NFSA The Voice of the Fire Sprinkler Industry

TechNotes

Editor-Kenneth E. Isman, P.E. Issue# 276 September 17, 2013

Best of August 2013

This month, we have selected the following dozen questions as the "Best of August 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 – Static Pressure Loss with Backflow Preventer

The static pressure reading at a hydrant upstream of an RPZ backflow device was 68 psi, but the static pressure downstream of the RPZ was 56 psi (no elevation change). The spec sheet for the RPZ shows a loss of 10 pounds at very low flows, but it does not mention the words "static pressure loss". I have not been able to find any other documentation to support what we are seeing there. Is it reasonable to expect a static loss of 12-15 psi across an RPZ?

Answer: What you are describing is unusual, but not completely out of the question. An RPZ is manufactured with springs forcing the check valves closed. When there is a small differential in pressure between the water supply side and the sprinkler system side of the RPZ, the springs keep the check valves closed, even if the pressure on the water supply side is a bit higher. Typically the springs hold for pressures of about 5 to 10 psi higher on the water supply side than the sprinkler system side.

One possible explanation for what you have observed is that this RPZ has stronger than normal springs. Another possible explanation is that there is something else stuck in the backflow preventer that is not allowing the valve to open. This is why NFPA 25 requires a forward flow test of a backflow preventer. During a forward flow test, you will see if the RPZ opens. If it does, then there will be a difference in residual pressure between the two pressure gages. This difference in residual pressure is usually smaller at high flows and higher at low flows because the momentum of the water flowing through the RPZ at high flows helps to push the spring loaded check valves open and keep them open. At low flows, the springs take over and make it harder to push the valve open.

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As you shut down the flow from the test, the pressure differential increases and the valve sometimes closes up in the static condition with a different pressure on either side of the valves.

If the difference in static pressures is a concern for some reason, you might be able solve the problem by replacing the springs. My understanding is that there is some variation in RPZ springs and that you may have gotten springs at the high end of the tolerance from the manufacturer and that springs with less of a push might be available.

Question 2 – Sprinklers in a Grease Duct

What are the discharge requirements for sprinklers in a grease duct?

Answer: Section 11.2.3.4.3 of NFPA 13 requires sprinklers within the duct to be hydraulically designed to provide a discharge pressure of not less than 7 psi at each sprinkler with all sprinklers within the duct flowing.

Question 3 – ESFR Sprinklers in Racks

Since ESFR sprinklers are specifically for the protection of rack storage, can they be used as in-rack sprinklers?

Answer: No. ESFR sprinklers are not intended to be used in racks and section 8.13.2.1 of NFPA 13 prohibits the use of ESFR sprinklers in racks. The use of an ESFR sprinkler in a rack is a waste of money and water. The only sprinklers that make sense for use in racks are k-5.6, k-8 or k-11.2 spray sprinklers.

Question 4 – Small Orifice Sprinklers and Ordinary Hazard

Does section 8.3.4 of the 2007 edition of NFPA 13 prohibit the use of small orifice sprinklers in ordinary hazard occupancies?

Answer: Yes. Section 8.3.4.1 limits the use of small orifice sprinklers to those systems that meet two conditions. The systems have to be light hazard and the systems have to have a flow demand that is less than what a k-5.6 sprinkler would discharge at 7 psi (which is 14.8 gpm). The system has to meet both conditions in order to be able to use small orifice sprinklers.

You are not the first person to ask this question. For the 2013 edition,

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the committee rewrote section 8.3.4.1 to specifically say that sprinklers in all occupancies are limited to k-5.6 or larger unless they meet the rules of the rest of the section. The rest of the section goes on to contain the limits that have been in the previous editions of light hazard and limited flow demand. This change in the 2013 edition should be seen as a clarification of previous intent and not a change in the philosophy of the committee.

Question 5 – Shallow Ceiling Pockets

We have a situation where the ceiling has multiple pockets close together (within 10 ft of each other) that are only 11 inches deep. We are using standard spray sprinklers. Do we need to put sprinklers up in all of the pockets?

Answer: No, as long as sprinklers are installed within 1 inch of the ceiling at the lower ceiling elevation (assuming these sprinklers cover the floor area correctly). Spray sprinklers are required to be installed within 12 inches of the ceilings throughout the coverage area of the sprinkler (see section 8.6.4.1.1.1). A sprinkler within 1 inch of the lower ceiling is within 12 inches of the higher ceiling elevation, thus meeting the installation rules.

Question 6 – Hydraulic Nameplate Data

NFPA 13 requires the hydraulic nameplate to have entered on it the sprinkler system demand at the base of the riser, including hose stream demand. Are we supposed to enter just the inside hose stream demand, since this is all that would exist at the base of the riser, or are we supposed to put the outside hose demand on the nameplate?

Answer: Ultimately, it does not matter how you fill out the data plate as long as the hose demand that is added in for the flow demand at the base of the riser is also entered into the place on the nameplate for the hose stream. All that is important is that from the hydraulic nameplate data, you need to be able to figure out what the sprinklers need in the way of flow by themselves.

The literal text of NFPA 13 is to enter the demand at the base of the riser. This would only include inside hose. Then, you enter the inside hose in that blank spot. From that information, you can back out the sprinkler flow demand.

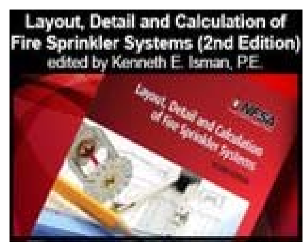
If you enter the total flow demand at the street, which includes the outside hose demand. This is okay as long as they enter the total inside and outside hose demand in the hose stream line. This way, you can still back out the sprinkler flow demand on its own.

Either situation will provide the information that is needed from the sign. Although the second one is technically more information than the standard requires, it's not terrible and most AHJ's accept it as equivalent.

Question 7 – Small Walk-In Freezers

Are sprinklers required in walk-in freezers, no matter how small?

Answer: Yes. Sprinklers are required in a walk-in freezer, see section



8.1.1(1). There is no exception in the standard that allows sprinklers to be omitted from walk-in freezers of any size. Walk-in freezers should be treated like closets. We sprinkler every closet, regardless of size (with the exception of closets in hotel guest rooms). Since there are no walk-in freezers in hotel guest rooms, the analogy is valid and we need to sprinkler them.

Question 8 – Sprinkler Penetrations in Floor/Ceiling Assemblies

Where do the codes and standards specifically deal with the penetration of a sprinkler in a 2-hr rated floor/ceiling assembly and the potential need to seal the penetration?

Answer: The answer depends on the type of penetration and the building/fire code that the local jurisdiction is using. There are two types of penetrations of fire rated floor/ceiling assemblies. Most floor/ceiling assemblies are made up of multiple layers (called membranes) with a 2-hr rated assembly usually consisting of some amount of steel, some amount of concrete or cement and some amount of gypsum board or a lay-in tile ceiling. If the sprinkler (and the piping leading to the sprinkler) only penetrates one of these layers, the penetration is called a "membrane penetration". If the sprinkler and the piping leading to it penetrate more than one layer, then the penetration is called a "through penetration" because it goes all the way from one side of the assembly to the other.

Through penetrations are much more of a concern than membrane penetrations. A through penetration always needs to be sealed with fire resistant material equivalent in duration to the rating of the assembly that has been penetrated. But membrane penetrations are less of a concern because the fire can't follow the pipe from one side of the penetration to the other. Most building/fire codes have more relaxed rules when it comes to membrane penetrations.

The International Building Code (IBC) specifically discusses the membrane penetration of a sprinkler and the piping feeding a sprinkler in two different sections, one for vertical assemblies like walls and the other for horizontal assemblies like floor/ceilings. For horizontal assemblies, Exception 5 to section 714.4.1.2 allows sprinkler penetrations with metallic escutcheons to be exempt from the rules of sealing the penetration. For vertical assemblies like walls, Exception 5 to section 714.3.2 allows sprinkler penetrations with metallic escutcheons to be exempt from the rules of sealing the penetration.

Most of the sprinkler penetrations of floor/ceiling assemblies are only membrane penetrations. The branch line piping is in the concealed space between the drop ceiling and the floor slab/deck and the drop to the pendent sprinkler only penetrates the membrane of the drop ceiling. In these circumstances, nothing else is needed as long as the hole is covered with a metallic escutcheon.

Question 9 – Number of Inlets on FDC's

Why do NFPA 13 and NFPA 14 have different rules for how many inlet connection have to be installed on fire department connections (FDC's)? NFPA 13 only requires 2 inlets (2-1/2 inch connections) in Section 6.8.1 while NFPA 14 (in Section 7.12.3) requires one 2-1/2 inch connection for

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each 250 gpm of demand, so you may end up with 3, 4 or 5 connections depending on whether your standpipe demand is 750, 1000 or 1250 gpm. Why the difference? In a combined sprinkler/standpipe system, is the requirement to add the number of outlets? If we have a combined sprinkler/standpipe system with a standpipe flow demand of 1000 gpm, do we need 4 or 6 inlets for the FDC?

Answer: As you pointed out in your question, NFPA 13 is very clear on the subject of the number of inlets for the fire department connection. Section 6.8.1 of NFPA 13 specifically requires 2 inlets (2½ inches in size) for the FDC. The number of inlets is not required to increase if the flow demand of the system increases. Section 6.8.1 applies equally to Extra Hazard Group 2 systems as well as Light Hazard systems. As far as NFPA 13 is concerned, the FDC is not there to provide the entire flow for the fire sprinkler system. NFPA 13 requires a reliable water supply to provide the full flow. The purpose of the FDC is to act as an auxiliary pressure source and a supplement to the water supply if such a supplement becomes necessary.

The NFPA 14 committee feels differently about the FDC. They want the standpipe flow demand to be able to get through the FDC. Section 7.12.3 of NFPA 14 requires the user to size the FDC for the standpipe system demand with a 2½ inch connection for every 250 gpm of flow demand. Note that section 7.12.3 specifically says to use the “standpipe system demand” to make this determination, not the sprinkler system demand or the combined water supply demand.

Section 7.12.3 of NFPA 14 prohibits the AHJ from considering the sprinkler system demand when determining the number of inlets for the FDC. In your situation, the standpipe system has a flow demand of 1000 gpm, therefore, four inlets will meet the requirements of both NFPA 13 and NFPA 14.

Question 10 – Multiple FDC’s on Standpipe System

Does a standpipe system with more than one fire department connection (FDC) need to be calculated to the remote FDC?

Answer: Yes, if the FDC is installed because of section 7.12. Section 7.7.1 of NFPA 14 requires that calculations be provided to show that the system demand can be supplied from “each fire department connection, which is provided in accordance with Section 7.12.” Since the section uses the term “each”, it means that the remote one has to work as well as the closer one, assuming that both are being installed due to section 7.12. If the remote FDC is installed for the convenience of the client, then it might not be required under section 7.12 and you could make the case that it does not need to supply the system demand.

When calculating the demand to a remote FDC, the water supply becomes the equipment that the fire department brings to the fire. Frequently, this means that you can comply with section 7.7.1 without upsizing the pipe in the standpipe system as long as you know that the fire department is going to bring a pumper truck that has the capability to provide some high pressure.

Question 11 – Pump Sensing Line Check Valves and Unions

NFPA 20 requires the installation of two check valves or ground face

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unions (with 3/32 inch holes drilled in them) in the sensing line from the controller to the discharge side of the pump. How do you select whether to use a check valve or a ground face union? Do the check valves or ground face unions need to be installed horizontally?

Answer: The installer of a sensing line for a fire pump or jockey pump can choose between two options for pressure dampening in a system: check valves or ground face unions. The choice to use ground face unions should only be made when the water is clean enough that you do not need to worry about sediment in the water clogging up a 3/32 inch wide hole, which means that the water needs to be pretty clean to make this selection.

The check valves also have 3/32 inch holes drilled in them. But if the holes in the check valves clog up with sediment, the check valves will still swing open when the water pressure in the fire protection system drops and the lower pressure will still be sensed back at the pressure switch in the controller.

If the holes in ground face unions get clogged, there is no way for them to swing open, so you don’t want to select the use of ground face unions unless the water is very clean.

There is no rule in NFPA 20 to put either check valves or ground face unions in the horizontal position. The annex figures in NFPA 13 show them in the horizontal position, but these are not legally enforceable. The annex figures are merely informational.

Many installers like the idea of installing the check valves horizontally to prevent sediment from building up on the check valve and preventing the check valve from opening. This would be a preference for installation, not a requirement.

But if you have decided to chose ground face unions as your method of dampening pressure surges, then it should not matter whether they are horizontal or vertical because it is only legitimate to make this selection when the water is free of sediment, so you should not have to worry about where the sediment will fall. There should not be any sediment in the water.

Question 12 – Break Tanks in Earthquake Areas

The NFPA Fire Pump Handbook for the 2010 Edition of NFPA 20 has commentary to Section 4.31 dealing with break tanks regarding areas that are subject to earthquake protection. Specifically, it says that break tanks can’t be used in an area subject to earthquake. Is that correct?

Answer: It depends on the situation where the break tank is being proposed. A break tank is defined in Section 3.3.6 of NFPA 20 as "A tank providing suction to a fire pump whose capacity is less than the fire protection demand (flow rate times flow duration)." Refill from the water supply is expected to make up the difference so that the duration demand of the fire protection system can be met. NFPA 13 and NFPA 22 both allow the use of break tanks to meet the system demand, but these are not the only documents with rules that need to be followed.

The International Building Code has a requirement (903.3.5.2) for secondary water supplies in high-rise buildings in seismic design categories C through F. This secondary supply is required to be on-site. The commentary to the IBC text notes that a second connection to the municipal supply is to be avoided, which is why the code calls for the supply to be "on-site." This means that a tank for this scenario would have to be sized for the demand of the system (including applicable hose stream). Therefore, it would no longer meet the break tank definition in NFPA 20.

If the purpose of the tank and pump is to provide fire protection for a high-rise building in an earthquake area, then a break tank cannot be used if the IBC is the code being enforced. But if the pump and tank is for a building that does not meet the definition of high-rise, then a break tank could be used, even in an earthquake area. The Handbook was trying to offer insight to users on this, but did not go far enough to grasp the whole picture.

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