NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Tuesday e-Tech Alert
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No. 65

Best Questions of August 2006

We have selected the following questions as the "best of August 2006" answered by the NFSA Engineering staff:

Question 1 - Pressure Reducing Valves in Pump Discharge vs. Discharge Piping

We were under the impression that NFPA 20 does not allow for the installation of pressure reducing valves in the discharge piping of the fire pump as per Section 5.7.4.2 (2003 edition) and have been using variable speed driver pumps because of this. But we recently read that NFPA 14 has adopted changes allowing for "master pressure reducing valves" on the discharge side of fire pumps. Will NFPA 20 allow their use?

Answer: NFPA 20 prohibits the use of pressure reducing valves in the discharge pipe of a fire pump. The discharge pipe is the small length of pipe between the pump discharge flange and the control valve on the discharge side of the pump. Beyond the discharge pipe, NFPA 20 has no control over the devices used in the rest of the fire protection system. With respect to pressure reducing valves being used, the situation needs to be addressed by NFPA 13, NFPA 14 or NFPA 24, depending on where the pipe goes after the discharge valve of the pump.

NFPA 24 prohibits the use of pressure reducing valves anywhere in the private fire service main. NFPA 13 allows the use of pressure reducing valves anywhere in the piping including the riser and in the floor control assemblies. NFPA 14 has just taken steps to only allow pressure reducing valves to be used to serve more than 2 outlets if there are two valves installed in series to handle the concern of the valve failing in the open position. Note that this can only be done with pilot operating devices. Direct acting pressure reducing valves would not be able to be installed in series to prevent a problem if they were to fail in the open position.

As you can see, the requirements are all over the map, so it is impossible to make a single statement regarding the use of pressure reducing valves. Variable speed driver pumps (pressure limiting control) are considered more reliable and more predictable in their response, and are universally allowed in accordance with NFPA 20, NFPA 24, NFPA 14 and NFPA 13.

Question 2 - Low Obstructions

Is there an industry standard regarding when to locate sprinklers beneath obstructions that are located close to the floor? In other words, below what elevation does it become reasonable to omit sprinklers below obstructions greater than 4 ft in width? For example, if a conveyor is over 4 ft wide and is only 30 inches above the floor, it would technically require sprinklers beneath it but is not very practical

Answer: You are correct that in the example you gave sprinklers need to be installed. We can't provide any additional guidance except to say that the authority having jurisdiction (AHJ) gets the last say on practical matters. You can omit sprinklers in special cases if the AHJ allows it.

During the last revision cycle, representatives of General Motors proposed that NFPA 13 include a section to specifically permit sprinklers to be omitted from spaces under conveyor belts that were more than 4 ft wide but close to the floor. The Committee rejected the proposal, noting that combustibles could build up under the belt. The Committee went on to state that if General Motors or other users of the standard wanted to leave sprinklers out of such a space, they could close it in with noncombustible or limited combustible material and create a concealed space from which sprinklers could legitimately be omitted.

Question 3 - Composite Wood Joists vs. Wood Joists

Why are composite wood joists separated from solid wood joists with regard to the 6-inch rule and the omission of sprinklers therein? Is it because of the flammability of the composite wood joists? The chance for greater depth? The chance for a greater span?

Answer: Composite wood joists are treated differently from solid wood joists because they are different. Although they are both of wood, composite wood joists have different burning characteristics, are typically larger in dimension and installed at greater distances apart, allowing more space for the fire to grow and spread more easily. Sprinklers are permitted to be omitted from small spaces below solid wood joists due to the impracticality of installing sprinklers and pipe in these spaces. The solid wood joists are generally not very deep and are usually very close together. Composite wood joists have thinner web members, making them both more susceptible to fire and easier to penetrate with piping. Since they are also generally deeper and farther apart, it is possible to consider getting the sprinklers and piping into the space.

Question 4 – Pump Transfer Switch Provision and Location

An automatic transfer switch for a pump project is being provided by the electrician, not as part of the fire pump controller package. Is this arrangement correct by code? We were under the assumption that both controller and transfer switch had to be UL/FM listed as one device. Aren’t there also requirements for them to be located close together?

Answer:

Section 10.8.2.2 of NFPA 20 (2003 edition) permits the use of "individually listed fire pump controller and owner transfer switch." It is necessary to keep the transfer switch/controller "as close as is practical to the motors and shall be within sight of the motors" according to Section 10.2 whether or not the transfer switch is part of the controller unit or a separate device.

In addition, when the transfer switch is separate from the controller, some extra requirements apply due to the fact that the separate transfer switch contains a circuit breaker that would isolate power from the pump. See Section 10.8.2.2 for the extra requirements, which include a sign to make sure that people understand that the pump will not function is the switch is thrown and supervision (mechanical or electrical) of the isolation switch.

Question 5 – Aligning Overhead Systems with Systems Under Obstructions

I have a project that is a freezer building with 4 double interlock preaction systems. In this building are several large refrigeration ducts that are 3 ft tall, 11 ft wide and 242 ft long that obviously will require sprinklers below them. Since this is a freezer building, it would be prudent to minimize the number of low point drains required under these ducts. Therein lies my question. With the ducts being 242 ft long, they span two different overhead systems. Can I make a single connection to one of the overhead systems and protect the entire length of the ducts, even though they span two systems? I can't find anything in NFPA 13 that even remotely addresses this situation. Hydraulically, I am treating them as a special design area with

a single row of sprinklers and calculating the most remote seven heads at the design density of the overhead. Is this correct?

Answer: You are correct that NFPA 13 does not directly address the issue. This means that the Committee has not seen the need to add any language to the standard in order to address the issue. Certainly the requirement to sprinkler under obstructions has been around for a while. Since the Committee has not seen the need to align the sprinkler coverage under the obstructions with the overhead systems, then there is no need to worry about it. In fact, it's better fire protection if you don't. Put the systems on completely separate control valves, just make sure that each control valve does not control more than 40,000 sq ft by itself. The same situation holds for in-rack sprinkler systems. There is no requirement for the in-rack sprinkler system 40,000 sq ft to line up with the ceiling sprinkler system 40,000 sq ft. In most cases, they don't. The in-rack sprinkler system 40,000 sq ft can be underneath two or more ceiling systems without any problem.

With respect to the 7-sprinkler design, this is also correct under section 11.2.3.4.2. As the annex note to this section points out, it is appropriate for all preaction and dry systems as well as wet systems.

Question 6 - Standpipe Branch Lines

Does NFPA 14 require control valves for hose stations located adjacent to a standpipe, i.e. is this piping considered a branch line?

Answer: The definition for a branch line can be found in NFPA 14 Section 3.3.2 (2003 edition), which reads, *"Branch Line. A piping system, generally in a horizontal plane, connecting not more than one hose connection with a standpipe."* By this narrow definition, every hose station will be found on a branch line. However, the requirements for control valves on branch lines can be found in NFPA 14 Section 6.2.3: *"Listed indicating-type valves shall be provided at the standpipe for controlling branch lines for remote hose stations."* As such, control valves are only required for branch lines that supply remote hose stations. These stations are not adjacent to the standpipe ("adjacent" generally means within the stairwell or on a nearby wall). If the hose station is not adjacent, then it should be considered remote. The requirements for the control valve would allow the owner to have the branch line piping investigated during an impairment without impairing the entire system. Fewer control valves in a supply line should always be desirable, but if the hose station is truly remote, the control valve becomes an important tool during an impairment.

Question 7 - Sizing Pump Suction Piping

In NFPA 20, is the size indicated for suction piping applicable to only the 10 pipe diameters prior to the suction flange? Can smaller piping be used further upstream provided it meets the requirement of at least 0 psi when flowing 150%?

Answer: Yes. Section 5.14.3.4 of NFPA 20 (2003 edition) states, "The size of that portion of the suction pipe located within 10 pipe diameters upstream of the pump suction flange shall not be less than that specified in Table 5.25." If for example you had used a 1500 gpm pump, the table would require an 8-inch suction pipe diameter. This means that for 80 inches prior to the pump suction flange the pipe must be minimum 8-inch diameter. Piping that is further away than the 10 pipe diameters from the suction flange can be smaller than 8-inch so long as the pressure losses through the pipe still allow a positive suction pressure.

Question 8 - Center-Load Beam Clamps for Hanging Sprinkler Pipe

A "center-load" beam clamp has a "maximum recommended load" of 700 pounds
per the manufacturer's documentation. Center-load clamps are not listed by UL or FM since they are a typical "mechanical" hanger component. How much weight of sprinkler pipe is this beam clamp allowed to support? 700 pounds? Or 700 - 250 = 500 / 5 = 100 pounds?

Answer: You have asked if the load capacity of a "center-load" beam clamp, noted by the manufacturer, can be used in hanging a sprinkler system even though the clamp is not listed. The answer is “no”. Section 9.1.1.4.1 of NFPA 13 (2002 edition) states: "Unless permitted by 9.1.1.4.2 or 9.1.1.4.3, the components of hanger assemblies that directly attach to the pipe or to the building structure shall be listed." Your scenario does not fit either of the exceptions noted and therefore would require the beam clamp, which attaches to the structure, to be listed. Another type of clamp or attachment will have to be selected to hang the sprinkler system.

One manufacturer's websites had information on the "center-load" beam clamp being an alternate arrangement for an "I-beam" attachment that is listed for use in sway bracing. In speaking with a staff member of UL, it seems that there used to be many of these types of clamps listed. Due to the higher cost associated with them over other types of beam clamp options the value in having them listed may have dissipated. However, NFPA 13 requires that portion of a hanger to be listed or certified by a professional engineer to meet the performance criteria noted in Section 9.1.1.2.

Question 9 – Phase Converters and Fire Pumps

As an AHJ, I have an appeal pending in front of our Construction Code Board of Appeals regarding an electrical contractor who utilized an electrical phase converter on a single phase electrical system to supply three phase power to a vertical turbine fire pump installation at a residential hotel. Is the use of a phase converter installed in the electrical supply for a fire pump an allowable use under the applicable codes, including the requirements of NFPA 70 (National Electrical Code) and NFPA 20?

I have researched the codes extensively and I find no reference to the use of a phase converter in an application such as this. Since the electrical requirements of the NEC (NFPA 70) Article 695 are essentially verbatim with what is in NFPA 20, I am quoting the requirements from NFPA 70, Article 695.

In Article 695 of NFPA 70 (2002 edition) I find that Section 695.1 covers the power sources and switching and control equipment for fire pumps.

I also find in Section 695.4 (A) that the pump must be powered by a direct connection from the power source to the pump controller. The phase converter is installed between the power supply from the utility and the fire pump controller.

In Section 695.5, the Electrical Code discusses the use of transformers where the service or system voltage is different from the utilization voltage of the fire pump motor. Does this section, when referring to transformers, also apply to phase converters?

My position, as well as the position of the electrical inspector, is that the phase converter is not allowable for these reasons:

1. The phase converter is not listed specifically for use for fire protection systems.

2. The phase converter is not a dependable piece of equipment and will compromise the reliability of the electrical supply to the pump.

3. The phase converter will not allow for the proper phase reversal annunciation at the fire pump controller and at the fire alarm panel.

Answer: Unfortunately, as you have seen through your analysis, the subject has not been directly addressed in NFPA 20 or NFPA 70 in the past. Ultimately, what both NFPA 20 and NFPA 70 require is that a reliable power supply be used for the fire pump motor.

With regard to your first conclusion, care must be taken since there are many portions of the electrical supply that are not listed for fire protection systems, but are still acceptable to use. For example, a transformer is not listed for fire protection systems, yet is permitted to be installed between the fire pump and the power source when the electricity is not being supplied at the same voltage necessary for the pump motor. So it might be difficult to draw the conclusion that a phase converter needs to be listed when it performs a similar function, altering the electricity when it is being delivered in a manner inconsistent with how the pump needs to perform.

Ultimately, everything comes down to your second conclusion. If as the AHJ you feel that the power supply is not reliable, you have the right to not approve the installation, or require a backup generator in case the phase converter fails. Both NFPA 20 and NFPA 70 give you that ultimate authority.

The forthcoming 2007 edition of NFPA 20 will contain annex language submitted by NFSA based on Committee deliberations and accepted as the Committee's position on the subject:

> "A.9.2.1.1 Phase converters that take single phase power and convert it to three phase power for the use of fire pump motors are not recommended because of imbalance in the voltage between the phases when there is no load on the equipment. If the power utility installs phase converters in their own transmission lines, such phase converters are outside the scope of the standard and need to be evaluated by the AHJ to determine the reliability of the electric supply."

Question 10 - ESFR Sprinklers in Preaction Systems

A customer has come to asking that we convert his wet pipe system in a small warehouse to a pre-action system. He would like to avoid in-rack protection of his encapsulated commodities stored to 17 feet in double row racks. The existing system has ESFR sprinklers. Is there any way that ESFR sprinklers can be used in pre-action systems?

Answer: No. Section 12.1.4.3 of NFPA 13 (2002 edition) states: "ESFR sprinklers shall only be permitted to be wet pipe systems." The handbook for NFPA 13 goes on to add, "ESFR sprinklers are prohibited from use in dry-pipe or preaction systems, as stated in 12.1.4.3. However, ESFR sprinklers can be utilized in a wet system that utilizes an antifreeze solution if the solution is listed for use with ESFR sprinklers." The ability to quickly put water on a fire is crucial to the ability to suppress the fire, which is the goal of an ESFR sprinkler. Therefore, any delay in water delivery can be detrimental to the suppression of the fire.

Question 11 – Demonstration of Detection System Operation Prior to Sprinklers

In NFPA 13 (2002 edition) Section 12.3.2.2.3.5(a), relating to rules for protection of rack storage by large drop and specific application control mode sprinklers it says: "For the purpose of using Table 12.3.2.2.1 (a) and Table 12.3.2.2.1 (b), preaction systems shall be classified as dry pipe systems."

However in Section 12.3.2.2.3.5(b) it says: "Where it can be demonstrated that the detection system activating the preaction system will cause water to be at the sprinklers when they operate, preaction systems shall be permitted to be treated as wet pipe systems."

It seems that there are several variables, including the time for the sprinkler to operate once it's activation temperature is reached, the time for a detector to operate once it's activation temperature is reached, the rate of rise of the temperature from the lower detector activation temperature to the higher sprinkler activation temperature, and the time for the water to reach the inspector's test valve once a signal has been sent to the single interlocked pre-action system riser. Other than actually testing an installed system to show that the detection system has allowed water to reach the inspector's test before a sprinkler would operate, is there a generally accepted method of predicting that this would happen?

Answer: Specifically, you have asked what is the industry practice on demonstrating the ability of the detection system to operate before the large drop sprinklers. The ability for a detection system to operate before the sprinklers is not necessarily a point that needs to be physically demonstrated. It could mean installing heat detectors that operate at a lower temperature than the sprinklers to ensure that water will be at the sprinklers by the time they operate so that the water can be quickly dispersed on the fire, similar to a wet system. There are many different types of detection systems used, which is why the standard does not detail a method that has to be followed to demonstrate that the detectors will operate first. This is merely a point that needs to be thought about and planned for when using a preaction system.

Question 12 – Fabric Duct Obstructions

Should sprinklers be installed below fabric or vinyl covered fabric round ducts that exceed 48 inches in width?

Answer: Yes. Section 8.5.5.3.1 of NFPA 13 (2002 edition) states: "Sprinklers shall be installed under fixed obstruction over 4 feet wide such as ducts, decks, open grate flooring, cutting tables, and overhead doors." The sprinkler is required under this type of large obstruction regardless of the duct material. It is important to make sure that if a fire starts under a large obstruction that there will be sprinkler discharge available to control fire growth and minimize possible damage.

Upcoming NFSA Technical Tuesday Online Seminar

Topic: Concealed Spaces
Instructor: Cecil Bilbo, Jr., NFSA Director of Technical Services
Date: September 12, 2006

Determining if concealed spaces require sprinklers is often an area of confusion. NFPA 13 has defined many specific concealed spaces that do not require sprinkler protection. However, there are often field situations that leave the determination up to the layout technician. This seminar will cover the existing rules that require and allow omission of sprinklers and the common areas that can cause problems in the field. Also, spacing sprinklers when they are required in the concealed spaces will be discussed.

Information and registration for this seminar is available at www.nfsa.org.

2006 Basic and Advanced Technician Training, NICET Inspection Seminars

The NFSA is the only organization that offers two-week basic technician training seminars, 3-day advanced technician training seminars, and NICET-oriented inspection and testing review seminars at various locations across the United States. The 2006 schedule still includes the following dates and locations:

2-week Basic Technician Training

October 16-27, 2006 – Philadelphia, PA

3-day Advanced Technician Training

October 3-5, 2006 – Minneapolis, MN

3-day NICET Inspection and Testing Certification Review

September 6-8, 2006 – Dallas, TX
November 14-16, 2006 – Anchorage, AK

For more information, contact Nicole Sprague at: Sprague@nfsa.org or call (845) 878-4200 ext. 149

NFSA In-Class Training Opportunities

NFSA also offers in-class training on a variety of subjects at locations across the country. Here are some upcoming seminars:

Two-day NFPA 13 Overview & Intro to Plan Review	Eugene, OR	Sept 11-12
Hydraulics for Fire Protection	Eugene, OR	Sept 13
Basic Seismic Protection (1/2 day)(AM)	Eugene, OR	Sept 14
Underground Piping (1/2 day) (PM)	Eugene, OR	Sept 14
Introduction to Sprinkler Systems (1/2 day) (AM)	Dublin, OH	Sept 19
Basic Seismic Protection (1/2 day) (PM)	Dublin, OH	Sept 19
Two-day NFPA 13 Overview & Intro to Plan Review	Dublin, OH	Sept 20-21
Introduction to Sprinkler Systems (1/2 day) (AM)	Appleton, WI	Sept 26
Underground Piping (1/2 day) (PM)	Appleton, WI	Sept 26
Standpipe Systems (1/2 day) AM	Kansas City, MO	Sept 26
Underground Piping (1/2 day) PM	Kansas City, MO	Sept 26
Two-day NFPA 13 Overview & Intro to Plan Review	Seattle, WA	Sept 26-27
Inspection, Testing & Maintenance	Appleton, WI	Sept 27
Pumps for Fire Protection	Kansas City, MO	Sept 27
Inspection, Testing & Maintenance	Kansas City, MO	Sept 28
Hydraulics for Fire Protection	Seattle, WA	Sept 28
Pumps for Fire Protection	Appleton, WI	Sept 28
Two-day NFPA 13 Overview & Intro to Plan Review	Meridian, ID	Oct 3-4
Inspection, Testing & Maintenance	North Las Vegas, NV	Oct 3
Residential: Homes to High-Rise	North Las Vegas, NV	Oct 4
Hydraulics for Fire Protection	Meridian, ID	Oct 5
Standpipe Systems (1/2 day) (AM)	North Las Vegas, NV	Oct 5
Underground Piping (1/2 day) (PM)	North Las Vegas, NV	Oct 5
Two-day NFPA 13 Overview & Intro to Plan Review	Noblesville, IN	Oct 17-18
Inspection, Testing & Maintenance	Noblesville, IN	Oct 19
Introduction to Sprinkler Systems (1/2 day) (AM)	Southfield, MI	Oct 24
Standpipe Systems (1/2 day) (PM)	Southfield, MI	Oct 24
Introduction to Sprinkler Systems (1/2 day) (AM)	Willoughby, OH	Oct 24
Standpipe Systems (1/2 day) (PM)	Willoughby, OH	Oct 24
Hydraulics for Fire Protection	Southfield, MI	Oct 25
Sprinklers for Dwellings	Willoughby, OH	Oct 25
Pumps for Fire Protection	Willoughby, OH	Oct 26
Two-day NFPA 13 Overview & Intro to Plan Review	Southfield, MI	Oct 26-27
Two-day NFPA 13 Overview & Intro to Plan Review	Winston-Salem, NC	Nov 14-15
Hydraulics for Fire Protection	Winston-Salem, NC	Nov 16

For more information or to register, visit www.nfsa.org or call Michael Repko at 845-878-4207 or email: seminars@nfsa.org.

In the promotion of the fire sprinkler concept, the National Fire Sprinkler Association represents all fire sprinkler industry interests including fire sprinkler contractors, manufacturers and suppliers of fire sprinklers and related equipment and fire protection professionals. Established in 1905, the National Fire Sprinkler Association provides publications, nationally accredited seminars, representation in codes and standards-making, market development, labor relations and other services to its membership. Headquartered in Patterson, New York, the National Fire Sprinkler Association has regional operations offices throughout the country.