NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Tuesday e-Tech Alert
January 9, 2007
Number 73

Best Questions of December 2006

We have selected the following questions as the "best of December 2006" answered by the engineering staff as part of the NFSA "Engineer of the Day" member assistance program:

Question 1 – Definition of Multiple Row Rack

Per NFPA 13 2002 Edition, Section 3.10.8.3 defines racks greater than 12 ft. wide or single or double row racks separated by aisles less than 3.5 ft. wide having an overall width greater than 12 ft. as multiple-row racks. We have a project with flow-through racks three (3) pallet loads deep with an overall rack width of up to 12 ft. (but not exceeding 12 ft.) and separated by 8 ft. or greater aisles. Please confirm this is not a multiple row rack and can be protected as a single or double row rack.

Answer: The definition of double-row rack has been revised in the 2007 edition of NFPA 13 to read as follows: "Racks less than or equal to 12 ft (3.7 m) in depth or single-row racks placed back-to-back having an aggregate depth up to 12 ft (3.7 m), with aisles having an aisle width of at least 3.5 ft (1.1 m) between loads on racks." Among other things this revised definition indicates that there can be multiple longitudinal flues formed by three or more single-row racks while still meeting the double-row rack definition. Since the Committee has not developed special rules for placement of sprinklers within multiple longitudinal flues, it must be assumed that the flues would all be treated as if they were the only longitudinal flue in traditional double-row rack configurations.

You have described your situation as a flow-through rack, which traditionally has been considered a multiple-row rack. Since longitudinal flues cannot be maintained in flow-through racks, double-row rack criteria requiring longitudinal sprinklers cannot be utilized, and you would need to revert to multiple-row rack criteria in the event longitudinal sprinklers were required.

Question 2 – Clearance Issues for ESFR Sprinklers

Table 12.3.5.3.1 of NFPA 13 (2002 edition) contains various maximum heights of storage under maximum ceiling or roof heights? Are there also limitations on clearance for ESFR sprinklers as there are with spray sprinklers?

Answer: No. A basic premise incorporated into the testing of ESFR sprinklers is that worst-case clearance conditions are considered as part of the sprinkler listing process. For example, when the original goal was to protect 25 ft of storage under a 30-ft ceiling, some of the qualifying tests examined the suppression ability of the sprinklers when only 15 ft of storage was provided along with 15 ft of clearance.

Question 3 – Dedicated Preaction Sprinkler System in an Electrical Room

We have been advised that so long as an electrical room is a "dedicated electrical room" serving no other purpose, we can install a cross-zoned double interlock preaction system dedicated to protecting only the electrical room, and that that running exposed lines and/or mains above the panels (which take up the entire room) would not be a code violation. Is this correct?

Answer: There is a protected area above and in front of electrical equipment known as the "dedicated equipment space". NFPA 70, the *National Electrical Code (NEC)* contains the requirements for these spaces. There are different sections for electrical installations less than 600 volts (Section 110.26), electrical installations 600 volts and more (Section 110.34), and transformer vaults (Section 450). They all carry the same type of exception allowing fire protection piping to pass through dedicated equipment spaces when the piping serves the system in that area. There is always a concern for accidental water discharge, but the Committees have felt it more important to provide a higher level of fire protection for these areas, since fires often result in abundant toxic products of combustion in abundance. As an example of language that can be found in each of these sections, NFPA 70 Section 110.34 states:

"Work Space and Guarding

(F) Protection of Service Equipment, Metal-Enclosed Power Switchgear, and Industrial Control Assemblies. Pipes or ducts foreign to the electrical installation and requiring periodic maintenance or whose malfunction would endanger the operation of the electrical system shall not be located in the vicinity of the service equipment, metal-enclosed power switchgear, or industrial control assemblies. Protection shall be provided where necessary to avoid damage from condensation leaks and breaks in such foreign systems. Piping and other facilities shall not be considered foreign if provided for fire protection of the electrical installation."

This section and the others clearly exempt fire sprinkler protection for these electrical rooms and equipment from the "dedicated equipment space" rules. The cross-zoned preaction system you have proposed to install in this area goes above and beyond the requirements of the standards and codes.

Question 4 – Small Light Hazard Areas

In a light hazard building being designed to a 0.10 gpm/sq ft density per NFPA 13, such as a nursing home or board and care facility, what is the proper way to calculate a small kitchen, laundry room or other ordinary hazard area too small to meet the minimum 1500 sq ft remote area (or 900 sq ft if for low ceiling heights and QR sprinklers) but not meeting the requirements for use of the room design method. Do you calculate the remaining area outside the kitchen or other ordinary hazard room at 0.10 gpm/sq ft? If so, how do you designate it on your hydraulic placard?

Answer: Density/area calculations are performed without respect to walls or partitions. If you are calculating an ordinary hazard area in accordance with the density/area method of calculations, and the actual area of the ordinary hazard portion of the occupancy is not sufficient to meet the “area” portion of the calculations (1500 sq ft unless reduced for QR sprinklers) then you have to go outside the ordinary hazard area and pick up additional sprinklers in the light hazard space. The additional sprinklers that are picked up in the light hazard space are only required to flow whatever is necessary for them to achieve their 0.10 gpm per sq ft density. Depending on the relative protection areas of the sprinklers in the light hazard and ordinary hazard spaces, the light hazard sprinklers may flow more than what is needed to achieve their

density, and the water supply must be capable of supplying whatever flow is occurring at the light hazard sprinklers in the design area in addition to the ordinary hazard space sprinklers. The placard would indicate the number of sprinklers calculated at both ordinary and light hazard densities.

Question 5 – Radiant Heaters

A new warehouse is being constructed with ESFR sprinklers and gas fired radiant heaters. Both NFPA and FM specify required distance from sprinklers to various heat sources but nothing mentions radiant heaters. Should special precautions be employed?

Answer: The basic rules of unit heaters still apply in accordance with Section 8.3.2.5 of NFPA 13 (2002 edition). Radiant heaters can be high-intensity space heaters, which can appear very similar to traditional unit heaters, or can be low-intensity tube heaters, in which there is a burner connected to tubes that can extend 80 ft or more from the unit. Regardless of the type of sprinkler, only high-temperature sprinklers should be used within the 7 ft radius cylinder around a unit heater. Radiant heaters generally need to be pointed down at the floor to heat the space, or with a maximum horizontal angle of about 30 degrees, so there should never be any sprinklers in the direct line of sight of the radiant elements. While it is also advisable to check with the manufacturer of the ESFR sprinkler to see if they have any specific guidance beyond that contained within NFPA 13, the ultimate test is to ensure that the temperatures at the location of the sprinkler do not exceed the maximums allowed for the temperature rating in accordance with Table 6.2.5.1.

Question 6 – Composite Wood Joist Void Spaces

When the density/area curves are used I understand that a design area of 3000 sq ft is not required if gypsum board is directly attached to solid wood joists, provided that the resulting concealed spaces are less than 160 cubic feet each in accordance with Section 11.2.3.1.8(4)(b) of NFPA 13 (2002 edition). With composite wood joists, Section 8.14.1.2.6 states that concealed spaces formed by gypsum board on hat channels require 3.5 inches of insulation and firestopping so that voids are less than 160 cu. ft. or else sprinklers are required in these spaces. Section 8.14.1.2.8 says that voids formed by gypsum board directly attached to composite wood joists need to be firestopped into volumes of less than 160 cubic feet AND filled with insulation or sprinklers are required in these concealed spaces.

It seems clear that in all cases of composite wood joist construction (when using the density/area design method) all voids created by composite wood joists have to have firestopping at not more than 160 cubic feet and one of the two insulation methods. What I don't know is if and how composite wood joists affect the size of the hydraulic design area. Section 11.2.3.1.8(4)(b) very clearly does not mention them. If the nonsprinklered void spaces are firestopped and filled with insulation, does the remote area need to be increased?

Also, what about ducting and wiring penetrations through the composite wood joist web? Is it required that they be fire sealed?

Answer: Chapters 8 and 11 deal with two different issues that are best kept apart. Section 8.14.1.2 addresses whether sprinklers are required in the concealed space. Sprinklers are required unless the concealed space meets one of the exceptions listed in subsections 8.14.1.2.1 through 8.14.1.2.15. It is not necessary to meet all of the sections, only one of the sections in order to allow sprinklers to be omitted. These sections have been written by different committees over a

period of decades. In each case, the Sprinkler Committee agreed upon a reasonable circumstance under which sprinklers could be omitted, without necessarily considering the other sections. Incidentally, you have mischaracterized Section 8.14.1.2.8 requirements. Where ceilings are directly attached to the underside of the composite wood joists, Section 8.14.1.2.6 allows the omission of sprinklers from voids in firestopped composite wood joists without the requirement for insulation. Section 8.14.1.2.8 addresses both solid and composite wood joists where the ceiling is not directly attached to the underside o the joists, which is why insulation is required to fill up to the underside of the joists.

Once the determination has been made as to whether or not sprinklers will be installed in the space, Chapter 11 addresses the system design area. If sprinklers are installed in the concealed space, then there is no adjustment needed to the design area. If sprinklers are being omitted from a combustible concealed space using any of the exceptions listed in subsections 8.14.1.2.1 through 8.14.1.2.15, then Section 11.2.3.1.8(3) requires that the design area be increased to 3000 sq ft unless one of the special cases of Section 11.2.3.1.8(4)(a) through (e) apply. These special cases are those for which the Committee believes the 3,000 sq. ft. area is not necessary, since there is a low probability of a fire emerging from a concealed space and challenging the sprinkler system over a large area.

Composite wood joists are not addressed directly in any of the sections 11.2.3.1.8(4)(a) through (e). However, they could fall under item (a), (c) or (d) if they were filled with noncombustible insulation, manufactured of fire retardant treated lumber, or very small in size.

Holes drilled for wiring and other conduit are generally not considered a problem provided the holes are reasonably tight around the penetrations. The main issue with composite wood joists is heat channeling in the direction of the joists skewing the fire growth and operating area of sprinklers, and the resulting size of fire that could quickly compromise the web members.

Question 7 – NFPA 13 Residential Design Option with Composite Wood Joists

I had a question re: a multi-story building with one level of parking, one level of retail space, and three levels of residential apartments. The parking and retail levels are built with post-tensioned concrete floors, but the residential levels are built with composite wood joists with ceilings attached directly to the bottom of the joists and the joist channels fire stopped into volumes not exceeding 160 cu. ft. Per NFPA 13 (2002 edition) our design criteria is 0.15 gpm/sq ft over 1950 sq ft for the dry pip system in the parking level, 0.20 gpm/sq ft over 1500 sq ft for the retail level, and 0.10 gpm/sq ft for the four most demanding residential sprinklers on the residential floors.

The question came up as to whether the design areas required a minimum of 3000 sq ft per the restrictions in Section 11.2.3.1.8(3). Also, does the same requirement apply to the parking or retail levels that are designed using the density / area method?

Answer: The 3000 sq ft minimum design area for unsprinklered combustible concealed spaces applies only to the use of the density/area method of Section 11.2.3.2 and the room design method of Section 11.2.3.3, not the residential sprinkler design approach of Section 11.2.3.5. It also only applies to the area of the building with the unsprinklered combustible concealed spaces, so would not affect the design areas for the parking garage or retail areas of the building project under consideration.

Question 8 – Standpipe Water Supply Valves

In Section 6.2.1 of NFPA 14 (2003 edition), the connection to water supplies requires an "approved indicating-type valve and check valve located close to the supply." Does this mean that if a water supply feeds multiple standpipes, then each standpipe needs to have this pair of valves?

Answer: No. The indicating valve and check valve are intended in order to maintain any of the water supply equipment. Section 6.2.1 intends for the set of valves to serve the water supply, not the individual downstream systems. This means that if one water supply with a fire pump is feeding three standpipes then the indicating valve and check valve following the fire pump serves all three standpipes.

However, it should also be noted that Section 6.2.2 states: "Valves shall be provided to allow isolation of a standpipe without interrupting the supply to other standpipes from the same source of supply." This section does require additional valves so that each standpipe can be separated from the others in case repairs or maintenance is necessary.

Question 9 – Canopy Over Buried Tanks or Fueling Station

A newly constructed building has a noncombustible canopy enclosed on three (3) sides. One of the three sides opens into a parking garage. The deck of this canopy slopes from an elevation of 17'-4" at the building down to 14'-8" at the outer edge. Under the ground below this canopy there are two (2) fuel tanks buried, one diesel and one gasoline. There is no storage above grade below this canopy. Is sprinkler protection required below the canopy?

Answer: Since the fuel tanks are buried, the answer depends on whether they serve a fueling station in that location or are simply piped to services elsewhere. The relevant requirement of NFPA 13 (2002 edition) is Section 8.14.7.4: “Sprinklers shall be installed under roofs or canopies where combustibles are stored and handled.” Since the tanks are buried, the ground cover isolates the storage aspect and protects them from mechanical damage, ignition sources and other harmful situations. This isolation is lost, however, if there are pumping facilities that expose the above-ground area to the possibility of spills.

Question 10 - Dust Collectors

An older building of combustible construction is used for production of wood furniture. They have two dust collectors that are situated in a new addition to the building with the appropriate fire rating between the building and the dust collector room addition. Does the ducting require sprinkler protection? NFPA 654 – *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids* and NFPA 664 – *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities* appear only to recommend sprinkler protection, with no requirement that the ducts be sprinklered. Is there additional information elsewhere?

Answer: There are a variety of codes and considerations that might be involved, and the size of the ducts can also be important to the issue of whether sprinklers are required. Section 8.2.2.1.1 of NFPA 664 (2002 edition) requires the use of NFPA 654 for dust collection systems, but neither standard is referenced by NFPA 13 and neither standard requires automatic sprinklers for dust collectors or their collection ducts. NFPA 654 does require a documented risk analysis acceptable to the AHJ to determine the need for sprinklers when a process involves both combustible

particulate solids and flammable or combustible liquids. NFPA 664 requires that ductwork for dust collection systems be metallic other than for minimum lengths at the machines.

The *International Fire Code* (2003 edition Section 1903.2) and *International Mechanical Code* (2003 edition Section 510.2.1) require equipment used to collect, process or convey combustible dusts in woodworking facilities to be provided with an approved explosion-control system. Separately, Section 510.7 of the *International Mechanical Code* requires fire suppression systems in all ducts 10 inches and larger used to convey materials unless the materials are nonflammable and noncombustible under all conditions and in all concentrations.

These two separate requirements reflect two different protection goals. Fires in dust collection systems for woodworking facilities are usually started by sparks created at machines, such as from a nail being hit by a saw blade, from a dull saw blade, or from an abrasive belt ripping. The sparks cause some of the wood dust particles to ignite and become burning embers in the duct, potentially becoming a fireball. The air and dust are typically conveyed at speeds of up to 4,000 feet per minute (approximately 45 mph). To stop burning embers in the ducts from reaching the dust collector, some type of fast acting explosion suppression system is needed.

There are some who therefore question the use of sprinklers in dust collector ducts, claiming that a burning ember does not have enough heat to activate an automatic sprinkler as it passes or that, by the time a sprinkler activated, the burning embers would be far downstream. This is true for a well-maintained clean duct, but the sprinkler would be useful in suppressing a fire that takes place in any build-up of material over time. Although NFPA 654 calls for regular cleaning of ducts and other areas where dust could accumulate, it is worth noting that NFPA 664 requires the hangers for ductwork in dust collector systems to be capable of supporting the duct half-filled with material.

Question 11 – Nonmetallic Piping Under Building Floors

A project will have piping running about 40 ft under a structure to get to the center of the building for the riser. The contractor who will be installing the lead-in piping from outside the building foundation to the riser location plans to use listed nonmetallic piping, converting to ductile iron to make the transition above the floor. The water department is fine with this and the sprinkler contractor will accept it due to the fact they are connecting to ductile iron. As the Authority Having Jurisdiction I am concerned with Section 10.6.2(2) of NFPA 13 and NFPA 24 (2002 editions), which allows running pipe under buildings only with certain precautions, including running the pipe in covered trenches. Does that imply some type of sleeve so that the pipe could be removed if there was a leak/break without digging up the floor? I cannot picture the elbow and up portion being removed in this process. Then the next reference in the code, Section 10.6.3, states the main can enter a building adjacent to the foundation, and the NFPA's *Automatic Sprinkler Systems Handbook* commentary on this section indicates the main must rise immediately inside the building adjacent to the exterior wall. This seems to basically state the riser needs to be as close to the exterior wall as possible. What is the requirement?

Answer: The *Sprinkler Handbook* commentary is consistent with the traditional intent to have the riser adjacent to the exterior wall to minimize the amount of piping that must be run under the building slab. In some cases, however, there are no alternatives. In those situations, the standards refer to the use of isolation valves and covered trenches to address the possibility of inaccessible damage. In the commentary to Section 10.6.4 the *Handbook* clarifies that "covered trenches" refers to "trench plates or other means of access" The purpose of this access is clear: in the event

maintenance or repair work needs to be done during the life of the system, the piping can be examined and worked on without disrupting the building structure.

It should also be noted that the listing of the nonmetallic piping may require that the piping be buried. It is unlikely that a comparable degree of protection can be provided if the piping is placed in a trench within the building, since it would be susceptible to damage from combustible or corrosive liquid spills.

Question 12 – Criteria for Choosing Variable Speed Fire Pump Drivers

What in your opinion are some of the key factors/variables for selecting a constant speed controller vs. a variable speed controller? Are there any current tools available to the designer/contractor/manufacturer to assist in selecting the appropriate type of controller? Are acceptance, routine testing and maintenance requirements different from those of constant speed pumps? If so, what are they?

Answer: Variable speed drivers should only be used where there is a potential over-pressurization situation. The device adds a layer of complexity to an otherwise simple fire pump situation. The electric version is more questionable than the diesel, since it requires the conversion of electricity from AC to DC and then back to AC at variable frequencies. Although the listing process helps to ensure product reliability, there is a possibility of error that could impair the fire pump. It is always best to avoid the unnecessary use f any device that complicates the system.

Each of the variable speed controller/driver manufacturers will help select the correct device from their line of equipment. The variables are the size of the pump and the maximum pressure that you are trying to maintain. Given those parameters, the manufacturer can suggest an appropriate device.

During the testing of the pump (acceptance test or periodic) the variable speed device needs to be tested and exercised. Each of these devices was not developed for the fire pump business. They were developed for other industries that see more regular use and adapted to fire pump use. Therefore, they need to be exercised once in a while. If the pressure is not sufficient to slow the driver down during regular weekly testing, then the test should be scheduled as such a time as a high suction pressure exists to see if the pump will slow down as it is supposed to.

Last Chance for NFSA "Top Tech" Competition

Tomorrow, January 10th, is the deadline for indicating interest in the National Fire Sprinkler Association's "Top Tech" competition. System layout and detailing technicians working for NFSA member companies will be competing through written examinations for spots on twelve regional teams from the United States and Canada. Regional teams will then enter a final competition in Las Vegas on May 3-4, 2007. On each regional team there can only be one representative per company, but companies that have offices in multiple regions are eligible to have multiple representatives. To compete for the recognition and prizes, individuals must provide their name, member company affiliation, address, telephone number, fax number and e-mail address to the appropriate individual below. Contestants will be notified no later than January 20, 2007 of testing dates for locations near them.

Applicant Location	Contact
Northeast (CT, ME, MA, NH, NY, RI, VT)	Dom Kass Phone: (518) 373-9392 Cell: (914) 414-3337 e-mail: Kass@nfsa.org
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Upcoming NFSA Technical Tuesday Online Seminar – January 16th

Topic: Changes to NFPA 13 Definitions and System/Component Requirements
Instructor: Russell P. Fleming, P.E., NFSA Executive Vice President
Date: January 16, 2007

This seminar is the first of a series of ten on changes to the 2007 editions of NFPA 13, 13D, 13R, 20 and 24. In the new 2007 edition of NFPA 13, there are some significant changes in Chapters 1 through 7. This seminar will explore the new definitions used throughout the new standard, the changes to the requirements regarding individual system components, and changes to the performance requirements for systems, including the TIA on water delivery requirements for dry-pipe systems that was issued on both the 2007 and 2002 editions of the standard. Even if you will not be using the 2007 edition of NFPA 13, you will find that the changes and clarifications will affect your understanding of the requirements of earlier editions.

Information and registration for this seminar is available at www.nfsa.org or by calling Dawn Fitzmaurice at 845-878-4200 ext. 133 or email: dawn@nfsa.org.

NFSA Sets 2007 Schedule for 3-day Advanced Technician Training and NICET Inspector Certification Review Classes

The NFSA Engineering Department has set up the following classes for open registration:

May 22-24	**ITM NICET Review**	**Anchorage, AK**
June 19-21	**ITM NICET Review**	**Wilmington, DE**
July 24-26	**Advanced Technician Training**	**Chicago, IL**
August 14-16	**ITM NICET Review**	**San Antonio, TX**
September 5-7	**Advanced Technician Training**	**St Louis, MO**
November 6-8	**ITM NICET Review**	**Providence, RI**

For more information, contact Nicole Sprague at 845-878-4200 ext. 149 or email: Sprague@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.