NFPA No.

231D

STANDARD FOR STORAGE OF RUBBER TIRES 1975

NATIONAL FIRE PROTECTION ASSOCIATION

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See Inside Back Cover for Official NFPA Definitions

Standard for

Storage of Rubber Tires

NFPA No. 231D — 1975

Origin and Development of 231D

The tentative standard was developed by a subcommittee. It was approved by the Committee on General Storage, and was adopted as a tentative standard at the NFPA Annual Meeting in May 1974.

1975 Edition of No. 231D

This first official edition of NFPA No. 231D was prepared by the Committee on General Storage. It includes revisions made to the tentative standard, and was adopted at the NFPA Fall Conference in 1975.

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Interpretation Procedure of the Committee on General Storage

Those desiring an interpretation shall supply the Chairman with five identical copies of a statement in which shall appear specific reference to a single problem, paragraph, or section. Such a statement shall be on the business stationery of the inquirer and shall be duly signed.

When applications involve actual field situations they shall so state and all parties involved shall be named.

The Interpretations Committee will reserve the prerogative to refuse consideration of any application that refers specifically to proprietary items of equipment or devices. Generally inquiries should be confined to interpretation of the literal text or the intent thereof.

Requests for interpretations should be addressed to the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

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Storage of Rubber Tires

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NOTICE

An asterisk (*) preceding the number designating a paragraph or section in the text indicates recommendations in regard to that paragraph or section in Appendix A.

A dagger (†) preceding 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 1-2.

1-2 Definitions.

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.

Horizontal Channel. Any uninterrupted space in excess of five feet in length between horizontal layers of stored tires. Such channels may be formed by pallets, shelving, racks or other storage arrangements.

Rack means 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 pallet loads. (*See Figures 1–2.1 to 1–2.8*)

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

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

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

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

On-side Storage means tires stored horizontally or flat. (*See Figure 1–2.6*)

On-tread Storage means tires stored vertically or on their treads. (*See Figure 1–2.7*)

On-floor Storage means 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.

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

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

***Units** (equivalent passenger) means one average size passenger tire weighing approximately 25 pounds.

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

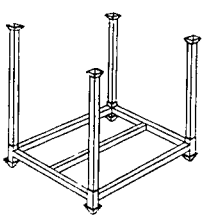
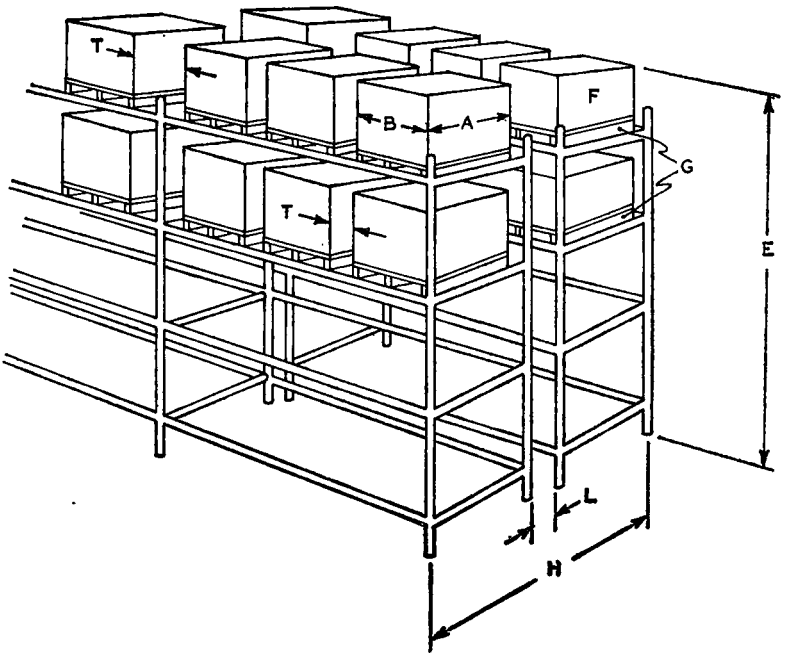


Fig. 1-2.1 Open Portable Rack Unit

Fig. 1-2.2 Palletized Portable Rack Unit

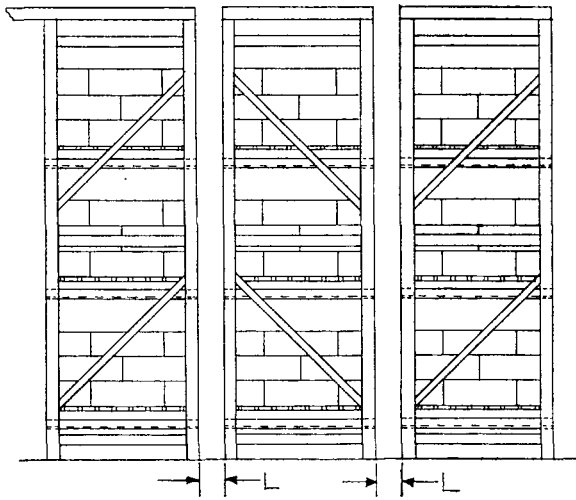
Fig. 1-2.3 Open Portable Racks

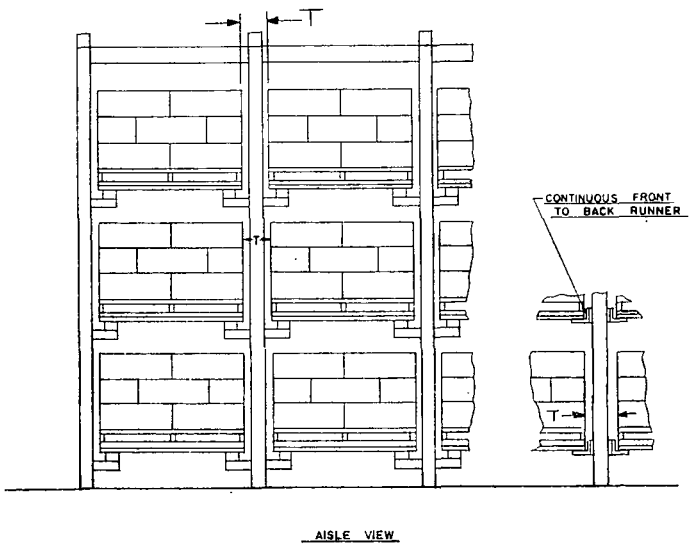


Legend

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

Fig. 1-2.4 Double Row Racks without Solid or Slatted Shelves





Legend

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

Fig. 1-2.5 Multiple-Row Rack

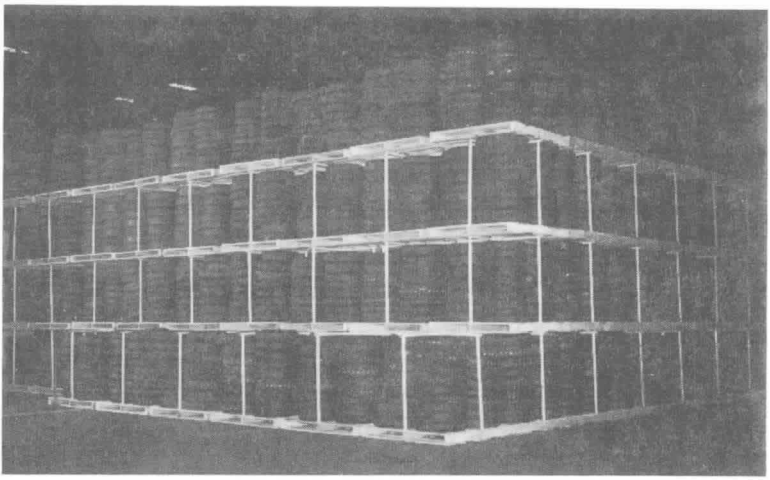


Fig. 1-2.6 Palletized Portable Rack On-Side Storage Arrangement

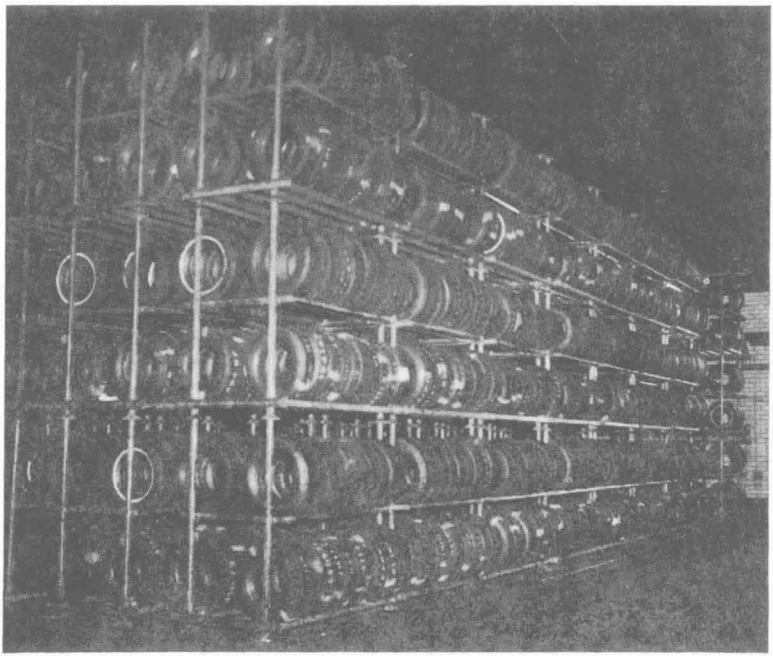


Fig. 1-2.7 Open Portable Rack On-Tread Storage Arrangement

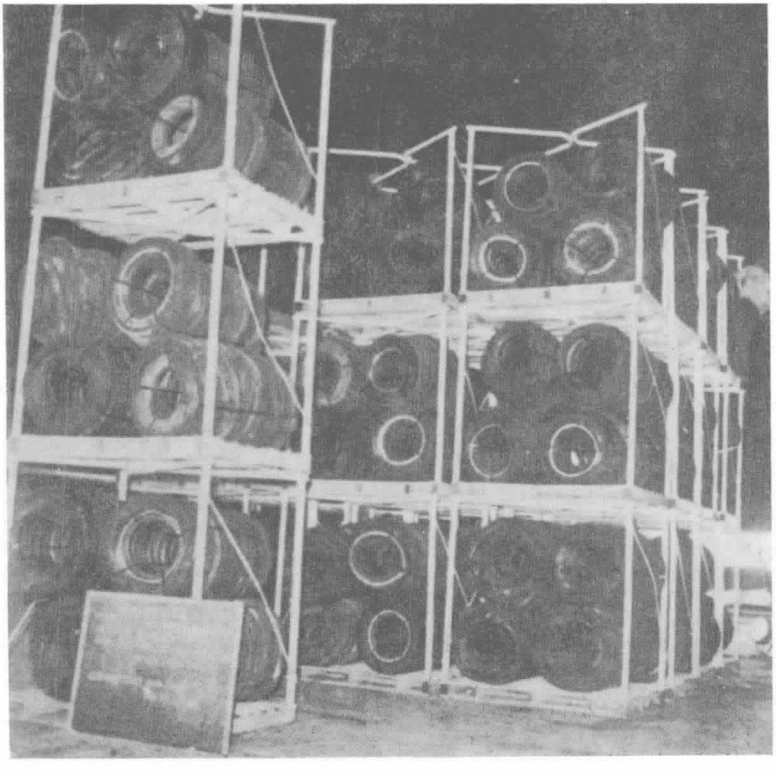


Fig. 1-2.8 Bundled Tires — Palletized — Portable Rack On-Tread Storage Arrangement

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 *Standard Types of Building Construction, NFPA No. 220–1975.*

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

(a) Storage exceeding 15 feet through 20 feet in height.
One hour fireproofing or one sidewall sprinkler head directed to one side of the column at 15-foot level.

(b) Storage exceeding 20 feet 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-foot 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.

2-1.3 Where protection in accordance with Section 4-1 is provided, stored tires shall be segregated from other combustible storage by aisles at least eight feet wide. Where not so protected, stored tires shall be cut off by fire walls. (*See 2-1.4.*)

2-1.4 When tires are stored up to 15 feet high, walls between adjacent warehouse areas and between manufacturing and warehouse areas shall have not less than a four hour fire rating. When tires are stored over 15 feet high, walls shall have not less than a six hour fire rating.

*2-2 Emergency Smoke and Heat Venting.

Chapter 3 Storage Arrangement

3-1 Piling Procedures.

3-1.1 Piles shall be not more than 50 feet in width except that piles along a wall shall not be more than 25 feet 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 feet.

3-1.2 The width of main aisles between piles shall be not less than eight feet.

3-2 Clearances.

3-2.1 The clearance from the top of storage to sprinkler deflectors shall be not less than three feet.

3-2.2 Storage clearance from ducts shall be maintained in accordance with *Blower and Exhaust Systems, NFPA No. 91 — 1973, Section 240.*

3-2.3 Storage clearance from unit heaters, radiant space heaters, duct furnaces and flues shall not be less than three feet in all directions, or shall be in accordance with the clearance shown on the approval agency label.

3-2.4 Clearance shall be maintained to lights or light fixtures to prevent possible ignition.

3-2.5 Not less than 24 inches 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 the *Standard for Installation of Sprinkler Systems, NFPA No. 13–1975*, 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 pounds per square inch 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 feet 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 square feet 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-inch orifice size pendent or upright.

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.

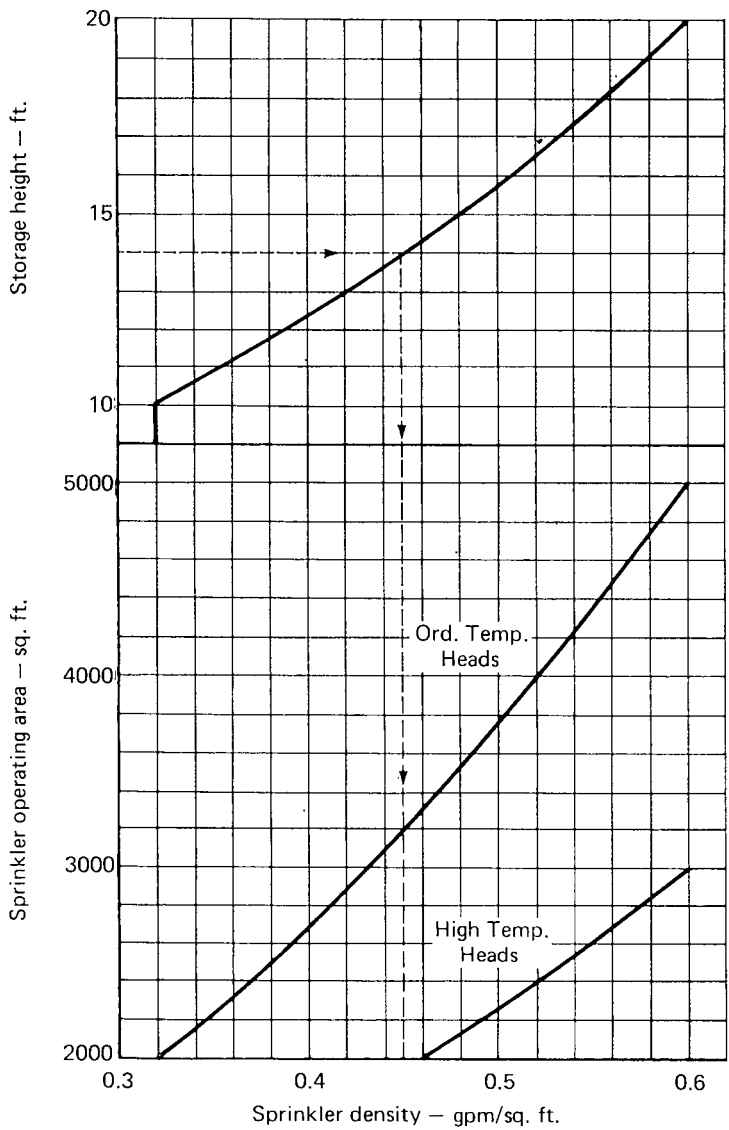


Fig. 4-1.2 Sprinkler System Design Curves for Palletized Storage and Fixed Rack Storage with Pallets.

To use curves, enter at storage height (example 14 ft.); read density (0.45) then down to sprinkler operating area; 3200 sq. ft. for ordinary heads, 2000 sq. ft., 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 Hi-X*	3,000	3,000
3. Open Portable Rack Storage	(2 racks) 12 (approx.)	0.6	5,000	3,000
On side or tread	(3 racks) 18 (approx.)	0.6	(*See Note 4*)	5,000
		0.9	(*See Note 4*)	3,000
		or 0.3 plus Hi-X*	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 Hi-X*	3,000	3,000
5. Double & Multi-row Fixed Rack Storage Without Pallets or Shelves On side or tread	12	0.6	5,000	3,000
	20	0.6	(*See Note 4*)	5,000
		0.9	(*See Note 4*)	3,000
		or 0.3 plus Hi-X*	3,000	3,000
		or 0.4 plus 1 line in-rack sprinklers	3,000	3,000

*High Expansion Foam

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.

4-1.4.7 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 inches. In-rack sprinklers shall be located at least two feet from rack uprights.

4-1.4.8 In-rack sprinklers at one level only for storage up to and including 20 feet high shall be located at ½ to ⅔ of the storage height.

4-1.4.9 Maximum horizontal spacing of sprinklers in racks shall be 8 feet.

4-1.4.10 Sprinklers in racks shall discharge at not less than 30 psi 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 *Standard for High Expansion Foam Systems, NFPA No. 11A–1970*, 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 gallons per minute per square foot, 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.

4-2.4 Detection systems, concentrate pumps, generators and other system components essential to the operation of the system shall have an approved stand-by 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 gallons-per-minute 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 three hours.

*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 inch) 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.

4-5.1 At locations without public hydrants, or where hydrants are not within 250 feet, private hydrants shall be installed in accordance with *Standard for Outside Protection, NFPA No. 24–1973.*

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 No. 601–1968.)

4-6.2 Alarm service shall comply with one of the following: *NFPA Nos. 71–1974, 72A–1974, 72B–1974, 72C–1974 or 72D–1974.*

†*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 on 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 — 1975, Standard for Powered Industrial Trucks, Including Type Designations and Areas of Use.*

5-2 Storage of Empty Wood Pallets.

5-2.1 Wood pallets shall be stored in accordance with the requirements of *Indoor General Storage, NFPA No. 231 — 1974, Section 4-4.*

5-3 Cutting and Welding Operations.

5-3.1 When welding or cutting operations are necessary, the precautions contained in *Cutting and Welding Processes, NFPA No. 51B — 1971,* 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 feet 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 minutes following completion of open flame operation.

5-4 Waste Disposal. Rubbish, trash, and other waste material shall be disposed of at regular intervals. (*See Standard on Incinerators and Rubbish Handling, NFPA No. 82 — 1972, 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.