

# Storage Protection

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*First in a Series*

## Navigating the Storage Requirements in NFPA 13

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**W**hen I began my career in 1987, NFPA 13 *Standard for the Installation of Sprinkler Systems* was an easy document to use. There were three basic types of sprinklers and two orifice sizes used for almost all systems except deluge. Most buildings fell into one of three occupancy classifications, regardless of what was stored. Other NFPA standards such as 231, 231C, and 231D applied to warehouses with large general storage, rack storage, and tires. Plastics were less prevalent and most everything was Class I, II, III, or IV.

Protection technology, however, advanced quickly. One of the biggest leaps was development of the Early Suppression - Fast Response (ESFR) sprinkler. Storage began to take on a whole new import due to the unique ways items were being stored, advances in protection technology, and increased use of plastics. To address protection in light of new hazards and technological advances, beginning with the 1999 edition, NFPA combined multiple protection documents to create one comprehensive set of guidance in NFPA 13.

This marked an important advancement in sprinkler system design, requiring a designer review all aspects of an occupancy

classification, including storage. Today, a basic understanding of how to use NFPA 13 is essential to determining appropriate levels of protection.

Storage in the 2013 edition of NFPA 13 is addressed in Chapters 12-22, with each detailing specific requirements depending on what is being stored and how. To apply NFPA 13, begin with three essential questions:

### **What will be stored?**

Are the items comprised mostly of plastics? The amount of plastics determines if the commodity is considered a Class III, Class IV, or a Group A plastic. Is the plastic expanded or unexpanded, and is it cartoned or exposed? Plastics require different protection than lumber, which requires different protection than tires.

### **How will it be stored?**

Rack storage, solid pile storage, and bin box storage have different protection needs. Will the products be in cartons? Will they be encapsulated — wrapped entirely in plastic?

Will single, double, or multiple row racks be used? Will solid shelving be used? Will shelves be on the rack, or will they be the gondola-type shelves found in a grocery store? Shelving provides an obstruction to sprinkler discharges, preventing water from reaching products stored under the shelf, so different protection options must be evaluated. Choosing the best option depends on how the product is being stored.

### How high will it be stored?

Products stored 12' in height or lower can be protected using ordinary and extra hazard occupancy criteria. Once storage exceeds 12' in height, protection options differ. Criteria for rack storage, for example, are based on a 20' height. Storage higher or lower than this can result in changes to the design density. In addition to needing to know the height of storage, it is also important to ask, "What will be the ceiling height?" as ceiling height and the clearance between the ceiling and the top of the storage have an impact on protection criteria. Testing is based on certain ceiling/roof heights and clearances provided between the top of storage and the roof deck.

Another question that might be asked, which also can impact storage design, involves whether or not there is a sprinkler or system type preference. Some owners prefer ESFR protection, while others leave the decision to the designer. Each type of system and sprinkler presents unique opportunities for protecting storage. As a result, this flexibility in design approaches can result in significantly reduced project cost.

Once these foundation questions are answered, one must review NFPA 13 Chapters 12 to 22 for the relevant criteria for protection of the commodity. Chapter 12 outlines the general requirements that apply to all storage, while Chapter 22 is largely based on special occupancies. Miscellaneous storage is defined in Chapter 13. Chapters 14 and 15 address protection of solid pile, bin box, shelf, and back-to-back shelf storage. Each chapter addresses protection schemes for control mode density/area sprinkler applications, Control Mode Specific Application (CMSA) sprinkler applications, ESFR sprinkler applications, and high-expansion foam systems. Chapter 14 addresses Class I through Class IV commodities, while Chapter 15 specifically addresses plastic and rubber commodities. Chapters 16 and 17 address protection for rack storage. Both chapters address protection of storage up to 25' in height versus storage over 25'. Similar to Chapters 14 and 15, Class I through Class IV commodities are covered in Chapter 16, whereas plastic and rubber commodities are specifically addressed in Chapter 17. Chapters 18 and 19 address rubber tires and rolled paper, respectively. Special design considerations are addressed in Chapter 20, including: protection of plastic motor vehicle components; plastics in retail stores; baled cotton; carton records storage; compact storage of paper files, books, magazines, etc.; and high bay records storage. Chapter 21 covers alternative designs for specific applications based on actual test conditions for different storage arrangements. These are not meant for general application but provide an alternative design to those outlined in Chapters 12-20. Care should be taken when utilizing criteria from Chapter 21 to ensure the proper design consideration is used for the specific application.

#### Consider the following example:

A project requires protection of plastic trash cans, laundry baskets, totes, and other similar plastic items in double-row

racks up to 20' in height in a 30' building. The products will be palletized on open steel grates in the racks, rather than solid shelves, and will be cartoned and non-encapsulated. The products should be considered Group A, non-expanded plastics. The owner is requiring use of ESFR protection using K-25.2 ESFR sprinklers.

In this example, our three major (and two minor) questions have been answered:

- What will be stored? Group A plastics, cartoned, non-expanded and non-encapsulated.
- How will it be stored? Double-row racks without solid shelves.
- How high will it be stored? Up to 20' in a 30' building (ceiling/roof height).
- How tall is the ceiling/roof? 30'.
- The owner requires the use of ESFR protection (preference question).

For rack storage of Group A plastics, refer to Chapters 12 and 17 of NFPA for the required design. Chapter 12 gives general requirements for ESFR in that a minimum of 12 sprinklers are required in the design area — four sprinklers on three lines. Chapter 17, Section 17.2, addresses rack storage of plastics up to 25' and Table 17.2.3.1 addresses ESFR protection. Four options are available for single, double, and multiple-row racks of cartoned, non-expanded plastics stored up to 20' in a 30' building, depending on the K-factor. As this example calls for K-25.2, the criteria calls for pendent orientation of the sprinklers providing a minimum operating pressure of 20 psi.

Remember, to properly design and install a fire sprinkler system protecting storage, one must know what is being stored, how it is being stored, and the height of the storage and the ceiling (roof deck). The application of these three key questions, combined with a basic understanding of NFPA 13, will help determine the right solution for protection.

#### About the Author:

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**Next Month: NFPA 13 Chapter 12**  
*General Requirements for Storage*