

| | |
|---|---|
| <p>July 1, 2010</p> | <p align="center">SANTA ROSA FIRE DEPARTMENT FIRE PREVENTION BUREAU STANDARD</p> |
|  | <p align="center">HIGH PILED STORAGE</p> |

PURPOSE

This standard outlines the general requirements for protection of high piled combustible storage (HPS) for a variety of commodities. Information contained herein applies to typical instances and may not address all circumstances.

CODE REFERENCES

- 2007 California Fire Code (CFC) Chapter 23 & 9
- 2007 California Building Code (CBC) Chapter 4 & 9
- 2002 NFPA 13 – Sprinkler Systems
- 2003 NFPA 230 – Combustible Storage

PERMIT(S) REQUIRED

A High Piled Combustible Storage Permit is required.

Additional required permits (depending on design) may include:

- Fire Alarm Installation
- Fire Sprinkler Installation

***Note - California Fire Code Permits—CFC 2301.2**

An annual CFC permit is required when a building or portion thereof is used for high piled storage exceeding 500 square feet in area (see the definition of high piled storage area under “Scope”). CFC permit fees are invoiced annually.

Categories and fee amounts are found at:

<http://ci.santa-rosa.ca.us/doclib/Documents/IB%20018.pdf>

ATTACHMENTS

- 1) Plan Review Checklist – Fire Department High Piled Storage
- 2) Inspection Checklist – Fixed Department High Piled Storage

REQUIRED INSPECTIONS

- 1) Fire Department Final

*The Final may include, but are not limited to, inspections of the racks, smoke/heat vents, and access doors.

Based on the design of the HPS, inspections may include:

- 2) Fire Sprinkler Pipe, Rough & Hydro, and Final Inspection

Standard
High Piled Storage

3) Fire Alarm Pre-wire and Final Inspection

Inspections shall be scheduled a minimum of 48 hours in advance. Directions for scheduling are found at: <http://ci.santa-rosa.ca.us/news/Pages/AutomatedFireInspectionRequestSystem.aspx>

The intent of this guideline is to provide the requirements for the protection of highpiled storage (HPS) for a variety of commodities. The following requirements will ensure that the minimum measures required by code have been taken to provide for the public safety and that the required protection of these commodities has been designed in accordance with Chapter 23 of the 2007 California Fire Code (CFC) and referenced standards.

DEFINITIONS

For the purposes of this guideline, certain terms are defined as follows:

High Piled Combustible Storage

The storage of combustible materials in closely packed piles, on pallets, in racks, or on shelves where the top of storage is greater than 12 feet in height. High piled combustible storage also includes certain high hazard commodities, such as rubber tires, Group A plastics, flammable and combustible liquids, idle pallets, and similar commodities where the top of storage is greater than six feet in height.

High Piled Storage Area

An area within a building that is designated, intended, proposed, or actually used for high piled combustible storage. For purposes of selecting the applicable fire protection requirement row in Table 2306.2:

- This area shall include the “footprint” of the actual storage array (racks, shelves, fixtures, or pallets), inclusive of aisles within the storage area(s). When individual storage arrays are separated by less than 15foot spaces, the spaces shall be considered aisles and shall be included in a single storage area footprint. When individual storage arrays are separated by more than 15foot spaces, the individual arrays shall be considered separate storage areas with their own footprint calculation.
- Each storage area shall also include a 48inch perimeter aisle calculated in the footprint. This additional perimeter aisle is not required for areas that abut to a wall.
- For multiple storage areas within a building, the aggregate of all high piled storage areas shall be used for selecting the applicable row in Table 2306.2, unless such areas are separated from each other by a one hour rated fire barrier wall constructed in accordance with Section 706 of the California Building Code (CBC). Openings in such walls shall be protected by fire assemblies having a one hour fire protection rating CFC 2306.3.2.1.

Rack Storage

A combination of vertical, horizontal, and diagonal members that support stored materials. Racks can be fixed or portable.

Shelf Storage

Storage on shelves less than 30 inches deep with the distance between shelves not exceeding three feet vertically. For larger shelves and other storage arrangements see Rack Storage.

Solid Shelving

Shelving that is solid, slatted, mesh, or grated located within racks that obstructs sprinkler water penetration through the racks.

PLAN SUBMITTIAL

Technical Assistance

Due to the complexity of the designs specified within the CFC and adopted standards, it may be necessary to obtain the service of a fire protection design professional to assist with developing a protection scheme that meets the requirements of the CFC and other applicable regulations.

Standard
High Piled Storage

At the time of permit application, plans and specifications, including but not limited to the information listed below, shall be submitted for review and approval. For certain HPS reviews, the services of a design professional familiar with the requirements contained in CFC Chapter 23 may be of great assistance. A minimum of three sets of plans shall be submitted with the following information per CFC 2301.3:

- A. A letter of intent containing a detailed description of the products to be stored and the description of all containers, pallets, and packaging materials. This letter must also include a detailed description of the storage methods (racks, shelves, pallets), the total storage area in square feet, maximum storage height, and aisle widths. An authorized officer of the company or business must sign this letter. The letter shall be copied onto the plans.
- B. A scaled site plan that shows the entire building, including all fire access lanes, fire hydrants, fire department connection, and fire sprinkler risers.
- C. A scaled floor plan of the building showing locations and dimensions of the HPS area, location of the racks, and access doors to the storage area.
- D. The maximum desired/proposed storage height for each designated storage area per array. This height is measured from the finished floor to the highest point of the commodity stored (not shelf level).
- E. The number of tiers within each rack.
- F. The commodity clearance between the top of storage and the sprinkler deflector for each storage arrangement.
- G. Aisle dimensions between each storage array. Aisles are measured from the actual edge of the commodity to commodity, not rack to rack.
- H. Maximum pile volume for each storage array.
- I. The location and classification of different commodity classes.
- J. The location of commodities that is banded or encapsulated.
- K. The dimension and location of the transverse and longitudinal flue spaces.
- L. The sprinkler design requirements based on commodity type, aisle width, and sprinkler temperature rating as outlined in 2002 NFPA 13, Chapter 12 (e.g., .45/3000 with 286degree heads). A complete sprinkler design shall be submitted under a separate Service Request number.
- M. The location of all steel columns in relationship to the racks. All steel columns located within a rack flue space or immediately adjacent to a rack in an aisle will require protection. See 2002 NFPA 13, Section 12.3.1.7.
- N. The location, make, model, type, and automatic link temperature of the automatic/manual release smoke vents. Fusible links shall be at least one temperature rating higher than the fire sprinklers

Note: New construction shall only use approved/labeled smoke vents as specified by CFC 2306.7. Required smoke vents in existing structures (constructed under the 1998 or previous codes) shall be inspected for proper operation (manual & automatic) and proper link temperature by an independent qualified contractor. Non-required existing vents shall be either treated as a required vent or shall have the automatic and manual mechanism deactivated including the removal of the release handles. An inspection report by the inspecting contractor shall be provided to Santa Rosa Fire Department (SRFD) prior to plan approval. The report at a minimum shall identify the year the building was constructed, a listing of all vents inspected, the fusible link

Standard
High Piled Storage

temperature rating, the presence of a manual release mechanism, and the operational status of each vent. Prior to submitting the report to SRFD, all identified deficiencies must be corrected and included within the report. If the smoke vents do not contain manual release devices, and SRFD determines that the manual release devices were not specifically required at the time of construction or during any previously approved high piled storage use, then manual release devices will not be required and notation will be placed on the Permit Conditions. The vent inspection report shall be copied onto the plans prior to OCFA plan approval.

- O. If required, the design (construction), location, and depth of the curtain board assembly, if applicable.
- P. The occupancy group as defined by CBC Chapter 3.

COMMODITY CLASSIFICATION—CFC 2303

Commodities shall be classified as Class I, II, III, IV, or High Hazard, in accordance with CFC Chapter 23. Plastics shall be classified as Group A, B, or C in accordance with CFC Chapter 23. To determine the proper commodity classification of products with limited quantities of Group A plastics in mixed commodities, use CFC Figure 2303.7.4. This figure identifies the quantity of Group A plastics allowed to be stored in a package, carton, or on a pallet without increasing the hazard and commodity classification to “high hazard.” The designation and protection features of a high piled combustible storage area intended for storage of different commodity classes shall be based on the highest hazard commodity stored, except as otherwise provided for by engineering analysis in CFC 2304.2.

STORAGE ARRANGEMENT REQUIREMENTS

Solid Piled and Shelf Storage

Shelf storage, storage in solid piles, solid piles on pallets, and storage in bin boxes not exceeding five feet in any dimension shall be in accordance with CFC 2306 and 2307.

Rack Storage

Rack storage shall be in accordance with CFC 2306 and 2308. Racks with solid shelving having an area greater than 32 square feet measured between approved flue spaces at all four edges of the shelf shall be in accordance with CFC 2308.2.2.

Automated Storage

Automated storage similar to carousel storage shall be in accordance with CFC 2309.

Specialty Storage

Record storage facilities used for rack or shelf storage of combustible paper records greater than 12 feet in height shall be in accordance with CFC 2306 2308, and NFPA 13 and NFPA 230. Palletized storage of records shall be in accordance with CFC 2307.

FIRE DEPARTMENT ACCESS—CFC 2306.6

When building access is required by CFC Table 2306.2, access roadways shall be provided to within 150 feet of all portions of the exterior walls of the building used for highpiled storage. When access doors are required by CFC Table 2306.2, they shall be provided in each 100 lineal feet of exterior wall and shall face the required access roadway.

FIRE PROTECTION—CFC 2306

Fire protection features for high piled storage areas shall be in accordance with CFC Chapter23 and other nationally recognized standards approved by the SRFD. Fire detection systems, smoke and heat removal, curtain boards, and fire sprinkler design densities shall extend to 15 feet beyond the high piled storage area or to a permanent partition, whichever is least. The aggregate of all high piled storage areas within a building shall be used to design the fire protection features found in CFC Table 2306.2 (attached), unless such areas are separated from each other by a one hour fire barrier wall constructed in accordance with CBC 706. Distinct occupancy groups shall be separated according to CBC 508.

Standard
High Piled Storage

Fire Sprinkler Systems

When fire sprinklers are required by CFC Table 2306.2 or the CBC (or if otherwise provided), the sprinkler system shall be installed in accordance with 2002 NFPA 13.

Small Hose Stations

Small hose valves and stations shall be required when a High Piled Storage exceeds 2500 square feet in area. An approved 1 1/2" hose valve shall be provided at approved locations.

Fire Detection Systems

When fire detection is required by CFC Table 2306.2, an approved automatic fire detection system shall be installed in accordance with 2002 NFPA 72 standard throughout the high piled storage area. This system shall be installed and monitored as required by CFC 907.

Smoke and Heat Removal

When smoke and heat removal are required by CFC Table 2306.2, smoke and heat vents shall be of an approved type and shall operate automatically by a heat response device rated between 100°F and 200°F above ambient temperatures and contain a manual release roof handle. Vent size shall be in accordance with CFC Table Section 910 (attached.) The fusible link temperature is required to be at least one temperature rating lower than that of the fire sprinkler head at the roof to allow for removal of smoke and other gasses prior to sprinkler head activation. Smoke and heat vents are not required when storage areas are protected by early suppression fast response (ESFR) sprinkler systems installed in accordance with 2002 NFPA 13. For existing conditions refer to Section 1 N of this document.

Curtain Boards

When required by CFC Table 2306.2, curtain boards shall be installed in accordance with CFC 910.3.5.

Rack Flue Spaces

Requirements for flue spaces within the rack storage are provided in CFC Table 2308.3 (attached). Double row racks shall be equipped with a pallet/commodity stop along the longitudinal flue space at each level. The stop shall be steel or other ferrous material 1/4" thick and in the mounted position shall extend a minimum of 4 inches above the shelf or cross member, or other method approved by the fire code official (CFC 2308.3 amended).

Control of Ignition Sources

Smoking shall be prohibited in the warehouse storage area. "NO SMOKING" signs shall be conspicuously posted. Clearance between ignition sources and the combustible storage shall be maintained in accordance with CFC 305 and 310.

MAINTENANCE —CFC Chapter 9

All fire and life safety equipment and systems required by the CFC shall be maintained operable at all times. Equipment, devices, and systems shall be regularly tested in accordance with nationally recognized standards, manufacturers' recommendations, and adopted regulations.

TABLE 2306.2: GENERAL FIRE-PROTECTION AND LIFE-SAFETY REQUIREMENTS

| Commodity Class | Size of High-Piled Storage Area ^a (square feet) (See Sections 2306.2 and 2306.4) | ALL STORAGE AREAS (See Sections 2306, 2307 and 2308) ^b | | | | | SOLID-PILED STORAGE, SHELF STORAGE AND PALLETIZED STORAGE (See Section 2307.3) | | |
|-----------------|---|---|--|--------------------------------------|---|-------------------------------------|--|--|----------------------------------|
| | | Automatic Fire-extinguishing System (See Section 2306.4) | Fire-detection System (See Section 2306.5) | Building Access (See Section 2306.6) | Smoke and Heat Removal (See Section 2306.7) | Draft curtains (See Section 2306.7) | Maximum Pile Dimension ^c | Maximum Permissible Storage Height ^d (feet) | Maximum Pile Volume (cubic feet) |
| I-IV | 0-500 | NR ^a | NR | NR ^a | NR | NR | NR | NR | NR |
| | 501-2,500 | NR ^a | Yes ⁱ | NR ^a | NR | NR | 100 | 40 | 100,000 |
| | 2,501-12,000 Public Accessible | Yes | NR | NR ^a | NR | NR | 100 | 40 | 400,000 |
| | 2,501-12,000 Nonpublic Accessible (Option 1) | Yes | NR | NR ^a | NR | NR | 100 | 40 | 400,000 |
| | 2,501-12,000 Nonpublic Accessible (Option 2) | NR ^a | Yes | Yes | Yes ^j | Yes ^j | 100 | 30 ^f | 200,000 |
| | 12,001-20,000 | Yes | NR | Yes | Yes ^j | NR | 100 | 40 | 400,000 |
| | 20,001-500,000 | Yes | NR | Yes | Yes ^j | NR | 100 | 40 | 400,000 |
| | 500,000+ ^g | Yes | NR | Yes | Yes ^j | NR | 100 | 40 | 400,000 |
| High-hazard | 0-500 | NR ^a | NR | NR ^a | NR | NR | 50 | NR | NR |
| | 501-2,500 Public Accessible | Yes | NR | NR ^a | NR | NR | 50 | 30 | 75,000 |
| | 501-2,500 Nonpublic accessible (Option 1) | Yes | NR | NR ^a | NR | NR | 50 | 30 | 75,000 |
| | 501-2,500 Nonpublic accessible (Option 2) | NR ^a | Yes | Yes | Yes ^j | Yes ^j | 50 | 20 | 50,000 |
| | 2,501-300,000 | Yes | NR | Yes | Yes ^j | NR | 50 | 30 | 75,000 |
| | 300,001-500,000 ^h | Yes | NR | Yes | Yes ^j | NR | 50 | 30 | 75,000 |

NR = Not Required

^a When fire sprinklers are required for reasons other than those in Chapter 23, the portion of the sprinkler system protecting the high-piled storage area shall be designed and installed in accordance with Sections 2307 and 2308.

^b For aisles, see Section 2306.9.

^c Piles shall be separated by aisles complying with Section 2306.9.

^d For storage in excess of the height indicated, special fire protection shall be provided in accordance with Footnote g when required by the chief. See also Chapters 28 and 34 for special limitations for aerosols and flammable and combustible liquids.

^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 chief.

^h High-piled storage areas shall not exceed 500,000 square feet. A two-hour fire wall constructed in accordance with the California 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 2307 and 2308.

^j Not required when storage areas are protected by early suppression fast response (ESFR) sprinkler systems installed in accordance with NFPA 13.

Standard
High Piled Storage-draft

TABLE 910.3: REQUIREMENTS FOR DRAFT CURTAINS AND SMOKE AND HEAT VENTS^a (See Section 2306.7)

| OCCUPANCY GROUP AND COMMODITY CLASSIFICATION | DESIGNATED STORAGE HEIGHT (feet) | MINIMUM DRAFT CURTAIN DEPTH (feet) | MAXIMUM AREA FORMED BY DRAFT CURTAINS (square feet) | VENT- AREA-TO FLOOR-AREA RATIO ^c | MAXIMUM SPACING OF VENT CENTERS (feet) | MAXIMUM DISTANCE TO VENTS FROM WALL OR DRAFT CURTAIN ^b (feet) |
|--|----------------------------------|------------------------------------|---|---|--|--|
| Group F-1 and S-1 | - | $0.2 \times H^d$ but ≥ 4 | 50,000 | 1:100 | 120 | 60 |
| Commodity Classification I-IV (Option 1) | ≤ 20 | 6 | 10,000 | 1:100 | 100 | 60 |
| | $> 20 \leq 40$ | 6 | 8,000 | 1:75 | 100 | 55 |
| Commodity Classification I-IV (Option 2) | ≤ 20 | 4 | 3,000 | 1:75 | 100 | 55 |
| | $> 20 \leq 40$ | 4 | 3,000 | 1:50 | 100 | 50 |
| High-hazard (Option 1) | ≤ 20 | 6 | 6,000 | 1:50 | 100 | 50 |
| | $> 20 \leq 30$ | 6 | 6,000 | 1:40 | 90 | 45 |
| High-hazard (Option 2) | ≤ 20 | 4 | 4,000 | 1:50 | 100 | 50 |
| | $> 20 \leq 30$ | 4 | 2,000 | 1:30 | 75 | 40 |

^a Requirements for rack storage heights in excess of those indicated shall be in accordance with Chapter 23. For solid-piled storage heights in excess of those indicated, an approved engineered design shall be used.

^b The distance specified is the maximum distance from any vent in a particular draft curtained area to walls or draft curtains which form the perimeter of the draft curtained area.

^c Where draft curtains are not required, the vent area to floor area ratio shall be calculated based on a minimum draft curtain depth of 6 feet (Option 1.)

^d "H" is the height of the vent, in feet above the floor.

TABLE 2308.3: REQUIRED FLUE SPACES FOR RACK STORAGE

| RACK CONFIGURATION | FIRE SPRINKLER PROTECTION Storage Height | | SPRINKLER AT THE CEILING WITH OR WITHOUT MINIMUM IN-RACK SPRINKLERS | | | IN-RACK SPRINKLERS AT EVERY TIER | NON-SPRINKLERED |
|--------------------|---|--------------------|---|----------|-------------|----------------------------------|-----------------|
| | | | ≤ 25 feet | | > 25 feet | | |
| | | | Option 1 | Option 2 | | | |
| Single-row Rack | Transverse Flue Space | Size ^b | 3 inch | NA | 3 inch | NR | NR |
| | | Vertically Aligned | NR | NA | Yes | NA | |
| | Longitudinal Flue Space | | NR | NA | NR | NR | |
| Double-row Rack | Transverse Flue Space | Size ^b | 6 inch ^a | 3 inch | 3 inch | NR | |
| | | Vertically Aligned | NR | NR | Yes | NA | |
| | Longitudinal Flue Space | | NR | 6 inch | 6 inch | NR | |
| Multi-row Rack | Transverse Flue Space | Size ^b | 6 inch | NA | 6 inch | NR | |
| | | Vertically Aligned | NR | NA | Yes | NA | |
| | Longitudinal Flue Space | | NR | NA | NR | NR | |

NR = "not required." NA means "not applicable."

^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.