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STORAGE OF RUBBER TIRES 1980

NATIONAL FIRE PROTECTION ASSOCIATION, INC.
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Standard for

Storage of Rubber Tires

NFPA 231D-1980

1980 Edition of NFPA 231D

This 1980 edition of NFPA 231D, *Standard for Storage of Rubber Tires,* was prepared by the Technical Committee on Storage of Rubber Tires and was adopted by the National Fire Protection Association, Inc. on November 18, 1980, at its Fall Meeting in San Diego, California. It was released for publication by the Standards Council on December 10, 1980.

It has been approved by the American National Standards Institute.

Origin and Development of NFPA 231D

A tentative standard on the storage of rubber tires was developed by a Subcommittee of the Committee on General Storage and adopted by the National Fire Protection Association, Inc. at the 1974 Annual Meeting in Miami Beach, Florida.

The first official edition of NFPA 231D was prepared by the Committee on General Storage. It included revisions made to the tentative standard, and was adopted by the Association at the 1975 Fall Meeting in Pittsburg, Pennsylvania.

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Standard for
Storage of Rubber Tires

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NOTICE: An asterisk (*) following the number designating a paragraph or section in the text indicates explanatory material on that paragraph or section in Appendix A.

A dagger (†) following the number designating a paragraph or section in the text indicates additional suggestions with regard to that paragraph or section in Appendix B.

Chapter 1 Introduction

1-1 Scope.

1-1.1 This standard applies to the storage of rubber tires when stored indoors.

1-1.2 The provisions contained in this standard apply to new facilities for tire storage and when converting existing buildings to tire storage occupancy. It may be used as a basis for evaluating existing storage facilities.

1-1.3 This standard is not intended to apply to small scale storage as defined in Section 1-2.

1-2 Definitions.

Approved. Means "acceptable to the authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or material, nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Available Height for Storage. The maximum height at which tires can be stored above the floor and still maintain adequate clearance from structural members and the required clearance below sprinklers.

Bundled Tires. A storage method in which a number of tires are strapped together. (*See Figure 1-2.8.*)

Conventional Pallet. A material handling aid designated to support a unit of load with stringers to provide support for material handling devices.

Horizontal Channel. Any uninterrupted space in excess of 5 ft (1.5 m) in length between horizontal layers of stored tires. Such channels may be formed by pallets, shelving, racks or other storage arrangements.

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing

states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

On-floor Storage. Tires stored directly on the floor without horizontal channels. Such storage may utilize boards, cardboard tubes or similar storage aids, but not pallets or racks.

On-side Storage. Tires stored horizontally or flat. (See Figure 1-2.6.)

On-tread Storage. Tires stored vertically or on their treads. (See Figure 1-2.7.)

Palletized. Storage on portable racks of various types utilizing a conventional pallet as a base.

Pyramid Storage. On-floor storage in which tires are pyramided to provide pile stability.

Rack. Any combination of vertical, horizontal and diagonal members which support stored materials. Racks may be fixed or portable. A fixed rack is a supporting framework which remains in a fixed position within the warehouse during normal usage and into which the placement and retrieval of storage is through the handling of tires individually or in pallets loads. (See Figures 1-2.1 to 1-2.8.)

Rubber Tires. Pneumatic tires for passenger automobiles, aircraft, light and heavy trucks, trailers, farm equipment, construction equipment (off-the-road) and buses.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Small Scale Storage. Storage of less than 10,000 units.

Storage Aids. Commodity storage devices such as shelves, pallets, dunnage, separators and skids.

Units (equivalent passenger)*. One average size passenger tire weighing approximately 25 lb (11 kg).

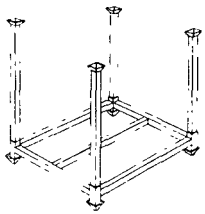


Fig 1-2.1 Open Portable Rack Unit

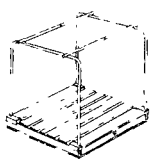


Figure 1-2.2 Palletized Portable Rack Unit

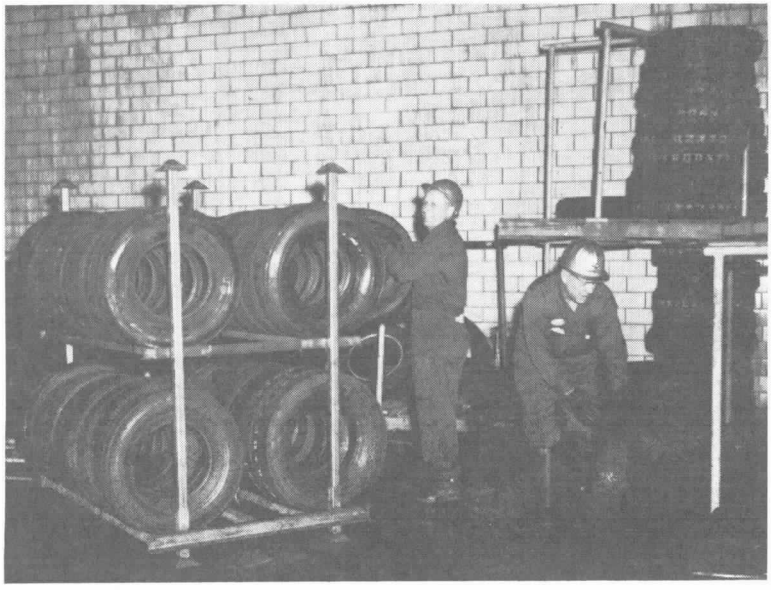
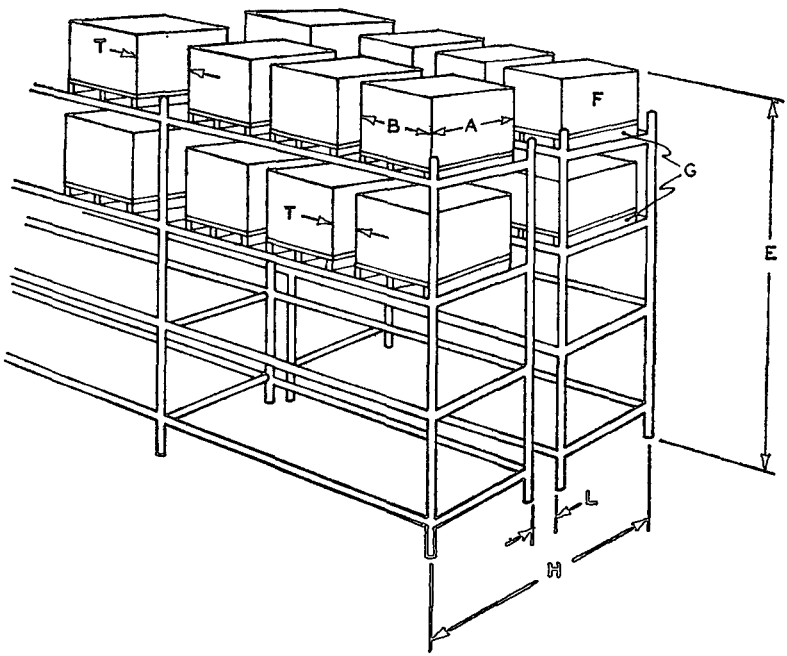


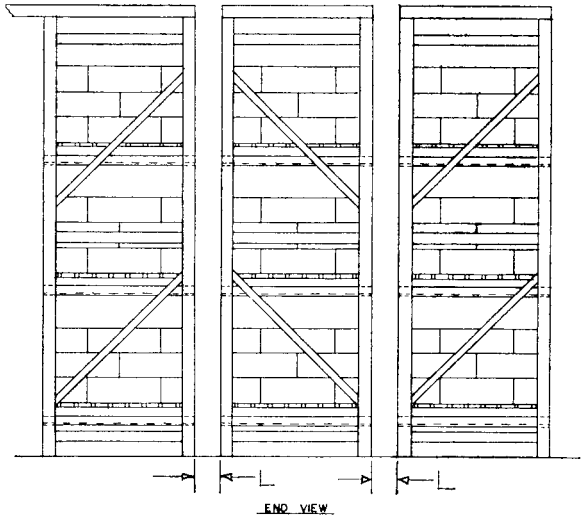
Figure 1-2.3 Open Portable Racks

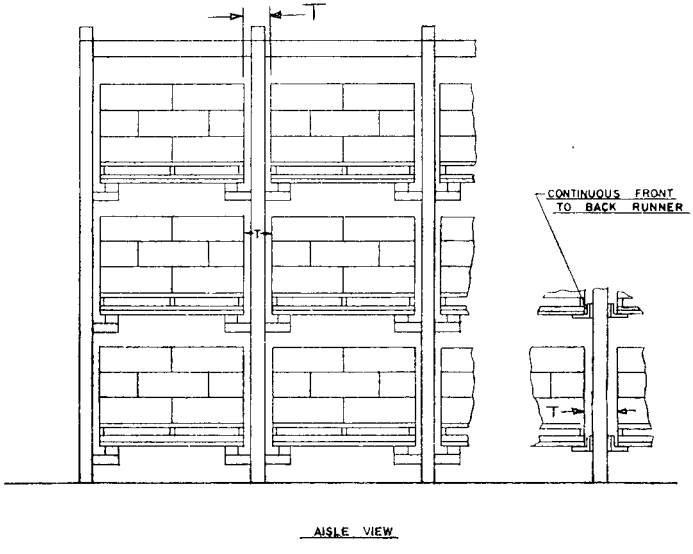


Legend

A — Load Depth
B — Load Width
T — Transverse Flue Space
L — Longitudinal Flue Space
E — Storage Height
F — Commodity
G — Pallet
H— Rack Depth

Figure 1-2.4 Double Row Racks without Solid or Slatted Shelves





Legend

L—Longitudinal Flue Space **T—Transverse Flue Space**

Figure 1-2.5 Multiple-Row Rack

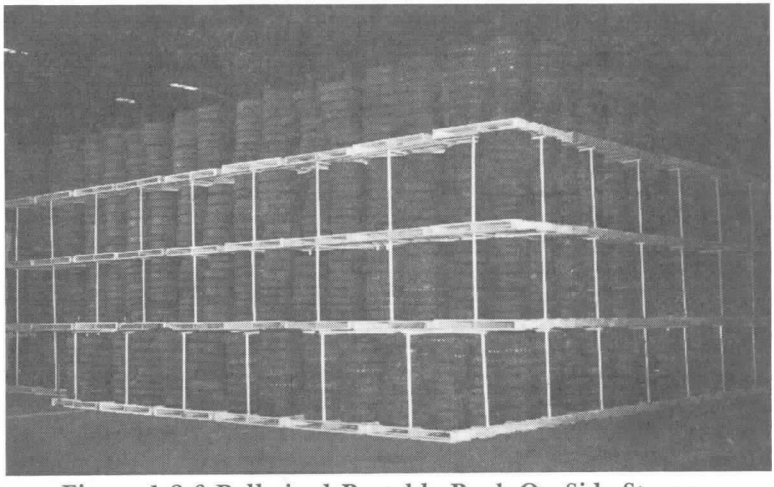


Figure 1-2.6 Palletized Portable Rack On-Side Storage Arrangement

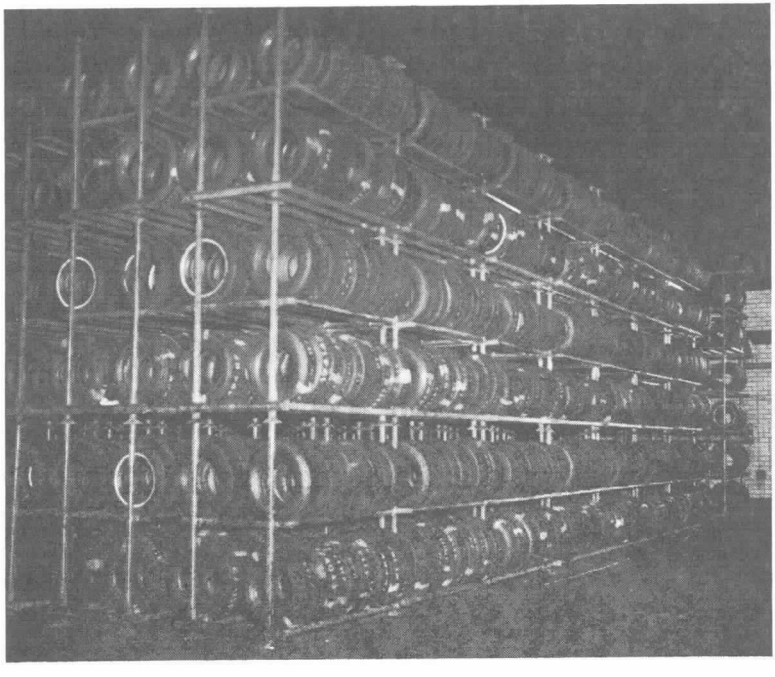


Figure 1-2.7 Open Portable Rack On-Tread Storage Arrangement

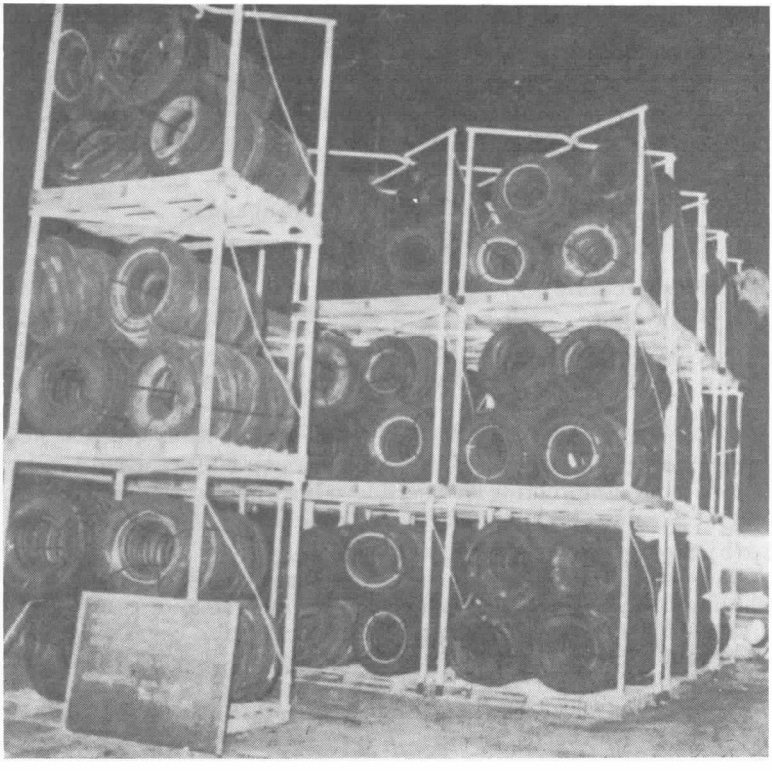


Figure 1-2.8 Bundled Tires — Palletized — Portable Rack On-Tread Storage Arrangement

Chapter 2 Building Arrangement

2-1 Construction.

2-1.1* Buildings used for the storage of tires which are protected according to this standard may be of any of the types described in NFPA 220, *Standard Types of Building Construction.*

2-1.2 Steel columns shall be protected according to the following:

(a) Storage exceeding 15 ft (4.6 m) through 20 ft (6 m) in height. One hour fireproofing or one sidewall sprinkler head directed to one side of the column at 15 ft (4.6 m) level.

(b) Storage exceeding 20 ft (6 m) in height. Two hour fireproofing for the entire length of the column, and including connections with other structural members; or two sidewall sprinkler heads, one at the top of the column and the other at the 15-ft (4.6-m) level, both directed to the side of the column.

Exception: The above protection is not required where storage in fixed racks is protected by in-rack sprinklers.

2-2* Emergency Smoke and Heat Venting.

2-3 Fire Walls.

2-3.1 Where protection in accordance with Section 4-1 is provided, stored tires shall be segregated from other combustible storage by aisles at least 8 ft (2.4m) wide. Where not so protected, stored tires shall be cut off by fire walls.

2-3.2 When tires are stored up to 15 ft (4.6 m) high, walls between adjacent warehouse areas and between manufacturing and warehouse areas shall have not less than a 4-hr fire rating. When tires are stored over 15 ft (4.6 m) high, walls between manufacturing and warehouse areas shall have a fire rating of not less than 6 hrs.

Chapter 3 Storage Arrangement

3-1 Piling Procedures.

3-1.1 Piles shall be not more than 50 ft (15 m) in width except that piles along a wall shall not be more than 25 ft (7.6 m) in width.

Exception: Where tires are stored on tread, the dimension of the pile in the direction of the wheel hole shall be not more than 50 ft (15 m).

3-1.2 The width of main aisles between piles shall be not less than 8 ft (2.4 m).

3-2 Clearances.

3-2.1 The clearance from the top of storage to sprinkler deflectors shall be not less than 3 ft (.9 m).

3-2.2 Storage clearance in all directions from roof structures shall be not less than 3 ft (.9 m).

3-2.3 Storage clearance from ducts shall be maintained in accordance with NFPA 91, *Blower and Exhaust Systems,* Section 240.

3-2.4 Storage clearance from unit heaters, radiant space heaters, duct furnaces and flues shall not be less than 3 ft (.9 m) in all directions, or shall be in accordance with the clearance shown on the approval agency label.

3-2.5 Clearance shall be maintained to lights or light fixtures to prevent possible ignition.

3-2.6 Not less than 24 in. (.6 m) clearance shall be maintained around the path of fire door travel unless a barricade is provided.

Chapter 4 Fire Protection

4-1 Automatic Sprinkler Systems.

4-1.1 Automatic sprinklers, where provided, shall be installed in accordance with NFPA 13, *Standard for Installation of Sprinkler Systems,* except as modified in this chapter.

4-1.2* Sprinkler discharge densities and areas of application shall be in accordance with Table 4-1.2.

4-1.3 System Requirements.

4-1.3.1 For the purpose of selecting sprinkler spacings in hydraulically designed sprinkler systems, to obtain a stipulated density, 60 lb (4 atmospheres) per square in. (414 kPa) shall be the maximum discharge pressure used at the calculation starting point.

4-1.3.2 In buildings which are occupied in part for tire storage, where only a portion of the sprinkler system is hydraulically designed, the design area shall extend not less than 15 ft (4.6 m) beyond the area occupied by the tires.

4-1.4 In-Rack Sprinkler System Requirements.

4-1.4.1 The area protected by a single system of sprinklers in racks (in-rack sprinklers) shall not exceed 40,000 sq ft (3716 m^2) of floor area occupied by the racks, including aisles, regardless of the number of intermediate sprinkler levels.

4-1.4.2 When sprinklers are installed in racks, separate indicating gate valves and drains shall be provided for ceiling sprinklers and sprinklers in racks, except such drains and valves are not required for small in-rack installations of less than 20 sprinklers.

4-1.4.3 Water demand of sprinklers installed in racks shall be added to ceiling sprinkler water demand at the point of connection.

4-1.4.4 Sprinklers in racks shall be ordinary temperature classification with nominal ½ in. (12.7 mm) orifice size pendent or upright.

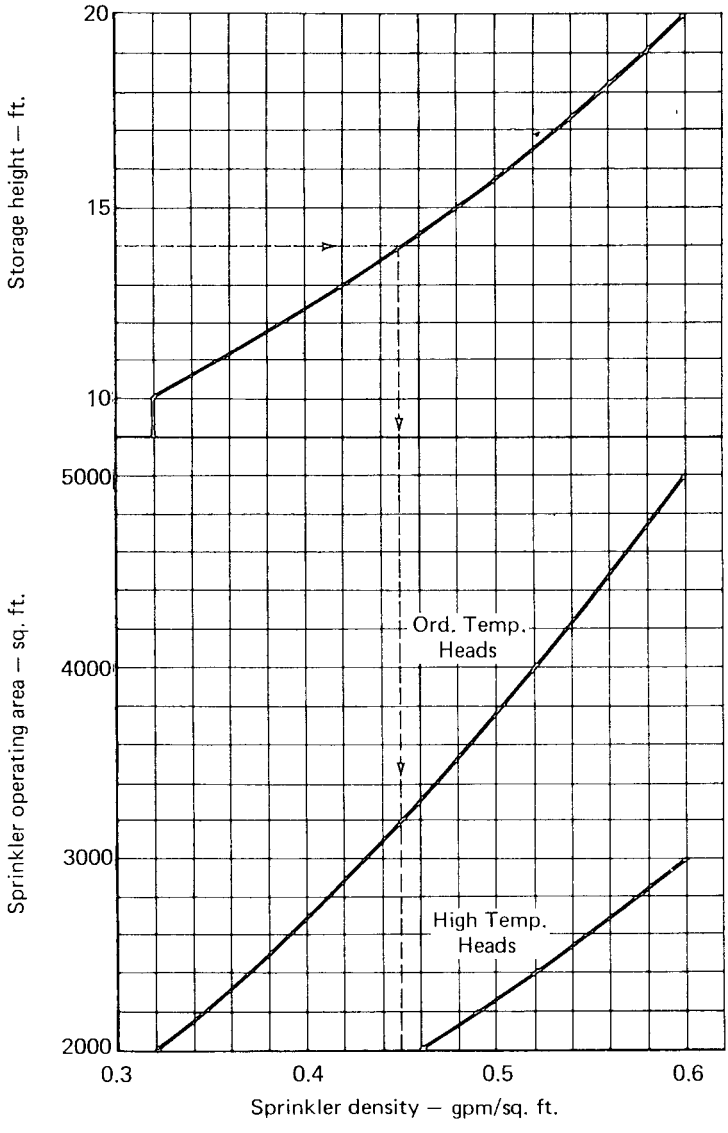


Figure 4-1.2 Sprinkler System Design Curves for Palletized Storage and Fixed Rack Storage with Pallets.

To use curves, enter at storage height (example 14 ft) (4.3 m); read density (0.45) then down to sprinkler operating area; 3200 sq ft (297 m²) for ordinary heads, 2000 sq ft (186 m²), for high temperature heads.

TABLE 4-1.2

Piling Method	Piling Height Feet	Sprinkler Discharge Density — Gallons Per Minute Per Square Foot (See Notes 1 and 2)	Areas of Application Square Feet (See Note 1)	
			Ord. Temp. Heads	High Temp. Heads
1. On Floor				
a. Pyramid piles	Up to 5	See NFPA #13, Standard For Installation of Sprinkler Systems		
b. Other arrangement such that no horizontal channels are formed	5 + to 7	0.24	2,000	2,000
	7 + to 8	0.26	2,000	2,000
c. Tires piled on floor on tread (*See Note 3*)	8 + to 10	0.28	2,000	2,000
	10 + to 12	0.32	2,000	2,000
d. Off the road tires				
2. Palletized				
On side or tread	9 to 20	See Figure 4-1.2		
	20 + to 30	0.3 plus high expansion foam	3,000	3,000
3. Open Portable Rack Storage				
On side or tread	Up to 12	0.6	5,000	3,000
	12 to 20	0.6	(*See Note 4*)	5,000
		0.9	(*See Note 4*)	3,000
		or 0.3 plus high expansion foam	3,000	3,000

4. **Double & Multi-row Fixed Rack Storage on Pallets** On side or tread	9–20	See Fig. 4-1.2	—	—
	20	0.4 plus 1 line in-rack sprinklers	3,000	3,000
		or 0.3 plus high expansion foam	3,000	3,000
5. **Double & Multi-row Fixed Rack Storage Without Pallets or Shelves** On side or tread	Up to 12	0.6	5,000	3,000
	12 to 20	0.6	(*See Note 4*)	5,000
		0.9	(*See Note 4*)	3,000
		or 0.3 plus high expansion foam or 0.4 plus 1 line in-rack sprinklers	3,000	3,000
			3,000	3,000

Notes:

1. Sprinkler discharge densities and areas of application are based on a maximum clearance of 10 feet between sprinkler deflectors and the maximum available height of storage.
2. Densities in table are based on standard sprinklers. In buildings where "old style" sprinkler heads exist, discharge densities shall be increased by 25%.
3. Piles not to exceed 25 feet in direction of wheel holes.
4. Water supply shall fulfill both requirements.

4-1.4.5 The number of sprinklers and the pipe sizing on a line of sprinklers in racks is restricted only by hydraulic calculations, and not by any piping schedule.

4-1.4.6 Water shields shall be provided directly above in-rack sprinklers, or listed sprinklers equipped with water shields shall be used when there is more than one level of in-rack sprinklers.

4-1.4.7 In-rack sprinkler deflectors shall be located at the same level as the bottom of the pallet support to maintain an unobstructed clear space of at least 4 in. (102 mm). In-rack sprinklers shall be located at least 2 ft (0.6 m) from rack uprights.

4-1.4.8 In-rack sprinklers at one level only for storage up to and including 20 ft (6 m) high shall be located at one half to two thirds of the storage height.

4-1.4.9 Maximum horizontal spacing of sprinklers in racks shall be 8 ft (2.4 m).

4-1.4.10 Sprinklers in racks shall discharge at not less than 30 psi (207 kPa) for all classes of commodity.

4-1.4.11 Water demand for sprinklers installed in racks shall be based on simultaneous operation of the most hydraulically remote 12 sprinklers when only one level is installed in racks.

4-2 High Expansion Foam Systems.

4-2.1* High expansion foam systems installed in accordance with NFPA 11A, *Standard for High Expansion Foam Systems,* as modified herein, may be installed in addition to automatic sprinklers. When so installed, a reduction in sprinkler discharge density to one half the density specified in Table 4-1.2 or 0.24 gal per min per sq ft [9.78 (L/min)/m^2], whichever is higher, will be allowed.

4-2.2 High expansion foam systems shall be automatic in operation.

4-2.3 Detectors shall be listed and shall be installed at the ceiling at one half listed spacing in accordance with NFPA 72E, *Standard for Automatic Fire Detectors.*

4-2.4 Detection systems, concentrate pumps, generators and other system components essential to the operation of the system shall have an approved standby power source.

4-3 Water Supplies.

4-3.1 The rate of water supply shall be sufficient to provide the required sprinkler discharge density over the required area of application plus provision for generation of high expansion foam and in-rack sprinklers when used.

4-3.2 Total water supplies shall include provision for not less than 750 gal/min (2835 L) for hose streams, in addition to that required for automatic sprinklers and foam systems. Water supplies shall be capable of supplying the demand for sprinkler systems and hose streams for not less than 3 hrs.

4-3.3* Where dry pipe systems are used, the area of sprinkler application shall be increased by not less than 30 percent.

4-4 Manual Inside Protection.

4-4.1 Where automatic sprinkler protection is provided, small hose (1½ in.) (38 mm) shall be provided to reach any portion of the storage area. Small hose may be supplied from

(a) Hydrants, or

(b) A separate piping system for small hose stations, or

(c) Valved hose connections on sprinkler risers where such connections are made upstream of sprinkler control valves, or

(d) Adjacent sprinkler systems.

4-4.2* In locations where small hose is provided, portable fire extinguishers for Class A fires may be omitted in storage areas.

4-5 Hydrants. At locations without public hydrants, or where hydrants are not within 250 ft (76 m), private hydrants shall be installed in accordance with NFPA 24, *Standard for Outside Protection.*

4-6 Alarm Service.

4-6.1 Automatic sprinkler systems and foam systems where provided shall have approved central station, auxiliary, remote station or proprietary waterflow alarm service.

Exception: Local waterflow alarm service may be provided where recorded guard service is also provided. (See NFPA 601.)

4-6.2 Alarm service shall comply with one of the following: NFPA 71, 72A, 72B, 72C or 72D.

4-7*† Fire Emergency Organization.

4-7.1 Arrangements shall be made to permit rapid entry into the premises by the municipal fire department, police department, or other authorized personnel in case of fire or other emergency.

4-7.2 Plant emergency organizations where provided shall be instructed and trained in the following procedures:

(a) Maintaining the security of the premises.

(b) Means of summoning outside aid immediately in an emergency.

(c) Use of portable extinguishers and small hose lines or small fires and mop-up operations.

(d) Operation of the sprinkler system and water supply equipment.

(e) Use of material handling equipment while sprinklers are still operating to effect final extinguishment.

(f) Supervision of sprinkler valves after the system is turned off so that the system can be reactivated if rekindling occurs.

4-7.3 A fire watch shall be maintained when the sprinkler system is not in service.

Chapter 5 Building Equipment, Maintenance and Operations

5-1 Mechanical Handling Equipment.

5-1.1 Industrial Trucks. Power-operated industrial trucks shall comply with NFPA 505, *Standard for Powered Industrial Trucks, Including Type Designations and Areas of Use.*

5-2 Storage of Empty Wood Pallets. Wood pallets shall be stored in accordance with the requirements of NFPA 231, *Indoor General Storage,* Section 4-4.

5-3 Cutting and Welding Operations.

5-3.1 When welding or cutting operations are necessary, the precautions contained in NFPA 51B, *Cutting and Welding Processes,* shall be followed. When possible, work shall be removed to a safe area.

5-3.2 Welding, soldering, brazing, and cutting may be performed on rack or building components which cannot be removed, provided no storage is located below and within 25 ft (7.6m) of the working area, and flameproof tarpaulins enclose this section. During any of these operations the sprinkler system shall be in service. Extinguishers suitable for Class A fires with a minimum rating of 2A and charged inside hose lines where provided shall be located in the working area. A fire watch shall be maintained during these operations and for not less than 30 min following completion of open flame operation.

5-4 Waste Disposal. Rubbish, trash, and other waste material shall be disposed of at regular intervals. (*See NFPA 82, Standard on Incinerators and Rubbish Handling, Section 80.*)

5-5 Smoking. Smoking shall be strictly prohibited, except in locations prominently designated as smoking areas. "No Smoking" signs shall be posted in prohibited areas.

5-6 Maintenance and Inspection.

5-6.1 Fire walls, fire doors, and floors shall be maintained in good repair at all times.

5-6.2* The sprinkler system and the water supplies shall be maintained and serviced.

Appendix A

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

A-1-2 Units. One H78-14 passenger tire weights about 25 lb (11 kg). One heavy service (truck) tire, size 10.00-20 weighs above 100 lb (45 kg) and is equivalent to four passenger units. Light heavy service tires vary in size and weight from passenger size to heavy service size—on the average being about 2½ equivalent passenger units. Other types of tires are found in a broad range of sizes. Except in large warehouses they are not likely to be encountered in significant quantities.

A-2-1.1 Building codes and insurance requirements may affect the type of construction selected.

A-2-2 Smoke removal is important to manual fire-fighting and overhaul. Since most fire tests were conducted without smoke and heat venting, protection specified in Section 4-1 was developed without the use of such venting. However, venting through eaveline windows, doors, monitors, gravity or mechanical exhaust systems is essential to smoke removal after control of the fire is achieved.

A-4-1.2 Density and areas of application in Table 4-1.2 have been developed from fire test data. Protection requirements for other storage methods are beyond the scope of the standard at the present time. From recent fire testing with densities (0.45 gpm/sq ft and higher) [(18.3 L/min)/m²] there have been indications that large orifice sprinklers at greater than 50 sq ft (4.6 m²) spacing produce better results than the ½ in. (12.7 mm) orifice sprinklers at 50 sq ft (4.6 m²) spacing.

A-4-2.1 In existing buildings to be used for tire storage, high expansion foam might be used to augment an existing sprinkler system whose calcalated density was below that required for the proposed storage height. For example, an existing system calculated to provide 0.25 gpm/sq ft [(10.2 L/min)/m²] could be used for storages requiring up to 0.50 gpm/sq ft [(20.3 L/min)/m²] with the addition of a high expansion foam system. An alternative may be to reinforce or redesign the sprinkler system.

A-4-3.3 Wet systems are recommended for tire storage occupancies. Dry systems are acceptable only where it is impracticable to provide heat.