NFSA The Voice of the Fire Sprinkler Industry

TechNotes

Editor-Kenneth E. Isman, P.E. **Issue# 299** **August 12, 2014**

Best of July 2014

This month, we have selected the following dozen" (12) questions as the "Best of July 2014" answered by the engineering staff as part of the NFSA's EOD member assistance program. If you have a question (and you're a member of the NFSA), you can send your question to eod@nfsa.org and we'll answer it as soon as we can.

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 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 – Residential Sprinklers in a Room with Two Different Ceiling Elevations

Section 8.6.4.1.1.3 of NFPA 13 tells the user how to deal with spacing sprinklers in a room with two different ceiling elevations. Can we use this rule for residential sprinklers?

Answer: No. Section 8.6 in NFPA 13 is only for upright and pendent standard spray sprinklers. All of the subsections within 8.6 only apply to standard spray sprinklers. Residential sprinklers are not standard spray sprinklers. Residential sprinklers have a very different water distribution pattern as compared to standard spray sprinklers.

See section 8.10 of NFPA 13 for rules that apply to the spacing of residential sprinklers.

Question 2 – Partitions in Ordinary and Extra Hazard Occupancies

We have a building that might be protected as ordinary or extra hazard. The partitions between the spaces in the building won't go all the way to the ceiling. Can we use Section (Table and Figure) 8.6.5.2.2 or anything like it to space the sprinklers at the ceiling to spray over the partitions?

Answer: You are not permitted to use Section 8.6.5.2.2 or its corresponding table or figure. These rules are only for light hazard. When protecting an ordinary or extra hazard situation, where partitions do not go all the way to the ceiling, you need to provide the minimum clearance for the sprinkler being used at the ceiling. For standard spray sprinklers, the minimum clearance is 18 inches. So, if the partitions stop at an elevation where there is at least 18 inches from the top of the partition to the sprinkler deflector, then you can ignore the location of the partitions when spacing the

sprinklers at the ceiling. If the top of the partition encroaches into the 18 inch clearance space, then you need to consider the partitions as walls when spacing your sprinklers, but you also need to make sure that the sprinklers are at least 6 feet apart at the ceiling because there will be no solid object protecting a sprinkler from the direct spray of water when a nearby sprinkler opens.

Question 3 – Copper Tube and Steel Hangers

We have a copper tube sprinkler system. NFPA 13 requires the use of ferrous (steel) hanger materials. Are we okay with steel hangers on this system or are our hangers going to experience galvanic corrosion?

Answer: Normally, with dissimilar metals in a water distribution system, there is a concern about galvanic corrosion due to the different metal materials. Water flow in the system sets up flow of electrons between the metals and over a period of time, one of the metals loses a significant amount of material. This process is called galvanic corrosion.

But since a sprinkler system does not have a regular flow of water, and since the mass of copper is relatively large in the system compared to the mass of steel in the hangers, galvanic corrosion is typically not an issue in copper tube sprinkler systems hung with steel hangers. Since NFPA 13 requires the hangers to be steel and does not have an exception for copper tube, you would violate NFPA 13 by using some other type of hanger material unless that material was specifically evaluated for sprinkler system use.

There is a very small chance that some other environmental conditions could occur that would act as an electrolyte instead of flowing water. This is one of the reasons why NFPA 25 requires inspection of the hangers on an annual basis. If there is a concern, the bottom of the hanger (that is in contact with the copper tube) can be wrapped with electrical tape to isolate the metals without changing the material of the hangers.

Question 4 – Waterflow Alarm Signals

NFPA 13 requires that a waterflow alarm be sent within 5 minutes of waterflow starting to occur. NFPA 72 requires that a waterflow alarm be sent within 90 seconds of waterflow starting to occur. Why do two NFPA standards contradict each other?

Answer: The different requirements are not a contradiction; they just apply in different circumstances. The right time limit to impose depends on how the building code and fire code are written in the jurisdiction where the building has been (or will be) constructed and the type of building.

If the local building code or fire code requires a fire alarm system for the type of building, then the fire alarm system has to be installed in accordance with NFPA 72. The sprinkler system waterflow device is an initiating device for the fire alarm system, so the time limit for getting an alarm is 90 seconds.

If the local building code or fire code does not require a fire alarm system for the building, then there is no need to get the waterflow alarm in 90 seconds. The purpose of the waterflow alarm has changed. With no requirement for a fire alarm in the building, the code is saying that there is no need to use the signal from the waterflow alarm as an emergency to evacuate the building. Therefore, the 5 minute limit of NFPA 13 applies, even if you use electronic type flow switches (paddle-type or pressure type).

Upcoming Technical Tuesdays

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Question 5 – Concrete Anchors

There have been changes between ASCE 7-2005 and ASCE 7-2010 regarding the factors used to calculate the loads when anchors are used in concrete. ASCE 7-2005 used a 1.3 factor while ASCE-2010 requires an omega factor of 2.5 applied to the loads (this statement is a simplification of ASCE 7 and several of its referenced documents like ACI 318).

The values in NFPA 13 did not seem to change from 2010 to 2013. So, the net result seems to be that the 1.3 factor we used to apply to the seismic load to anchors is gone, and is replaced by a 2.5 factor. We basically need to know if the values in Table 9.3.5.12.1 of NFPA 13 take into account these new structural requirements.

Answer: No. The first thing to discuss here is the revision cycles of the documents. The 2013 edition of NFPA 13 was published before ASCE 7-2010 Supplement 1. Therefore, the NFPA standard was not able to incorporate the modifications that occurred in Supplement 1 to the ASCE standard. The NFPA Committee met recently and modifications to the generic tables will incorporate the omega factor for the 2016 Edition of NFPA 13. When the ASCE 7 committees modified the document to include the omega or overstrength factor, it was not thought to have as great an impact on the end numbers as it actually has.

The challenge of correlating issues of the standards is always a difficult one. In general the tables in NFPA 13 are conservative. However, the fastener calculations have been evolving in recent years and until the 2016 Edition is published, the information cannot be line-by-line correlated. NFPA 13 is a "deemed to comply" standard for ASCE 7. Yet caution with this specific item should be taken. The proprietary fasteners that are available on the market often offer better load capacities. When using them, the calculations should be done in accordance with ASCE 7 for loads. This will incorporate both the prying factors (specific to the fitting used) and the overstrength fasteners necessary for concrete anchors. Unfortunately, concrete as a medium is difficult when handling loads for seismic applications.

At the end of your question, you noted that the 1.3 factor used in older editions of ASCE 7 does not appear to apply now that the 2.5 overstrength factor is used. This is correct. There is also a 1.2 increase permitted for allowable strength of the anchors.

Question 6 – Sizing Components for Trapeze Hangers

In the May/June 2003 edition of Sprinkler TechNotes, you answered a question regarding the sizing of components for trapeze hangers that indicated that components could be sized regarding the size of the trapeze

member instead of the size of the pipe being supported because the trapeze hanger had two supports rather than the single support of other hangers. Is this position still correct? For example, when hanging a 6-inch sprinkler pipe with a 1-1/4 inch trapeze, can we use a 3/8 inch rod, or are we required to use a ½ inch rod?

Answer: No. The NFPA Committee on Hanging and Bracing changed NFPA 13 in the 2007 edition and now requires that the individual components of the trapeze hanger need to be sized based on the size of the pipe that they will be supporting. The manufacturers of hangers needed to make some specific new components in order for this to happen so that the hanger straps could take the load of the trapeze while staying connected to the trapeze member correctly. To answer your question about the rods, you would need to use a ½ inch rod.

Question 7 – Measuring to the Underside of Insulation

When installing sprinklers beneath a ceiling with insulation tight to the top of the ceiling, section A.8.5.4.1 indicates that you can only measure the distance from the sprinkler deflector to the bottom of the insulation if the insulation is specifically “batt” insulation. But what about other types of insulation? Can’t you measure to the bottom of any type of insulation? Don’t all insulations form effective thermal barriers?

Answer: Yes, all forms of insulation form an effective thermal barrier as long as they are installed in such a way to stay in place early in the fire scenario (until sprinklers open). Section A.8.5.4.1 was written a while back to help people understand that we were only really worried about measuring to the underside of insulation, when it was in place. We used the term “batt insulation” because that was the only type of insulation that we could envision that would stay in place during a fire on the underside of a ceiling. Certainly, blown-in insulation would not work in that capacity. Since this was written, there have been all kinds of other insulation products developed. The concept holds true for any of them. Whatever insulation you are using, you only need to worry about measuring to the underside as long as the insulation will stay in place during a fire.

The text is just in the annex and is not legally enforceable. It was just meant as information to tell people that it is okay to measure to the underside of the insulation.

More recently, people have not liked the fact that this idea was in the annex, so we moved it up to the body of the standard in the 2013 edition. See section 8.5.4.1.3, which is applicable to all types of insulation, not just batt insulation. Since this text is in the body of the standard rather than the annex, it is more enforceable than the annex text.

Question 8 – Slave Pallets

What’s the difference between a slave pallet (defined in 3.9.1.24) and a solid shelf rack. If we have a slave pallet, section 16.2.1.3.4.7 of NFPA 13 requires a 20% increase in the density, but if the solid shelf rack has a similar blockage less than 20 sq ft, no increase is necessary. If a conventional pallet has a solid top, is it a slave pallet? Can you explain all this?

Answer: First, let's talk a little bit about slave pallets. A slave pallet is more than just a pallet with a flat bottom. As the definition states, it is a part of an automated material handling system. These systems are typically automated and since they don't need people or forklifts in the racks, they have narrow aisles. The fact that you need 20% more discharge from the ceiling sprinklers has to do with the combination of the pallets and the closer spacing of the product. See section C.9 for a description of the fire tests that were done in the late 1960's regarding these storage arrangements.

Since the 1960's, we've learned a great deal more about protecting storage on solid shelf racks. While there are some similarities between solid shelf racks and slave pallets, they are a bit different. The solid shelf racks can exist in any situation whereas the slave pallets are a part of a specific automated storage handling system.

The only place that NFPA 13 specifically requires anything different for the storage protection is section 16.2.1.3.4.7. Due to the placement of this section, it only applies to the storage of Class I-IV material up to 25 ft in height that is being protected with standard spray sprinklers. If you are protecting any other commodity or storage height, or if you are protecting the storage with a different kind of sprinkler (ESFR or CMSA), then section 16.2.1.3.4.7 does not apply.

If a conventional pallet has a solid top it is not, by itself, considered a slave pallet. As discussed above, the storage needs to be part of an automated system if it is to fall into the "slave pallet" situation. Just putting a solid top on a regular pallet on standard double row racks would not constitute a "slave pallet" situation.

If you truly have a slave pallet situation, the 20% increase to the density mandated by section 16.2.1.3.4.7 was based on fire tests where the storage was more tightly packed and had fewer flue spaces than conventional storage. Unfortunately, the fire tests have not been well documented and this 20% increase rule is all we have in the way of information to go on. This section of NFPA 13 is limited to storage of Class I-IV material up to 25 ft in height protected with spray sprinklers (CMDA) since that is the only package that was tested in the 1960's.

The rules for storage protected on solid shelf racks with solid blockage less than 20 sq ft is based on a much more recent analysis after much more recent fire tests. These rules are much broader in scope than slave pallets and apply to all different types of storage.

While the rules of NFPA 13 appear to be somewhat incongruous on this subject, the sprinkler committee has never had the time to go back and explore whether the slave pallet rules should be changed. Quite frankly, the committee tends to respond to outside requests much more than to generate internal changes on their own. So, my suggestion to you if you would like this particular situation to be addressed would be for you to submit a Public Input to change NFPA 13 the next time it is open for suggestion (after September 2015). This would force the committee to discuss the situation and decide if they should change or clarify the slave pallet rules.

Question 9 – Hazard Class for Diesel Driven Pump Rooms

We have noticed that NFPA 20 says that a diesel driven fire pump room needs to be sprinklered in accordance with the rules of NFPA 13 for Extra Hazard Group 2 while other NFPA standards (like the hydro-electric generating plant standard) say that rooms with similar diesel tanks only need to be protected as Extra Hazard Group 1. Which rules are correct? Since

View older issues in the "Members Only" section.

the rules in these other standards are extracted into NFPA 13 (into Chapter 22), are they required to be followed for sprinkler systems instead of NFPA 20?

Answer: The experts on fire pumps are on the NFPA 20 committee, not the NFPA 13 committee or the committee on hydro-electric generating plants.

The NFPA 20 committee, experts on the subject of protecting fire pumps, have reviewed the situation and concluded that Extra Hazard Group 2 is the correct protection for diesel driven fire pump rooms for two reasons:

1. The water is available. There is a fire pump in the room. You can take water from the discharge side of the pump and easily obtain protection for Extra Hazard Group 2.

2. We want the diesel tank in the pump room for reliability reasons. Many fire codes don't like the idea of putting combustible fluids in the pump room. We helped to convince them that the diesel fuel tank is not a problem in the pump room by increasing the sprinkler protection. This led to the NFPA 30 committee putting NFPA 20 on their "deemed to comply" list. This means that if you follow NFPA 20, you can ignore the specific rules of NFPA 30 and yet you can claim to meet NFPA 30. This is all based on the Extra Hazard Group 2 rules.

NFPA 20 trumps all of the other rules that you quoted. Put a sprinkler system in the pump room and protect the pump room as Extra Hazard Group 2 if it is a diesel driven pump with the diesel tank in the pump room.

Question 10 – Relief Valve and Flow Meter Discharge from Fire Pump to Tank

When a relief valve discharges back into a tank, is there a minimum distance from the discharge into the tank and the tank outlet to the pump?

Answer: Yes, there is a requirement, but it is performance based language rather than prescriptive language. The discharge from the relief valve is covered in section 4.18.8 of NFPA 20 and the discharge from the flow meter is addressed in section 4.20.2.9. In both cases the discharge should be placed at a distance sufficient that they do not introduce air into the tank suction outlet.

The annex comment to section 4.18.8 provides helpful commentary that applies to both situations. This annex note states that when the discharge enters the reservoir below the minimum water level, there is not likely to be an air problem. But if it enters over the top of the reservoir, the air problem is reduced by extending the discharge to below the normal water level.

Given that the flow meter discharge can be expected to be in operation when the tank is filled to its normal level it is reasonable to extend the discharge to just below that level. However, consideration should be given to the possibility of the relief valve opening during an extended period of pump operation when the water level in the tank is lower than normal. This would suggest that the relief valve discharge should be located at the lowest practical level in the tank to help prevent it from entraining air if it is activated when the water level is low.

Question 11 – Aircraft Hangars, Foam and the ICC

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 and it is available to our members 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.

The International Building Code and International Fire Code allow Group II aircraft hangars to be protected without foam, even in situations where NFPA 409 requires a foam system. Can you comment on how we would protect a Group II aircraft hangar without foam and still comply with NFPA 409?

Answer: It can't be done. When the members of the International Code Council voted to change the code and exempt people from the foam requirements, they did so in full violation of NFPA 409. When they eliminated the foam requirement, they took out a significant part of the fire protection for the building and the aircraft without replacing it with any additional fire protection to compensate for the loss. My understanding is that they did this due to the expense of installation, testing and discharge of the foam as well as some environmental concerns about some of the foam products on the market.

I believe that the foam manufacturers have dealt with the environmental concerns and that the expense of a foam system can be justified based on the value of the aircraft being protected. The best experts in the world regarding fire protection for aircraft get together on a regular basis to review and revise NFPA 409 and if they could find a way to protect Group II hangars designed for fueled aircraft without foam, they would have put it in NFPA 409 years ago. The fact that they have not been able to do it tells me that it cannot be done.

We have tried for years to get this exception out of the ICC codes, but we have not been successful. The foam systems are just not popular and most of the people voting on the code have very little experience with fires in aircraft hangars. You could design a closed-head sprinkler system at the ceiling in accordance with section 7.2 of NFPA 409 and ignore the low-level foam system due to the way that the IBC and IFC are written. If you did this, you would meet the letter of the Code, which is the ultimate legal authority. However, you would end up in violation of NFPA 409, which has been adopted as an American National Standard by the American National Standards Institute (ANSI). As such, if anything ever went wrong in the hangar, you would be open to serious liability (in my opinion as a layman who has seen many post-fire lawsuits, but not a lawyer) since you did not follow the American National Standard, which sets a minimum level of expected care.

My suggestion would be to go back to the person that owns the hangar and explain that there is a loophole in the Code that allows a hangar to be constructed without foam systems and that you can design and install such a system. However, that system would cost a significant amount of money and probably would be wasted since it would not actually control a fire or save an aircraft in the building from a fire. If they spend a little bit more to comply with the full rules of NFPA 409, they would get much better protection. Maybe they will see the light and authorize a low-level foam system. If not, get them to sign some document that says that you informed them of the fact that they really should have a low-level foam system and that they declined. At least then, you might have some defense if anything ever goes wrong in the hangar

Question 12 – Water Supply for Aircraft Hangars

Since NFPA 409 requires an extra fire pump for a Group II hangar, does it also require a redundant water supply in addition to the water utility that we are planning on using for our water supply?

Answer: If the city water main is truly capable of supplying the required demand, NFPA 409 only requires a single water supply. Section 6.2.10 of

the 2011 edition of NFPA 409 states that "at least one automatic water supply capable of supplying all required or installed fire suppression systems that are designed to operate simultaneously, including, but not limited to, sprinkler systems, foam-generating systems, and hand hose lines, shall be provided.".

Section 7.8 expands on the requirements of the water supply for Group II hangers, but does not require an additional water service.