STORAGE OF CARPETS

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1.0 SCOPE

This data sheet covers storage of carpets made from wool, cotton, man-made fibers, and synthetic blends. These carpets may have plastic or rubber pads bonded to them. For storage of carpet pads made of polyurethane, rubber foam, or rubber-coated fibers, apply Data Sheet 8-9, *Storage of Class 1, 2, 3, 4 and Plastic Commodities*.

1.1 Changes

October 2013. Interim revision. The following changes were made:

A. Ceiling sprinkler protection terminology has been replaced with “storage sprinkler.” This terminology is consistent with other FM Global data sheets.

B. All ceiling-level sprinkler protection options are now given as a number of sprinklers at a minimum operating pressure (e.g., 25 sprinklers @ 7 psi [3.4 bar]).

C. Additional guidance for the installation of in-rack sprinklers has been provided in section 2.4.3.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Introduction

2.1.1 Because carpet storage is greatly susceptible to water damage, lift truck operators should be properly instructed to prevent accidental damage to in-rack sprinkler systems. Painting sprinkler piping and nearby rack members is extremely helpful in warning lift truck operators. Rack members also can be used to provide protection for the piping against mechanical damage. See examples in Figure 1.

2.2 Construction and Location

2.2.1 Emergency Smoke and Heat Vents

This data sheet assumes roof vents and draft curtains are not provided. Fire tests have not shown automatic vents to be cost effective, and they may increase sprinkler water demand. Therefore, permanent heat and smoke vents, if any, should be arranged for manual — not automatic — operation. Smoke removal during mop-up operations can frequently be achieved through eave-line windows, doors, monitors, nonautomatic exhaust systems (gravity or manual), manually operated heat and smoke vents, or holes cut by fire service personnel.

2.3 Occupancy

2.3.1 Storage Arrangement of Carpet in Racks

Arrange storage of carpets on all racks in accordance with the following recommendations:

1. A minimum 2 to 4 in. (51 to 102 mm) transverse flue space at vertical supports should be maintained. About 1 ft (0.3 m) space between vertical members should be provided between the back-to-back racks.

2. To minimize water damage, the lowest level of carpet storage should be at least 4 in. (102 mm) above the floor.

3. For storage 12 ft (3.7 m) and lower on standard carpet racks, when no in-rack sprinklers are provided, a clear space of at least 8 ft (2.4 m) should be provided approximately every 100 ft (30.5 m) along the length of the rack to check the fire spread.

2.3.2 Storage Arrangement of Carpet in Tubes

Arrange storage of carpets in tubes in accordance with the following recommendations:

1. The length of the tubes should preferably be equal to or greater than the length of the carpet roll. However, the carpets should not overhang more than 6 in. (152 mm) on both ends of the tube.

2. To minimize water damage, the lowest level of tubes should be at least 4 in. (102 mm) above the floor.

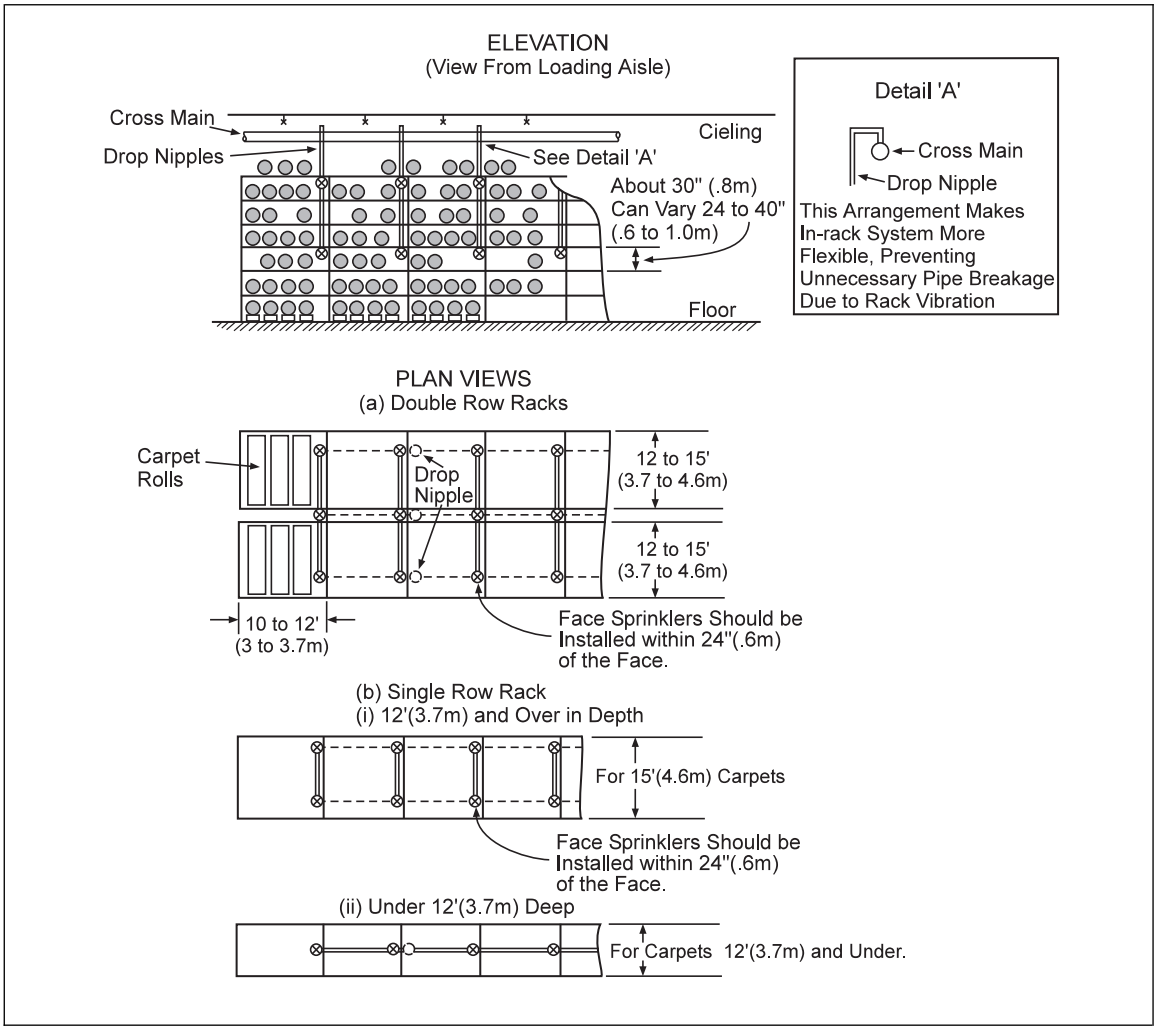

Fig. 1. Typical in-rack sprinkler installation for carpet racks. Note: Instead of one drop nipple at every upright, 1 to 3 drop nipples per rack can be used with in-rack sprinklers connected by pipes as indicated by dotted lines only

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2.3.3 Storage Clearance

Maintain storage a minimum of 36 in. (915 mm) below sprinkler deflectors.

2.4 Protection

2.4.1 Carpet Rolls on Floor and Carpet Pieces

Carpet rolls on floor and carpet pieces (with or without cartons) should be protected in accordance with the recommendations for a Class 4 commodity in Data Sheet 8-9. Polyurethane, foam rubber, or rubber-coated fiber carpet pads also should be protected in accordance with Data Sheet 8-9, guidelines for expanded plastic commodities.

2.4.2 Automatic Sprinkler Protection

Automatic sprinkler protection should be provided for finished or unfinished carpet roll storage in accordance with Table 1. Automatic sprinkler protection also should be provided in the transverse aisle ‘‘tunnels’’ of the rack storages. Details of ceiling and in-rack sprinklers should be in accordance with Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*, and Data Sheet 8-9, except as modified in this data sheet.

The sprinkler system should preferably be of wet pipe or preaction type; however, dry-pipe systems are acceptable. Temperature rating of sprinklers for new installations should be 286°F (141°C).

Table 1. Protection Requirements for Rack and Tube Storage of Carpet Rolls

Storage Arrangement	Storage Height, ft (m)	Ceiling Height / Clearance, ft (m)	Wet, Pendent 160°F (70°C)										Wet, Upright 160°F (70°C)							Dry, Upright 280°F (140°C)			
			Quick Response						Standard Response				Quick Response				Standard 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)	K16.8 (K240)	K22.4 (K320)	K11.2 (K160)	K14.0 (K200)	K16.8 (K240)	K25.2EC (K360EC)	K11.2 (K160)	K16.8 (K240)	K25.2 (K360)	K11.2 (K160)	K16.8 (K240)	K19.6 (K280)	K25.2 (K360)
Standard Carpet Racks	Up to 12 (3.6)	Up to 30 (9.0)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	15@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	15@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	40@7 (0.5)	40@7 (0.5)	40@7 (0.5)	40@7 (0.5)
	Over 12 (3.6) Note 1	Max. 20 (6.1) clearance	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	10@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	10@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	25@7 (0.5)	25@7 (0.5)	25@7 (0.5)	25@7 (0.5)
Cubicle Racks	Up to 15 (4.6)	Up to 30 (9.0)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	15@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	15@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	40@7 (0.5)	40@7 (0.5)	40@7 (0.5)	40@7 (0.5)
	Over 15 (4.6) Note 1	Max. 20 (6.1) clearance	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	10@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	10@7 (0.5)	20@7 (0.5)	20@7 (0.5)	20@7 (0.5)	25@7 (0.5)	25@7 (0.5)	25@7 (0.5)	25@7 (0.5)
Tube Storage	Up to 25 (7.5)	Up to 30 (9.0)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	15@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	15@7 (0.5)	30@7 (0.5)	30@7 (0.5)	30@7 (0.5)	40@7 (0.5)	40@7 (0.5)	40@7 (0.5)	40@7 (0.5)

Note 1. In-rack sprinklers needed. See Section 2.4.3.

2.4.3 In-Rack Sprinklers

2.4.3.1 General

2.4.3.1.1 Use nominally rated 160°F (70°C) FM Approved in-rack sprinklers for all in-rack sprinkler installations. For a list of FM Approved sprinklers, see the *Approval Guide,* an online resource of FM Approvals, under the heading of Storage Sprinklers (In-Racks). Use in-rack sprinklers listed as quick-response when installing K14.0 (K200) or smaller sprinklers. In-rack sprinklers with larger K-factor values can be either quick-response or standard-response. The minimum operating pressure of the in-rack sprinklers is 7 psi (0.5 bar).

In-rack sprinkler systems can be wet-pipe, dry-pipe, preaction, or refrigerated area. Note, however, that grid-type piping configurations are only recommended for wet-pipe sprinkler systems. The maximum water delivery time for any dry-type in-rack sprinkler system is 60 seconds and is based on the operation of the hydraulically most remote in-rack sprinkler.

2.4.3.1.2 Locate all in-rack sprinklers within the rack storage array. At each tier level where in-rack sprinklers are needed, position the in-rack sprinkler deflector at or just below the bottom of the rack's horizontal support member when it is under full load conditions. Arrange sprinkler piping and in-rack sprinklers to avoid mechanical damage, but ensure proper distribution from the in-rack sprinkler can be achieved. Prior to installing in-rack sprinklers, check the proposed in-rack sprinkler locations to ensure both adequate protection against mechanical damage and proper sprinkler discharge are provided.

2.4.3.1.3 Balance the in-rack sprinkler system water demand with the ceiling-level sprinkler water demand at the point where the two systems are connected.

2.4.3.2 Standard Carpet Racks

In-rack sprinklers are needed in standard carpet racks for storage heights in excess of 12 ft (3.6 m). Locate in-rack sprinklers vertically every 8 ft (2.4 m) while not leaving more than 5 ft (1.5 m) of storage above the top level of in-rack sprinklers. For racks less than 12 ft (3.6 m) deep, install one line of in-rack sprinklers horizontally down the center of the rack on spacing not exceeding 12 ft (3.6 m). For racks 12 ft (3.6 m) deep or more, install in-rack sprinklers within 24 in. (600 mm) of the face of each rack, as well as within the rack, as needed, so there is no more than 12 ft (3.6 m) horizontally between any in-rack sprinkler. Design the in-rack sprinkler system to provide a minimum flow of 22 gpm (85 L/min) from the most remote 8 in-rack sprinklers if only one level of in-rack sprinklers has been installed, or a minimum flow of 22 gpm (85 L/min) from the most remote 14 in-rack sprinklers (7 on 2 levels) if more than one level of in-rack sprinklers has been installed.

If in-rack sprinkler protection has been installed for storage heights up to a maximum height of 12 ft (3.6 m), the ceiling demand in the presence of in-rack sprinklers can be based on the protection indicated in Table 1 for storage height over 12 ft (3.6 m) high.

If the clearance between the top of storage and the overhead ceiling exceeds 20 ft (6.0 m), install in-rack sprinklers as outlined above, at the top of the carpet storage rack so that only one tier of storage is located above the top level of in-rack sprinklers.

2.4.3.3 Cubicle Racks

In-rack sprinklers are needed in cubicle carpet racks for storage heights in excess of 15 ft (4.5 m). Locate in-rack sprinklers vertically every 15 ft (4.5 m) while not leaving more than 10 ft (3.0 m) of storage above the top level of in-rack sprinklers. For racks less than 12 ft (3.6 m) deep, install one line of in-rack sprinklers horizontally down the center of the rack on spacing not exceeding 12 ft (3.6 m). For racks 12 ft (3.6 m) deep or more, install in-rack sprinklers within 24 in. (600 mm) of the face of each rack, as well as within the rack, as needed, so there is no more than 12 ft (3.6 m) horizontally between any in-rack sprinkler. Design the in-rack sprinkler system to provide a minimum flow of 22 gpm (85 L/min) from the most remote 8 in-rack sprinklers if only one level of in-rack sprinklers has been installed, or a minimum flow of 22 gpm (85 L/min) from the most remote 14 in-rack sprinklers (7 on 2 levels) if more than one level of in-rack sprinklers has been installed.

If in-rack sprinkler protection has been installed for storage heights up to a maximum height of 15 ft (4.5 m), the ceiling demand in the presence of in-rack sprinklers can be based on the protection indicated in Table 1 for storage height over 15 ft (4.5 m).

If the clearance between the top of storage and the overhead ceiling exceeds 20 ft (6.0 m), install in-rack sprinklers, as outlined above, at the top of the cubicle storage rack so that only one tier of storage is located above the top level of in-rack sprinklers.

2.4.4 Small Hose Stations

Provide small (1-½ in. [38 mm]) hose stations with combination solid stream and spray nozzles at intervals that will permit application of at least one hose stream an any point in the rack. Hoses should be no longer than 100 ft (20.5 m). Feeds should be independent of in-rack and ceiling sprinklers in the immediate vicinity.

2.4.5 Water Supplies

Water supplies should be capable of providing the sprinkler demand shown in Table 1 together with a hose stream demand of 500 gpm (1900 L/min) for at least two hours.

2.4.6 Alarms

Because of the relatively slow development of carpet fires and the special arrangement of carpet storages, manual firefighting can be very effective in the early stages of a fire. To alert the public fire service and the emergency response team, Class III or higher alarm service should be provided in accordance with Data Sheet 9-1, *Supervision of Property.*

Smoke-actuated automatic fire alarm systems may be used with sprinkler waterflow alarms for a more prompt response.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 Carpet Storage

3.1.1 General

Carpets are usually made from natural fibers (wool or cotton), man-made fibers (rayon, nylon, acrylics, etc.), or blends. Carpet backing usually consists of jute, latex, foam rubber, or foam plastic. Rolls of finished carpets usually are wrapped in laminated paper, burlap, heavy Kraft paper, or plastic film. Carpet rolls are mostly stored on specially designed large paperboard tubes nested on the floor or on racks. Smaller pieces of carpet (sometimes packed in cartons) are often solid piled, palletized, or stored in regular open steel racks.

Large-scale fire tests of carpet stored on racks indicated that fire developed in a vertical fan-shaped form, from floor level to the top of the rack, involving more of the storage in the upper tiers than in the lower tiers. The ceiling sprinklers opened quickly, and in-rack sprinklers were effective in the tier level in which they were installed and, to a certain degree, in one or two tiers below.

Vertical barriers in racks are not a substitute for in-rack sprinklers.

Because of the smoldering nature of carpet fires, manual firefighting is extremely valuable in reducing the extent of the fire and completely extinguishing it.

3.1.2 Storage Arrangement

3.1.2.1 *Finished Carpets.* Although small amounts of carpet rolls and carpet pieces (door mats, runner carpet, etc.) in cartons are stored on-floor, palletized, or on racks, rolls of finished carpets are generally stored in standard carpet racks (Fig. 2), cubicle racks (Fig. 3), or in specially designed paperboard tubes (Fig. 4).

3.1.2.2 *Rack Storage.* Standard racks (Fig. 2) may be constructed of steel or wood frames with slatted, solid, or metal decking shelves. They have a rack-tier height of 27 to 40 in. (586 to 1016 mm), but usually are 30 to 36 in. (762 to 914 mm) high. These carpet racks have between 4 and 10 tiers and are 9 to 27 ft (2.7 to 8.2 m) high. The rack length may extend several hundred feet, with vertical supports located every 10 to 12 ft (3.0 to 3.7 m). Normally there are transverse flue spaces at these vertical supports. The rack width is usually 12 to 15 ft (3.7 to 4.6 m) and often racks are placed back to back.

Cubicle racks (Fig. 3) have a series of cubicles approximately 32×32 in. (813×813 mm) high formed by vertical and horizontal rack members. One or two boards (6 to 12 in. [152 to 305 mm] wide) are placed on the lower horizontal rack member of each cubicle. One carpet roll is placed in each cubicle on the board(s), thus separating each roll from adjacent ones by 8 to 12 in. (203 to 305 mm) spaces.

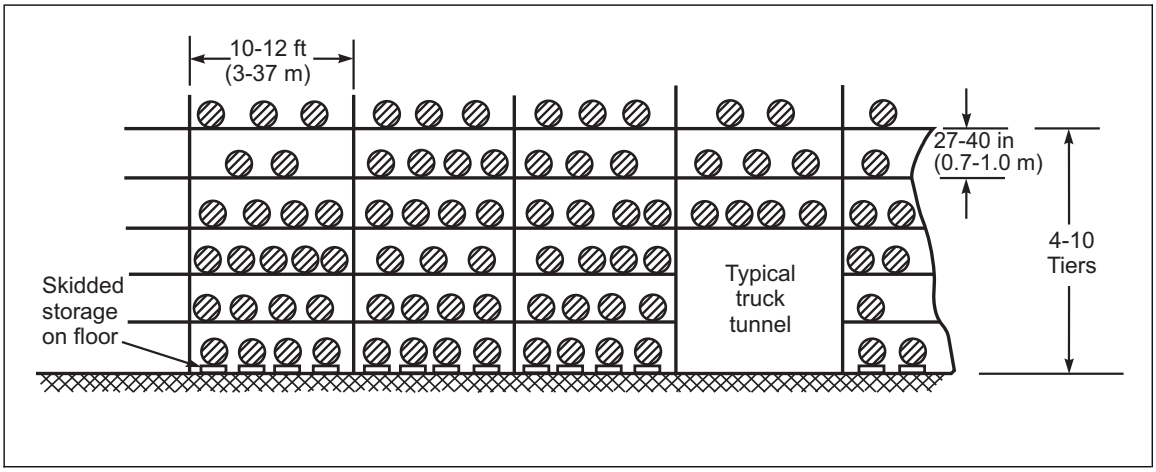

Fig. 2. Typical standard rack for carpet storage

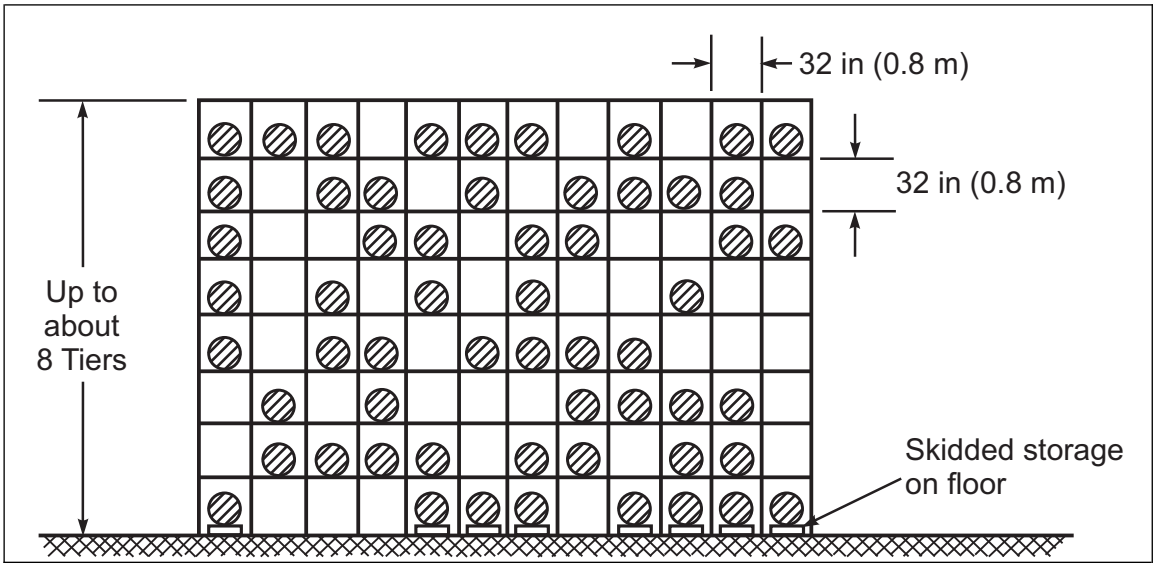

Fig. 3. Typical cubicle rack for carpet storage

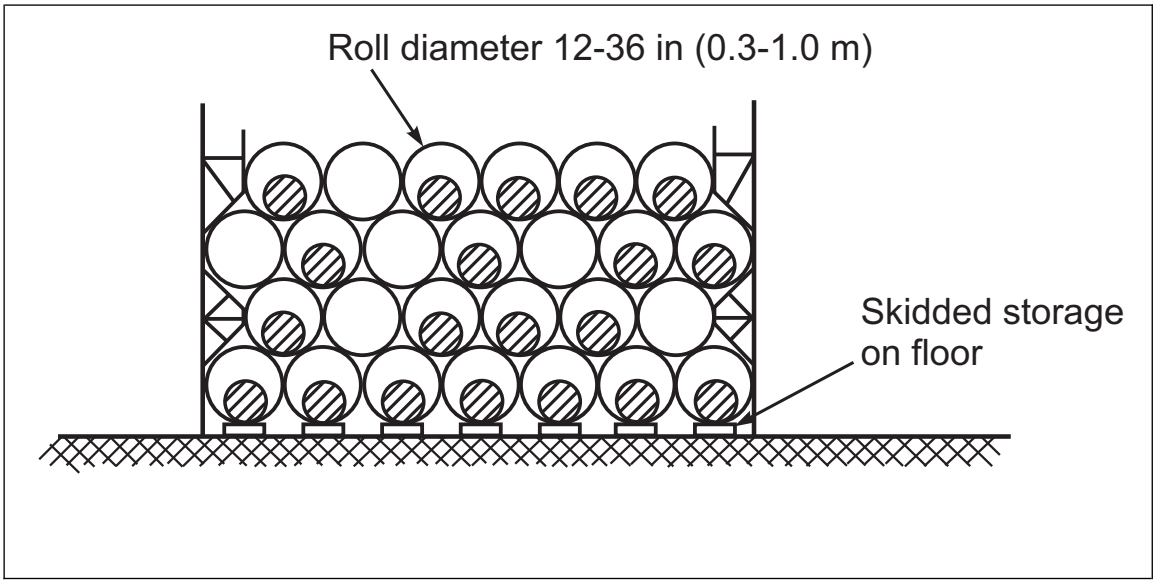

Fig. 4. Typical tube storage of carpets

Carpet racks usually have transverse and longitudinal flue spaces unobstructed by carpet, wrapping, or shelving that permits sprinkler water to run down through the storage. In general, the more flue space there is, the better the penetration of water to lower storage.

The longitudinal aisles are usually 20 to 30 ft (6.1 to 9.1 m) wide. The transverse aisles (sometimes called ‘‘tunnels’’) are usually 10 to 12 ft (3.0 to 3.7 m) wide and have storage above the aisles. Clearance in the transverse aisles for lift truck operation is about 10 to 12 ft (3.0 to 3.7 m) high.

3.1.2.3 *Tube Storage*. Tube storage of carpets (Fig. 4) consists of paperboard tubes primarily nested on floor on special racks. Carpet rolls are placed in these tubes. Generally, the diameter of the tube varies from 12 to 36 in. (305 to 914 mm), depending on the diameter of the roll handled. The tube thickness is designed to hold the carpets and is about 5⁄8 in. (16 mm). The tubes may have a wax coating on the outside.

3.1.2.4 *Unfinished Carpets.* Rolls of unfinished carpets, usually about 4 ft (1.2 m) in diameter, are generally stored in racks two or three tiers high to an overall height of about 12 ft (3.7 m).

4.0 REFERENCES

4.1 FM

Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*
Data Sheet 8-9, *Storage of Class 1, 2, 3, 4 and Plastic Commodities*
Data Sheet 8-33, *Carousel Storage and Retrieval Systems*
Data Sheet 9-1, *Supervision of Property*

APPENDIX A GLOSSARY OF TERMS

FM Approved: References to “FM Approved” in this data sheet mean the products and services have satisfied the criteria for FM Approval. Refer to the *Approval Guide,* an online resource of FM Approvals, for a complete listing of products and services that are FM Approved.

APPENDIX B DOCUMENT REVISION HISTORY

October 2013. Interim revision. The following changes were made:

A. Ceiling sprinkler protection terminology has been replaced with “storage sprinkler.” This terminology is consistent with other FM Global data sheets.

B. All ceiling-level sprinkler protection options are now given as a number of sprinklers at a minimum operating pressure (e.g., 25 sprinklers @ 7 psi [3.4 bar]).

January 2003. Clarification regarding storage clearance was added.

May 2000. This revision of the document has been reorganized to provide a consistent format.

December 1990. Reaffirmed.

March 1977. Complete rearrangement of the data sheet.