



Protecting Non-Storage Occupancies

NL training sessions 2026

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Recent examples

1 januari 2026, 14.09 uur · Aangepast 1 januari 2026, 21.17 uur · Door: Floris Spaans & Chris Visser

In een autobedrijf aan de Mossel in Noord-Scharwoude is vanmiddag een grote brand uitgebroken. Het vuur is inmiddels onder controle, maar de brandweer is nog bezig met nablussen. De veiligheidsregio heeft omwonenden gewaarschuwd om binnen te blijven, omdat er asbest is vrijgekomen.



Grote brand bij autobedrijf Noord-Scharwoude - NH Nieuws

Noord-Scharwoude (January 1st 2026)

Source: nhnieuws.nl

Brand bij metaalbedrijf Bunnik geblust, pand verwoest

Eva de Boer 16 december 2025, 06:28 · Aangepast 21 januari, 02:07 · 2 minuten leestijd



© KLF Media

Bunnik - In Bunnik is het sein brand meester gegeven nadat er vanmorgen rond 04.30 uur een zeer grote brand uitbrak in een metaalverwerkingsbedrijf aan de Rumpsterweg. De brandweer schaalde flink op en kwam met meerdere eenheden ter plaatse. Het pand is volledig uitgebrand en moet als verloren worden beschouwd, meldt de Veiligheidsregio Utrecht (VRU). Rond 07.45 uur was de brand geblust.

Het gaat om vier aan elkaar geschakelde panden, waarvan er eentje uitgebrand is. Het direct aangrenzende pand is gebruikt als "stoplijn", vertelt een woordvoerder van de VRU. "Om te voorkomen dat de brand doorgaat naar het daarnaast gelegen pand". Dat was niet makkelijk. "Er is heel hard voor gewerkt om die scheiding in stand te houden. En dat is gelukkig gelukt." Het dak van dat pand is deels opengemaakt om te blussen.

Bunnik (December 16th 2025)

Source: rtvutrecht.nl

Overview

- 01** Scope and definitions
- 02** Occupancy protection
- 03** Low piled storage protection
- 04** Special cases and EN12845

Which Data Sheet Should be Used

- **Datasheet 3-26: *Fire Protection for Nonstorage Occupancies***

- **Occupancy specific Data Sheets**

- Precedence over DS 3-26
- Specific industrial processes: 7 series
- Storage occupancies: 8 series
- Increased fire hazards:
ignitable liquids, combustible dust,
combustible construction, concealed spaces

7-10 Wood Processing and Woodworking Facilities

7-14 Fire Protection for Chemical Plants

7-96 Printing Plants

8-9 Storage of Class 1, 2, 3, 4 and Plastic Commodities

7-32 Ignitable Liquid Operations

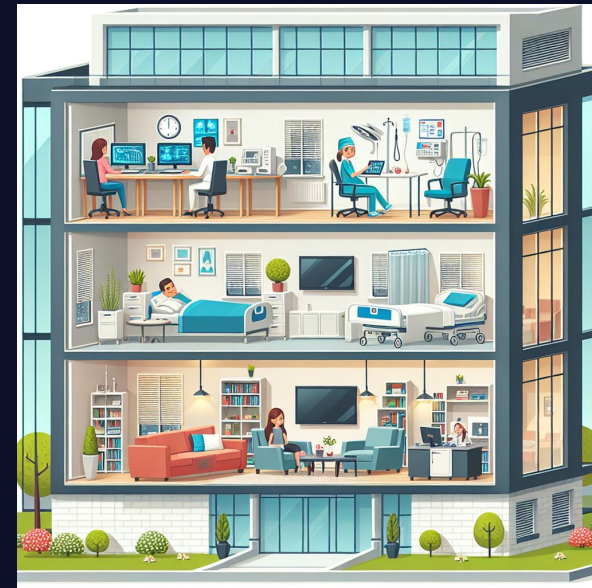
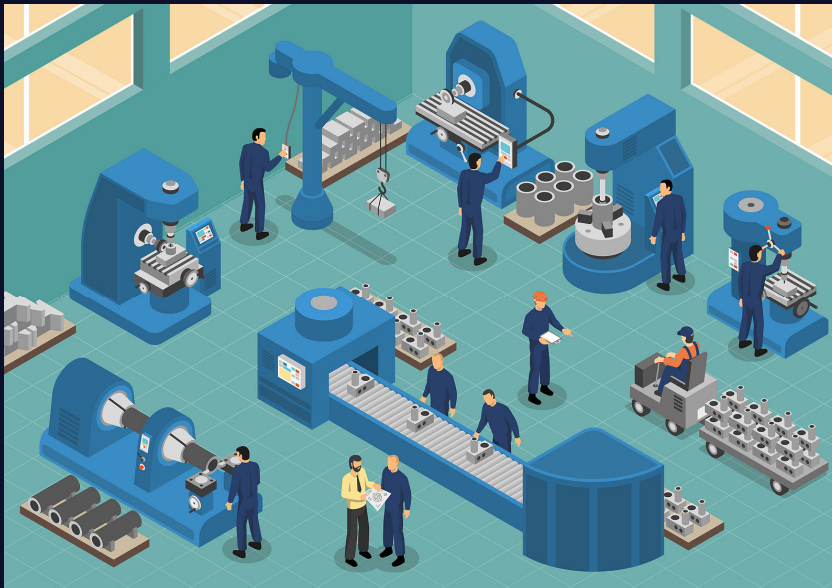
1-57 Plastics in Construction

SCOPE AND DEFINITIONS

Data Sheet 3-26, *Fire Protection for Nonstorage Occupancies*

Definition:

Area or building consisting of equipment, processes, and/or materials that are not maintained in a storage arrangement. (...) The occupancy may contain industrial or manufacturing processes as well as non-manufacturing operations.



SCOPE AND DEFINITIONS

Data Sheet 3-26, Hazard categories

HC-1

- Limited combustibles in processes, or operations of low hazard.
- Combustible furnishings typically noncontinuous in well-subdivided areas.
- Does not include any incidental storage of plastics, or plastics used in the construction of walls and/or ceilings.
- Can have incidental amounts of ignitable liquids

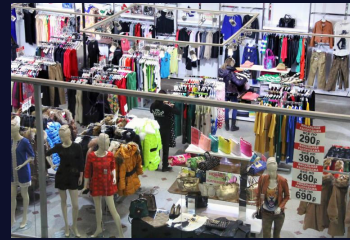
Examples: offices, hospitals, apartments...



HC-2

- Moderate combustibles used in processes, or operations of moderate hazard.
- Limited quantities ignitable liquids
- Limited quantities of plastics

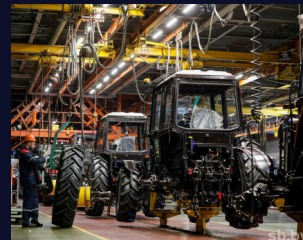
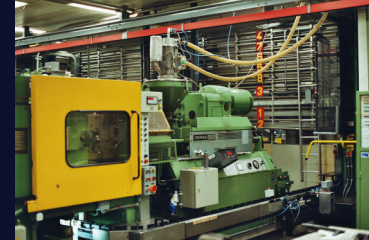
Examples: machine shops, woodworking, food production, Retail, theaters...



HC-3

- Heavy combustibles used in processes
- Limited quantities ignitable liquids
- Heavier amounts of plastics

Examples: plastic mfg, vehicle mfg, paper coating, printing plants, film studios...



SCOPE AND DEFINITIONS

Data Sheet 3-26, Hazard categories

HC-1

HC-2

HC-3

Examples of Hazard categories can be found in appendix C of DS 3-26

<i>Occupancy</i>	<i>Description</i>	<i>Hazard Category</i>	<i>Considerations</i>
Metals, Glass, and Ceramics	- Glass Factories- Mineral Processing such as: Glass, Cement, Ore Treating, Gypsum Processing, etc. (without Ignitable Liquids) - Cement Factories - Brick and Clay Factories - Molten Metal Products	HC-1	Data sheets to consider: - 7-25, <i>Blast Furnace Ironmaking and Basic Oxygen Steelmaking</i> - 7-26, <i>Glass Plants</i> - 7-33, <i>Molten Metals and Other Materials</i> - 7-41, <i>Oil Quenching and Molten Salt Baths</i> - 7-104, <i>Metal Treatment Process</i>
Rubber and Plastic	- Floor Cloth and Linoleum Manufacture - Rubber Goods Factories	HC-2	Data sheets to consider: - 7-24, <i>Blowing Agents</i>
	- Synthetic Fiber Factories - Carpet Factories Including Unexpanded Plastics - Footwear Factories, Including Plastics and Rubber Soles - Cable Factories for PP/PE/PS or Similar - Plastics Factories and Plastic Goods - Printing Works (Plastic and Rubber) - Rubber Tire Manufacturing - Coating Process (Electrostatic, Thermal or Bath) - Production of Unexpanded Plastic or Rubber Products	HC-3	Data sheets to consider: - 7-29, <i>Ignitable Liquid Storage in Portable Containers</i> - 7-32, <i>Ignitable Liquid Operations</i> - 7-73, <i>Dust Collectors and Collection Systems</i> - 7-76, <i>Prevention and Mitigation of Combustible Dust Explosions and Fires</i> - 7-98, <i>Hydraulic Fluids</i> - 7-99, <i>Heat Transfer Fluid Systems</i> - 8-30, <i>Storage of Carpets</i>

SCOPE AND DEFINITIONS

Data Sheet 3-26, Storage in nonstorage occupancies

Incidental Storage

Solid-pile, palletized, rack, shelf, or bin-box storage that is normal for an occupancy

- Plastics: <1.8 m high and < 6 m²
- Class 3: <3.0 m high and < 20 m²
- Aisle separation > 2.4m

Low piled storage

Non rack storage that meets the height restriction for incidental storage but not the area restriction

- Plastics: <1.8 m high and > 6 m²
- Class 3: <3.0 m high and > 20 m²

Storage parameter		Incidental Storage	Low-pile Storage
Class 1-3 Storage	Height	≤ 3,0 m	≤ 3,0 m
	Area	≤ 20 m ²	> 20 m ²
Plastics Storage	Height	≤ 1,8 m	≤ 1,8 m
	Area	≤ 6 m ²	> 6 m ²
Aisle Width		≥ 2,4 m	./.

SCOPE AND DEFINITIONS

Data Sheet 3-26, Storage in nonstorage occupancies

Storage parameter		Incidental Storage	Low-pile Storage
Class 1-3 Storage	Height	≤ 3,0 m	≤ 3,0 m
	Area	≤ 20 m ²	> 20 m ²
Plastics Storage	Height	≤ 1,8 m	≤ 1,8 m
	Area	≤ 6 m ²	> 6 m ²
Aisle Width		≥ 2,4 m	./.



In-process storage

Incidental: protection guidance for non-storage occupancies
Low-piled: specific protection guidelines in table 2.3.3.1



SCOPE AND DEFINITIONS

Data Sheet 3-26, Storage in nonstorage occupancies

Storage parameter		Incidental Storage	Low-pile Storage
Class 1-3 Storage	Height	≤ 3,0 m	≤ 3,0 m
	Area	≤ 20 m ²	> 20 m ²
Plastics Storage	Height	≤ 1,8 m	≤ 1,8 m
	Area	≤ 6 m ²	> 6 m ²
Aisle Width		≥ 2,4 m	./.



Storage occupancy

See Data Sheet 8-9



SCOPE AND DEFINITIONS

Not covered in Data Sheet 3-26: Increased fire hazard

Ignitable liquid / dust

- Ignitable liquid storage or use in HC-1 occupancies in excess of the quantities considered incidental
- Combustible dust or lint collected on horizontal surfaces

Plastic construction

- Insulated metal panel walls (sandwich panels)
- Spray-on foam insulation
- Interior finish materials

Concealed spaces

- With combustible construction or content
- False ceiling, raised floors, box-in-box, cas-niveau, conveyors, machine casing, attics...

Overview

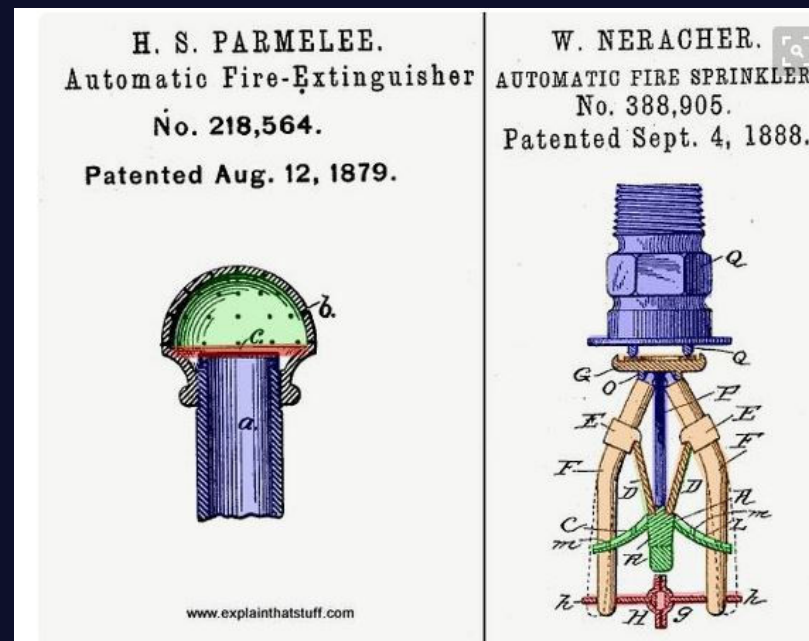
- 01** Scope and definitions
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Automatic sprinkler protection

Automatic Fire sprinkler heads were introduced in 1874.

Originally designed outside the realm of FM, FM's further development and promotion of the sprinkler head aided in its eventual widespread use and acceptance.

FM Approvals founded in 1886 as Factory Mutual Laboratories.



Basic Installation Standards

- **Data Sheet 2-0, Installation Guidelines for Automatic Sprinklers**

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- **Data Sheet 3-7, Fire Protection Pumps**
- **Data Sheet 3-10, Installation/Maintenance of Fire Service Mains**
- **Data Sheet 3-1, Tanks and Reservoirs for Interconnected Fire Service and Public Mains**

Factors for nonstorage sprinkler design

Sprinkler system

- Wet pipe system
- Others: Dry / Preaction / Antifreeze / (watermist)
- Pendant / Upright / Sidewall
- Standard rating: 70°C
- Standard coverage / extended coverage
- Standard response / quick response
- K80 / K115
- Hose allowance: 950 lpm / 1900 lpm
- Duration: 60 minutes

Building construction

- Ceiling height
- Obstructed / Unobstructed ceilings
- Roof and ceiling slope
- Solid or grated mezzanines
- Heat/smoke vents and draft curtains

General Sprinkler Demands

Table 2.3.1.10 Sprinkler Design Demands for Hazard Categories

Hazard Category	Ceiling Height up to 30 ft (9 m)		Ceiling Height 30-45 ft (9-13.5 m)		Ceiling Height 45-60 ft (13.5-18 m)		Ceiling Height 60-100 ft (18-30 m)	
	(gpm/ft ²)/ft ² [(mm/min)/m ²]							
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
HC-1	0.1/1500 (4/140) ^{Note 1}	0.1/1500 (4/140)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.6/1200 (24/110)	Design guidance currently unavailable.
HC-2	0.2/2500 (8/230) ^{Note 2}	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.6/1200 (24/110)	
HC-3	0.3/2500 (12/230) ^{Note 2}	0.3/3500 (12/330)	0.3/3600 (12/340)	0.3/4600 (12/430)	0.5/3000 (20/280)	0.5/4000 (20/370)	0.6/1200 (24/110)	

From DS2-0

Table 2.5.2.1.1(b). Recommended Minimum Allowable Nonstorage Pendent and Upright Sprinkler K-factors

Recommended Density from Occupancy-Specific Data Sheet, gpm/ft ² (mm/min)	Minimum Recommended Standard- Coverage Ceiling Sprinkler K-factor	Minimum Recommended Extended- Coverage Ceiling Sprinkler K-factor
Density ≤ 0.10 (4)	K5.6 (K80)	K5.6EC (K80EC)
0.10 (4) < Density ≤ 0.30 (12)	K5.6 (K80)	K11.2EC (K160EC)
Density > 0.30 (12)	K11.2 (K160)	K25.2EC (K360EC)

General Sprinkler Demands

Table 2.3.1.10 Sprinkler Design Demands for Hazard Categories

Hazard Category	Ceiling Height up to 30 ft (9 m)		Ceiling Height 30-45 ft (9-13.5 m)		Ceiling Height 45-60 ft (13.5-18 m)		Ceiling Height 60-100 ft (18-30 m)	
	(gpm/ft ²)/ft ² [(mm/min)/m ²]							
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
HC-1	0.1/1500 (4/140) ^{Note 1}	0.1/1500 (4/140)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.6/1200 (24/110)	Design guidance currently unavailable.
HC-2	0.2/2500 (8/230) ^{Note 2}	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.6/1200 (24/110)	
HC-3	0.3/2500 (12/230) ^{Note 2}	0.3/3500 (12/330)	0.3/3600 (12/340)	0.3/4600 (12/430)	0.5/3000 (20/280)	0.5/4000 (20/370)	0.6/1200 (24/110)	

From DS2-0

Table 2.5.2.1.1(b). Recommended Minimum Allowable Nonstorage Pendent and Upright Sprinkler K-factors

Recommended Density from Occupancy-Specific Data Sheet, gpm/ft ² (mm/min)	Minimum Recommended Standard- Coverage Ceiling Sprinkler K-factor	Minimum Recommended Extended- Coverage Ceiling Sprinkler K-factor
Density ≤ 0.10 (4)	K5.6 (K80)	K5.6EC (K80EC)
0.10 (4) < Density ≤ 0.30 (12)	K5.6 (K80)	K11.2EC (K160EC)
Density > 0.30 (12)	K11.2 (K160)	K25.2EC (K360EC)

General Sprinkler Demands

Table 2.3.1.10 Sprinkler Design Demands for Hazard Categories

Hazard Category	Ceiling Height up to 30 ft (9 m)		Ceiling Height 30-45 ft (9-13.5 m)		Ceiling Height 45-60 ft (13.5-18 m)		Ceiling Height 60-100 ft (18-30 m)	
	(gpm/ft ²)/ft ² [(mm/min)/m ²]							
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
HC-1	0.1/1500 (4/140) ^{Note 1}	0.1/1500 (4/140)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.6/1200 (24/110)	Design guidance currently unavailable.
HC-2	0.2/2500 (8/230) ^{Note 2}	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.6/1200 (24/110)	
HC-3	0.3/2500 (12/230) ^{Note 2}	0.3/3500 (12/330)	0.3/3600 (12/340)	0.3/4600 (12/430)	0.5/3000 (20/280)	0.5/4000 (20/370)	0.6/1200 (24/110)	

From DS2-0

Table 2.5.2.1.1(b). Recommended Minimum Allowable Nonstorage Pendent and Upright Sprinkler K-factors

Recommended Density from Occupancy-Specific Data Sheet, gpm/ft ² (mm/min)	Minimum Recommended Standard- Coverage Ceiling Sprinkler K-factor	Minimum Recommended Extended- Coverage Ceiling Sprinkler K-factor
Density ≤ 0.10 (4)	K5.6 (K80)	K5.6EC (K80EC)
0.10 (4) < Density ≤ 0.30 (12)	K5.6 (K80)	K11.2EC (K160EC)
Density > 0.30 (12)	K11.2 (K160)	K25.2EC (K360EC)

Overview

- 01** Scope and definitions
- 02** Occupancy protection
- 03** Low piled storage protection
- 04** Special cases and EN12845

Data Sheet 3-26, *Storage in nonstorage occupancies*

Incidental Storage

Solid-pile, palletized, rack, shelf, or bin-box storage that is normal for an occupancy

Low piled storage

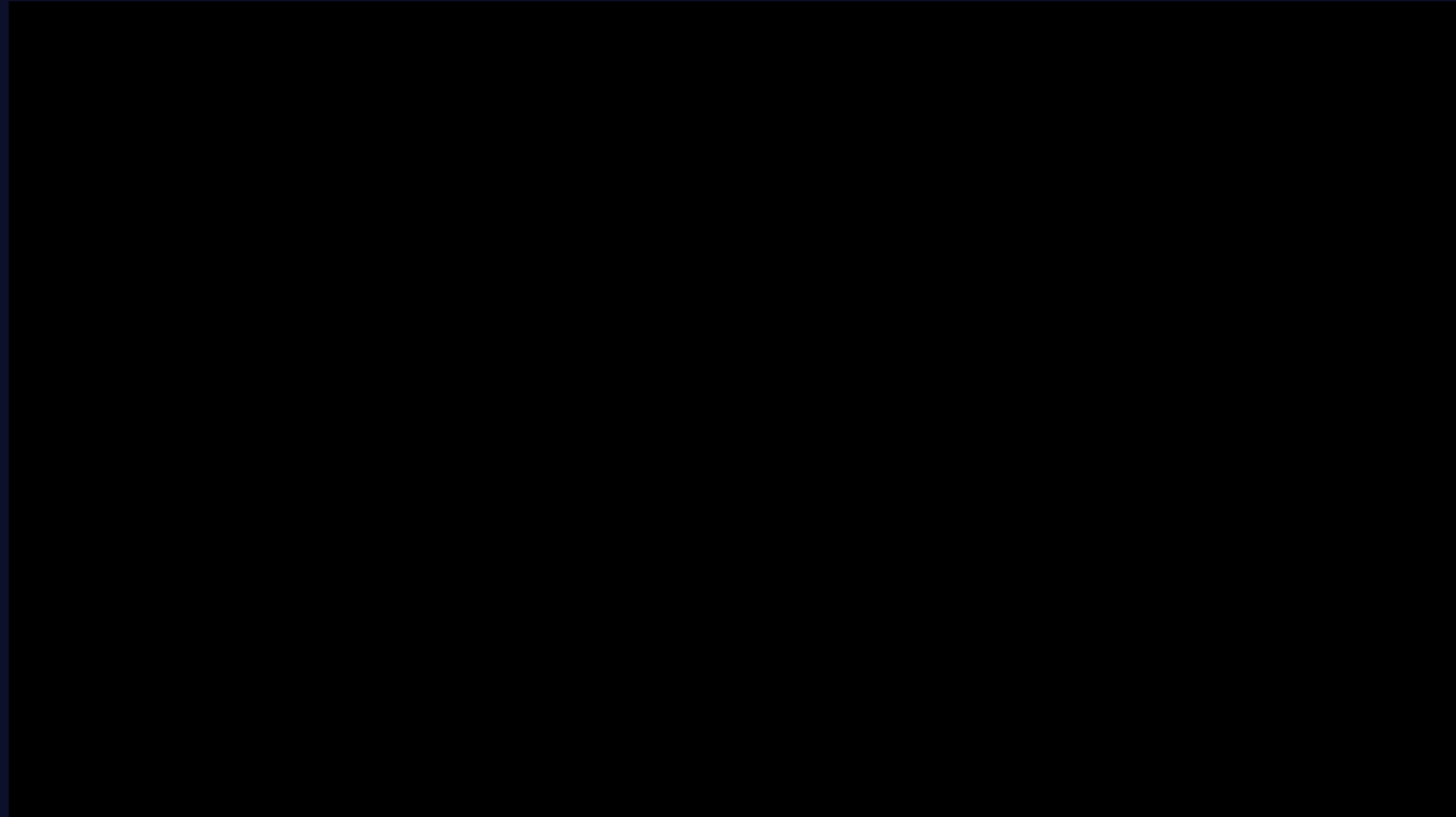
Non rack storage that meets the height restriction for incidental storage but not the area restriction

Storage parameter		Incidental Storage	Low-pile Storage
Class 1-3 Storage	Height	$\leq 3,0 \text{ m}$	$\leq 3,0 \text{ m}$
	Area	$\leq 20 \text{ m}^2$	$> 20 \text{ m}^2$
Plastics Storage	Height	$\leq 1,8 \text{ m}$	$\leq 1,8 \text{ m}$
	Area	$\leq 6 \text{ m}^2$	$> 6 \text{ m}^2$
Aisle Width		$\geq 2,4 \text{ m}$	./.

Storage Testing

Reference: incidental storage test

- UUP to 1.8m
 - Four stacks, 6m²
 - 2.4m aisles to adjacent pallets
 - K160 heads, 12 mm/min density
 - 9m ceiling
-
- All 49 ceiling sprinklers operated
 - Fire did not spread to CUP commodity 2.4 m away



Low Piled Storage Protection

Storage obstruction rules need to be applied

DS 3-26

Table 2.3.3.1. Sprinkler Protection Guidelines for Low-Piled Storage

Wet System, Pendent Sprinklers, 160°F (70°C), Number of AS @ psi (bar)

Commodity	Max. Ceiling Height, ft (m)	Quick-Response						K11.2 (K160)
		K11.2 (K160)	K14.0 (K200)	K16.8 (K240)	K22.4 (K320)	K25.2 (K360)	K25.2EC (K360EC)	
Up to CEP Note 1	30 (9)	25 @ 7 (0.5)	25 @ 7 (0.5)	25 @ 7 (0.5)	25 @ 15 (1)	25 @ 15 (1)	6 @ 52 (3.5)	25 @
	45 (14)	25 @ 16 (1)	25 @ 10 (0.7)	25 @ 7 (0.5)	25 @ 15 (1)	25 @ 15 (1)	6 @ 52 (3.5)	
	60 (18)	25 @ 16 (1)	25 @ 10 (0.7)	25 @ 7 (0.5)	25 @ 15 (1)	25 @ 15 (1)	6 @ 52 (3.5)	
UUP	30 (9)	25 @ 50 (3.4)	10 @ 62 (4.3)	10 @ 43 (3)	14 @ 24 (1.7)	14 @ 19 (1.3)		25 @
	45 (14)		10 @ 62 (4.3)	10 @ 43 (3)	14 @ 24 (1.7)	14 @ 19 (1.3)		
	60 (18)				10 @ 50 (3.4)	10 @ 40 (2.8)		

Wet System, Upright Sprinklers, 160°F (70°C), Number of AS @ psi (bar)

Commodity	Max. Ceiling Height, ft (m)	Quick-Response						K11.2 (K160)
		K11.2 (K160)	K14.0 (K200)	K14.0EC (K200 EC)	K16.8 (K240)	K25.2EC (K360EC)		
Up to CEP Note 1	30 (9)	25 @ 7 (0.5)	25 @ 7 (0.5)	6 @ 73 (5)	25 @ 7 (0.5)	6 @ 52 (3.5)		25 @
	45 (14)	25 @ 16 (1)	25 @ 10 (0.7)		25 @ 7 (0.5)	6 @ 52 (3.5)		
	60 (18)	25 @ 16 (1)	25 @ 10 (0.7)		25 @ 7 (0.5)	6 @ 52 (3.5)		
UUP	30 (9)	25 @ 50 (3.4)	10 @ 62 (4.3)		10 @ 43 (3)			25 @
	45 (14)		10 @ 62 (4.3)		10 @ 43 (3)			
	60 (18)							

¹ Protect Class 1-3 commodities stored up to 10 ft (3 m) high using the guidelines for CEP commodities stored under a 30 ft (9 m) ceiling.

LOW PILED STORAGE PROTECTION

Low Piled Storage Protection

Storage obstruction rules need to be applied

DS 3-26

Table 2.3.3.1. Sprinkler Protection Guidelines for Low-Piled Storage

Wet System, Pendent Sprinklers, 160°F (70°C), Number of AS @ psi (bar)

Commodity	Max. Ceiling Height, ft (m)	Quick-Response					
		K11.2 (K160)	K14.0 (K200)	K16.8 (K240)	K22.4 (K320)	K25.2 (K360)	K25.2EC (K360EC)
Up to CEP Note 1	30 (9)	25 @ 7 (0.5)	25 @ 7 (0.5)	25 @ 7 (0.5)	25 @ 15 (1)	25 @ 15 (1)	6 @ 52 (3.5)
	45 (14)	25 @ 16 (1)	25 @ 10 (0.7)	25 @ 7 (0.5)	25 @ 15 (1)	25 @ 15 (1)	6 @ 52 (3.5)
	60 (18)		25 @ 10 (0.7)	25 @ 7 (0.5)	25 @ 15 (1)		6 @ 52 (3.5)
UUP	30 (9)	12mm/min (2828lpm)	10 @ 62 (4.3)	10 @ 43 (3)	14 @ 24 (1.7)		25 @
	45 (14)		10 @ 62 (4.3)	10 @ 43 (3)	14 @ 24 (1.7)		
	60 (18)			10 @ 50 (3.4)			

Wet System, Upright Sprinklers, 160°F (70°C), Number of AS @ psi (bar)

Commodity	Max. Ceiling Height, ft (m)	Quick-Response					
		K11.2 (K160)	K14.0 (K200)	K14.0EC (K200 EC)	K16.8 (K240)	K25.2EC (K360EC)	K11.2
Up to CEP Note 1	30 (9)	25 @ 7 (0.5)	25 @ 7 (0.5)	6 @ 73 (5)	25 @ 7 (0.5)	6 @ 52 (3.5)	25 @
	45 (14)	25 @ 16 (1)	25 @ 10 (0.7)		25 @ 7 (0.5)	6 @ 52 (3.5)	
	60 (18)	25 @ 16 (1)	25 @ 10 (0.7)		25 @ 7 (0.5)	6 @ 52 (3.5)	
UUP	30 (9)	25 @ 50 (3.4)	10 @ 62 (4.3)		10 @ 43 (3)		25 @
	45 (14)		10 @ 62 (4.3)		10 @ 43 (3)		
	60 (18)						

¹ Protect Class 1-3 commodities stored up to 10 ft (3 m) high using the guidelines for CEP commodities stored under a 30 ft (9 m) ceiling.

DS 8-9 Table 4. Ceiling-Level Protection Guidelines for

Protection of Cartoned Expanded Plastic

Wet System, 160°F (70°C) Nominally Rated

Max. Ceiling Height, ft (m)	Quick Response					
	K11.2 (K160)	K14.0 (K200)	K16.8 (K240)	K22.4 (K320)	K25.2 (K360)	K25.2EC (K360EC)
10 (3.0)				9 @ 20 (1.4)		
20 (6.0)				9 @ 20 (1.4)		
25 (7.5)				9 @ 20 (1.4)		
30 (9.0)	25 @ 50 (3.5)	12 @ 50 (3.5)	12 @ 35 (2.4)	12 @ 25 (1.7)	12 @ 20 (1.4)	12 @ 38 (2.6)
35 (10.5)				12 @ 63 (4.3)	12 @ 50 (3.5)	
40 (12.0)				12 @ 75 (5.2)	12 @ 60 (4.1)	

25*300lpm
(7483lpm)

12*426lpm
(5111lpm)

25*360lpm
(9000lpm)

LOW PILED STORAGE PROTECTION

Low Piled Storage Protection

Storage obstruction rules need to be applied

DS 3-26

Table 2.3.3.1. Sprinkler Protection Guidelines for Low-Piled Storage

Wet System, Pendent Sprinklers, 160°F (70°C), Number of AS @ psi (bar)

Commodity	Max. Ceiling Height, ft (m)	Quick-Response						K11.2 (K160)
		K11.2 (K160)	K14.0 (K200)	K16.8 (K240)	K22.4 (K320)	K25.2 (K360)	K25.2EC (K360EC)	
Up to CEP Note 1	30 (9)	25 @ 7 (0.5)	25 @ 7 (0.5)	25 @ 7 (0.5)	25 @ 15 (1)	25 @ 15 (1)	6 @ 52 (3.5)	25 @
	45 (14)	25 @ 16 (1)	25 @ 10 (0.7)	25 @ 7 (0.5)	25 @ 15 (1)	25 @ 15 (1)	6 @ 52 (3.5)	
	60 (18)	25 @ 16 (1)	25 @ 10 (0.7)	25 @ 7 (0.5)	25 @ 15 (1)	25 @ 15 (1)	6 @ 52 (3.5)	
UUP	30 (9)	25 @ 50 (3.4)	10 @ 62 (4.3)	10 @ 43 (3)	14 @ 24 (1.7)	14 @ 19 (1.3)		25 @
	45 (14)		10 @ 62 (4.3)	10 @ 43 (3)	14 @ 24 (1.7)	14 @ 19 (1.3)		
	60 (18)				10 @ 50 (3.5)			

25*295lpm
(7375lpm)

14*410lpm
(5746lpm)

¹ Protect Class 1-3 commodities stored up to 10 ft (3 m) high using the guidelines for CEP commodities stored under a 30 ft (9 m) ceiling.

DS 8-9 Table 4. Ceiling-Level Protection Guidelines for

Protection of Cartoned Expanded Plastic

Wet System, 160°F (70°C) Nominally Rated

Max. Ceiling Height, ft (m)	Quick Response					
	K11.2 (K160)	K14.0 (K200)	K16.8 (K240)	K22.4 (K320)	K25.2 (K360)	K25.2EC (K360EC)
10 (3.0)	12 @ 10 (0.7)	12 @ 7 (0.5)	12 @ 7 (0.5)	9 @ 20 (1.4)	9 @ 20 (1.4)	6 @ 20 (1.4)
20 (6.0)	12 @ 40 (2.8)	12 @ 18 (1.2)	12 @ 13 (0.9)	9 @ 20 (1.4)	9 @ 20 (1.4)	6 @ 20 (1.4)
25 (7.5)	12 @ 50 (3.5)	9 @ 50 (3.5)	9 @ 35 (2.4)	9 @ 20 (1.4)	9 @ 20 (1.4)	6 @ 20 (1.4)
30 (9.0)	25 @ 50 (3.5)	12 @ 50 (3.5)	12 @ 35 (2.4)	12 @ 25 (1.7)	12 @ 20 (1.4)	12 @ 38 (2.6)
35 (10.5)				12 @ 63 (4.3)	12 @ 50 (3.5)	
40 (12.0)				12 @ 75 (5.2)	12 @ 60 (4.1)	

DS 8-9 Table 5. Ceiling-Level Protection Guidelines for Un

Protection of Uncartoned Unexpanded Plastic

Wet System, 160°F (70°C) Nominally Rated

Max. Ceiling Height, ft (m)	Quick Response					
	K11.2 (K160)	K14.0 (K200)	K16.8 (K240)	K22.4 (K320)	K25.2 (K360)	K25.2EC (K360EC)
10 (3.0)				9 @ 20 (1.4)	9 @ 20 (1.4)	6 @ 20 (1.4)
20 (6.0)				9 @ 20 (1.4)	9 @ 20 (1.4)	6 @ 20 (1.4)
25 (7.5)				9 @ 20 (1.4)	9 @ 20 (1.4)	6 @ 20 (1.4)
30 (9.0)	25 @ 50 (3.5)	9 @ 100 (6.9)	9 @ 70 (4.8)	9 @ 50 (3.5)	9 @ 40 (2.8)	12 @ 38 (2.6)
35 (10.5)				12 @ 63 (4.3)	12 @ 50 (3.5)	
40 (12.0)				12 @ 75 (5.2)	12 @ 60 (4.1)	

25*300lpm
(7483lpm)

9*602lpm
(5421lpm)

Overview

- 01** Scope and definitions
- 02** Occupancy protection
- 03** Low piled storage protection
- 04** Special cases and EN12845

Special cases

Interaction with Ventilation and Smoke and Heat Exhaust systems

Datasheet 1-10, *Interaction of Sprinkler, Smoke and Heat Vents, and Draft Control*

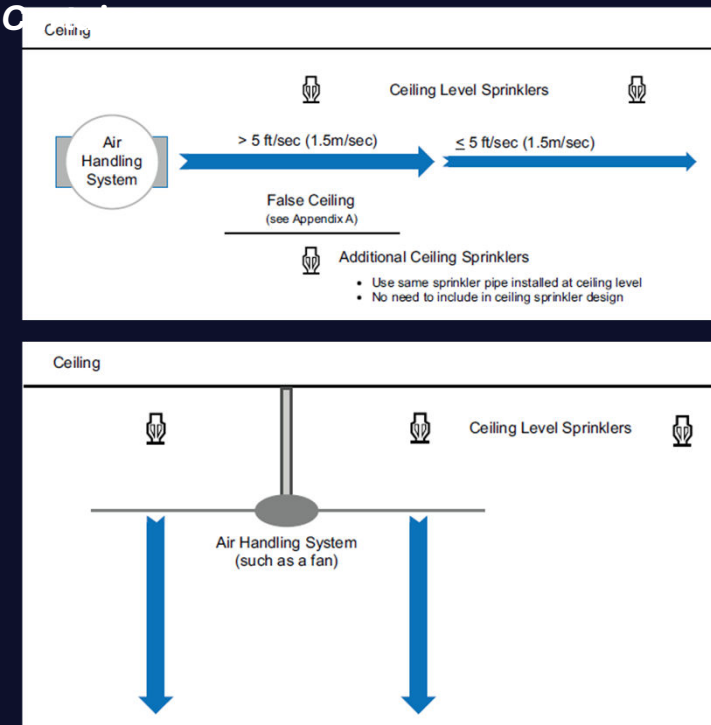
Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers:*

- Airflow velocity between the occupancy and the ceiling-level sprinklers max. 1.5 m/sec.
- Do not install gravity heat vents or gravity smoke vents in buildings protected by ceiling sprinklers”
If unavoidable see DS 2-0, section 2.5.2.1.3

Vents $> 3.7\text{m}^2$, not expected to be kept closed during non-fire events

Acceptable Options:

- (1) The vent is arranged to be manually operated and always kept closed during non-fire conditions
- (2) The vent is arranged to always be kept closed during non-fire conditions
- (3) The vent is separated horizontally from the nearest similar vent by a distance equal to or greater than the maximum linear spacing of the ceiling sprinklers
- (4) The size of the vent is limited to a maximum area of 40 ft^2 (3.7 m^2) and arranged in accordance with Item (3)
- (5) The vent is equipped with a thermal element having a temperature rating equal to or greater than 360°F (180°C)
- (6) Additional ceiling sprinklers are installed as indicated in either Figure 2.5.2.1.3.2(c) or Figure 2.5.2.1.3.2(d)
- (7) The vent is arranged to open automatically upon sprinkler system waterflow, or an equivalent faster detection method, but with a minimum 10 minute delay

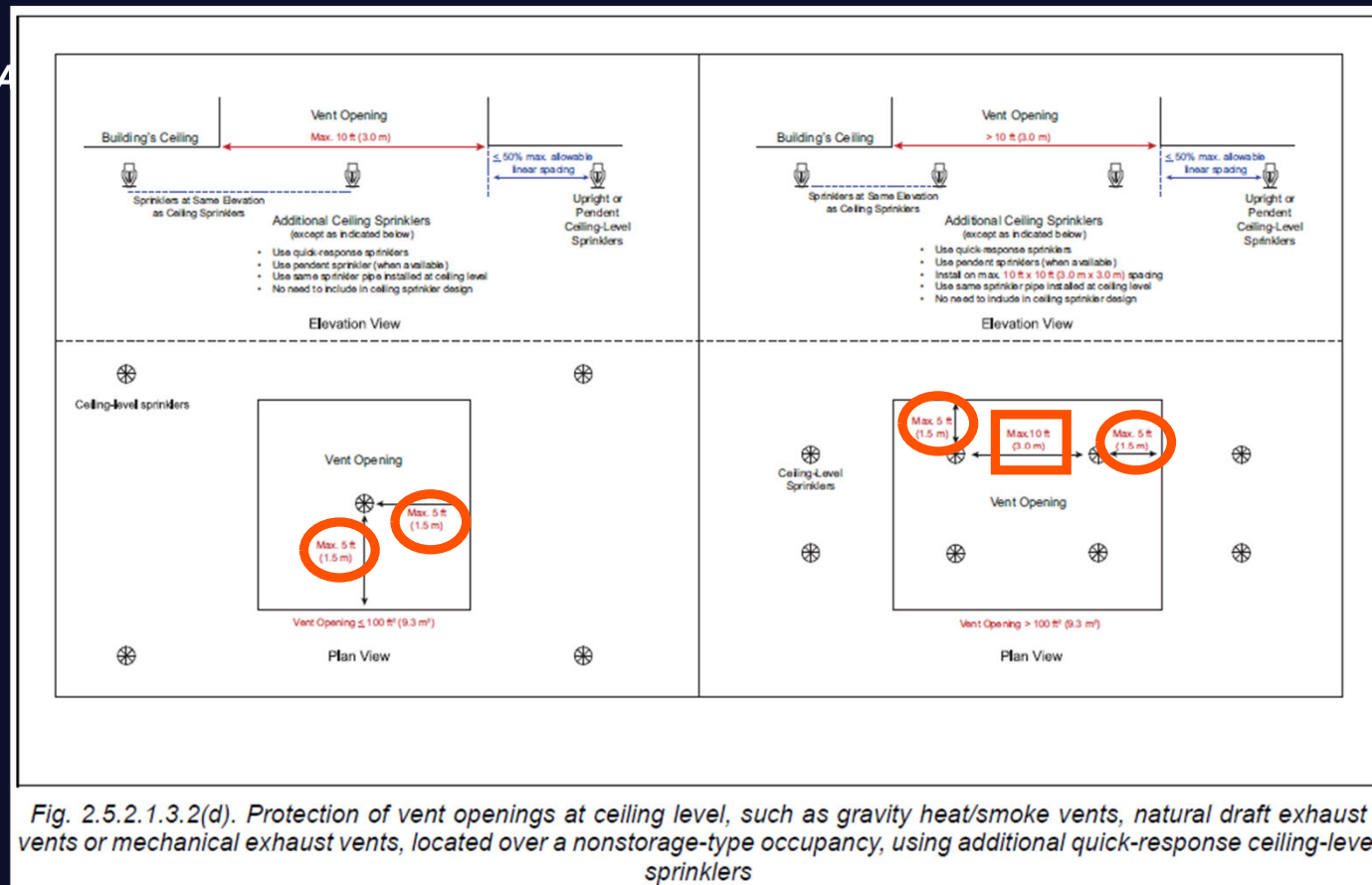


Special cases

Interaction with Ventilation and Smoke and Heat Exhaust systems

Data Sheet 2-0, *Installation Guidelines for A*

- Heads: Quick Response, Pendant
- Does not need to be included in ceiling sprinkler design
- Max. distance from vent edge: 1.5m
- Max spacing 3.0m



Special cases

Antifreeze, pre-action & dry systems

Use wet-pipe systems unless the protected area is refrigerated or unheated ($T < 4^{\circ}\text{C}$)

Anti freeze systems:

- wet-pipe system

Pre-action systems:

- Single interlocked = wet or dry pipe system
- Non- or Double interlocked = dry pipe system

Dry-pipe systems:

- Heads: upright or dry-pendant
- Rating: 140°C. (70°C acceptable for HC-1 & HC-2)
- Standard coverage.
- Standard response (QR acceptable for HC-1 & HC-2)
- Water delivery time (if not specified in specific DS):
 - 60s to most remote sprinkler,
 - 40s to 4 most remote sprinklers (2 on 2 lines).

Table 2.3.1.10 Sprinkler Design Demands for

Hazard Category	Ceiling Height up to 30 ft (9 m)	Ceiling Height 30-45 ft (9-13.5 m)		Ce	
	(gpm/ft ²)/ft ² [(mm/mi				
	Wet	Dry	Wet	Dry	
HC-1	0.1/1500 (4/140) ^{Note 1}	0.1/1500 (4/140)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.2 (8
HC-2	0.2/2500 (8/230) ^{Note 2}	0.2/3500 (8/330)	0.2/2500 (8/230)	0.2/3500 (8/330)	0.2 (8
HC-3	0.3/2500 (12/230) ^{Note 2}	0.3/3500 (12/330)	0.3/3600 (12/340)	0.3/4600 (12/430)	0.5 (20

Special cases

Water mist systems

May be used in lieu of automatic sprinkler protection for HC-1, HC- 2, and HC-3 occupancies

- Installation in accordance with:
 - DS 3-26.
 - Data Sheet 4-2, Water Mist Systems.
 - System's Approval listing.
 - Manufacturer's DIOM manual.
- Ceiling height limitations associated with their FM Approval
- Systems are also not intended for:
 - Occupancies with exhaust openings at ceiling level. (e.g. smoke vents)
 - Storage of any amount of uncartoned plastics.
 - Areas exposed to outdoor conditions

DS 4-2

- Application of FM Approved water mist systems for HC-1 occupancies is limited to:
 - A. wet pipe systems; do not use dry or preaction systems.
 - B. maximum ceiling height of 16.4 ft (5 m).
 - C. minimum 30-minute fire resistance rating of the wall and/or ceiling.

DS 4-2

2.4.3.4.1 If the water mist system has a limited supply of gas and/or water, provide a connected reserve supply equivalent to the in-service supply if any of the following conditions exist:

- A. The system is protecting two or more hazards using a single supply through selector valves.
- B. The system cannot be restored to service within 24 hours from an outside source.
- C. The system provides primary protection for valuable or important assets of an occupancy, unless all of the following criteria are met:
 1. Protection can be fully restored within 24 hours.
 2. The occupancy is constantly attended.
 3. Written impairment procedures have been established

EN12845 (2019)

FM guidelines characteristics

FM designs will often obviously meet or exceed EN12845

Key differences:

- Use of FM Approved Equipment
- One fire pump generally acceptable
- No limit on number of sprinklers fed by one control valve
- Minimum K80 sprinklers ; Minimum 25mm pipe
- No precalculated (pipe schedule) systems
- No velocity limit in hydraulic calculations but use Darcy Weisbach equation when it exceeds 9.1 m/s
- No requirement to calculate most favorable areas

More detailed guidance on:

- ceiling slope
- obstructions to sprinkler discharge
- ceiling construction
- fans and airflow
- extended coverage sprinklers

EN12845

Design comparison

For a wet sprinkler protection system, ceiling height up to 9m

FM DS 3-26	EN12845	
HC-1 4mm/min – 140m ² 560 lpm	OH1 5mm/min – 72m ² 360 lpm	OH2 5mm/min – 140m ² 720 lpm
HC-2 8mm/min – 230m ² 1840 lpm	OH4 5mm/min – 360m ² 1800 lpm	
HC-3 12mm/min – 230m ² 2760 lpm	HHP2 10.0mm/min – 260m ² 2600 lpm	HHP3 12.5mm/min – 260m ² 3250 lpm

Overview

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Conclusion

01 Scope and definitions

- Data Sheet 3-26, *Fire Protection for Nonstorage Occupancies*
- HC-1 , HC-2 , HC-3 + incidental & low piled storage
- Consider occupancy specific Data Sheets & increased fire hazards guidelines

02 Occupancy protection

- Data sheet 3-26, *Fire Protection for Nonstorage Occupancies*
- Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*
- Design primarily based on ceiling height and system type
- Consider hose allowance and water supply duration

03 Low piled storage protection

- Specific protection design criteria in Data Sheet 3-26
- Storage sprinklers needed: Storage guidelines apply
- Consider future flexibility: storage protection according to Data Sheet 8-9

04 Special cases and EN12845

- Interaction with ventilation & smoke and heat control systems
- Other system types: antifreeze, pre-action, dry, water mist
- Designs will often obviously meet or exceed EN12845