CHAPTER 32
HIGH-PILE COMBUSTIBLE STORAGE

SECTION 3201
GENERAL

3201.1 Scope.
High-piled combustible storage shall be in accordance with this chapter. In addition to the requirements of this chapter, the following material-specific requirements shall apply:

1. Aerosols shall be in accordance with Chapter 51.
2. Flammable and combustible liquids shall be in accordance with Chapter 57.
3. Hazardous materials shall be in accordance with Chapter 50.
4. Storage of combustible paper records shall be in accordance with NFPA 13.
5. Storage of combustible fibers shall be in accordance with Chapter 52.
6. General storage of combustible material shall be in accordance with Chapter 3.

3201.2 Permits.
A permit shall be required as set forth in Section 105.6.

3201.3 Construction documents.
At the time of building permit application for new structures designed to accommodate high-piled storage or for requesting a change of occupancy/use, and at the time of application for a storage permit, plans and specifications shall be submitted for review and approval. In addition to the information required by the International Building Code, the storage permit submittal shall include the information specified in this section. Following approval of the plans, a copy of the approved plans shall be maintained on the premises in an approved location. The plans shall include the following:

1. Floor plan of the building showing locations and dimensions of high-piled storage areas.
2. Usable storage height for each storage area.
3. Number of tiers within each rack, if applicable.
4. Commodity clearance between top of storage and the sprinkler deflector for each storage arrangement.
5. Aisle dimensions between each storage array.
6. Maximum pile volume for each storage array.

7. Location and classification of commodities in accordance with Section 3203.

8. Location of commodities which are banded or encapsulated.

9. Location of required fire department access doors.

10. Type of fire suppression and fire detection systems.

11. Location of valves controlling the water supply of ceiling and in-rack sprinklers.

12. Type, location and specifications of smoke removal and curtain board systems.


14. Additional information regarding required design features, commodities, storage arrangement and fire protection features within the high-piled storage area shall be provided at the time of permit, when required by the fire code official.

3201.4 Evacuation plan.
When required by the fire code official, an evacuation plan for public accessible areas and a separate set of plans indicating location and width of aisles, location of exits, exit access doors, exit signs, height of storage, and locations of hazardous materials shall be submitted at the time of permit application for review and approval. Following approval of the plans, a copy of the approved plans shall be maintained on the premises in an approved location.

SECTION 3202
DEFINITIONS

3202.1 Definitions.
The following terms are defined in Chapter 2:

ARRAY.

ARRAY, CLOSED.

AUTOMATED RACK STORAGE.

BIN BOX.

COMMODITY.
DRAFT CURTAIN.

EARLY SUPPRESSION FAST-RESPONSE (ESFR) SPRINKLER.

EXPANDED PLASTIC.

EXTRA-HIGH-RACK COMBUSTIBLE STORAGE.

HIGH-PILED COMBUSTIBLE STORAGE.

HIGH-PILED STORAGE AREA.

LONGITUDINAL FLUE SPACE.

MANUAL STOCKING METHODS.

MECHANICAL STOCKING METHODS.

SHELF STORAGE.

SOLID SHELVING.

SPECULATIVE BUILDING.

TRANSVERSE FLUE SPACE.

SECTION 3203
COMMODITY CLASSIFICATION

3203.1 Classification of commodities.
Commodities shall be classified as Class I, II, III, IV or high hazard in accordance with this section and NFPA 13. Materials listed within each commodity classification are assumed to be unmodified for improved combustibility characteristics. Use of flame-retarding modifiers or the physical form of the material could change the classification. See Section 3203.7 for classification of Group A, B and C plastics.

3203.2 Class I commodities.
Class I commodities are essentially noncombustible products on wooden or nonexpanded polyethylene solid deck pallets, in ordinary corrugated cartons with or without single-thickness
dividers, or in ordinary paper wrappings with or without pallets. Class I commodities are allowed to contain a limited amount of Group A plastics in accordance with Section 3203.7.4. Examples of Class I commodities include, but are not limited to, the following:

- Alcoholic beverages not exceeding 20-percent alcohol
- Appliances noncombustible, electrical
- Cement in bags
- Ceramics
- Dairy products in nonwax-coated containers (excluding bottles)
- Dry insecticides
- Foods in noncombustible containers
- Fresh fruits and vegetables in nonplastic trays or containers
- Frozen foods
- Glass
- Glycol in metal cans
- Gypsum board
- Inert materials, bagged
- Insulation, noncombustible
- Noncombustible liquids in plastic containers having less than a 5-gallon (19 L) capacity
- Noncombustible metal products

3203.3 Class II commodities.
Class II commodities are Class I products in slatted wooden crates, solid wooden boxes, multiple-thickness paperboard cartons or equivalent combustible packaging material with or without pallets. Class II commodities are allowed to contain a limited amount of Group A plastics in accordance with Section 3203.7.4. Examples of Class II commodities include, but are not limited to, the following:

- Alcoholic beverages not exceeding 20-percent alcohol, in combustible containers
- Foods in combustible containers
- Incandescent or fluorescent light bulbs in cartons
- Thinly coated fine wire on reels or in cartons

3203.4 Class III commodities.
Class III commodities are commodities of wood, paper, natural fiber cloth, or Group C plastics or products thereof, with or without pallets. Products are allowed to contain limited amounts of Group A or B plastics, such as metal bicycles with plastic handles, pedals, seats and tires. Group A plastics shall be limited in accordance with Section 3203.7.4. Examples of Class III commodities include, but are not limited to, the following:

- Aerosol, Level 1 (see Chapter 28)
- Combustible fiberboard
- Cork, baled
- Feed, bagged
- Fertilizers, bagged
- Food in plastic containers
- Furniture: wood, natural fiber, upholstered, nonplastic, wood or metal with plastic-padded and covered arm-rests
- Glycol in combustible containers not exceeding 25 percent
- Lubricating or hydraulic fluid in metal cans
<table>
<thead>
<tr>
<th>Commodity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumber</td>
</tr>
<tr>
<td>Mattresses, excluding foam rubber and foam plastics</td>
</tr>
<tr>
<td>Noncombustible liquids in plastic containers having a capacity of more than 5 gallons (19 L)</td>
</tr>
<tr>
<td>Paints, oil base, in metal cans</td>
</tr>
<tr>
<td>Paper, waste, baled</td>
</tr>
<tr>
<td>Paper and pulp, horizontal storage, or vertical storage that is banded or protected with approved wrap</td>
</tr>
<tr>
<td>Paper in cardboard boxes</td>
</tr>
<tr>
<td>Pillows, excluding foam rubber and foam plastics</td>
</tr>
<tr>
<td>Plastic-coated paper food containers</td>
</tr>
<tr>
<td>Plywood</td>
</tr>
<tr>
<td>Rags, baled</td>
</tr>
<tr>
<td>Rugs, without foam backing</td>
</tr>
<tr>
<td>Sugar, bagged</td>
</tr>
<tr>
<td>Wood, baled</td>
</tr>
<tr>
<td>Wood doors, frames and cabinets</td>
</tr>
<tr>
<td>Yarns of natural fiber and viscose</td>
</tr>
</tbody>
</table>

### 3203.5 Class IV commodities.
Class IV commodities are Class I, II or III products containing Group A plastics in ordinary corrugated cartons and Class I, II and III products with Group A plastic packaging, with or without wooden or plastic pallets. Group B plastics and free-flowing Group A plastics are also included in this class. The total amount of nonfree-flowing Group A plastics shall be in accordance with Section 3203.7.4. Examples of Class IV commodities include, but are not limited to, the following:

- Aerosol, Level 2 (see Chapter 51)
- Alcoholic beverages, exceeding 20-percent but less than 80-percent alcohol, in cans or bottles in cartons
- Clothing, synthetic or nonviscose
- Combustible metal products (solid)
- Furniture, plastic upholstered
- Furniture, wood or metal with plastic covering and padding
- Glycol in combustible containers (greater than 25 percent and less than 50 percent)
- Linoleum products
- Paints, oil base in combustible containers
- Pharmaceutical, alcoholic elixirs, tonics, etc.
- Rugs, foam back
- Shingles, asphalt
- Thread or yarn, synthetic or nonviscose

### 3203.6 High-hazard commodities.
High-hazard commodities are high-hazard products presenting special fire hazards beyond those of Class I, II, III or IV. Group A plastics not otherwise classified are included in this class. Examples of high-hazard commodities include, but are not limited to, the following:

- Aerosol, Level 3 (see Chapter 51)
- Alcoholic beverages, exceeding 80-percent alcohol, in bottles or cartons
- Commodities of any class in plastic containers in carousel storage
- Flammable solids (except solid combustible metals)
Glycol in combustible containers (50 percent or greater)
Lacquers, which dry by solvent evaporation, in metal cans or cartons
Lubricating or hydraulic fluid in plastic containers
Mattresses, foam rubber or foam plastics
Pallets and flats which are idle combustible
Paper and pulp, rolled, in vertical storage which is unbanded or not protected with an approved wrap
Paper, asphalt, rolled, horizontal storage
Paper, asphalt, rolled, vertical storage
Pillows, foam rubber and foam plastics
Pyroxylin
Rubber tires
Vegetable oil and butter in plastic containers

3203.7 Classification of plastics.
Plastics shall be designated as Group A, B or C in accordance with Sections 3203.7.1 through 3203.7.4.

3203.7.1 Group A plastics.
Group A plastics are plastic materials having a heat of combustion that is much higher than that of ordinary combustibles, and a burning rate higher than that of Group B plastics. Examples of Group A plastics include, but are not limited to, the following:

ABS (acrylonitrile-butadiene-styrene copolymer)
Acetal (polyformaldehyde)
Acrylic (polymethyl methacrylate)
Butyl rubber
EPDM (ethylene propylene rubber)
FRP (fiberglass-reinforced polyester)
Natural rubber (expanded)
Nitrile rubber (acrylonitrile butadiene rubber)
PET or PETE (polyethylene terephthalate)
Polybutadiene
Polycarbonate
Polyester elastomer
Polyethylene
Polypropylene
Polystyrene (expanded and unexpanded)
Polyurethane (expanded and unexpanded)
PVC (polyvinyl chloride greater than 15-percent plasticized, e.g., coated fabric unsupported film)
SAN (styrene acrylonitrile)
SBR (styrene butadiene rubber)

3203.7.2 Group B plastics.
Group B plastics are plastic materials having a heat of combustion and a burning rate higher than that of ordinary combustibles, but not as high as those of Group A plastics. Examples of Group B plastics include, but are not limited to, the following:

Cellulosics (cellulose acetate, cellulose acetate butyrate, ethyl cellulose)
Chloroprene rubber
Fluoroplastics (ECTFE, ethylene-chlorotrifluoroethylene copolymer; ETFE, ethylene-
tetrafluoroethylene copolymer; FEP, fluorinated ethylene-propylene copolymer)
Natural rubber (nonexpanded)
Nylon (Nylon 6, Nylon 6/6)
PVC (polyvinyl chloride greater than 5-percent, but not exceeding 15-percent plasticized)
Silicone rubber

3203.7.3 Group C plastics.
Group C plastics are plastic materials having a heat of combustion and a burning rate
similar to those of ordinary combustibles. Examples of Group C plastics include, but are not
limited to, the following:

  Fluoroplastics (PCTFE, polychlorotrifluoroethylene; PTFE, polytetrafluoroethylene)
  Melamine (melamine formaldehyde)
  Phenol
  PVC (polyvinyl chloride, rigid or plasticized less than 5 percent, e.g., pipe, pipe fittings)
  PVDC (polyvinylidene chloride)
  PVDF (polyvinylidene fluoride)
  PVF (polyvinyl fluoride)
  Urea (urea formaldehyde)

3203.7.4 Limited quantities of Group A plastics in mixed commodities.
Figure 3203.7.4 shall be used to determine the quantity of Group A plastics allowed to be
stored in a package or carton or on a pallet without increasing the commodity classification.
FIGURE 3203.7.4
MIXED COMMODITIES

a. This figure is intended to determine the commodity classification of a mixed commodity in a package, carton or on a pallet where plastics are involved.

b. The following is an example of how to apply the figure: A package containing a Class III commodity has 12-percent Group A expanded plastic by volume. The weight of the unexpanded Group A plastic is 10 percent. This commodity is classified as a Class IV commodity. If the weight of the unexpanded plastic is increased to 14 percent, the classification changes to a high-hazard commodity.

$$\frac{\text{Volume of plastic in pallet load}}{\text{Total volume of pallet load, including pallet}}$$

c. Percent by volume =
d. Percent by weight = 

SECTION 3204
DESIGNATION OF HIGH-PILED STORAGE AREAS

3204.1 General.
High-piled storage areas, and portions of high-piled storage areas intended for storage of a different commodity class than adjacent areas, shall be designed and specifically designated to contain Class I, Class II, Class III, Class IV or high-hazard commodities. The designation of a high-piled combustible storage area, or portion thereof intended for storage of a different commodity class, shall be based on the highest hazard commodity class stored except as provided in Section 3204.2.

3204.2 Designation based on engineering analysis.
The designation of a high-piled combustible storage area, or portion thereof, is allowed to be based on a lower hazard class than that of the highest class of commodity stored when a limited quantity of the higher hazard commodity has been demonstrated by engineering analysis to be adequately protected by the automatic sprinkler system provided. The engineering analysis shall consider the ability of the sprinkler system to deliver the higher density required by the higher hazard commodity. The higher density shall be based on the actual storage height of the pile or rack and the minimum allowable design area for sprinkler operation as set forth in the density/area figures provided in NFPA 13. The contiguous area occupied by the higher hazard commodity shall not exceed 120 square feet (11 m²) and additional areas of higher hazard commodity shall be separated from other such areas by 25 feet (7620 mm) or more. The sprinkler system shall be capable of delivering the higher density over a minimum area of 900 square feet (84 m²) for wet pipe systems and 1,200 square feet (111 m²) for dry pipe systems. The shape of the design area shall be in accordance with Section 903.

SECTION 3205
HOUSEKEEPING AND MAINTENANCE

3205.1 Rack structures.
The structural integrity of racks shall be maintained.

3205.2 Ignition sources.
Clearance from ignition sources shall be provided in accordance with Section 305.

3205.3 Smoking.
Smoking shall be prohibited. Approved “No Smoking” signs shall be conspicuously posted in accordance with Section 310.

3205.4 Aisle maintenance.
When restocking is not being conducted, aisles shall be kept clear of storage, waste material and debris. Fire department access doors, aisles and exit doors shall not be obstructed. During restocking operations using manual stocking methods, a minimum unobstructed aisle width of
24 inches (610 mm) shall be maintained in 48-inch (1219 mm) or smaller aisles, and a minimum unobstructed aisle width of one-half of the required aisle width shall be maintained in aisles greater than 48 inches (1219 mm). During mechanical stocking operations, a minimum unobstructed aisle width of 44 inches (1118 mm) shall be maintained in accordance with Section 3206.9.

3205.5 Pile dimension and height limitations. Pile dimensions and height limitations shall comply with Section 3207.3.

3205.6 Designation of storage heights. Where required by the fire code official, a visual method of indicating the maximum allowable storage height shall be provided.

3205.7 Arrays. Arrays shall comply with Section 3207.4.

3205.8 Flue spaces. Flue spaces shall comply with Section 3208.3.

SECTION 3206
GENERAL FIRE PROTECTION AND LIFE SAFETY FEATURES

3206.1 General. Fire protection and life safety features for high-piled storage areas shall be in accordance with Sections 3206.2 through 3206.10.

3206.2 Extent and type of protection. Where required by Table 3206.2, fire detection systems, smoke and heat removal, draft curtains and automatic sprinkler design densities shall extend the lesser of 15 feet (4572 mm) beyond the high-piled storage area or to a permanent partition. Where portions of high-piled storage areas have different fire protection requirements because of commodity, method of storage or storage height, the fire protection features required by Table 3206.2 within this area shall be based on the most restrictive design requirements.

3206.2.1 Speculative building. Group S, F and M speculative buildings that have an interior clear height greater than 12 feet where high pile storage may accrue shall comply with this chapter.
### TABLE 3206.2
GENERAL FIRE PROTECTION AND LIFE SAFETY REQUIREMENTS

<table>
<thead>
<tr>
<th>COMMODITY CLASS</th>
<th>SIZE OF HIGH-PILED STORAGE AREA&lt;sup&gt;a&lt;/sup&gt; (square feet) (see Sections 3206.2 and 3206.4)</th>
<th>ALL STORAGE AREAS&lt;sup&gt;b&lt;/sup&gt; (See Sections 3206, 3207 and 3208)</th>
<th>SOLID-PILED STORAGE, SHELF STORAGE AND PALLETIZED STORAGE (see Section 3207.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Automatic fire-extinguishing system (see Section 3206.4)</td>
<td>Fire detection system (see Section 3206.5)</td>
<td>Building access (see Section 3206.6)</td>
</tr>
<tr>
<td>I-IV</td>
<td>0-500</td>
<td>Not Required&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Not Required&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>501-2,500</td>
<td>Not Required&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Yes&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>2,501-12,000 Public accessible</td>
<td>Yes</td>
<td>Not Required&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>2,501-12,000 Nonpublic accessible (Option 1)</td>
<td>Yes</td>
<td>Not Required&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> As noted in Sections 3206.2 and 3206.4

<sup>b</sup> As noted in Sections 3206, 3207 and 3208

<sup>c</sup> As noted in Section 3206.7

<sup>d</sup> As noted in Section 3206.7
<table>
<thead>
<tr>
<th>Height Range</th>
<th>Not Required</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>100</th>
<th>30</th>
<th>200,000</th>
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<tbody>
<tr>
<td>2,501-12,000 Nonpublic</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>100</td>
<td>30</td>
<td>200,000</td>
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<td>12,001-20,000</td>
<td>Yes</td>
<td>Not Required</td>
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<td>Yes</td>
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<td>40</td>
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<td>20,001-500,000</td>
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<td>40</td>
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<td>Greater than 500,000</td>
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<td>Yes</td>
<td>Not Required</td>
<td>100</td>
<td>40</td>
<td>400,000</td>
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<td>High hazard</td>
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<tr>
<td>0-500</td>
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<td>Not Required</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Not Required</td>
<td>50</td>
<td>Not Required</td>
<td>Not Required</td>
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<tr>
<td>501-2,500 Public accessible</td>
<td>Yes</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Not Required</td>
<td>50</td>
<td>30</td>
<td>75,000</td>
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<tr>
<td>501-2,500 Nonpublic</td>
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<td>Not Required</td>
<td>Not Required</td>
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<td>Not Required</td>
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<td>2,501-300,000</td>
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<td>Not Required</td>
<td>Yes</td>
<td>Yes</td>
<td>Not Required</td>
<td>50</td>
<td>30</td>
<td>75,000</td>
</tr>
<tr>
<td>300,001-500,000</td>
<td>Yes</td>
<td>Not Required</td>
<td>Yes</td>
<td>Yes</td>
<td>Not Required</td>
<td>50</td>
<td>30</td>
<td>75,000</td>
</tr>
</tbody>
</table>

For SI: 1 foot = 304.8 mm, 1 cubic foot = 0.02832 m$^3$, 1 square foot = 0.0929 m$^2$.

a. When automatic sprinklers are required for reasons other than those in Chapter 32, the portion of the sprinkler system protecting the high-piled storage area shall be designed and installed in accordance with Sections 3207 and 3208.

b. For aisles, see Section 3206.9.

c. Piles shall be separated by aisles complying with Section 3206.9.

d. For storage in excess of the height indicated, special fire protection shall be provided in accordance with Note g when required by the fire code official. See also Chapters 51 and 57 for special limitations for aerosols and flammable and combustible liquids, respectively.
e. Section 503 shall apply for fire apparatus access.
f. For storage exceeding 30 feet in height, Option 1 shall be used.
g. Special fire protection provisions including, but not limited to, fire protection of exposed steel columns; increased sprinkler density; additional in-rack sprinklers, without associated reductions in ceiling sprinkler density; or additional fire department hose connections shall be provided when required by the fire code official.
h. High-piled storage areas shall not exceed 500,000 square feet. A 2-hour fire wall constructed in accordance with Section 706 the *International Building Code* shall be used to divide high-piled storage exceeding 500,000 square feet in area.
i. Not required when an automatic fire-extinguishing system is designed and installed to protect the high-piled storage area in accordance with Sections 3207 and 3208.
j. Not required when storage areas are protected by early suppression fast response (ESFR) sprinkler systems installed in accordance with NFPA 13.
3206.3 Separation of high-piled storage areas.
High-piled storage areas shall be separated from other portions of the building where required by Sections 3206.3.1 through 3206.3.2.2.

3206.3.1 Separation from other uses.
Mixed occupancies shall be separated in accordance with the International Building Code.

3206.3.2 Multiple high-piled storage areas.
Multiple high-piled storage areas shall be in accordance with Section 3206.3.2.1 or 3206.3.2.2.

3206.3.2.1 Aggregate area.
The aggregate of all high-piled storage areas within a building shall be used for the application of Table 3206.2 unless such areas are separated from each other by 1-hour fire barriers constructed in accordance with Section 707 the International Building Code. Openings in such fire barriers shall be protected by opening protectives having a 1-hour fire protection rating.

3206.3.2.2 Multiclass high-piled storage areas.
High-piled storage areas classified as Class I through IV not separated from high-piled storage areas classified as high hazard shall utilize the aggregate of all high-piled storage areas as high hazard for the purposes of the application of Table 3206.2. To be considered as separated, 1-hour fire barriers shall be constructed in accordance with Section 707 of the International Building Code. Openings in such fire barriers shall be protected by opening protectives having a 1-hour fire protection rating.

Exception: As provided for in Section 3204.2.

3206.4 Automatic sprinklers.
Automatic sprinkler systems shall be provided in accordance with this Section and Sections 3207, 3208 and 3209.

3206.4.1 Sprinkler design.

3206.4.1.1 General.
The design automatic sprinkler systems designed for the protection of Group M and S occupancies containing high-pile storage or high-challenge commodities over an area equal to or greater than 2,500 ft.² (232 m²) and designed for the protection of hazardous materials stored more than one pallet high in Group M, S or H occupancies, shall be in accordance with this section. This section does not apply to miscellaneous storage within the scope of NFPA 13.

3206.4.1.2 Requirements for all plan submittals.
See Phoenix Fire Code Chapter 9 Design Documents for plan submittal requirements.

3206.4.1.3 Minimum design requirements for speculative warehouses.
The design of the automatic sprinkler system for speculative warehouses shall be based on storage of a cartoned Class A nonexpanded plastic to the available storage height.
The storage height shall be determined by subtracting 48 inches (from the highest point of the roof above each system for ESFR and 30 inches for area density applications.

3206.4.1.4 Minimum requirements for client leased or occupant owned warehouses. The design of an automatic sprinkler system for client leased or occupant owned buildings containing high pile storage shall be based on the requirements of NFPA 13, Chapter 12. The responsible Fire Protection Engineer shall perform a survey of the building to determine commodity classification, storage configuration, building height and other information related to the development of an appropriate sprinkler system design. The Engineer shall also make reasonable efforts to meet with the building owner or operator to understand seasonal or customer related fluctuations to the stored commodities, storage height, and configuration.

The sprinkler design shall be based on the most demanding requirements determined through the on-site survey and discussions with the building owner or operator. Technical Report shall clearly define the basis for determining the commodity and sprinkler design selection, along with how the commodities will be isolated or separated, and the referenced design document(s), including NFPA 13 or the current applicable Factory Mutual Data Sheets. If a specific fire test is used as the basis of design, a copy of the fire test report shall be provided at the time of plan review.

3206.4.1.5 Required information at plan submittal.
All plans, hydraulic calculations and technical reports shall be submitted with the plan submittal form. The individual submitting the design package shall ensure that all of the required information requested on the plan submittal form is included. The plan review fee shall be paid at the time the plans are submitted. If the required information is not provided, the Fire Department may charge a fee in accordance with Chapter 81 for the handling and preliminary review of the plans.

3206.4.1.6 Minimum plan information requirements.
In addition to the requirements of NFPA 13, Chapter 14, the following information shall be included in the plans or technical report.

3206.4.1.6.1 Class I-IV and Group A plastic commodities.

A) An owner’s certificate in accordance with NFPA 13. The design criteria, e.g., NFPA 13, Factory Mutual Data Sheet, or a specific fire test report.
B) A City of Phoenix Water Supply Flow & Pressure Test Report performed within 90 days of the plan submittal
C) The type of design, e.g., Control Mode Density/Design Area Method; Specific Application Control Mode Method; Suppression Mode Method, including appropriate code references.
D) A description of the stored commodities and how the commodity classification was determined.
E) A layout of the proposed storage arrangement. If the storage is in racks, a plan and elevation detail illustrating rack heights, flue dimensions and arrangement. This detail is not required for speculation warehouses.
F) The aisle dimensions between each storage array.
G) If a high challenge commodity is separated using fire-resistive construction, the boundary of the fire-resistive construction shall be illustrated.
H) A data sheet for the backflow preventer. If a data sheet is not available, the
design professional shall include a statement addressing the minimum required
pressure loss.
I) A data sheet for each installed automatic sprinkler.
J) A data sheet for each pipe hanger used to hang or support the sprinkler piping.
K) If a fire pump will be installed or used, the manufacturer’s factory test curve shall
be included in the submittal.
L) A cross-section view illustrating obstructions to the ceiling sprinklers, e.g., lights,
structural members, cable trays, electrical bus ducts and HVAC ductwork.

3206.4.1.6.2 Hazardous materials.
In addition to the requirements of this section, the following information shall be
included in a hazardous materials technical report.

A) A hazardous materials inventory statement
B) For flammable & combustible liquids, an analysis of the miscibility of Class I
liquids, the size and type of the packaging, the packaging materials of
construction, and if the containers have a pressure relieving mechanism.
C) For Level 2 or 3 aerosols, a statement indicating that the aerosols are cartoned
or uncartoned.

3206.4.1.7 Identification of sprinkler system capabilities and limitations.
An adhesive label shall be permanently installed at or adjacent to each sprinkler
riser. When a building contains more than four risers, the sign shall be located at
an approved location inside the building. When sprinkler risers are located
outside of the building, the sign shall be stamped metal. The minimum sign
dimension is 6-inches (152 mm) high by 4-inches (101 mm) wide. The sign
shall specify the capabilities and limitations of the automatic sprinkler system.
The sign shall include the following information:

A) The design base or basis, including the edition used
B) A statement indicating if the sprinkler design is control mode density area
method, control mode specific application, suppression mode, or any
combination thereof.
C) When used, all of the storage conditions stipulated NFPA 13 for Special Designs.
D) The maximum storage height
E) The minimum required aisle width
F) If storage is in racks, the maximum rack width and minimum transverse and
longitudinal flue widths.
G) Commodities that can be protected by the automatic sprinkler system
H) Commodities that cannot be protected by the automatic sprinkler system
I) Limits on storage heights of idle wood and plastic storage
J) Limits on storage heights of miscellaneous Group A plastic, tire and rolled paper
storage
K) Locations where in-rack sprinklers are required
L) Locations where horizontal and/or vertical barriers are required
M) Information explaining the manufacturer, sprinkler identification number, k-factor, and operating temperature of the overhead sprinklers protecting the high pile storage.

The following example illustrates a suggested label or sign.

---

**Automatic Sprinkler System Capabilities & Limitations**

<table>
<thead>
<tr>
<th>Stored Commodity</th>
<th>Class I water miscible flammable liquids in 1 &amp; 5 gallon polyethylene containers in fiberboard cartons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Type</td>
<td>Control Mode, Density/Area Method</td>
</tr>
<tr>
<td>Max. Storage Height</td>
<td>25 feet</td>
</tr>
<tr>
<td>Min. Aisle Width</td>
<td>8 feet</td>
</tr>
<tr>
<td>Max. Rack Width</td>
<td>9 feet</td>
</tr>
<tr>
<td>Flue Dimensions</td>
<td>Longitudinal: Min. 6 inches Transverse: Min. 3 inches</td>
</tr>
<tr>
<td>System Capabilities</td>
<td>Class I-IV commodities, stored commodity, solid pile or palletized Group A plastics to 12 feet; rack storage of Group A plastics to 25 feet.</td>
</tr>
<tr>
<td>System Limitations</td>
<td>No level 2 or 3 aerosols, Class 2, 3 or 4 oxidizers</td>
</tr>
<tr>
<td>Idle Pallets</td>
<td>6 feet maximum storage height</td>
</tr>
<tr>
<td>Tire Storage</td>
<td>5 feet maximum storage height</td>
</tr>
<tr>
<td>Rolled Paper Storage</td>
<td>5 feet maximum storage height</td>
</tr>
<tr>
<td>In-rack sprinklers</td>
<td>In-rack sprinklers are required at each of 3 rack tiers containing the stored commodity. In-rack sprinklers are Tyco/Central FS-B, 17/32” orifice, QR 155°F element, SIN TY0041</td>
</tr>
<tr>
<td>Horizontal Barriers</td>
<td>Required at each rack tier containing the stored commodity.</td>
</tr>
<tr>
<td>Ceiling Sprinkler</td>
<td>Tyco ELO-231B, ¾” orifice, SR 286°F element, upright, SIN TY0030</td>
</tr>
</tbody>
</table>

---

**3206.5 Fire detection.**

Where fire detection is required by Table 3206.2, an approved automatic fire detection system shall be installed throughout the high-piled storage area. The system shall be monitored and be in accordance with Section 907.

**3206.6 Building access.**

Where building access is required by Table 3206.2, fire apparatus access roads shall be in accordance with Chapter 5.
Exception: Where fire apparatus access roads cannot be installed because of topography, railways, waterways, non-negotiable grades or other similar conditions, the fire code official is authorized to require additional fire protection. Specifications for fire apparatus access roads shall be in accordance with Chapter 5.

3206.6.1 Access doors.
Where building access is required by Table 3206.2, fire department access doors shall be provided in accordance with this section. Access doors shall be accessible without the use of a ladder.

3206.6.1.1 Number of doors required.
A minimum of one access door shall be provided in each 100 lineal feet (30 480 mm), or fraction thereof, of the exterior walls that face required fire apparatus access roads. The required access doors shall be distributed such that the lineal distance between adjacent access doors does not exceed 100 feet (30 480 mm).

3206.6.1.2 Door size and type.
Access doors shall not be less than 3 feet (914 mm) in width and 6 feet 8 inches (2032 mm) in height. Roll-up doors shall not be used unless approved.

3206.6.1.3 Locking devices.
Only approved locking devices shall be used.

3206.7 Smoke and heat removal.
Where smoke and heat removal are required by Table 3206.2, smoke and heat vents shall be provided in accordance with Section 910. Where draft curtains are required by Table 3206.2, they shall be provided in accordance with Section 910.3.5.

3206.8 Fire department hose connections.
Where exit passageways are required by the International Building Code for egress, a Class I standpipe system shall be provided in accordance with Section 905.

3206.9 Aisles.
Aisles providing access to exits and fire department access doors shall be provided in high-piled storage areas exceeding 500 square feet (46 m²), in accordance with Sections 3206.9.1 through 3206.9.3. Aisles separating storage piles or racks shall comply with NFPA 13. Aisles shall also comply with Chapter 10.

Exception: Where aisles are precluded by rack storage systems, alternate methods of access and protection are allowed when approved.

3206.9.1 Width.
Aisle width shall be in accordance with Sections 3206.9.1.1 and 3206.9.1.2.

Exceptions:

1. Aisles crossing rack structures or storage piles, which are used only for employee access, shall be a minimum of 24 inches (610 mm) wide.
2. Aisles separating shelves classified as shelf storage shall be a minimum of 30 inches (762 mm) wide.

**3206.9.1.1 Sprinklered buildings.**
Aisles in sprinklered buildings shall be a minimum of 44 inches (1118 mm) wide. Aisles shall be a minimum of 96 inches (2438 mm) wide in *high-piled storage areas* exceeding 2,500 square feet (232 m²) in area, that are accessible to the public and designated to contain high-hazard commodities.

**Exception:** Aisles in *high-piled storage areas* exceeding 2,500 square feet (232 m²) in area, that are accessible to the public and designated to contain high-hazard commodities, are protected by a sprinkler system designed for multiple-row racks of high-hazard commodities shall be a minimum of 44 inches (1118 mm) wide.

Aisles shall be a minimum of 96 inches (2438 mm) wide in areas accessible to the public where mechanical stocking methods are used.

**3206.9.1.2 Nonsprinklered buildings.**
Aisles in nonsprinklered buildings shall be a minimum of 96 inches (2438 mm) wide.

**3206.9.2 Clear height.**
The required aisle width shall extend from floor to ceiling. Rack structural supports and catwalks are allowed to cross aisles at a minimum height of 6 feet 8 inches (2032 mm) above the finished floor level, provided that such supports do not interfere with fire department hose stream trajectory.

**3206.9.3 Dead ends.**
Dead-end aisles shall be in accordance with Chapter 10.

**3206.10 Portable fire extinguishers.**
Portable fire extinguishers shall be provided in accordance with Section 906.

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**SECTION 3207**
**SOLID-PILED AND SHELF STORAGE**

**3207.1 General.**
Shelf storage and storage in solid piles, solid piles on pallets and bin box storage in bin boxes not exceeding 5 feet (1524 mm) in any dimension, shall be in accordance with Sections 3206 and this section.

**3207.2 Fire protection.**
Where automatic sprinklers are required by Table 3206.2, an *approved automatic sprinkler system* shall be installed throughout the building or to 1-hour *fire barriers* constructed in accordance with Section 707 of the *International Building Code*. Openings in such *fire barriers* shall be protected by opening protectives having a 1-hour *fire protection rating*. The design and installation of the *automatic sprinkler system* and other applicable fire protection shall be in accordance with the *International Building Code* and NFPA 13.
3207.2.1 Shelf storage.
Shelf storage greater than 12 feet (3658 mm) but less than 15 feet (4572 mm) in height shall be in accordance with the fire protection requirements set forth in NFPA 13. Shelf storage 15 feet (4572 mm) or more in height shall be protected in an approved manner with special fire protection, such as in-rack sprinklers.

3207.3 Pile dimension and height limitations.
Pile dimensions, the maximum permissible storage height and pile volume shall be in accordance with Table 3206.2.

3207.4 Array.
Where an automatic sprinkler system design utilizes protection based on a closed array, array clearances shall be provided and maintained as specified by the standard used.

SECTION 3208
RACK STORAGE

3208.1 General.
Rack storage shall be in accordance with Section 3206 and this section. Bin boxes exceeding 5 feet (1524 mm) in any dimension shall be regulated as rack storage.

3208.2 Fire protection.
Where automatic sprinklers are required by Table 3206.2, an approved automatic sprinkler system shall be installed throughout the building or to 1-hour fire barriers constructed in accordance with Section 707 of the International Building Code. Openings in such fire barriers shall be protected by opening protectives having a 1-hour fire protection rating. The design and installation of the automatic sprinkler system and other applicable fire protection shall be in accordance with Section 903.3.1.1 and the International Building Code.

3208.2.1 Plastic pallets and shelves.
Storage on plastic pallets or plastic shelves shall be protected by approved specially engineered fire protection systems.

Exception: Plastic pallets listed and labeled in accordance with UL 2335 shall be treated as wood pallets for determining required sprinkler protection.

3208.2.2 Racks with solid shelving.
Racks with solid shelving having an area greater than 320 20 square feet (3 1.9 m²), measured between approved flue spaces at all four edges of the shelf, shall be in accordance with this section.

Exceptions:

1. Racks with mesh, grated, slatted or similar shelves having uniform openings not more than 6 inches (152 mm) apart, comprised of at least 50 percent of the overall shelf area, and with approved flue spaces are allowed to be treated as racks without solid shelves.
2. Racks used for the storage of combustible paper records, with solid shelving, shall be in accordance with NFPA 13.

**3208.2.2.1 Fire protection.**
Fire protection for racks with solid shelving shall be in accordance with NFPA 13.

**3208.3 Flue spaces.**
Flue spaces shall be provided in accordance with Table 3208.3. Required flue spaces shall be maintained.

<table>
<thead>
<tr>
<th>TABLE 3208.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>REQUIRED FLUESPACES FOR RACK STORAGE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RACK CONFIGURATION</th>
<th>AUTOMATIC SPRINKLER PROTECTION</th>
<th>SPRINKLER AT THE CEILING WITH OR WITHOUT MINIMUM IN-RACK SPRINKLERS</th>
<th>IN-RACK SPRINKLERS AT EVERY TIER</th>
<th>NONSPRINKLERED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Storage height</td>
<td>Option 1</td>
<td>Option 2</td>
<td>&gt; 25 feet</td>
</tr>
<tr>
<td>Single-row rack</td>
<td>Transverse flue space</td>
<td>Size b</td>
<td>3 inches</td>
<td>Not Applicable</td>
</tr>
<tr>
<td></td>
<td>Vertically aligned</td>
<td>Not Required</td>
<td>Not Applicable</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Longitudinal flue space</td>
<td>Not Required</td>
<td>Not Applicable</td>
<td>Not Required</td>
</tr>
<tr>
<td>Double-row rack</td>
<td>Transverse flue space</td>
<td>Size b</td>
<td>6 inches a</td>
<td>3 inches</td>
</tr>
<tr>
<td></td>
<td>Vertically aligned</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Longitudinal flue space</td>
<td>Not Required</td>
<td>6 inches</td>
<td>6 inches</td>
</tr>
<tr>
<td>Multi-row rack</td>
<td>Transverse flue space</td>
<td>Size b</td>
<td>6 inches</td>
<td>Not Applicable</td>
</tr>
<tr>
<td></td>
<td>Vertically aligned</td>
<td>Not Required</td>
<td>Not Applicable</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Longitudinal flue space</td>
<td>Not Required</td>
<td>Not Applicable</td>
<td>Not Required</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
a. Three-inch transverse flue spaces shall be provided at least every 10 feet where ESFR sprinkler protection is provided.
b. Random variations are allowed, provided that the configuration does not obstruct water penetration.

**3208.3.1 Flue space protection.**
Where required by the fire code official, flue spaces required by Table 3208.3, in single-, double- or multiple-row rack storage installations shall be equipped with approved devices to protect the required flue spaces. Such devices shall not be removed or modified.
3208.4 Column protection.
Steel building columns shall be protected in accordance with NFPA 13.

3208.5 Extra-high-rack storage systems.
Approval of the fire code official shall be obtained prior to installing extra-high-rack combustible storage.

3208.5.1 Fire protection.
Buildings with extra-high-rack combustible storage shall be protected with a specially engineered automatic sprinkler system. Extra-high-rack combustible storage shall be provided with additional special fire protection, such as separation from other buildings and additional built-in fire protection features and fire department access, when required by the fire code official.

SECTION 3209
AUTOMATED STORAGE

3209.1 General.
Automated storage shall be in accordance with this section.

3209.2 Automatic sprinklers.
Where automatic sprinklers are required by Table 3206.2, the building shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

3209.3 Carousel storage.
High-piled storage areas having greater than 500 square feet (46 m²) of carousel storage shall be provided with automatic shutdown in accordance with one of the following:

1. An automatic smoke detection system installed in accordance with Section 907, with coverage extending 15 feet (4575 mm) in all directions beyond unenclosed carousel storage systems and which sounds a local alarm at the operator's station and stops the carousel storage system upon the activation of a single detector.

2. An automatic smoke detection system installed in accordance with Section 907 and within enclosed carousel storage systems, which sounds a local alarm at the operator's station and stops the carousel storage system upon the activation of a single detector.

3. A single dead-man-type control switch that allows the operation of the carousel storage system only when the operator is present. The switch shall be in the same room as the carousel storage system and located to provide for observation of the carousel system.

3209.4 Automated rack storage.
High-piled storage areas with automated rack storage shall be provided with a manually activated emergency shutdown switch for use by emergency personnel. The switch shall be clearly identified and shall be in a location approved by the fire chief.
SECTION 3210
SPECIALTY STORAGE

3210.1 General.
Records storage facilities used for the rack or shelf storage of combustible paper records
greater than 12 feet (3658 mm) in height shall be in accordance with Sections 3206 and 3208
and NFPA 13. Palletized storage of records shall be in accordance with Section 3207.