



Coffee Break Training - Fire Protection Series

Storage Practices: Shelf and Rack Influences on Fire Sprinkler Systems

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Learning Objective: The student shall be able to explain how the difference between shelves and racks affects sprinkler design.

The last two Coffee Break Training sessions have explained the difference between shelf and rack storage configurations with the emphasis that proper definition of the storage components is important to sprinkler system design.

Today we provide an example of both how complicated the design determination process can be, as well as the different outcomes based simply on the definition of the storage component as a shelf or rack. The example is from the National Fire Protection Association (NFPA) 13, *Standard for the Installation of Sprinkler Systems*, and includes the following criteria that go into the design determination process. Our example product is a finished wood product.



The metal structures are the framing of what eventually will become storage racks.

Design Element	Factor
Commodity/Class	Wood product/Class III
Encapsulation/Banding	None
Sprinklers	Control mode
Sprinkler design method	Area/Density
Temperature rating	Ordinary (135–170 °F/57–77 °C)
Location	Ceiling sprinklers only
Storage height (maximum)	15 ft (457 cm)
Storage configuration	Single-row shelf/rack

Given this design information, NFPA 13 allows a sprinkler system designer a variety of options to achieve an adequate fire protection solution.

Shelf Storage

ft ²	Area/Density (Range)		mm/min.	Required Density Adjustment	Adjusted Density	
	gpm/min.	m ²			gpm/min.	mm/min.
2,000	0.285	186	11.5	70%	0.20	8.05
3,000	0.225	279	8.5	70%	0.16	5.95

Rack Storage

ft ²	Area/Density (Range)		mm/min.	Required Density Adjustment	Adjusted Density	
	gpm/min.	m ²			gpm/min.	mm/min.
2,000	0.485	186	20.2	60%	0.291	12.1
3,000	0.44	279	18	60%	0.264	10.8

Notice that by changing only the storage configuration from shelf to rack storage, there are significant differences in the adjusted density figures for the two storage arrays. Proper classification of the storage element (shelf or rack) makes a big difference to the sprinkler system design.

For additional information, refer to *International Fire Code*[®], Chapter 23, or NFPA 1, *Uniform Fire Code*[™], Chapter 20, or NFPA 13.



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