic fixtures. A residential sprinkler will have flows and pressure requirements well in excess of any typical plumbing fixture. As long as the pump at worst case does not exceed the maximum pressure ratings of all the components including the domestic fixtures, over pressurizing the system should not be an issue. If there is a concern of overpressurizing the system a pressure-reducing valve set to 80 psi is acceptable.

Question 10 - Sprinklers Remaining in Noncombustible Concealed Space

Ceilings are added below existing sprinklers in a tenant fit out creating a noncombustible concealed space. New sprinklers are to be installed above the new, lower ceiling level. Is it permissible to leave the existing sprinklers in place in the newly created concealed space?

Answer: Yes, **NFPA 13 Section 8.15.1.2.1*** does not require sprinklers in noncombustible concealed spaces but it does not prohibit them.

8.15.1.2.1* Concealed spaces of noncombustible and limitedcombustible construction with minimal combustible loading having no access shall not require sprinkler protection.

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Question 11 - Minimum Height for Sprinkler Pipe

Is there a required minimum height above the floor for sprinkler piping?

Answer: Yes. The building code via the barrier free code (ICC/ANSI A117.1) would require, in a general sense, a minimum of 6 feet-8 inches (80 inches) of clearance. Fire sprinkler pipe should be at or above this minimum height. The 80 inches would also apply to signs on posts and other projections. 80 inches is the height of a door. This allows for clear passage under the pipe, through a door, under a post-mounted sign for most people. The building code has a higher headroom requirement for habitable spaces and rooms at 7 feet, but fire sprinkler pipe would not be required at this minimum height.

Question 12 - Determining Limited-Combustibles by Heat Release Rate

A concealed space will have exposed 2 by 6 douglas fir wood structural members. Is it possible to consider douglas fir a limited combustible material based on its heat release rate (HRR)?

Answer: No, douglas fir wood cannot be treated as a limited combustible material in accordance with **NFPA 13 Section 3.3.16***.

3.3.16* Limited-Combustible (Material). Refers to a building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8100 kJ/kg), where tested in accordance with NFPA 259, and includes either of the following: (1) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 1/8 in. (3.2 mm) that has a flame spread index not greater than 50; or (2) materials, in the form and thickness used, having neither a flame spread index greater than 25 nor evidence of continued progressive combustion, and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion, when tested in accordance with ASTM E84, Standard Test Method of Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard Test Method of Surface Burning Characteristics of Building Materials.

Even if the material had a low enough potential heat value, douglas fir wood could not comply with the other requirements of the section. There are no natural wood materials that we are aware of that will have a low enough flame spread rating to pass the necessary testing. Wood materials that are acceptable for omitting sprinklers from within a concealed space are those that are fire retardant-treated wood complying with **NFPA 703 per 8.15.1.2.11**.

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