NFSA The Voice of the Fire Sprinkler Industry TechNotes

Editor-Kenneth E. Isman, P.E. **Issue# 278** **October 15, 2013**

Best of September 2013

This month, we have selected the following dozen questions as the "Best of September 2013" answered by the engineering staff as part of the NFSA's EOD member assistance program.

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. These have not been processed as a formal interpretation in accordance with the NFPA Regulations Governing Committee Projects and should therefore not be considered, nor relied upon, as the official position of the NFPA or its Committees.

Question 1 – ESFR Obstructions in Non-Storage Use

NFPA 13 allows ESFR sprinklers to be used to protect light and ordinary hazard occupancies. When ESFR sprinklers are used in this manner, do the ESFR obstruction rules need to be followed?

Answer: Yes. The ESFR installation and discharge rules need to be followed including the obstruction rules, even if the hazard is light or ordinary rather than high-piled storage.

Question 2 – Toggle Hangers in Gypsum Ceiling

Can toggle hangers be used to support 1-inch branch line piping from gypsum board?

Answer: No. Sections 9.2.1.1.1 and 9.2.1.1.2 of NFPA 13 only allow toggle hangers for small pipe in ceilings of hollow tile or metal lath and plaster. Annex section A.9.2.1.1.1 further clarifies, "Fasteners used to support sprinkler system piping should not be attached to ceilings of gypsum or other similar soft material." The gypsum board, if saturated with water, would not have the same strength as dry gypsum board.

Question 3 – Returning an Old System to Service

What's the procedure for returning a sprinkler system to service after it has been out of service for many years?

Answer: The only requirement in the codes and standards that we are aware of is in NFPA 25. Section 14.3.1(10) of NFPA 25 requires that whenever a system has been shut down for more than a year, that an internal obstruction investigation be conducted to make sure that nothing is inside the piping that will cause an obstruction to water flow.

We are not aware of requirements for other tests, but we would certainly believe that a hydrostatic test would be in order to insure the integrity of the piping system. However, you would not want to run such a test at 200 psi. The hydrostatic test should be run at whatever would be a reasonable maximum system working pressure given the conditions of the water supply.

Question 4 – Cast-in-Place Concrete Anchors for Seismic

We have noticed that there are requirements for post-installed anchors to be prequalified for use in seismic applications. But what about cast-in-place concrete anchors? Can they be used in seismic applications or do they have to be certified by a registered professional engineer?

Answer: Cast-in-place anchors can be used. Although NFPA 13 only notes a difference between cast-in anchors and post-installed anchors in Figure A.9.1.1. The rules would need to be tweaked for cast-in anchors. When the Committee added the language for seismic requirements on concrete anchors, the intent was to address post-installed anchors as they are more commonly used due to the timing of projects and not having to locate hangers prior to the concrete being poured. Therefore, cast-in anchors would have to be listed for the application. A brief search shows that there are such hangers listed for these applications, but none specifically noting seismic protection. Even with Section 9.3.7.8 in NFPA 13, 2013 edition, cast in place anchors would not be ruled out since the prequalification standard only addresses post-installed anchors.

The intention of the Committee was not to prohibit these devices. The language in the standard does not clearly separate post-installed anchors, so we will add this to our files for future revisions. The building codes do have calculation requirements for concrete anchors when they are installed in a seismic area, which should be reviewed when selecting proper components.

Question 5 – Splicing Seismic Restraint Wire

Does NFPA 13 permit the splicing of seismic restraint wire (#12, 440 lb, single strand) to create longer restraint assemblies?

Answer: No. It is not acceptable to splice restraint wire because that would create a weak point in the restraint wire. Braces line restraints are not required to be listed, but they are required to be approved by the AHJ. It may be possible to convince the AHJ that the spiced wire would meet the requirements of NFPA 13 - 2013, section 9.3.6.1, however, it would be difficult to prove that the splice would meet the strength specifications of the accepted No. 12, 440 lb wire.

Question 6 – Room Design Method and High Piled Storage

Can the room design method be used with high piled storage?

Answer: Yes. Section 12.7.1 states that the water supply can be determined by the density/area method of Chapters 12-20 or by room design method of Section 12.10.

Question 7 – Separate Control Valves for Dwelling Units in NFPA 13R Systems

Is there a requirement in NFPA 13R to have a control valve for each dwelling unit?

Answer: No. However, if each dwelling unit is townhouse style, then each dwelling could have a control valve or separate sprinkler system according to Section 4.6. If a single control valve is used in multiple dwelling units, the control valve needs to be in a common area, not in one of the dwelling units.

Question 8 – Pressure for Manual Standpipe System

We are calculating a manual-wet standpipe system and the pressure demand at the FDC will exceed the 150 psi net pressure that the fire department pumper will can provide. Can we count on some pressure from the public water supply?

Answer: Yes, as long as the residual pressure from the city supply is a reasonable worse-case given daily and seasonal fluctuations and as long as the pressure is evaluated at the demand flow of the standpipe system. The 150 psi that is discussed by NFPA 1901 for a fire department pumper truck is a net pressure. The discharge pressure from the pumper truck will be the net pressure plus the suction pressure. To be fair, you would need to subtract the friction loss in the hose from the hydrant to the fire truck and from the fire truck to the FDC.

Question 9 – Standpipe System for Building with Two Different Heights

We are designing a standpipe system with two different parts to the building. One part of the building is 90 ft tall and has three Class I standpipe risers. The other part of the building is 300 ft tall and has two Class I standpipe risers. Do we need to calculate the 300 ft portion of the building with 1000 gpm even though there are only two risers?

Answer: You need to perform two different hydraulic calculations. The first is performed at the high elevation (300 ft) and the maximum flow for this calculation would be 750 gpm because you only have two standpipes. Then, you need to perform the second hydraulic calculation at the 90 ft elevation and here you would calculate a maximum of 1000 gpm (assuming that the building is fully sprinklered). This may or may not include the two standpipes that feed the tower, depending on which standpipes are most remote from the water supply. But if this calculation includes the standpipes in the tower, you only consider the flow from the outlets at the 90 ft elevation for the second calculation, not the 300 ft elevation for the second calculation. The purpose of the second calculation is to see that the fire department has the correct flow available for a fire at the 90 ft elevation.

Question 10 – Sediment from Ponds

Are the double screens required by NFPA 20 sufficient for keeping sediment out of a sprinkler system with ½ inch sprinklers when the water supply comes from a pond or open reservoir? Should the pond or open reservoir be lined as recommended by FM?

Answer: The double removable screens (as shown in Figure A.7.2.2.2 of NFPA 20) are sufficient for making sure that the big stuff does not get into the system. There is also a basket suction strainer at the intake of the vertical shaft turbine pump to help eliminate more debris from entering the system.

Small silt and sediment can still get through the fire protection system. For this reason, section 8.15.18 of NFPA 13 requires the use of upright sprinklers or pendent sprinklers on return bends when the system is from a pond or reservoir. The small stuff that gets through the screens and strainers is suspended in the water and settles at the bottom of the pipe. This should not affect an upright sprinkler. To prevent clogging of pendent sprinklers, we have found return bends to be sufficient.

If the sediment can get through a couple of ½ inch screens, it should be able to get through a ½ inch sprinkler opening. If there is concern about the screen mesh being too large, it can always be smaller (the ½ inch size in NFPA 20 is a maximum, so you are allowed to go smaller), but then you need bigger screens because you need 1 sq inch of opening in the screen for each 1 gpm flow of the pump (evaluated at maximum flow; 150% of rated flow).

We have not seen the need to require ponds or reservoirs to be lined. We are aware of several water supplies for sprinkler systems taking suction from ponds and reservoirs that are not lined and we are not aware of problems with these systems. FM, of course, is welcome to do whatever they want, and they frequently have higher expectations of their clients than the NFPA standards.

The 5-year internal inspection required by NFPA 25 should be sufficient for determining if sediment is causing an unacceptable build-up in the piping system.

Question 11 – C-Factor for Old Underground Pipe

We are calculating a new fire sprinkler system that will be connected to some old underground. What C-factor should we use for the old underground pipe?

Answer: The C-factors in NFPA 13 (140 for lined ductile iron and 150 for plastic) already have assumptions in them for aged pipe. So, most people use 140 and 150 for lined ductile iron and plastic types of underground, even when they have been installed for some time.

If the system is really old, the underground might be unlined ductile iron. NFPA 24 allowed this prior to 1977. Starting with the 1977 edition, NFPA 24 required the use of lined iron pipe for underground. Unlined ductile iron pipe is required to be calculated with a C-factor of 100. This C-factor of 100 does account for a significant amount of aging (new iron pipe has a C-factor closer to 150). So, there is significant aging accounted for in the C-factor of 100.

If there is any question about the C-factor of the pipe, you can run a C-factor test as long as there are three hydrants connected to the underground in a row where you could run water from one hydrant and have all of the flow come past the other two. Put a gage at each hydrant where the water is flowing past and take pressure readings. Assuming that the hydrants are at the same elevation (adjust if they are not), the difference between the gage readings is the friction loss between the hydrants. Once you know the friction loss, you can calculate backwards through the Hazen-Williams formula to determine the C-factor as follows:

$$C = \frac{2.26Q}{d^{2.63}\,p^{0.54}}$$

In the equation above, the Q is the flow going past the hydrants (you'll need a flow meter or pitot gage to get this from the flowing hydrant), the d is the internal diameter of the pipe and the P is the friction loss per foot of pipe. You get the friction loss from the difference in the gages on the hydrants and then you have to divide it by the distance between the hydrants.

Question 12 – Starting the "Clock" on New Sprinklers

We are installing quick response sprinklers in a system that are three years old. These sprinklers have never been installed and meet the definition of "new" sprinklers. NFPA 25 requires that quick response sprinklers be tested when they are 20 years old. So, do these sprinklers need to be tested in 2033 or 2030?

Answer: 2030. The clock starts when they are manufactured, not installed.

Did You Know??

The NFSA keeps a member of the Engineering Department staff on duty every business day to answer your technical questions live. We call this the Expert of the Day (EOD) program. You can reach the expert of the day by phone, fax, or e-mail. Call us at (845) 878-4200 and press 5, or you can send a fax to (845) 878-4215, or you can e-mail us at eod@nfsa.org. Last year we answered more than 2600 requests for assistance.