

Focus on ESFR Sprinklers

This issue of e-TechNotes is being dedicated to answering a series of questions related to the use of ESFR sprinklers. The questions will be answered with section numbers quoted from the 2013 edition of NFPA 13. In most cases, similar sections exist in previous editions. In those cases where the sections are new to the 2013 edition, they should be considered clarifying sections to the previous editions and should be permitted even in jurisdictions enforcing previous editions.

Question 1) Can ESFR sprinklers be used to protect light hazard occupancies?

Answer: This question used to be somewhat difficult to answer. While ESFR sprinklers dramatically exceed anything required for light hazard fire protection (a k-14 ESFR sprinkler operating at 50 psi would produce a density of 0.99 gpm per sq ft at maximum spacing, which is effectively 10 times the density required for light hazard), and would basically drown any fire in a light hazard occupancy, NFPA 13 never really came right out and said that it was okay to use ESFR sprinklers in light hazard occupancies.

Still, there was nothing in NFPA 13 that stated that any particular type of building had to be considered "light hazard". One common question regarding ESFR sprinklers and light hazard occupancies was asked for gyms. In many cases, gyms were moving into spec buildings that had been protected with ESFR sprinklers and owners wanted to know if they had to change the sprinklers since gyms are typically sprinklered as light hazard. But there is nothing wrong with considering a gym an ordinary hazard occupancy, and NFPA 13 specifically said that ESFR sprinklers could be used to protect ordinary hazard occupancies (see section 12.6.7 in the 2010 edition of NFPA 13, similar sections in previous editions). In the 2013 edition of NFPA 13, the committee came right out and specifically stated that ESFR sprinklers are permitted to be used to protect light hazard occupancies. See section 8.4.6.6 and section 12.6.7.1.

Question 2) If ESFR sprinklers are used in a building that has an unsprinklered combustible concealed space qualifying for section 11.2.3.1.4(3) or section 12.9.1, is the design area required to be increased to 3,000 sq ft?

Answer: No. Sections 11.2.3.1.4(3) and 12.9.1 only apply to sprinkler protection based on density/area criteria. These sections do not apply to ESFR sprinklers. Very few fires actually start in concealed spaces. Sections 11.2.3.1.4(3) and 12.9.1 are based on the philosophy that a fire will start in a normally sprinklered space and will be contained in that space, but might burn through a combustible concealed space without sprinklers and pop out

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somewhere else, which would require a larger water supply to deal with. ESFR sprinklers, if installed correctly in a building that is maintained correctly, should be able to suppress a fire fast enough that it will not burn into a combustibile concealed space. The NFPA Technical Committee on Sprinkler System Discharge Criteria faced this decision a few cycles ago when the copied the 3,000 sq ft rules into Chapter 12 to make sure that they were applied to storage situations. They specifically added the phrase, "When using the density/area method" to the beginning of the sentence to clarify that the requirement was not to apply to ESFR sprinklers. Since the committee deliberately took this action, it should be clear that the 3,000 sq ft rule does not apply to ESFR sprinklers, even when qualifying combustibile concealed spaces are not sprinklered in the building.

Question 3) Can ESFR sprinklers and standard response spray sprinklers be used in the same compartment?

Answer: Yes. Section 12.3 of NFPA 13 allows different hazards in the same compartment to be protected with different types of sprinklers. This section gives the user some choices in how to prevent a fire in the higher hazard area from opening sprinklers in the lower hazard area. These choices include:

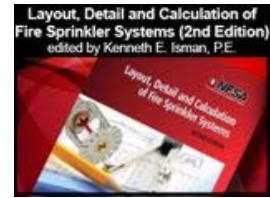
- Extending the protection for the higher hazard 15 ft into the area of the lower hazard.
- Creating a barrier to prevent the hot gasses from a fire in one of the areas from opening sprinklers in the other area.
- Using a change in ceiling elevation that is at least 2 ft deep to separate the areas.

Since Option 3 allows a change in ceiling elevation that is only 2 ft deep to be a sufficient barrier to heat at the higher elevation setting off sprinklers at the lower elevation, it would stand to reason that a 2 ft deep draft curtain between the two different types of sprinklers would be all that is necessary to meet Option 2.

Section 8.4.6.4.1 of NFPA 13 requires that when standard response spray sprinklers and ESFR sprinklers are installed in the same compartment that a 2 ft deep draft curtain be installed between the two different types of sprinklers. Since this draft curtain has to be installed anyway, the user can select Option 2 and not worry about extending the sprinklers for the higher hazard into the lower hazard area.

Many people that ask this question are concerned with section 8.3.3.2, which states that in compartments with quick response sprinklers, there can only be quick response sprinklers. They think that the mixing of ESFR sprinklers and standard response sprinklers in the same compartment violates this section. But they are wrong. ESFR sprinklers are not "quick response sprinklers." Quick response sprinklers are defined by section 3.6.4.7 of NFPA 13 as "A type of spray sprinkler". ESFR sprinklers are NOT spray sprinklers. They are a different type of sprinkler and do not qualify as a quick response sprinkler.

ESFR sprinklers have a fast response element. But that is not enough to make them a quick response sprinkler. The fast response element is just one characteristic of a sprinkler. Why quick response sprinklers also have fast response elements, they also have other characteristics which make them a different type of sprinkler than an ESFR sprinkler. ESFR sprinklers are not quick response sprinklers and are not bound by the limitations of section



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8.3.3.2.

Question 4) If ESFR sprinklers and quick response spray sprinklers are installed in the same compartment, is a draft curtain required between the two different types of sprinklers?

Answer: No. Section 8.4.6.4 (which requires the draft curtain) only applies to situations where ESFR sprinklers are installed in the same compartment as standard response sprinklers. Quick response sprinklers are not standard response sprinklers and therefore there is no requirement for a draft curtain to be installed. It is interesting to note from the answer to Question 3 that the installation of quick response sprinklers and ESFR sprinklers is technically a violation of section 8.3.3.2 of NFPA 13. Yet we know of many such installations that have been done and we do not think they are a challenge to fire protection as long as the sprinklers are properly designed to handle whatever is going on below them. In these situations, we assume that the Authority Having Jurisdiction has granted a waiver to section 8.3.3.2 to allow the quick response sprinklers to be installed in the same compartment as the ESFR sprinklers.

Question 5) Can standard response spray sprinklers be installed under a mezzanine where ESFR sprinklers are installed at the higher roof in the rest of the building?

Answer: Yes, as long as the sprinklers under the mezzanine can handle the protection of whatever the space under the mezzanine is being used for. The same issues exist for separating the sprinklers under the mezzanine from the ceiling sprinklers as described in the answer to Question 3. A 2 ft deep draft curtain would need to be installed around the perimeter of the mezzanine.

If the mezzanine is smaller than the design area for the hazard under the mezzanine, the hydraulic calculations might get a little complicated. Under older editions of NFPA 13, the user might have to pick up additional ESFR sprinklers at the higher ceiling to finish the calculations. For example, if the area under the mezzanine was 1600 sq ft and the design area was 3000 sq ft for the standard response sprinklers under the mezzanine, then technically, the user (under the old rules of NFPA 13) would have to pick up four ESFR sprinklers at the higher ceiling area to get the 2000 sq ft design area.

But in the 2013 edition of NFPA 13, the committee clarified that you do not have to add additional ESFR sprinklers at the ceiling in a new sections 23.4.4.1.1.4 and 23.4.4.1.1.5. Instead, the committee created the concept of an extra flow that is added to the calculations at a remote branch line to make up the difference for the area being too small to calculate.

Continuing our example from above, let's say that the area under the mezzanine can be protected with standard response spray sprinklers at a density of 0.3 gpm per sq ft over 2000 sq ft. If we calculate the 1600 sq ft under the mezzanine and find that it takes 530 gpm to feed those sprinklers under the mezzanine, we then add an additional flow to our hydraulic calculations of 70 gpm where the most remote branch line for the mezzanine connects to a sprinkler main rather than adding the flow from four additional ESFR sprinklers.

The 70 gpm in the example above comes from multiplying the density (0.3) times the design area (2000) to come up with a minimum flow for the mezzanine of 600 gpm. We already calculated 530 for the sprinklers actually

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under the mezzanine, so we need to add another 70 gpm ($600 - 530 = 70$) to get the flow for these sprinklers equal to the minimum flow necessary to protect 2000 sq ft. This new rule in NFPA 13 saves considerable flow for these situations and is true to the idea of protecting the area under the mezzanine with sprinklers that are designed for that hazard.

The term that committee members have used to describe this additional flow that you add to the calculations is “phantom flow”. Although the term “phantom flow” does not appear in NFPA 13, sections 23.4.4.1.4 and 23.4.4.1.5 specifically allow its use.

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