

CHAPTER 32

HIGH-PILED COMBUSTIBLE STORAGE

User note:

About this chapter: Chapter 32 provides guidance for reasonable protection of life from hazards associated with the storage of combustible materials in closely packed piles or on pallets, in racks or on shelves where the top of storage is greater than 12 feet in height, or 6 feet for high-hazard commodities. It provides requirements for identifying various classes of commodities; and general fire and life safety features including storage arrangements, smoke and heat venting, fire department access and housekeeping and maintenance. This chapter attempts to define the potential fire severity and, in turn, determine fire and life safety protection measures needed to control and in some cases suppress a potential fire. This chapter does not cover miscellaneous combustible material storage as regulated in Section 315.

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 37.
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 Sections 105.5 and 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. The *construction documents* shall include all of 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 that are banded or encapsulated.
9. Location of required fire department access doors.
10. Type of fire [protection](#) 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.
13. Dimension and location of transverse and longitudinal flue spaces.
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, where required by the *fire code official*.

3201.3.1 Approved construction documents. Following approval of the *construction documents*, a copy of the *approved plans* shall be maintained on the premises in an *approved location*.

3201.3.2 Approved storage layout. A floor plan, of legible size, shall be provided, mounted on a wall and protected from damage. The floor plan shall be mounted in an *approved* location and show the following:

1. Locations, dimensions and rack layout of *high-piled storage areas*.
2. Design storage height for each storage area.
3. Types of commodities.
4. Commodity clearance between top of storage and the sprinkler deflector for each storage arrangement.
5. Aisle dimensions between each storage array.
6. For palletized and solid-piled storage, the maximum pile volume for each storage array.
7. Location and classification of commodities in accordance with Section 3203.
8. Location of required fire department access doors.
9. Location of valves controlling the water supply of ceiling and in-rack sprinklers.

[S] 3201.4 Fire safety and evacuation plan. Where required by the Section 403, a fire safety and evacuation plan shall be submitted at the time of permit application for review and approval by the fire code official. A copy of the *approved* fire safety and evacuation plan 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.

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.

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 Sections 3203.2 through 3203.10.3. 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.

3203.2 Class I commodities. Class I commodities are noncombustible products in ordinary corrugated cartons with or without single-thickness dividers, or in ordinary paper wrappings with or without wood pallets. The amount of Group A plastics shall be limited in accordance with Section 3203.9.

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 wood pallets. The amount of Group A plastics shall be limited in accordance with Section 3203.9.

3203.4 Class III commodities. Class III commodities are products of wood, paper, natural fiber cloth, or Group C plastics or products thereof, with or without wood pallets. The amount of Group A plastics shall be limited in accordance with Section 3203.9.

3203.5 Class IV commodities. Class IV commodities are Class I, II or III products containing Group A plastics in ordinary corrugated cartons; Class I, II and III products with Group A plastic packaging; Group B plastics; and free-flowing Group A plastics with or without wood pallets. The total amount of nonfree-flowing Group A plastics shall be limited in accordance with Section 3203.9.

3203.6 High-hazard commodities. High-hazard commodities are 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.

3203.7 Classification of plastics. Plastics shall be designated as Group A, B or C in accordance with Sections 3203.7.1 through 3203.7.3.

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.

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.

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.

3203.8 Examples of commodity classification. Table 3203.8 shall be used to determine the commodity classification for various products and materials. Products not found in the list shall be classified based on the classification descriptions in Sections 3203.2 through 3203.6 and the products they most nearly represent in Table 3203.8. Table 3203.8 considers the product and the packaging if *listed* with the item. Products with additional packaging consisting of Group A plastics shall be classified in accordance with Section 3203.9.

The commodity classifications are based on products with, or without, wood pallets. Where plastic pallets are used, the commodity classification shall be modified in accordance with Section 3203.10.

TABLE 3203.8
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|------------------|--|-------------------------------------|
| Aerosols | Level 1 | Class III (See Chapter 51) |
| | Level 2 | Class IV (See Chapter 51) |
| | Level 3 | High-hazard (See Chapter 51) |
| Batteries | Dry cells (excludes lithium, lithium-ion and other similar exotic metals or combustible electrolyte); without blister packing (if blister packed, refer to the commodity classification definitions) | Class I |
| | Dry cells (nonlithium or similar exotic metals); in blister packing; cartoned | Class II |
| | Vehicle; any size (for example, automobile or truck); empty plastic casing | High-hazard (Group A unexpanded) |
| | Vehicle; large (in other words, truck or larger); dry or wet cells (excludes lithium-ion and other cells containing combustible electrolytes) | High-hazard (Group A unexpanded) |
| | Vehicle; small (for example, automobile); wet cells (excludes lithium-ion and other cells containing combustible electrolytes) | Class I |
| | Lithium-ion | High-hazard |
| Biomass | Circular baled corn stover | Class IV |
| | Rectangular baled corn stover | Class III |
| | Rectangular baled switchgrass | High-hazard |
| Empty containers | Noncombustible | Class I |
| | PET | Class IV |
| | Rigid plastic (not including PET) | High-hazard (Group A unexpanded) |
| | Wood; solid sided (such as crates, boxes) | Class II |

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|------------------------------------|---|-------------------------------------|
| Film rolls, including photographic | Polypropylene, polyester, polyethylene; rolled on any reel type | High-hazard (Group A unexpanded) |
| | 35 mm metal film cartridges in polyethylene cans; cartoned | Class III |
| | Motion picture or bulk rolls in polycarbonate, polyethylene or in metal cans; polyethylene bagged; cartoned | Class II |
| | Rolls in polycarbonate plastic cassettes; cartoned | Class IV |
| | Photographic paper; sheets; bagged in polyethylene; cartoned | Class III |
| Flammable and combustible liquids | Glycol in combustible containers (50 percent or greater) | High-hazard |
| | Lacquers, which dry by solvent evaporation, in metal cans or cartons | High-hazard |
| | Lighters; butane; blister-packed; cartoned | High-hazard (Group A unexpanded) |
| | Over 20- and up to 50-percent alcohol (such as alcoholic beverages, hair spray); up to 1-gallon glass bottles or jars; in racks; cartoned | Class III |
| | Over 20- and up to 50-percent alcohol (such as alcoholic beverages, hair spray); up to 1-gallon glass bottles or jars; palletized; cartoned | Class IV |
| | Over 20- and up to 50-percent alcohol (such as alcoholic beverages, hair spray); up to 1-gallon plastic bottles or jars; cartoned | Class IV |
| | Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); greater than 5-gallon plastic containers with wall thickness greater than 0.25 inch | High-hazard (Group A unexpanded) |
| | Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); metal, glass or ceramic containers | Class I |
| | Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); plastic containers greater than 5 gallons and wall thickness up to 1/4 inch | Class II |
| | Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); up to 5-gallon plastic bottles or jars | Class I |
| | Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); wood containers | Class II |
| | Lubricating or hydraulic fluid in plastic containers | High-hazard |
| | Nail polish; up to 2-ounce glass bottles or jars; cartoned | Class IV |
| | Nail polish; up to 2-ounce plastic bottles or jars; cartoned | High-hazard (Group A unexpanded) |
| Flammable solids | Except solid combustible metals | High-hazard |
| Food products, frozen | In nonwaxed or nonplastic packaging | Class I |
| | In plastic trays | Class III |
| | In waxed or plastic-coated paper packaging | Class II |

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|-----------------------------|---|-------------------------------------|
| Food products, nonfrozen | Butter (stick or whipped spread) or margarine (up to 50-percent oil) | Class III |
| | Butter; whipped spread | Class III |
| | Dry foods (such as baked goods, candy, cereals, cheese, chocolate, cocoa, coffee, grains, granular sugar, nuts); bagged or cartoned | Class III |
| | Foods (such as coffee, fish products, fruit, meat products, nuts, poultry); metal cans | Class I |
| | Fruits and vegetables (noncombustible semiliquid); crushed; plastic containers up to 5 gallons | Class I |
| | Fruits and vegetables; fresh; wood spacers, nonplastic trays or containers | Class I |
| | Margarine; over 50- and up to 80-percent oil | High-hazard (Group A unexpanded) |
| | Meat; fresh; no plastic packaging; uncartoned | Class I |
| | Meat; fresh; no plastic packaging; cartoned | Class II |
| | Meat; fresh; plastic tray | Class III |
| | Milk; any container; stored in solid plastic crates | High-hazard (Group A unexpanded) |
| | Milk; paper containers, or plastic bottles or jars up to 5 gallons | Class I |
| | Salt; bagged | Class I |
| | Salt; cartoned | Class II |
| | Snack foods (such as potato chips); plasticized aluminum bags; cartoned | High-hazard (Group A unexpanded) |
| | Syrup; wooden container | Class II |
| Furniture and bedding | Box spring; standard (minimal plastic materials) | Class III |
| | Box spring; wrapped in plastic cover | Class IV |
| | Furniture and bedding; with foam cushioning | High-hazard (Group A expanded) |
| | Furniture; metal (such as file cabinets or desks with minimal plastic trim); cartoned | Class I |
| | Furniture; wood (such as doors, windows, cabinets); no plastic coverings or foam cushioning | Class III |
| | Furniture; wood; plastic coverings; nonexpanded plastic trim | Class IV |
| | Mattress; foam (in finished form) | High-hazard (Group A expanded) |
| | Pillows, foam rubber and foam plastics | High-hazard (Group A expanded) |

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|----------------------------------|--|-------------------------------------|
| Housing materials and appliances | Appliances; major (for example, stoves, refrigerators); no appreciable plastic interior or exterior trim; cartoned | Class II |
| | Appliances; major (for example, stoves, refrigerators); no appreciable plastic interior or exterior trim; uncartoned | Class I |
| | Appliances; no appreciable plastic exterior trim (interior of unit can have appreciable plastic) | Class III |
| | Carpet tiles; cartoned | High-hazard (Group A unexpanded) |
| | Fiberglass insulation; paper-backed rolls; bagged or unbagged | Class IV |
| | Floor coverings; vinyl, stacked tiles | Class IV |
| | Floor coverings; vinyl; rolled | High-hazard (Group A unexpanded) |
| | Gypsum board | Class I |
| | Housing materials (such as sinks, countertops); noncombustible, cartoned or crated | Class II |
| | Light fixtures; nonplastic; cartoned | Class II |
| | Paint; oil-based; friction-top metal containers; cartoned | Class IV |
| | Paint; water-based (latex); friction-top metal containers; cartoned | Class I |
| | Paper; asphalt; rolled, horizontal or vertical storage | High-hazard |
| | Roofing shingles; asphalt-coated fiberglass | Class III |
| | Roofing shingles; asphalt-impregnated felt | Class IV |
| Miscellaneous | Ammunition; small arms and shotgun; cartoned | Class IV |
| | Charcoal; mineral-spirit impregnated; bagged | High-hazard (Group A expanded) |
| | Charcoal; standard (nonmineral-spirit impregnated); bagged | Class III |
| | Fertilizers; nitrates; bagged | Class II |
| | Fertilizers; phosphates; bagged | Class I |
| | Leather hides; baled | Class II |
| | Leather; finished products (such as shoes, jackets, gloves, bags, luggage, belts) | Class III |
| | Motors; electric | Class I |
| | Pallets and flats that are idle; combustible | High-hazard |
| | Shock absorbers; metal dust cover | Class II |
| | Shock absorbers; plastic dust cover | Class III |
| | Skis; wood | Class III |
| | Skis; composite materials (such as plastic, fiberglass, foam) | Class IV |
| | Tobacco products; cartoned | Class III |
| | Toys; stuffed; foam or synthetic | High-hazard (Group A expanded) |
| | Transformer; dry or empty (in other words, void of oil) | Class I |

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|------------------------|--|-------------------------------------|
| Noncombustible liquids | Liquids or semiliquids; PET containers greater than 5 gallons having a nominal wall thickness greater than 1/4 inch | Class IV |
| | Liquids or semiliquids; PET containers up to 5 gallons having a nominal wall thickness less than 1/4 inch | Class I |
| | Liquids or semiliquids (such as crushed fruits and vegetables); plastic containers up to 5-gallon capacity | Class I |
| | Liquids or semiliquids; plastic (except PET) containers greater than 5-gallon capacity having a nominal wall thickness greater than 1/4 inch | High-hazard (Group A unexpanded) |
| | Liquids or semiliquids; plastic (except PET) containers greater than 5-gallon capacity having a nominal wall thickness up to 1/4 inch | Class II |
| | Liquids; cardboard drink boxes, plastic coated, wax coated, and/or aluminum lined; uncartoned or on corrugated carton trays with plastic sheeting | Class I |
| | Liquids; cardboard drink boxes, plastic coated, wax coated, and/or aluminum lined; stored in plastic containers | High-hazard (Group A unexpanded) |
| | Liquids; glass bottles or jars; cartoned | Class I |
| | Liquids; less than 5-gallon plastic containers | Class I |
| | Liquids; pharmaceuticals (nonflammable); glass bottles or jars; cartoned | Class II |
| | Liquids; plastic bottles or jars; stored in open or solid plastic crates | High-hazard (Group A unexpanded) |
| Paper products | Book signatures (paper part of book without hard cover) | Class II |
| | Cartons (such as cardboard flats); corrugated; partially assembled | Class IV |
| | Cartons (such as cardboard flats); corrugated; unassembled in neat piles | Class III |
| | Cartons; wax coated, single-walled corrugated | High-hazard (Group A unexpanded) |
| | Cellulosic paper products; nonwax coated (such as books, cardboard games, cartoned tissue products, magazines, newspapers, paper cups, paper plates, paper towels, plastic-coated paper food containers, stationary) | Class III |
| | Cellulosic paper products; wax coated (such as paper plates, cups); loosely packed; cartoned | High-hazard (Group A unexpanded) |
| | Cellulosic paper products; wax coated (such as paper plates, cups); nested; cartoned | Class IV |
| | Matches; paper-type; cartoned | Class IV |
| | Matches; wooden; cartoned | High-hazard (Group A unexpanded) |
| | Rolled; lightweight; in storage racks | Class IV |
| | Rolled; medium or heavyweight; in storage racks or onside | Class III |
| | Rolled; in horizontal storage or vertical storage that is banded or protected with an approved wrap | Class III |
| | Rolled; in vertical storage that is unbanded or not protected with an approved wrap | High-hazard |
| | Tissue products; plastic wrapped; cartoned | Class III |
| | Tissue products; plastic wrapped; uncartoned | High-hazard (Group A unexpanded) |

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|------------------|--|-------------------------------------|
| Plastic, rubber | ABS (Acrylonitrile-butadiene-styrene copolymer) | High-hazard (Group A unexpanded) |
| | Acetal (polyformaldehyde) | High-hazard (Group A unexpanded) |
| | Acrylic (polymethyl methacrylate) | High-hazard (Group A unexpanded) |
| | Automobile bumpers and dashboards | High-hazard (Group A expanded) |
| | Butyl rubber | High-hazard (Group A unexpanded) |
| | Cellulose acetate | Class IV (Group B plastic) |
| | Cellulose acetate butyrate | High-hazard (Group A unexpanded) |
| | Chloroprene rubber | Class IV (Group B plastic) |
| | Containers; Nonexpanded plastic gridded or solid; collapsed or nested with no air spaces | High-hazard (Group A unexpanded) |
| | ECTFE (ethylene-chlorotrifluoro-ethylene copolymer) | Class IV (Group B plastic) |
| | EPDM (ethylene-propylene rubber) | High-hazard (Group A unexpanded) |
| | ETFE (ethylene-tetrafluoroethylene copolymer) | Class IV (Group B plastic) |
| | Ethyl cellulose | High-hazard (Group A unexpanded) |
| | FEP (fluorinated ethylene-propylene copolymer) | Class IV (Group B plastic) |
| | FRP (fiberglass-reinforced polyester) | High-hazard (Group A unexpanded) |
| | Melamine (melamine formaldehyde) | Class III (Group C plastic) |
| | Nitrile rubber (acrylonitrile-butadiene rubber) | High-hazard (Group A unexpanded) |
| | Nylon (nylon 6, nylon 6/6) | High-hazard (Group A unexpanded) |
| | PCTFE (polychlorotrifluoroethylene) | Class III (Group C plastic) |
| | PET (Polyethylene terephthalate-thermoplastic polyester) | High-hazard (Group A unexpanded) |
| | Phenolic | Class III (Group C plastic) |
| | Plastics; stored in fully closed and solid (no openings) metal containers | Class I |
| | Polybutadiene | High-hazard (Group A unexpanded) |
| | Polycarbonate | High-hazard (Group A unexpanded) |
| | Polyester elastomer | High-hazard (Group A unexpanded) |
| | Polyethylene | High-hazard (Group A unexpanded) |
| | Polypropylene | High-hazard (Group A unexpanded) |
| | Polystyrene; foam products (such as plates, cups) | High-hazard (Group A expanded) |

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|--------------------------------|--|-------------------------------------|
| Plastic, rubber (continued) | Polystyrene; rigid products | High-hazard (Group A unexpanded) |
| | Polyurethane | High-hazard (Group A expanded) |
| | PTFE (polytetrafluoroethylene) | Class III (Group C plastic) |
| | PVC (polyvinyl chloride) products; plasticizer content 20 percent or less | Class III (Group C plastic) |
| | PVC (polyvinyl chloride) products; plasticizer content greater than 20 percent | High-hazard (Group A unexpanded) |
| | PVC resins; bagged | Class III (Group C plastic) |
| | PVDC (polyvinylidene chloride) | Class III (Group C plastic) |
| | PVDF (polyvinylidene fluoride) | Class III (Group C plastic) |
| | PVF (polyvinyl fluoride) | High-hazard (Group A unexpanded) |
| | Pyroxylin | High-hazard |
| | Rubber; natural in blocks; cartoned | High-hazard (Group A unexpanded) |
| | Rubber; natural; expanded | High-hazard (Group A expanded) |
| | Rubber; natural; Nonexpanded | High-hazard (Group A unexpanded) |
| | Rubber; synthetic (santoprene) | High-hazard (Group A unexpanded) |
| | Rubber tires | High-hazard |
| | SAN (styrene acrylonitrile) | High-hazard (Group A unexpanded) |
| | SBR (styrene-butadiene rubber) | High-hazard (Group A unexpanded) |
| | Silicone rubber | Class IV (Group B plastic) |
| | Urea (urea formaldehyde) | Class III (Group C plastic) |
| Plastic containers | Bottles or jars greater than 1 gallon containing noncombustible solids | High-hazard (Group A unexpanded) |
| | Bottles or jars up to 1 gallon containing noncombustible solids | High-hazard (Group A unexpanded) |

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|--------------------------------|--|-------------------------------------|
| Powders, pills | Pharmaceutical pills; glass bottles or jars; cartoned | Class II |
| | Pharmaceuticals pills; plastic bottles or jars; cartoned | Class IV |
| | Polyvinyl alcohol (PVA) resins; bagged | Class IV |
| | Powders; combustible (ordinary—such as sugar or flour); free-flowing; bagged | Class II |
| | Powders; noncombustible free-flowing powdered or granular materials (such as cement, calcium chloride, clay, iron oxide, sodium chloride, sodium silicate); bagged | Class I |
| | Powders; noncombustible; glass bottles or jars; cartoned | Class I |
| | Powders; noncombustible; PET bottles or jars | Class II |
| | Powders; noncombustible; plastic (other than PET) bottles or jars; uncartoned | High-hazard (Group A unexpanded) |
| | Powders; noncombustible; plastic bottles or jars greater than 1-gallon capacity | High-hazard (Group A unexpanded) |
| | Powders; noncombustible; plastic bottles or jars up to 1-gallon capacity; cartoned | Class IV |
| Textile materials and products | Cloth; natural fibers; baled | Class III |
| | Cloth; synthetic cloth | Class IV |
| | Clothing; natural fibers (such as wool, cotton) and viscose | Class III |
| | Cotton; cartoned | Class III |
| | Diapers; cotton or linen | Class III |
| | Diapers; plastic or nonwoven fabric; cartoned | Class IV |
| | Diapers; plastic or nonwoven fabric; plastic-wrapped; uncartoned | High-hazard (Group A unexpanded) |
| | Fabric; rayon and nylon | Class IV |
| | Fabric; synthetic (except rayon and nylon); greater than 50/50 blend | High-hazard (Group A unexpanded) |
| | Fabric; synthetic (except rayon and nylon); up to 50/50 blend | Class III |
| | Fabric; vinyl-coated (such as tablecloth); cartoned | High-hazard (Group A unexpanded) |
| | Fibers; rayon and nylon; baled | Class IV |
| | Fibers; synthetic (except rayon and nylon); baled | High-hazard (Group A unexpanded) |
| | Thread or yarn; rayon and nylon; wood or paper spools | Class IV |
| | Thread or yarn; rayon or nylon; plastic spools | High-hazard (Group A unexpanded) |
| | Thread or yarn; synthetic (except rayon and nylon); greater than 50/50 blend; paper or wood spools | Class IV |
| | Thread or yarn; synthetic (except rayon and nylon); greater than 50/50 blend; plastic spools | High-hazard (Group A unexpanded) |
| | Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; plastic spools | High-hazard (Group A unexpanded) |
| | Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; wood or paper spools | Class III |
| Wax products | Candles | High-hazard (Group A expanded) |
| | Paraffin or petroleum wax; blocks | High-hazard (Group A expanded) |

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

| PRODUCT CATEGORY | PRODUCT | CLASSIFICATION |
|---------------------|--|----------------------------------|
| Wire, cable, spools | Spools; plastic; empty | High-hazard (Group A unexpanded) |
| | Spools; wood; empty | Class III |
| | Wire or cable; PVC insulated; metal or wood spools | Class II |
| | Wire or cable; PVC insulated; plastic spools | Class IV |
| | Wire; bare; metal spools; uncartoned | Class I |
| | Wire; bare; metal spools; cartoned | Class II |
| | Wire; bare; plastic spools; cartoned | Class IV |
| | Wire; bare; plastic spools; uncartoned | High-hazard (Group A unexpanded) |
| | Wire; bare; wood or cardboard spools | Class II |
| Wood products | Wood patterns | Class IV |
| | Wood products (such as fiberboard, lumber, particle board, plywood, pressboard with smooth ends and edges); bundled solid blocks | Class II |
| | Wood products (such as fiberboard, lumber, particle board, plywood, pressboard with smooth ends and edges); unbundled or nonsolid blocks | Class III |
| | Wood products (such as toothpicks, clothespins and hangers) | Class III |

For SI: 1 inch = 25.4 mm, 1 gallon = 3.8 L, 1 ounce = 29.57 ml.

3203.9 Limited quantities of Group A plastics in mixed commodities. Figures 3203.9(1) and 3203.9(2) shall be used to determine the commodity classification based on the quantity of Group A plastics in the following situations:

1. The product is not listed in Table 3203.8 and contains Group A plastics.
2. The commodity contains Group A plastics and is not classified as high hazard in Table 3203.8.
3. The product listing in Table 3203.8 does not specifically include packaging, and the packaging material includes Group A plastics.

3203.9.1 Classifying mixed commodities with limited Group A plastics. The percentage of Group A plastics determined in accordance with Section 3203.9.2 shall be used in Figures 3203.9(1) and 3203.9(2). Results from Figure 3203.9(1) must be compared to results from Figure 3203.9(2) and the commodity will be classified with the highest commodity classification.

Figures 3203.9(1) and 3203.9(2) shall not be used to reduce the commodity classification shown in Table 3203.8.

3203.9.2 Percentage of Group A plastics. The pallet, if any, shall not be included when measuring the weight of the commodity (W_{PU} or W_{PE}) or the volume of the commodity (V_{PE}). The pallet, if any, shall be included when measuring the weight of the entire load (W_L) or the volume of the entire load (V_L).

Exception: Where noncombustible pallets are used, the pallets shall not be included in the volume and weight calculations.

The percentage by weight of Group A unexpanded plastics in the load shall be calculated in accordance with Equation 32-1.

The percentage by volume of Group A expanded plastics in the load shall be calculated in accordance with Equation 32-2.

The percentage by weight of Group A expanded plastics in the load shall be calculated in accordance with Equation 32-3.

$$P_{WU} = W_{PU}/W_L$$

(Equation 32-1)

where:

P_{WU} = Percentage by weight of Group A unexpanded plastic.

W_{PU} = Weight of Group A unexpanded plastic in the commodity, not including the weight of the pallet, if any.

W_L = Weight of the entire load, including the weight of the pallet, if any.

$P_{VE} = V_{PE} / V_L$ (Equation 32-2)

where:

- P_{VE} = Percentage by volume of Group A expanded plastic.
- V_{PE} = Volume of Group A expanded plastic in the commodity, not including the volume of the pallet, if any.
- V_L = Volume of the entire load, including the volume of the pallet, if any.

$P_{WE} = W_{PE} / W_L$ (Equation 32-3)

where:

- P_{WE} = Percentage by weight of Group A expanded plastic.
- W_{PE} = Weight of Group A expanded plastic in the commodity, not including the weight of the pallet, if any.
- W_L = Weight of the entire load, including the weight of the pallet, if any.

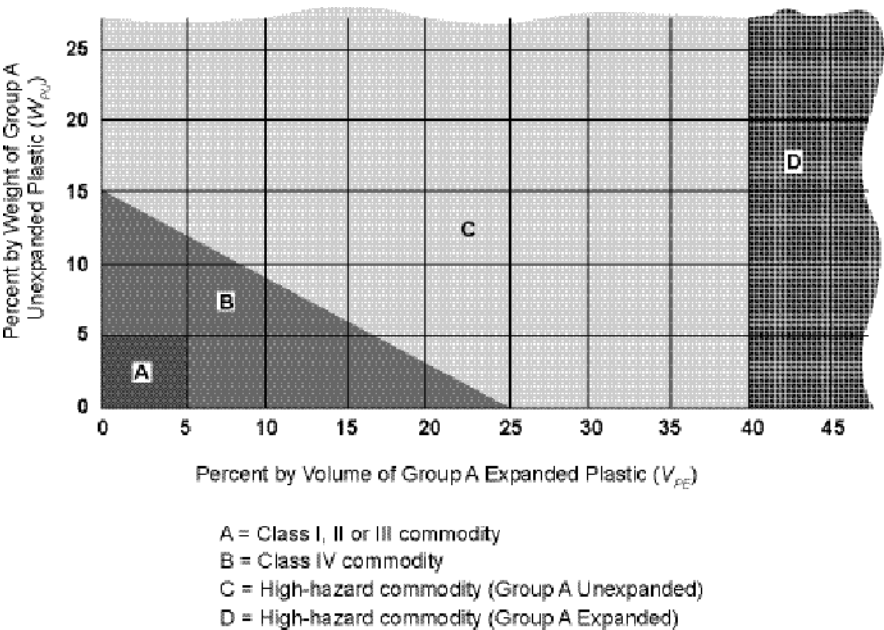


FIGURE 3203.9(1)
EVALUATION OF CARTONED COMMODITIES CONTAINING GROUP A PLASTICS a, b

- a. This figure is used to determine the commodity classification of a mixed commodity with Group A plastics in a package or crate.
- b. The following is an example of how to apply Figure 3203.9(1): A pallet load consists of a Class III commodity in cardboard boxes with components of unexpanded Group A plastic and packing material of expanded Group A plastic. Using Equation 32-1, the weight of unexpanded Group A plastic is 5 percent. Using Equation 32-2, the volume of expanded Group A plastic is 15 percent. This commodity is classified as a Class IV commodity. If the volume of the expanded Group A plastic is increased to 20 percent, the classification changes to a high-hazard (Group A unexpanded) commodity. Where the load is stored on a plastic pallet, the requirements in Section 3203.10 also apply.

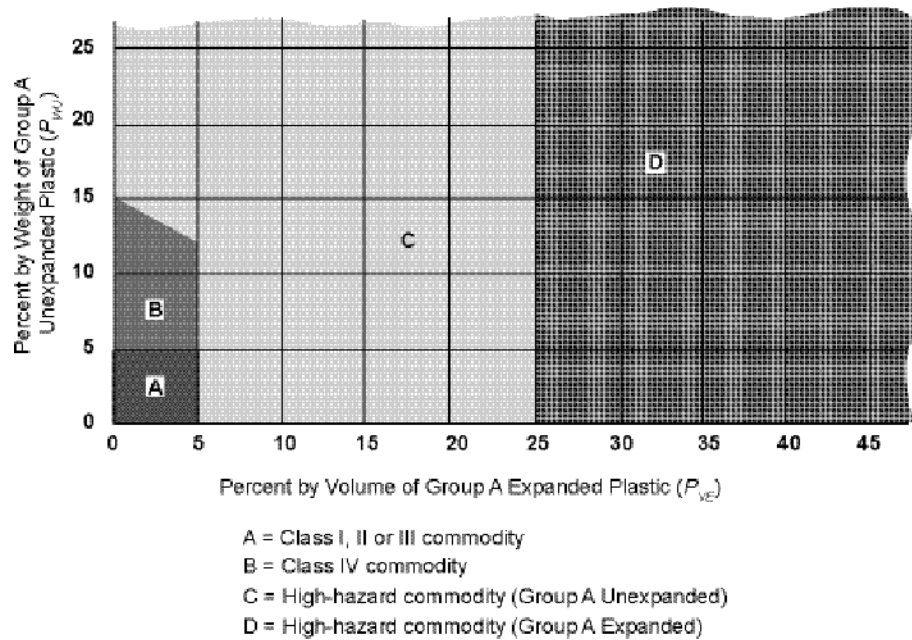


FIGURE 3203.9(2)

EVALUATION OF EXPOSED COMMODITIES CONTAINING GROUP A PLASTICS ^{a, b}

- This figure is used to determine the commodity classification of a mixed commodity with Group A plastics where the products are exposed.
- The following is an example of how to apply Figure 3203.9(2): A pallet load consists of an exposed Class III commodity with components of unexpanded Group A plastic and packing material of expanded Group A plastic. Using Equation 32-1, the weight of unexpanded Group A plastic is 5 percent. Using Equation 32-2, the volume of expanded Group A plastic is 6 percent. This commodity is classified as a high-hazard (Group A unexpanded) commodity. Where the load is stored on a plastic pallet, the requirements in Section 3203.10 also apply.

3203.10 Plastic pallets. The commodity classification determined in Section 3203.8 or 3203.9 shall be modified in accordance with Sections 3203.10.1 through 3203.10.3 where plastic pallets are used.

Exception: The commodity classification is not modified where any of the following conditions occur:

- Group A plastic commodities are stored on plastic pallets.
- Sprinkler protection consists of sprinklers at the ceiling only, using sprinklers with a minimum K-factor of K-16.8 (240).
- The plastic pallets are *listed* and *labeled* in accordance with Section 3206.4.1.1.

3203.10.1 Unreinforced plastic pallets. For Class I through IV commodities, where unreinforced polypropylene or unreinforced high-density polyethylene plastic pallets are used, the commodity classification shall be increased one class. To be considered unreinforced plastic pallets, the pallets shall be marked with a permanent symbol indicating the pallet is unreinforced.

3203.10.2 Reinforced plastic pallets. For Class I through IV commodities, where reinforced polypropylene or reinforced high-density polyethylene plastic pallets are used, the commodity classification shall be increased two classes except for Class IV commodities, which shall be increased to a high-hazard (Group A plastic, cartoned, unexpanded) commodity.

3203.10.3 Other pallets. For Class I through IV commodities stored on plastic pallets other than polypropylene or high-density polyethylene plastic pallets, the commodity classification shall be increased two classes unless specific testing is conducted by a testing laboratory.

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 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 where 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 Storage layout plan maintenance. The *approved storage layout* shall be verified and evaluated annually in accordance with Section 3201.3.2. Modifications or changes to the provisions of the *approved storage layout* shall not be made without the prior approval of the *fire code official*.

3205.2 Rack structures. The structural integrity of racks shall be maintained.

3205.3 Ignition sources. Clearance from ignition sources shall be provided in accordance with Section 305.

3205.4 Smoking. Smoking shall be prohibited. *Approved* “No Smoking” signs shall be conspicuously posted in accordance with Section 310.

3205.5 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 3206.10.

Exception: In high-piled single- and double-row rack storage of combustible materials protected by *automatic sprinkler systems* designed and installed in accordance with the requirements of NFPA 13 governing the use of K-25.2 (360) sprinklers, displays and wing stacks not exceeding 48 inches (1219 mm) in height provided that they do not obstruct or reduce the clear width of the aisle to less than 48 inches (1219 mm).

3205.6 Pile dimension and height limitations. Pile dimensions and height limitations shall comply with Section 3207.3.

3205.7 Designation of storage heights. Where required by the *fire code official*, a visual method of indicating the maximum allowable storage height shall be provided.

3205.8 Arrays. Arrays shall comply with Section 3207.4.

3205.9 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 3206.11.

3206.2 Type of protection. Where required by Table 3206.2, fire detection systems, smoke and heat removal and automatic sprinkler design densities shall be provided to protect the *high-piled storage area*.

TABLE 3206.2
GENERAL FIRE PROTECTION AND LIFE SAFETY REQUIREMENTS

| COMMODITY CLASS | SIZE OF HIGH-PILED STORAGE AREA ^a (square feet) (see Sections 3206.2 and 3206.3) | ALL STORAGE AREAS (see Sections 3206, 3207 and 3208) ^b | | | | SOLID-PILED STORAGE, SHELF STORAGE AND PALLETIZED STORAGE (see Section 3207.3) | | |
|-----------------|---|--|---|--|---|---|---|-------------------------------------|
| | | Automatic fire-extinguishing system (see Section 3206.4) | Fire detection system (see Section 3206.5) | Fire department access doors (see Section 3206.7) | Smoke and heat removal (see Section 3206.8) | Maximum pile dimension ^c (feet) | Maximum permissible storage height ^d (feet) | Maximum pile volume (cubic feet) |
| I–IV | 0–500 | Not Required ^a | Not Required | Not Required | Not Required | Not Required | Not Required | Not Required |
| | 501–2,500 | Not Required ^a | Yes ^g | Not Required | Not Required | 120 | 40 | 100,000 |
| | 2,501–12,000 Open to the public | Yes | Not Required | Not Required | Not Required | 120 | 40 | 400,000 |
| | 2,501–12,000 Not open to the public (Option 1) | Yes | Not Required | Not Required | Not Required | 120 | 40 | 400,000 |
| | 2,501–12,000 Not open to the public (Option 2) | Not Required ^a | Yes | Yes | Yes _{h, i} | 120 | 30 ^e | 200,000 |
| | 12,001–500,000 | Yes | Not Required | Yes | Yes _{h, i} | 120 | 40 | 400,000 |
| | Greater than 500,000 ^f | Yes | Not Required | Yes | Yes _{h, i} | 120 | 40 | 400,000 |
| High hazard | 0–500 | Not Required ^a | Not Required | Not Required | Not Required | 60 | Not Required | Not Required |
| | 501–2,500 Open to the public | Yes | Not Required | Not Required | Not Required | 60 | 30 | 75,000 |
| | 501–2,500 Not open to the public (Option 1) | Yes | Not Required | Not Required | Not Required | 60 | 30 | 75,000 |
| | 501–2,500 Not open to the public (Option 2) | Not Required ^a | Yes ^g | Yes | Yes _{h, i} | 60 | 20 | 50,000 |
| | 2,501–300,000 | Yes | Not Required | Yes | Yes _{h, i} | 60 | 30 | 75,000 |
| | Greater than 300,000 ^f | Yes | Not Required | Yes | Yes _{h, i} | 60 | 30 | 75,000 |

For SI: 1 foot = 304.8 mm, 1 cubic foot = 0.02832 m³, 1 square foot = 0.0929 m².

a. Where 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 3206.10.

c. Piles shall be separated by aisles complying with Section 3206.10.

d. For storage in excess of the height indicated, special fire protection shall be provided in accordance with Note f where required by the fire code official. See Chapters 51 and 57 for special limitations for aerosols and flammable and combustible liquids, respectively.

e. For storage exceeding 30 feet in height, Option 1 shall be used.

f. 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 fire department hose connections shall be provided where required by the fire code official.

g. Not required where an automatic fire-extinguishing system is designed and installed to protect the high-piled storage area in accordance with Sections 3207 and 3208.

h. Not required where storage areas are protected by either early suppression fast response (ESFR) sprinkler systems or control mode special application sprinklers with a response time index of 50 (meters-seconds)^{1/2} or less that are listed to control a fire in the stored commodities with 12 or fewer sprinklers, installed in accordance with NFPA 13.

- i. Not required in frozen food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.

3206.2.1 Extent of protection. The fire safety features required in Table 3206.2 shall extend to the lesser of 15 feet (4572 mm) beyond the *high-piled storage area* or a full height wall. 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.

3206.3 High-piled storage areas. For the application of Table 3206.2, the size of the *high-piled storage areas* shall be determined in accordance with Sections 3206.3.1 through 3206.3.2.1.

3206.3.1 Size of high-piled storage area. The size of each *high-piled storage area* shall include the footprint of the actual high-piled storage racks, shelves or piles and the following aisles:

1. Interior aisles within the footprint of the storage area.
2. An aisle around the perimeter of the footprint with a minimum width as required in Section 3206.10.1 or the dimension to a full height wall, whichever is less.

3206.3.2 Multiple high-piled storage areas. Where a building contains multiple *high-piled storage areas*, the aggregate of all *high-piled storage areas* shall be used for the application of Table 3206.2 unless the *high-piled storage areas* are separated in accordance with one of the following:

1. *High-piled storage areas* separated by *fire barriers* with a minimum *fire-resistance-rating* of 1 hour constructed in accordance with Section 707 of the *International Building Code*.
2. In buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, *high-piled storage areas* separated by 100 feet (30 480 mm) or more. The area providing the separation shall not contain *high-piled combustible storage*.

3206.3.2.1 Multiple class 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. Multiple class *high-piled storage areas* meeting the separation requirements in Section 3206.3.2 shall be considered as separated. The fire safety features in Table 3206.2 shall be extended beyond the higher-hazard storage area in accordance with Section 3206.2.1.

Exception: Multiple class *high-piled storage areas* do not need to be separated where in accordance with Section 3204.2.

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

3206.4.1 Pallets. *Automatic sprinkler system* requirements based on the presence of pallets shall be in accordance with NFPA 13.

3206.4.1.1 Plastic pallets. Plastic pallets *listed* and *labeled* in accordance with FM 4996 or UL 2335 shall be treated as wood pallets for determining required sprinkler protection.

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. Fire apparatus access roads in accordance with Section 503 shall be provided within 150 feet (45 720 mm) of all portions of the *exterior walls* of buildings used for high-piled storage.

Exception: Where fire apparatus access roads cannot be installed because of topography, railways, waterways, nonnegotiable grades or other similar conditions, the *fire code official* is authorized to require additional fire protection.

3206.7 Fire department access doors. Where fire department access doors are required by Table 3206.2, fire department access doors shall be provided in accordance Sections 3206.7.1 through 3206.7.8.

3206.7.1 Exterior walls without fire department access doors. Fire department access doors are not required in an exterior wall that does not face a fire apparatus access road provided that all of the following conditions occur:

1. The opposite exterior wall faces a fire apparatus access road.
2. The opposite exterior wall is provided with fire department access doors.
3. The entire interior surface of the exterior wall is less than 150 feet (45 720 mm) away from a fire department access door.
4. The building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

3206.7.2 Where located. Where exterior walls surrounding *high-piled storage areas* face fire apparatus access roads, such walls shall be provided with fire department access doors.

3206.7.3 Access to doors. Fire department access doors shall be able to be accessed without the use of a ladder.

3206.7.4 Marking on fire department access doors. Fire department access doors shall be labeled on the exterior side with the following sign or other *approved* sign:

FIRE DEPARTMENT ACCESS DOOR
DO NOT BLOCK

The lettering shall be in a contrasting color to the background. Letters shall have a minimum height of 2 inches (51 mm) with a minimum stroke of 3/8 inch (10 mm).

3206.7.5 Number of doors required. The required fire department access doors shall be distributed such that the lineal distance between adjacent fire department access doors does not exceed 125 feet (38 100 mm) measured center to center.

Exception: The linear distance between adjacent access doors shall not exceed 200 feet (60 960 mm) in existing buildings where change in occupancy is not proposed.

3206.7.6 Door size and type. Fire department access doors shall be not less than 3 feet (914 mm) in width and 6 feet 8 inches (2032 mm) in height. Roll-up doors shall not be considered fire department access doors unless *approved*.

3206.7.7 Locking devices. Locking devices on fire department access doors shall be *approved*.

[S] 3206.7.8 Key box. Where fire department access doors are required, *the fire code official may require* a key box ~~((shall))~~ *to* be installed in accordance with Section 506.1. The key box shall contain keys or devices to allow for entry through the fire department access doors.

3206.8 Smoke and heat removal. Where smoke and heat removal is required by Table 3206.2 it shall be provided in accordance with Section 910.

3206.9 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.

3206.10 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 3206.10.1 through 3206.10.3. Aisles separating storage piles or racks shall comply with NFPA 13. Aisles shall comply with Chapter 10.

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

3206.10.1 Width. Aisle width shall be in accordance with Sections 3206.10.1.1 and 3206.10.1.2.

Exceptions:

1. Aisles crossing rack structures or storage piles, that are used only for employee access, shall be not less than 24 inches (610 mm) wide.
2. Aisles separating shelves classified as shelf storage shall be not less than 30 inches (762 mm) wide.

3206.10.1.1 Sprinklered buildings. Aisles in sprinklered buildings shall be not less than 44 inches (1118 mm) wide. Aisles shall be not less than 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.

Aisles shall be not less than 96 inches (2438 mm) wide in areas open to the public where mechanical stocking methods are used.

Exceptions:

1. Aisles in *high-piled storage areas* exceeding 2,500 square feet (232 m²) in area, that are open to the public and designated to contain high-hazard commodities, and that are protected by a sprinkler system designed for multiple-row racks of high-hazard commodities, shall be not less than 44 inches (1118 mm) wide.
2. Aisles that are in *high-piled storage areas* exceeding 2,500 square feet (232 m²) in area, not open to the public and protected by a sprinkler system designed for multiple-row racks, shall be not less than 24 inches (610 mm) wide.

3206.10.1.2 Nonsprinklered buildings. Aisles in nonsprinklered buildings shall be not less than 96 inches (2438 mm) wide.

3206.10.2 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.

3206.10.3 Dead-end aisles. Dead-end aisles shall not exceed 20 feet (6096 mm) in length in Group M occupancies. Dead-end aisles shall not exceed 50 feet (15 240 mm) in length in all other occupancies.

Exception: Dead-end aisles are not limited where the length of the dead-end aisle is less than 2.5 times the least width of the dead-end aisle.

3206.11 Portable fire extinguishers. Portable fire extinguishers shall be provided in accordance with Section 906.

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 Section 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 Arrays. 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.

3208.1.1 Storage racks. The design and installation of storage racks shall be in accordance with the *International Building Code*.

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 shelves. Storage on plastic shelves shall be protected by *approved* specially engineered *fire protection systems*.

3208.2.2 Racks with solid shelving. Racks with solid shelving having an area greater than 20 square feet (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, comprising not less than 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. Rack storage areas protected with an *automatic sprinkler system* shall be provided with flue spaces in accordance with Table 3208.3. Required flue spaces shall be maintained.

**TABLE 3208.3
REQUIRED FLUE SPACES FOR RACK STORAGE**

| RACK CONFIGURATION | FLUE DESIGN | | AUTOMATIC SPRINKLER PROTECTION | | |
|----------------------------|-------------------------|--------------------|--|--------------------------|----------------------------------|
| | | | Sprinklers at the ceiling with or without minimum in-rack sprinklers | | In-rack sprinklers at every tier |
| | | | Storage height ≤ 25 feet | Storage height > 25 feet | Any height |
| Single-row rack | Transverse flue space | Size ^b | 3 inches | 3 inches | Not required |
| | | Vertically aligned | Not required | Yes | Not required |
| | Longitudinal flue space | | Not required | Not required | Not required |
| Double-row rack (Option 1) | Transverse flue space | Size ^b | 6 inches ^a | 3 inches | Not required |
| | | Vertically aligned | Not required | Yes | Not required |
| | Longitudinal flue space | | Not required | 6 inches | Not required |
| Double-row rack (Option 2) | Transverse flue space | Size ^b | 3 inches | 6 inches | Not required |
| | | Vertically aligned | Not required | Yes | Not required |
| | Longitudinal flue space | | 6 inches | Not required | Not required |
| Multiple-row rack | Transverse flue space | Size ^b | 6 inches | 6 inches | Not required |
| | | Vertically aligned | Not required | Yes | Not required |
| | Longitudinal flue space | | Not required | Not required | Not required |

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Three-inch transverse flue spaces shall be provided not less than 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. Flue spaces required by Table 3208.3 above the first tier of storage in single-, double- or multiple-row rack storage installations shall, where required by the *fire code official*, be equipped with *approved* protection devices. 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, where 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 that sounds a local alarm at the operator's station and stops the carousel storage system upon the activation of a single detector.

Blue 2021 IFC New Language, Green 2021 WA State Amendment, Red Current 2018 Seattle amendments, Purple Proposed 2021 Seattle Amendments

2. An automatic smoke detection system installed in accordance with Section 907 and within enclosed carousel storage systems, that 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 **and automatic shutdown in accordance with Sections 3209.4.1 and 3209.4.2.**

3209.4.1 Manual activated shutdown. A manually activated switch shall be provided to initiate the *approved* automatic shutdown process. The switch shall be clearly identified and shall be in a location *approved* by the *fire code official*.

3209.4.2 Automatic shutdown. Automatic shutdown shall be required for *high-piled combustible storage* areas greater than 500 square feet (46 m²). The *approved* automatic shutdown process shall commence upon any of the following events:

1. Water flow is detected in the *automatic sprinkler system*, if present.
2. Activation of the fire detection system, if present.

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. Palletized storage of records shall be in accordance with Section 3207.

3210.1.1 Alternative fire protection. The design and installation of automatic fire-extinguishing systems in archives, vaults and record storage rooms shall be in accordance with NFPA 232.