

FIRE PROTECTION FOR NONSTORAGE OCCUPANCIES

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1.0 SCOPE

This data sheet provides recommendations for fire protection in nonstorage occupancies. A nonstorage occupancy is an area or building consisting of equipment, processes, and/or materials that are not maintained in a storage arrangement. These materials may be combustible or noncombustible. The occupancy may contain industrial or manufacturing processes as well as non-manufacturing operations such as offices, or retail or residential spaces.

1.1 Changes

October 2020. Interim revision. Added guidance on defining incidental storage/use of ignitable liquids in HC-1 occupancies.

1.2 Hazard

Refer to the following Understanding the Hazard (UTH) publications for detailed information on the hazards associated with this data sheet:

- *Combustible Concealed Construction (P0114)*
- *Fire and Explosion Exposure (P0251)*
- *Inadequate Automatic Fire Detection (P0247)*
- *Lack of Automatic Sprinklers (P0037)*
- *Lack of Emergency Response (P0034)*
- *Lack of Pre-Incident Planning (P0033)*
- *Lint (P0315)*

1.3 Superseded Information

This document supersedes Engineering Bulletin EB 04-12, *New Protection Guidance for Extended Coverage Sprinklers for Nonstorage Applications*, which has been incorporated into the data sheet.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Introduction

2.1.1 Use FM Approved equipment, materials, and services whenever they are applicable and available. For a list of products and services that are FM Approved, see the *Approval Guide*, an online resource of FM Approvals.

2.2 Occupancy

2.2.1 There may be guidance and recommendations in other data sheets that supersede those within Data Sheet 3-26. Use Figure 1 to determine the appropriate data sheet to use.

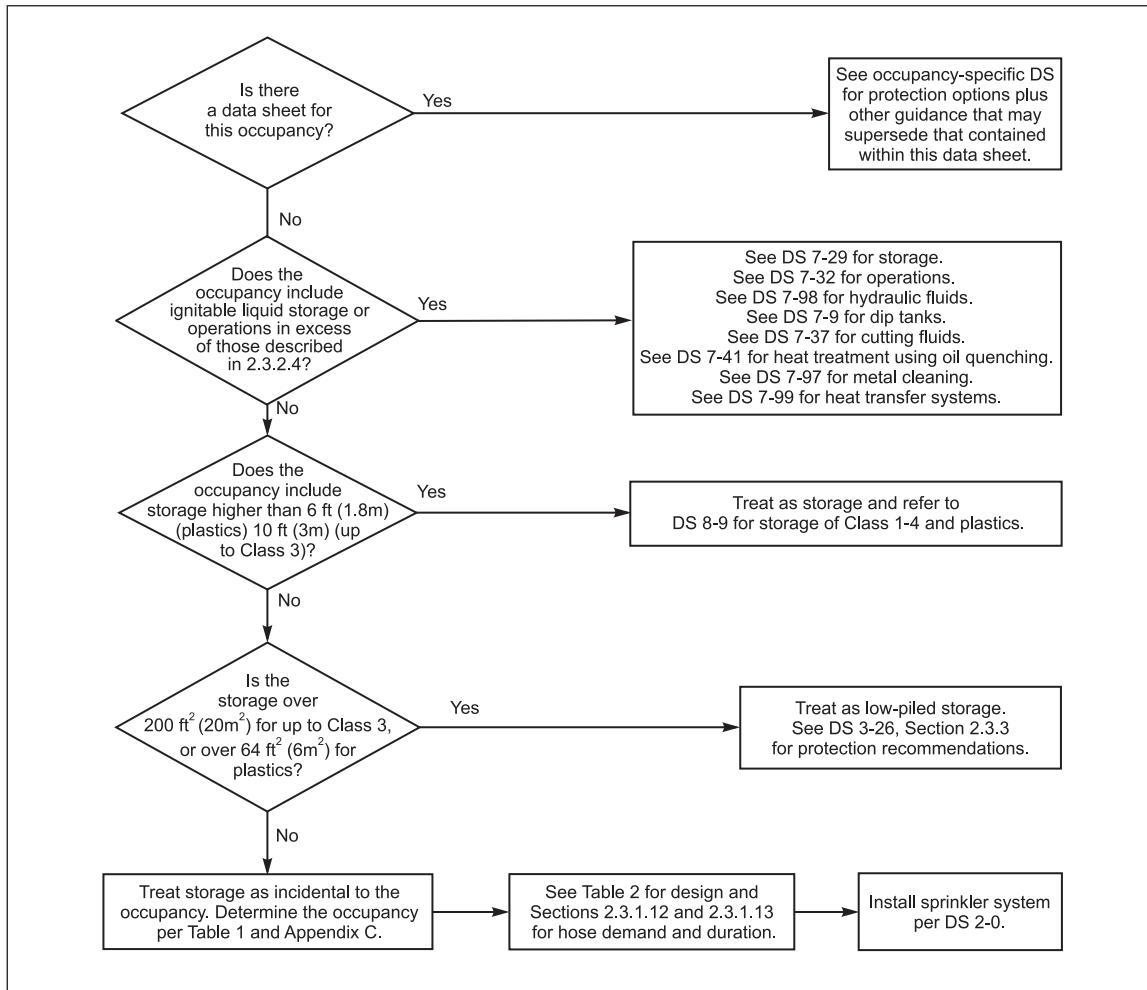


Fig. 1. Flowchart for determining appropriate use of Data Sheet 3-26

2.2.2 Use Table 1 to determine the hazard category (HC) based on the predominant occupancy. See Appendix C For specific examples of HC-1, HC-2, and HC-3 occupancies.

Table 1. Hazard Categories Based on Predominant Occupancy

Hazard Category	Predominant Occupancy
HC-1	<p>Areas with light overall combustibles loading with limited combustibles used in processes, or operations of low hazard. This includes combustibles furnishings that are typically noncontinuous in well-subdivided areas. This hazard category does not include any incidental storage of plastics, or plastics used in the construction of walls and/or ceilings. This hazard category can have incidental amounts of ignitable liquids in accordance with 2.3.2.4.</p> <p>Examples include residential, offices, noncombustible manufacturing, and hospitals.</p>
HC-2	<p>Areas with moderate continuous combustibles loading with combustibles in processes, or operations of moderate hazard due to limited quantities of plastics or ignitable liquids.</p> <p>Examples include manufacturing, such as machine shops, woodworking, and electronic assembly, as well as retail, theatres, and food production.</p>
HC-3	<p>Areas with generally continuous heavier combustibles loading with limited quantities of ignitable liquids and/or heavier amounts of plastics.</p> <p>Examples include plastic manufacturing, vehicle manufacturing and assembly, and printing plants.</p>

2.2.3 Classify buildings that are of wood construction but otherwise contain no combustible materials as HC-1 occupancies.

2.2.4 Identify spaces concealed from ceiling sprinklers that have combustible construction features or contain combustible material and provide sprinkler protection in those spaces. Concealed spaces can include equipment with combustible material; areas obstructed by ductwork, light fixtures, or hoods; and hidden combustible construction.

2.2.4.1 Protect combustible concealed spaces as HC-1 in accordance with FM Global Data Sheet 1-12, *Ceilings and Concealed Spaces*.

2.2.4.2 Protect other shielded areas, including machine covers, spray booths, ovens, printing presses, combustible ductwork, plastic tanks, and conveyors, as follows:

A. Where a data sheet relevant to these hazards or occupancies exists, adhere to the recommendations in that data sheet.

B. Otherwise, protect underneath the shielded area with sprinklers providing the same density as the ceiling system and in accordance with Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*.

2.2.5 For locations with mixed occupancy hazards that are not separated by fire partitions, protect for the greatest hazard or see Data Sheet 2-0 for other protection options.

2.2.6 Establish and implement a housekeeping program to minimize accumulations of lint, dust, and other combustible materials.

2.3 Protection

2.3.1 General

2.3.1.1 See Data Sheet 1-57, *Plastics in Construction*, for protection guidance when building construction contains plastic.

2.3.1.2 Install sprinklers in accordance with Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*.

2.3.1.3 In addition to the recommendations in this data sheet, refer to Data Sheet 2-8, *Earthquake Protection for Water-Based Fire Protection Systems*, for facilities located in earthquake-prone regions.

2.3.1.4 Install a wet pipe, dry pipe, pre-action, or antifreeze sprinkler system to protect nonstorage occupancies. An FM Approved water mist system may also be used to protect HC-1 occupancies (see Section 2.3.5).

2.3.1.5 Use wet-pipe sprinkler systems unless the protected area is refrigerated or unheated, and the temperature can fall below 40°F (4°C). See Data Sheet 2-0, Section 2.4, for further information. For wet-pipe sprinkler systems, use the following sprinklers:

- Sidewall (HC-1 and HC-2 occupancies only), pendent, upright, or dry-pendent.
- Nominal 160°F (70°C) temperature rating. Only use sprinklers with a nominal temperature rating of 212°F (100°C) where the ambient temperature is in excess of 100°F (38°C).
- Standard coverage or extended coverage.
- Standard response or quick response. Do not use standard response sprinklers when ceiling heights are greater than 60 ft (18 m).

2.3.1.6.1 Use the following sprinklers for dry-pipe sprinkler systems:

- Upright or dry-pendent. Dry sidewall can be used under certain conditions; see Data Sheet 2-0.
- Nominal 280°F (140°C) temperature rating. Nominal 165°F (70°C) sprinklers are acceptable for HC-1 and HC-2 occupancies.
- Standard coverage.
- Standard response. Quick-response sprinklers are acceptable for HC-1 and HC-2 occupancies.

2.3.1.6.2 For dry-pipe and equivalent sprinkler systems, if a maximum water delivery time is not specified in an occupancy-specific data sheet, use one of the following water delivery times:

- 60 seconds with the operation of the single most remote sprinkler
- 40 seconds with the operation of the most remote four sprinklers (two sprinklers on two lines)

2.3.1.7 Treat single-interlocked preaction sprinkler systems as either wet-pipe or dry-pipe systems. Treat non-interlocked or double-interlocked preaction sprinkler systems as dry-pipe systems. See Data Sheet 5-48 for additional guidance on preaction systems, including detector spacing.

2.3.1.8 Treat anti-freeze sprinkler systems as wet-pipe systems. See Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*, for additional guidance antifreeze solution sprinkler systems.

2.3.1.9 Use minimum sprinkler K-factors in accordance with FM Global Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*.

2.3.1.10 Design the sprinkler system in accordance with Table 2, based on the applicable hazard category.

Table 2. Sprinkler Design Demands for Hazard Categories

Hazard Category	Ceiling Height up to 30 ft (9 m) ^{Note 2}		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)	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)	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)	

Note 1. The demand area for dormitories, residential, and dwelling type areas may be based on the largest room area, but not less than four sprinklers provided fire compartmentation with a minimum one hour fire rating is present. Treat corridors as rooms in making this determination.

Note 2. For HC-2 and HC-3 occupancies with ceiling heights up to 30 ft (9 m) where K11.2EC or K14.0EC upright 160°F (70°C) rated sprinklers are used, the design can be reduced to the following:

- K11.2EC: 0.30 gpm/ft² over 1500 ft² (12mm/min over 140 m²). Ensure a minimum of 6 sprinklers in the design
- K14.0EC 0.30 gpm/ft² over 1000 ft² (12mm/min over 90 m²). Ensure a minimum of 4 sprinklers in the design

2.3.1.11 Regardless of the design demands in Table 2, provide a minimum design pressure at the most remote sprinkler per the sprinkler's FM Approval listing.

2.3.1.12 Provide a hose stream allowance of 250 gpm (950 L/min) for HC-1 and HC-2 occupancies, and a hose stream allowance of 500 gpm (1900 L/min) for HC-3 occupancies.

2.3.1.13 Ensure a water supply capable of providing the design sprinkler discharge flow rate plus hose stream for 60 minutes for all hazard categories.

2.3.1.14 Manufacturing and assembly of large, contiguous components, such as large aircraft, boats, and wind turbine blades, create the potential for shielded fires. The presence of these operations represents an increased fire hazard beyond typical HC-2 or HC-3 occupancies. For ceilings below 60 ft (18 m) use Table 2. For ceilings above 60 ft (18 m) protect these areas with K25.2 (K360) sprinklers using a design of 12 sprinklers at 50 psi (2.5 bar).

2.3.2 Incidental Storage

2.3.2.1 Treat storage of Class 1-3 commodities up to 10 ft (3 m) high and no more than 200 ft² (20 m²) in area as incidental to the occupancy. Provide protection using Table 2.

2.3.2.2 In HC-2 and HC-3 occupancies, treat storage of plastic commodities up to 6 ft (1.8 m) high and no more than 64 ft² (6 m²) in area (approximately four pallets) as incidental to the occupancy. Provide protection using Table 2.

2.3.2.3. Multiple areas of storage within the limits listed in Sections 2.3.2.1 and 2.3.2.2 may still be considered as incidental to the occupancy if separated by aisles not less than 8 ft (2.4 m) wide.

2.3.2.4 Evaluate the storage/use of ignitable liquids in sprinklered HC-1 occupancies with noncombustible construction in accordance with the following and Table 2.3.2.4:

- A. Do not store any ignitable liquids in stairwells, aisles, or any area in which foot traffic is expected.
- B. Locate larger quantities or container sizes, regardless of bottle construction, outside the building in FM Approved ignitable liquid cabinets or safety cans.

Table 2.3.2.4. Incidental Storage of Ignitable Liquids in HC-1 Occupancies in Containers of Any Construction

<i>Liquid Type</i>	<i>Maximum Container Size</i>	<i>Total Quantity of Ignitable Liquid</i>	<i>Location</i>
Non-water-miscible	8 oz (240 ml)	8 oz (240 ml)	Anywhere
	Any	> 8 oz (240 ml)	Outside building/FM Approved ignitable liquid cabinets or safety cans
Group 1 water-miscible	1 gal (3.8 L)	1 gal (3.8 L)	Anywhere
	5 gal (19 L)	5 gal (19 L)	Storage rooms with noncombustible walls or regular metal cabinets
Group 2-4 water-miscible	5 gal (19 L)	5 gal (19 L)	Anywhere
	5 gal (19 L)	20 gal (76 L)	Storage rooms with noncombustible walls or regular metal cabinets

2.3.3 Low-Piled Storage

2.3.3.1 Where storage exceeds the area limitations in Section 2.3.2.1 and 2.3.2.2 but not the height limitations, treat it as low-piled storage and provide protection in accordance with Table 3.

Table 3. 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						Standard-Response			
		K11.2 (K160)	K14.0 (K200)	K16.8 (K240)	K22.4 (K320)	K25.2 (K360)	K25.2EC (K360EC)	K11.2 (K160)	K14.0 (K200)	K19.6 (K280)	K25.2 (K360)
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 @ 7 (0.5)	25 @ 7 (0.5)	25 @ 16 (1)	25 @ 15 (1)
	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 @ 50 (3.4)			25 @ 15 (1)
	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						Standard-Response			
		K11.2 (K160)	K14.0 (K200)	K14.0EC (K200 EC)	K16.8 (K240)	K25.2EC (K360EC)		K11.2 (K160)	K16.8 (K240)	K25.2 (K360)	
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 @ 7 (0.5)	25 @ 7 (0.5)	25 @ 7 (0.5)	
	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 @ 50 (3.4)	25 @ 22 (1.5)	25 @ 15 (1)	
	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.

2.3.4 Storage

2.3.4.1 Where the storage height limitations in Section 2.3.2.1 and 2.3.2.2 are exceeded, protect the storage area in accordance with Data Sheet 8-9, *Storage of Class 1, 2, 3, and 4 and Plastic Commodities*.

2.3.5 Water Mist Systems

2.3.5.1 Water mist systems with FM Approval for light hazard occupancies may be used to provide sole protection for HC-1 Occupancies (i.e., in lieu of automatic sprinkler protection) when all of the recommendations in this section are met. Do not use water mist systems to protect HC-2 or HC-3 occupancies.

2.3.5.2 Install water mist systems in accordance with the recommendations in this section, the system's FM Approval Guide listing, and the manufacturer's FM Approved design, installation, operation and maintenance manual. Refer to Data Sheet 4-2, *Water Mist Systems*, for additional installation recommendations.

2.3.5.3 Limit the use of water mist systems to wet pipe distribution systems.

2.3.5.4 Limit the use of water mist systems to areas with the following types of smooth, flat ceilings and with ceiling slopes not exceeding 1 in./ft (83 mm/m):

- Flat slab, reinforced concrete
- Smooth, monolithic ceilings attached to the underside of wood joists, wood trusses and bar joists
- Suspended ceilings

2.3.5.5 Determine the design area based on the following:

A. For systems FM Approved for an unrestricted enclosure area, design the water mist system to supply whichever of the following is greater:

1. The hydraulically most remote nine (9) automatic nozzles
2. All automatic nozzles within a 1500 ft² (140 m²) demand area

B. For systems FM Approved with a specified maximum enclosure area, design the water mist system to supply all automatic nozzles within the compartment.

C. For systems in corridors that can be protected by one row of nozzles, design the water mist system to supply whichever of the following is less:

1. A maximum of five (5) automatic nozzles for the demand area.
2. In an unrestricted enclosure area, all automatic nozzles within a 1500 ft² (140 m²) demand area.
3. For corridors smaller than 1500 ft² (140 m²) all automatic nozzles in the area.

2.3.5.6 Install automatic nozzles using the following as specified in the system's FM Approval Guide listing and FM Approved design, installation, operation and maintenance manual:

- Minimum linear spacing
- Maximum linear spacing, but not to exceed 16 ft (4.9 m)
- Maximum distance from the wall
- Maximum ceiling height
- Maximum clearance between ceiling and nozzle
- Obstructions
- Minimum operating pressure (for each nozzle within the design area)
- Minimum fire resistance of enclosure 30 minutes

2.3.5.7 Provide a water supply capable of supplying the maximum water mist system demand for the design area, plus 250 gpm (950 L/min) for hose streams, for a duration of 60 minutes.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 General

3.1.1 Hazard Categories

This data sheet recommends sprinkler protection based on the expected fire hazard of a building or area. The fire hazard depends on the occupancy, exposure, and combustible loading. This data sheet approximates an area's fire hazard by assigning a hazard category (HC) to the area, where HC-1, HC-2, and HC-3 represent an increasing hazard level with the potential for a more severe fire event.

A nonstorage occupancy is an area or building consisting of equipment, processes, and/or materials that are not maintained in a storage arrangement. These materials may be combustible or noncombustible. The operation may include industrial or manufacturing processes, as well as nonmanufacturing locations such as offices or residential spaces. Other codes and standards may refer to these areas as "light hazard" or "ordinary hazard" occupancies.

3.2 Nonstorage Occupancy Fire Protection

Automatic sprinkler protection is the best defense against a fire. Sprinklers have proven to be the most practical and reliable means of controlling a fire in business and industry. Sprinkler protection minimizes not only fire damage, but also nonthermal damage, and allows for quick resumption of normal operations. Sprinklers are needed wherever the building construction or occupancy is combustible.

The majority of fires in nonstorage occupancies in buildings with lower ceiling heights are controlled or extinguished as long as a sufficient sprinkler density is provided over a reasonable operating area. Variations in attributes such as temperature rating, RTI, orientation, and orifice size, among others, have had a limited effect on sprinkler performance in nonstorage occupancy fires, provided no critical deficiencies exist (e.g., obstruction to sprinkler discharge, a lack of sprinklers underneath obstructions or within concealed spaces).

Where the fire hazard exceeds that of a typical nonstorage occupancy, enhanced sprinkler protection may be needed, and the sprinkler system's performance may become more sensitive to specific automatic sprinkler attributes. Examples of these increased fire hazards include the following:

- The presence of storage
- The presence of combustible deposits such as dust, lint, oil, or other residues
- The presence of ignitable liquids

4.0 REFERENCES

4.1 FM Global

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

Data Sheet 5-12, *Electric AC Generators*

Data Sheet 5-14, *Telecommunications*

Data Sheet 5-23, *Emergency and Standby Power Systems*

Data Sheet 7-4, *Paper Machines and Pulp Dryers*

Data Sheet 7-29, *Ignitable Liquid Storage in Portable Containers*

Data Sheet 7-32, *Ignitable Liquid Operations*

Data Sheet 7-64/13-28, *Aluminum Industry*

Data Sheet 7-93N, *Aircraft Hangars*

Data Sheet 7-96, *Printing Plants*

Data Sheet 7-98, *Hydraulic Fluids*

Data Sheet 8-3, *Rubber Tire Storage*

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

Data Sheet 8-21, *Roll Paper Storage*

APPENDIX A GLOSSARY OF TERMS

Approval Guide: An online resource of FM Approvals that provides a guide to equipment, materials, and services that have been FM Approved for property conservation.

Combustible occupancy: An occupancy that contains sufficient combustible materials to allow horizontal fire spread throughout a given area in the absence of sprinkler protection; or an occupancy that contains a sufficient concentration of combustibles to cause significant damage to a building.

Commodity: A combination of material, external packaging (e.g., container), and material handling aids (e.g., pallets). The purpose of assigning a commodity classification is to determine the proper level of fire protection. A commodity classification is dependent on how the commodity burns and how the burning commodity responds to the application of sprinkler discharge. Refer to Data Sheet 8-1, *Commodity Classification*, for further information on specific commodities.

Demand area: The expected area of sprinkler operation, based on the hazard being protected, used for hydraulic design purposes. In English units it is expressed in ft²; in metric units, m² (1 ft² = 0.093 m²).

Dry-pipe sprinkler system: A sprinkler system that is located downstream of a dry-pipe valve. It is filled with a pressurized gaseous medium (typically air or an inert gas such as nitrogen) for the purpose of maintaining the dry-pipe valve closed. Upon sprinkler actuation, the pressure within the sprinkler system begins to drop until the pressure becomes too low to keep the dry-pipe valve closed. At this time the dry-pipe valve opens (trips) allowing water to fill the sprinkler system and discharge through any sprinklers that have been actuated. A dry-pipe sprinkler system is typically used in areas where the presence of water within the sprinkler system is not suitable.

Density: The amount of water applied by sprinklers over a given area in a certain amount of time. In English units, it is expressed in gpm/ft²; in metric units, in mm/min (1 gpm/ft² = 40.74 mm/min).

Duration or system duration: Water supply system duration is a defined time period between when a fire initially activates a sprinkler system and when the fire is extinguished. Fire extinguishment usually is accomplished by the manual firefighting efforts of public fire service personnel, facility fire service personnel, or facility emergency response team personnel. Duration takes into consideration the commodity hazard's expected fire size in the presence of the system's specific sprinklers and bases the design, as well as manual extinguishment by either one or two applied hose streams.

Extended-coverage sprinklers: The physical characteristics of extended-coverage (EC) sprinklers are similar to those of sprinklers for use with standard spacing. However, the deflector designs are enhanced to ensure proper uniformity and effectiveness of water distribution for the spacing and design pressures for which they are FM Approved.

FM Approved: Products and services that meet the requirements for FM Approval. See the *Approval Guide* for a list of products and services that are FM Approved.

Hose demand: The water flow required for hoses (common sizes are 2-1/2 in. and 1-1/2 in.). In English units it is expressed in gpm; in metric units, L/min.

Incidental storage: Storage that is normal for an occupancy (e.g., small amounts of packaging, raw materials, or the products being made). This is likely to be at the start or end of a production line and should not exceed the height and area limitations detailed in Section 2.3.2.1 and 2.3.2.2.

Library stack rooms: Rooms that house typical library bookshelves of approximately 8 ft (2.4 m) in height, containing books stored vertically on end, held in place in close association with each other, with aisles wider than 30 in. (762 mm).

Low-piled storage: Storage that is in excess of the area limitations detailed in Section 2.3.2.1 and 2.3.2.2 so cannot be considered incidental storage but does not exceed the height limitations and therefore can be protected in accordance with Table 3 and does not need to be evaluated per Data Sheet 8-9.

Nonstorage automatic sprinkler: A sprinkler that has been categorized by FM Global as acceptable for protecting nonstorage occupancies and/or any other low to moderate heat-release-rate fires as recommended in an applicable occupancy-specific data sheet.

Nonstorage occupancy: An occupancy consisting of combustible or noncombustible materials that are not maintained in a storage arrangement. May contain incidental storage or low-piled storage.

Quick-response (QR) sprinklers: QR sprinklers are similar to standard-response sprinklers, except they use a fast-response, heat-actuated element.

Sprinkler demand: The amount of water flow required for sprinkler protection. In English units it is expressed in gpm; in metric units, L/min (1 gpm = 3.79 L/min).

Waterflow alarm: A device that is installed on a sprinkler system and arranged to provide an alarm when one or more sprinklers operate.

Total water demand: The water flow required for both sprinklers and hoses (i.e., total water demand is equal to sprinkler demand plus hose demand). Hose demand is not always provided by the sprinkler system. In English units it is expressed in gpm; in metric units, L/min.

APPENDIX B DOCUMENT REVISION HISTORY

October 2020. Interim revision. Added guidance on defining incidental storage/use of ignitable liquids in HC-1 occupancies.

April 2019. This document has undergone a complete revision. Significant changes include the following:

- A. Changed the title of the data sheet from *Fire Protection Water Demand for Nonstorage Sprinklered Properties* to *Fire Protection for Nonstorage Occupancies*.
- B. Incorporated Engineering Bulletin 04-12, New Protection Guidance for Extended Coverage Sprinklers for Nonstorage Applications.
- C. Moved hazard category examples from Table 1 to Appendix C and expanded them.
- D. Added hazard category guidance in Appendix C for recycling, waste processing, and energy from waste facilities (and the treating of incoming waste material).
- E. Added a new flowchart (Figure 1) detailing the proper application of Data Sheet 3-26, including where other data sheets should be used, and how to treat incidental and low-piled storage.
- F. Added protection recommendations for the manufacture and assembly of large, contiguous components that present the hazard of a shielded fire (Section 2.3.1.14).
- G. Changed recommended system durations to 60 minutes for all hazard categories (Section 2.3.1.13).
- H. Changed recommendations on work-in-process storage. Added new guidance based on testing of low-piled storage to Table 3. This guidance is engineered toward the levels of storage common to nonstorage occupancies. The area limitations for up to Class 3 commodities remain 200 ft² (20 m²). The area limitation for plastic-containing commodities has been reduced from 200 ft² (20 m²) to 64 ft² (6 m², equivalent to four pallet loads).

April 2014. Table 2a, *Sprinkler Design Demands for Hazard Categories with Ceiling Heights up to 100 ft (30 m)*: The design listed for the K25.2EC (K360EC) sprinkler has been revised to provide the same design density as listed for the K25.2 (K360) design. Additionally, Table 2a has been revised include both upright and pendent sprinkler applications.

July 2011. Minor editorail changes and clarifications to Recommendations 2.1.1.1 and 2.1.1.10.1 were made for this revision.

January 2011. This document has been updated. The following is a list of the changes:

- Realigned atriiums, school & university classrooms, gymnasiums, metalworking and fabrication shops with non-hydraulic operations, and mineral operations to a more suited hazard category of HC-1 based on their light loading occupancy description.
- Re-evaluated Extended Coverage sprinkler design guidelines based on full scale fire test results.
- Added Extended Coverage Sprinklers K11.2EC (K160EC) and K14.0EC (K200EC) with a temperature rating of 160°F (70°C) as options for new installations in HC-2 & HC-3 occupancies with ceiling heights up to 30 ft (9 m).
- Deleted design requirement to supply the hydraulically most remote 9 sprinklers when using EC sprinklers for HC-1 and HC-2 occupancies.
- Reduced the wet and dry sprinkler design demand areas for HC-3 occupancies with ceilings up to 30 ft (9 m).
- Reduced the minimum water demand duration to 60 minutes for HC-2 occupancies.

- Removed any and all references to HC-4 categories due to vague occupancy description not fitting any comparable manufacturing sites.
- Reduced the minimum sprinkler K-Factors for new installations to K8.0 (K115) for HC-2 occupancies with ceiling heights up to 60 ft (18 m).
- Added protection option for HC-3 occupancies over 60 ft (18m) and up to 100 ft (30 m).
- Added guidelines covering acceptability for using storage sprinklers in mixed storage and Nonstorage occupancies.
- Added protection guidelines for use of water mist systems.

March 2010. This document has been completely rewritten. The following is a list of major changes:

- Added a table of hazard categories based on occupancy.
- Added a table of sprinkler design demands based on ceiling height and type of sprinkler system for each hazard category.
- Added design information on extended-coverage sprinklers for light- and ordinary-hazard occupancies.
- Added sprinkler protection design criteria for nonstorage and nonmanufacturing facilities with ceilings higher than 60 ft (20 m) and up to 100 ft (30 m).
- Added sprinkler protection design criteria for manufacturing facilities with ceilings up to 60 ft (20 m) high.
- Revised loss history.
- Updated Appendix A, Glossary of Terms.

July 2008. References to FM Global Loss Prevention Data Sheet 7-96, *Printing Plants*, were added to Table 1.

May 2008. Clarifications were made to the recommendations 2.1.1.1 and 2.1.2.1.2.

January 2008. The following changes were made:

1. Combined Tables 2 through 10 to simplify the recommendations for sprinkler system water demand.
2. Replaced Table 1, which described temperature ratings for sprinklers, with a recommendation to use 160°F (70°C) and 280°F (140°C) temperature-rated sprinklers for wet and for dry systems respectively.
3. Added sprinkler system water demand information for assembly facilities manufacturing fiberglass boats.

January 2006. Clarification was made to the recommendation 2.1.2.3.1 and Table 11.

January 2005. Protection criteria has been provided for light, moderately and heavily loaded nonstorage areas with floor to ceiling clearances up to 60 ft (18.3 m). Storage type, storage and building height and corresponding protection criteria are provided in Table 11.

January 2001. The protection requirements for the spray application of flammable liquids, including catalytic spraying have been removed from this data sheet and are included in Data Sheet 7-27, *Spray Application of Flammable and Combustible Materials*.

The protection requirements for hydraulic equipment using hydraulic fluids have been removed from this data sheet. The protection requirements are in Data Sheet 7-98, *Hydraulic Fluids*.

September 2000. This revision of the document was reorganized to provide a consistent format.

October 1992. The following changes were made for this revision:

1. Flammable Liquids

Water demand criteria for flammable liquids in open and closed tanks are not contained in this revision of Data Sheet 3-26. In the previous revision of this data sheet, the occupancies were titled Flammable Liquids In Open Tanks and Containers and Flooding Systems and Flammable Liquids in Closed Containers, Except Drum Storage. Water demand criteria for these occupancies are incorporated with the flammable liquid data sheets.

2. Woodworking Occupancy

Water demand criteria for the general occupancy, Woodworking, are not in this revision of Data Sheet 3-26. Data Sheet 7-10, *Wood Processing and Woodworking Facilities*, has been revised (June 1991). Water demand information is now included in Data Sheet 7-10.

3. Textile Occupancy

Water demand criteria for the textile occupancy are not in this revision of Data Sheet 3-26. Data Sheet 7-1, *Fire Protection for Textile Mills*, has been revised. Water demand information is now included in Data Sheet 7-1.

4. Miscellaneous Occupancies

The section titled "Miscellaneous Occupancies" is included to provide guidelines for occupancies that are not found within the specific occupancies.

5. Miscellaneous Nonmanufacturing

The title "Miscellaneous Nonmanufacturing" is used in place of "Light Hazard Occupancy." The new title better defines the various occupancies involved.

6. Office Occupancies

Guidelines in Data Sheet 3-26 for office occupancy are in Table 2, within the section titled Miscellaneous Nonmanufacturing. Loss data (see Support for Recommendations) and fire test data indicate that a water supply capable of providing a density of 0.10 gpm/ft² (4 mm/min) over an area of 1500 ft² (140 m²) will provide adequate protection for an office occupancy.

7. Electronic-Electrical Manufacturing and Assembly

A separate occupancy category for electronic and electrical manufacturing and assembly occupancies has been added.

8. Plastics Processing

Recent fire tests indicate that ordinary, intermediate or high temperature rated sprinklers over 2500 ft² (230 m²) (dry system: 3500 ft²) will provide adequate protection over this occupancy.

9. Quick Response Automatic Sprinklers (QRAS)

This data sheet includes guidance on the use of QRAS. The recommendations are based on the results of fire tests comparing QRAS and conventional response automatic sprinklers.

10. Title Change

The title change to include "Nonstorage" better describes the occupancies included within this data sheet.

11. International and National Fire Protection Association Standards

APPENDIX C HAZARD CATEGORY EXAMPLES

Table 1 of this data sheet provides a description of what a typical HC-1, HC-2, and HC-3 occupancy may include, but this table should not be viewed as an all inclusive list. Judgment is needed when determining an occupancy's hazard category.

Tables 4 and 5 provide specific examples of different occupancies and their associated hazard category, as well as any further guidance that may be applicable.

It should be noted that although a location may have a predominant occupancy of HC-1 or HC-2, consideration should be given to areas that owing to a higher hazard process or presence of higher hazard materials (such as plastics) may need to be afforded a greater level of protection such as HC-2 or HC-3 respectively. For example, a HC-2 metal manufacturing facility may have plating operations that would necessitate an HC-3 level of protection in those areas.

Table 4. Nonstorage, Non-Manufacturing Occupancies and their Associated Fire Hazard Categories

<i>Occupancy</i>	<i>Description</i>	<i>Hazard Category</i>	<i>Considerations</i>
Healthcare Facilities	- Hospitals and Hospital Laboratories - Nursing or Convalescent Homes - Kitchens - Care Homes - Penal Institutions (Jailhouses, etc.)	HC-1	Data sheets to consider: - 1-3, <i>High Riser Buildings</i> - 1-12, <i>Ceilings and Concealed Spaces</i> - 1-24, <i>Protection Against Liquid Damage</i> - 5-23, <i>Emergency and Standby Power Systems</i>
	- Hospital Utility Plants	HC-2	
	- Storage Room/Pharmacies with Storage	HC-3	- 6-4, <i>Oil or Gas Fired Single-Burner Boilers</i> - 6-5, <i>Oil or Gas Fired Multiple Burner Boilers</i> - 7-15, <i>Garages</i> - 7-52, <i>Oxygen</i>
Business Facilities & Apartments	- Offices - Hotels - Flats / Apartments	HC-1	Data sheets to consider: - 1-3, <i>High Rise Buildings</i> - 1-12, <i>Ceilings and Concealed Spaces</i> - 1-24, <i>Protection Against Liquid Damage</i> - 7-15, <i>Garages</i>
	- Utility Rooms	HC-2	
Educational Facilities	- Universities - Schools - Kindergartens - Colleges - Dormitories and Residence Halls - Prisons - Detention centers	HC-1	Data sheets to consider: - 1-3, <i>High Riser Buildings</i> - 1-12, <i>Ceilings and Concealed Spaces</i> - 1-24, <i>Protection Against Liquid Damage</i> - 5-23, <i>Emergency and Standby Power Systems</i> - 7-15, <i>Garages</i>
	- Utility Rooms	HC-2	
Transport & Logistic	- Airport Terminal - Bus Stations - Train Stations - Ferry Port - Cruise Terminal - Bicycle Parks	HC-1	Data sheets to consider: - 7-11, <i>Conveyors</i> - 7-15, <i>Garages</i> - 7-29, <i>Ignitable Liquid Storage in Portable Containers</i> - 7-32, <i>Ignitable Liquid Operations</i>
	- Parking Garage - Car Parks	HC-2	- 7-93, <i>Aircraft Hangars, Aircraft Manufacturing and Assembly Facilities, and Protection of Aircraft Interiors During Assembly</i>
	- Car-Sized Vehicle Repair Garages and Assembly Operations Where Unfueled Vehicles are Repaired, Tested or Assembled - Truck Loading Docks - loading and unloading canopies - Package Delivery/Distribution Hubs - Cross docking areas - Aircraft Hangar, - Zeppelin Hangar	HC-3	- 8-3, <i>Rubber Tire Storage</i> - 8-9, <i>Storage of Class 1, 2, 3, 4 and Plastic Commodities</i>
Energy Service Providers	- Gas and Oil Stations/Service Provider - Battery Stations - Solar Plant - Wind Turbines - Photo Voltaic Farms	HC-3	Data sheets to consider: - 3-10, <i>Wind Turbines</i>

Table 4. Nonstorage, Non-Manufacturing Occupancies and their Associated Fire Hazard Categories (cont'd)

Occupancy	Description	Hazard Category	Considerations
Leisure Facilities & Public Assembly	<ul style="list-style-type: none"> - Museums and Monuments - Restaurants (Seating Areas) - Gyms - Places of Worship - Ski Lift Station - Zoo / Aquarium - Auditoriums - Aquatic Center (Swimming Pool/ Spa) - Theatres - Cinemas - Convention Centers - Theme Parks - Libraries 	HC-1	<ul style="list-style-type: none"> - Theaters, auditoriums, and casinos may sometimes qualify as HC-1 occupancies when ordinary combustibles loading is minimal, or the construction of the building is noncombustible. For example, casino areas with ceilings under 30 ft (9 m) high and only lined with slot machines would qualify as HC-1. Auditoriums or theaters, including staging practically empty of ordinary combustibles, would also qualify. Consider backstage and below stage areas without storage to be HC-2.
	<ul style="list-style-type: none"> - Sport Arena - Theaters - Casinos - Night Clubs 	HC-2	<ul style="list-style-type: none"> - Large convention centers have the potential to display products that have high amounts of plastic and/or have concealed spaces.
	<ul style="list-style-type: none"> - Exhibition Halls - Theatre: Backstage and Below Stage Areas. - Convention Centers 	HC-3	
Mercantile Facilities	<ul style="list-style-type: none"> - Department Stores - front of house - Shopping Malls - Retail and Mercantile Areas - Supermarkets 	HC-2	<ul style="list-style-type: none"> - In general storage at these locations is retail items on display to less than 6 ft (1.8 m) (or as high as can be reached without equipment). - Back of house and bulk storage areas, wholesale/big-box stores, should be analyzed in line with Data Sheet 8-9, <i>Storage of Class 1, 2, 3, 4 and Plastic Commodities</i>.
Incoming Waste Material at Recycling/Waste Processing/Energy from Waste Facilities	<ul style="list-style-type: none"> - Mixed household/business waste or recyclables including metal, glass, cellulosic materials and small amounts of plastics 	HC-2	<ul style="list-style-type: none"> - The storage of incoming waste material should not be considered low-piled storage per Table 3; the sprinkler design should be based on either an HC-2 or an HC-3 occupancy per the adjacent description. The fire scenario is a relatively small fire spreading across the surface of the waste pile rather than involving the entire pile depth at one time. Therefore, basing protection on the height and/or size of the waste pile would be inappropriate. - For baled waste paper storage see Data Sheet 8-22. - For other baled commodities like plastics, see Data Sheet 8-9. - For energy from waste facilities, refer to Data Sheet 6-13.
	<ul style="list-style-type: none"> - Pre-sorted and/or shredded household/business waste or recyclables including metal, glass, cellulosic materials and also plastic material. 	HC-3	

Table 4. Nonstorage, Non-Manufacturing Occupancies and their Associated Fire Hazard Categories (cont'd)

Occupancy	Description	Hazard Category	Considerations
Telecommunication, Film Studios, and Research Centers	- Laboratories - Control Rooms for monitoring operations or network operations center, broad cast facilities, telecommunication	HC-1	Data sheets to consider: - 1-56, <i>Cleanrooms</i> - 1-57, <i>Plastics in Construction</i> - 5-14, <i>Telecommunications</i> - 5-18, <i>Protection of Electrical Equipment</i>
	- IT Facilities - I/O Distribution Room - Control Rooms - Electrical Rooms	HC-2	- 5-19, <i>Switchgear and Circuit Breakers</i> - 5-23, <i>Emergency and Standby Power Systems</i> - 5-32, <i>Data Centers and Relating Facilities</i>
	- Film and TV Studios	HC-3	

Table 5. Manufacturing Occupancies and Their Associated Fire Hazard Categories

Occupancy	Description	Hazard Category	Considerations
Mechanical Engineering or Assembly Plants	- Sheet Metal Product Factories - Metal-Working - Electric and Electronics Equipment Factories - White Goods Factories (Washing Machine, Dishwashing Machine, Refrigerator, Oven and Similar) - Circuit Board Manufacturing - Car Workshops - Mobile Phone Production - Electrical and Electronic Testing Areas	HC-2	Data sheets to consider: - 7-6 <i>Heated Plastic and Plastic Lined Tanks</i> - 7-21, <i>Rolling Mills</i> - 7-29, <i>Ignitable Liquid Storage in Portable Containers</i> - 7-32, <i>Ignitable Liquid Operations</i> - 7-37, <i>Cutting Fluids</i> - 7-41, <i>Oil Quenching and Molten Salt Baths</i> - 7-73, <i>Dust Collectors and Collection Systems</i>
	- Aluminum Manufacturing - Injection-Molding Machines (Plastics) for PP/PE/PS or Similar - Electric and Electronics Equipment Factories with Large Amounts of Plastic Boxes - Manufacturing/Assembly of Wind Turbines - Manufacturing/Assembly of Aircraft - Manufacturing/Assembly of Boats, Highway Trailers, Trucks, Boxcars, Mobile Homes, or Similar - Mixed Manufacturing Buildings with No Dominate Occupancy - Battery Manufacturing with and without plastic - Plating/etching/Anodizing with plastic tanks	HC-3	- 7-64, <i>Aluminum Industry</i> - 7-76, <i>Prevention and Mitigation of Combustible Dust Explosions and Fire</i> - 7-93, <i>Aircraft Hangers, Aircraft Manufacturing and Assembly Facilities, and Protection of Aircraft Interiors During Assembly</i> - 7-97, <i>Metal Cleaning</i> - 7-98, <i>Hydraulic Fluids</i> - 7-104, <i>Metal Treatment Process</i> - 7-108, <i>Silane</i>
Textiles and Clothing	- Leather Goods Factories - Carpet Factories (Excluding Rubber and Foam Plastics) - Cloth and Clothing Factories Fiber-Board Factories, Footwear Factories (Excluding Plastics and Rubber) - Knitting Factories, Linen Factories - Mattress Factories (Excluding Foam Plastics) - Sewing Factories, Weaving Mills - Woolen and Worsted Mills - Rope Factories	HC-2	Data sheets to consider: - 7-1, <i>Fire Protection for Textile Mills</i> - 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 Fire</i> - 7-98, <i>Hydraulic Fluids</i> - 8-7, <i>Baled Fiber Storage</i>
	- Washing, Bleaching, Dyeing, Printing and Fabric Chemical Treatment - Mattress Factories (Including Foam Plastics)	HC-3	- 8-23, <i>Rolled Nonwoven Fabric Storage</i>

Table 5. Manufacturing Occupancies and Their Associated Fire Hazard Categories (cont'd)

Occupancy	Description	Hazard Category	Considerations
Food and Beverages	<ul style="list-style-type: none"> - Abattoirs, Meat Factories - Rendering Plants - Bakeries - Biscuit Factories - Breweries - Chocolate Factories - Confectionery - Dairies Factories - Animal Feed Factories - Slaughter Houses - Seafood - Butchery - Corn Mills - Dehydrated Vegetable and Soup Factories - Sugar Factories - Alcohol Distilleries - Tobacco Processing - Beverage Bottling Plants - Snack Food 	HC-2	Data sheets to consider: - 1-57 <i>Plastics in Construction</i> - 7-2, <i>Waste Solvent Recovery</i> - 7-13, <i>Mechanical Refrigeration</i> - 7-20, <i>Oil Cookers</i> - 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> - 7-74, <i>Distilleries</i> - 7-75, <i>Grain Storage and Milling</i> - 7-76, <i>Prevention and Mitigation of Combustible Dust Explosions and Fire</i> - 7-98, <i>Hydraulic Fluids</i> - 8-8, <i>Distilled Spirits Storage</i> - 8-29, <i>Refrigerated Storage</i>
	<ul style="list-style-type: none"> - Blow Molding (Plastic and/or PET) - Plastic Packaging - Distilleries; Storage Rooms 	HC-3	
Paper	<ul style="list-style-type: none"> - Paper Factories (Pulp and Paper Making) - Washing, Bleaching and Chemical Treatment - Paper Making Machine Area - Book-Binding Factories - Cardboard/Corrugate Factories 	HC-2	Data sheets to consider: - 6-21, <i>Chemical Recovery Boilers</i> - 7-2, <i>Waste Solvent Recovery</i> - 7-4, <i>Paper Machines and Pulp Dryers</i> - 7-29, <i>Ignitable Liquid Storage in Portable Containers</i> - 7-32, <i>Ignitable Liquid Operations</i> - 7-57, <i>Pulp and Paper Mills</i> - 7-58, <i>Chlorine Dioxide</i> - 7-73, <i>Dust Collectors and Collection Systems</i> - 7-76, <i>Prevention and Mitigation of Combustible Dust Explosions and Fire</i> - 7-96, <i>Printing Plants</i> - 7-98, <i>Hydraulic Fluids</i> - 7-103, <i>Turpentine Recovery in Pulp and Paper Mills</i> - 8-21, <i>Roll Paper Storage</i> - 8-22, <i>Storage of Baled Waste Paper</i> - 8-27, <i>Storage of Wood Chips</i> - 8-28, <i>Pulpwood and Outdoor Log Storage</i>
	<ul style="list-style-type: none"> - Coating and Printing 	HC-3	
Timber and Wood	<ul style="list-style-type: none"> - Woodworking Factories (Sawmills, Planer Mills, Plywood, Particle Board) - Furniture Factories - Furniture Showrooms - Upholstery Factories - Wood Wool Manufacture - Prefab-Home Manufacturing (excluding plastic insulation) 	HC-2	Data sheets to consider: - 7-10, <i>Wood Processing and Woodworking Facilities</i> - 7-73, <i>Dust Collectors and Collection Systems</i> - 7-76, <i>Prevention and Mitigation of Combustible Dust Explosions and Fire</i> - 7-98, <i>Hydraulic Fluids</i>
	<ul style="list-style-type: none"> - Modular Building Subassemblies 	HC-3	

Table 5. Manufacturing Occupancies and Their Associated Fire Hazard Categories (cont'd)

<i>Occupancy</i>	<i>Description</i>	<i>Hazard Category</i>	<i>Considerations</i>
Metals, Glass, and Ceramics	<ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> - 7-25, <i>Molten Steel Production</i> - 7-26, <i>Glass Plants</i> - 7-33, <i>High Temperature Molten Materials</i> - 7-41, <i>Oil Quenching and Molten Salt Baths</i> - 7-104, <i>Metal Treatment Process</i>
Rubber and Plastic	<ul style="list-style-type: none"> - Floor Cloth and Linoleum Manufacture - Rubber Goods Factories 	HC-2	Data sheets to consider: <ul style="list-style-type: none"> - 7-24, <i>Blowing Agents</i> - 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 Fire</i> - 7-98, <i>Hydraulic Fluids</i> - 7-99, <i>Heat Transfer by Organic and Synthetic Fluids</i> - 8-30, <i>Storage of Carpets</i>
	<ul style="list-style-type: none"> - 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 - Injection Molding (Plastics) for PP/PE/PS or - Plastics Grinding - Production of Expanded Plastic or Rubber Products - Extrusion Involving Flammable Blowing Agents - Manufacturing and Assembly of Boats, Highway Trailers and Trucks, Boxcars, Mobile Homes, or Similar Metal Vehicles with Combustible Interiors with the Potential for a Shielded Fire 	HC-3	
Mining & Carbon Manufacturing	<ul style="list-style-type: none"> - Carbon Kilns - Carbon and Coke Storage - Carbon Furnaces, Crushing and Extruding 	HC-3	Data sheets to consider: <ul style="list-style-type: none"> - 7-12, <i>Mining and Ore Processing Facilities</i>

Table 5. Manufacturing Occupancies and Their Associated Fire Hazard Categories (cont'd)

<i>Occupancy</i>	<i>Description</i>	<i>Hazard Category</i>	<i>Considerations</i>
Chemicals and Pharmaceuticals	Laboratories	HC-1	Data sheets to consider:
	- Chemical Factories - Photographic Film - Dye Works - Soap Factories - Match Manufacturing - Pharmaceuticals Manufacturing - Health and Beauty Aids - Cosmetics and Perfumes - Biotechnology - Medical Care/Infusion	HC-2	- 6-21, <i>Chemical Recovery Boilers</i> - 7-2, <i>Waste Solvent Recovery</i> - 7-14, <i>Fire Protection for Chemical Plants</i> - 7-22, <i>Hydrazine and Its Derivatives</i> - 7-23, <i>Data on General Class of Chemicals</i> - 7-28, <i>Energetic Materials</i> - 7-29, <i>Ignitable Liquid Storage in Portable Containers</i>
	- Fire-Lighter Manufacture - Cigarette Lighter - Resin, Lamp Black and Turpentine - Rubber or Substitute Manufacture	HC-3	- 7-32, <i>Ignitable Liquid Operations</i> - 7-34, <i>Electrolytic Chlorine Process</i> - 7-36, <i>Pharmaceutical Operations</i> - 7-38, <i>Loss Prevention in Ethanol Fuel Production Facilities</i> - 7-46, <i>Chemical Reactors and Reactions</i> - 7-73, <i>Dust Collectors and Collection Systems</i> - 1-56, <i>Clean Rooms</i>