



# Corona Fire Department

## Guideline for High-Piled Combustible Storage per the 2016 California Fire Code

### PURPOSE

The intent of this guideline is to provide the requirements for the protection of high-piled combustible storage (HPS) for a variety of commodities. The following requirements will ensure that appropriate measures specified by code have been taken to provide safety to the public and that the required protection of these commodities has been designed for the appropriate level of hazard as required by the 2016 California Fire Code (CFC), Chapter 32, the 2016 California Building Code (CBC) and the 2016 edition of NFPA 13.

### SCOPE

This guideline provides the general requirements for all HPS within the jurisdiction of the City of Corona. The guideline does not address the structural design requirements contained in the California Building Code.

### DEFINITIONS (CFC §202)

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

Commodity: A combination of products, packing materials and containers that determine commodity classification. NFPA 13 §3.9.1.5

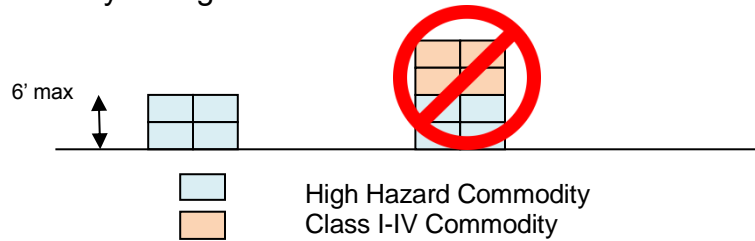
Expanded Plastic: A foam or cellular plastic material having a reduced density based on the presence of numerous small cavities or cells dispersed throughout the material.

Extra-high-rack Combustible Storage: Storage on racks of Class I, II, III or IV commodities which exceed 40 feet in height and storage on racks of high-hazard commodities which exceed 30 feet in height.

Free-Flowing Plastic Materials: Those plastics that fall out of their containers during a fire, fill flue spaces, and create a smothering effect of the fire. Examples include powders, pellets, flakes, or random-packed small objects [e.g., razor blade dispensers, 1 oz to 2 oz bottles, plastic caps]. NFPA 13 §3.9.1.4.

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 **6 feet** in height, by definition. CFC §3202

Note: to be considered non-high piled combustible storage for high hazard commodities ≤6' there cannot be any storage above 6'.



**Encapsulated storage:** Encapsulated commodities are products wrapped on six sides with plastic. Sprinkler water is not able to penetrate into the commodity if it is encapsulated. Typically, encapsulated products require a higher level of fire sprinkler protection.

**Non-encapsulated storage:** Non-encapsulated commodities are products which may be wrapped on four or five sides, with the top remaining open to permit fire sprinkler water to penetrate within the pile.

**High-Piled Storage Area:** An area within a building which is designated, intended, proposed, or actually used for high-piled combustible storage.

**Listed Plastic Pallets:** Plastic pallets listed and labeled in accordance with UL2335 or FM 4996 shall be treated as wood for determining required sprinkler protection.

**Rack Storage:** A combination of vertical, horizontal, and diagonal members that support stored materials. Racks can be fixed or portable. NFPA 13 §3.9.3.7

**Shelf Storage:** Storage on shelves less than 30 inches deep with the distance between shelves not exceeding 3 feet vertically. For larger shelves and other storage arrangements see rack storage. NFPA 13 §3.92.6

**Solid Shelving:** Shelving that is solid, slatted, mesh or grated, or of other construction and less than 50% open located within racks that obstruct sprinkler water penetration through the racks.

- There are two thresholds when determining whether the shelf is considered solid. CFC specifies 32 ft<sup>2</sup>, while NFPA 13 specifies 20 ft<sup>2</sup>. In sprinklered buildings, two factors are used to determine if the shelf is considered solid:
  - The construction of the shelf, and
  - The size of the products that will be stored on the shelf
    - If the item stored as a horizontal area that exceeds 20 ft<sup>2</sup>, the shelf is considered solid regardless of the construction of the shelf.
      - For example: The HPS uses wire mesh shelves with an opening greater than 50%. The commodity being stored is on a non-standard pallet measuring 4' x 6', with a total horizontal size of 24 ft<sup>2</sup>. The shelving in this example would be considered solid due to the pallet size, even though the shelf is wire mesh. NFPA 13 §3.9.3.8

## SUBMITTAL REQUIREMENTS

### California Fire Code Permits (CFC 3201.2)

Plans and specifications shall be submitted to Corona Fire Department, Fire Prevention Division as indicated elsewhere in this document. A CFC permit is required when a building or portion thereof is used for high-piled storage is greater than 500 ft<sup>2</sup> in area. All permits will be issued following plan approval and completion of corresponding inspections of the HPS installation. CFC permits for high piled storage shall be renewed every two years, or upon a change in commodity, configuration or ownership. A previously approved HPS plan may be used for renewing permits, unless changes in the storage configuration and/or commodity result in the need for a new plan review, update and/or approval.

### Plan Review Fees

Plan review fees are charged for the review and approval of High Piled Storage plans. Fees are payable at the time the plans are submitted for review and approval. High Piled Storage Plans shall be submitted to the Building Department for Fire Department plan review and approval. The structural plans shall be submitted separately to the Building Department and shall contain seismic calculations demonstrating structural stability.

### Plans and Specifications Submittal (CFC §3201.3)

At the time of permit application, plans and specifications shall be submitted for review and approval. In addition to the information required by the California Building Code, the storage permit submittal shall include but not be limited to, the information detailed below. Once approved, a laminated copy of the approved plan shall be posted and maintained on the premises in an approved location for the life of the HPS system. Three (3) sets of plans shall be submitted for review and approval, and as a minimum, shall include the following:

1. 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 detailed description of the storage method(s) proposed; racks, pallets and shelves, the total storage area in square feet, maximum storage height, aisle widths, and flue spaces. An authorized officer of the company or business must sign this letter.
2. A scaled site plan which shows the entire building, including all fire access lanes, fire hydrants, fire department connection, and fire sprinkler riser(s). CFC §3206.6
3. 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.
4. 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 the shelf level).

5. The number of tiers within each rack.
6. The commodity clearance between the top of storage and the sprinkler deflector for each storage arrangement.
7. Aisle dimensions between each storage array. Aisles are measured from the actual edge of the commodity to commodity, not rack to rack.
8. Maximum pile volume for each storage array for solid pile and shelf storage.
9. Location and classification of different commodity classes in accordance with CFC Section 3203. 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, *unless an engineering analysis has been submitted for review and approval per CFC 3204.2*
10. Location of commodities which are banded or encapsulated.
11. The dimension and location of the transverse and longitudinal flue spaces.
12. Type of fire suppression or fire detection systems.
  - a. The sprinkler design requirements based on commodity type, aisle width, and sprinkler temperature rating as detailed in NFPA 13, Chapters 12-18 (e.g., .45/3000 with 286° heads). A complete fire sprinkler plan shall be submitted separately by a licensed C-16 contractor.
  - b. The type of fire detection system. A complete fire detection/alarm plan shall be submitted by a licensed C-10 contractor.
13. Location of valves controlling the water supply of ceiling and in-rack sprinklers.
14. If required, the location and specifications of any smoke removal or curtain board assemblies.
15. The location, make, model, type, and automatic link temperature of the automatic/manual release smoke vents. Smoke and heat vents shall be listed in accordance with UL 793. and shall be so labeled. In sprinklered buildings, the fusible links for smoke and heat vents shall operate at a temperature no less than 100° above the sprinkler rating. In non-sprinklered buildings, the fusible links shall operate between 100° and 220° above the ambient temperature. Gravity-operated drop-out vents shall operate at 500°. For existing buildings, 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. The Fire Prevention Division reserves the right to require an inspection report describing the locations, release mechanisms, fusible link temperature rating and operational status of each vent. Any deficiencies identified shall be corrected.

16. A statement shall be included on the plans which states whether or not the building is equipped with a solar photovoltaic system on the roof.
17. Where plastic pallets are used for storage, the storage configuration shall be in accordance with NFPA 13, §12.12.2.2.
18. The location and dimensions of High Velocity Low Speed fans (HVLS). The installation of HVLS fans shall comply with NFPA 13, §11.1.7
  - a. Maximum fan diameter of 24',
  - b. HVLS fans centered approximately between 4 adjacent sprinklers,
  - c. Vertical clearance from HVLS fans to sprinkler deflector a minimum of 3',
  - d. All HVLS fans shall be interlocked to shut down immediately upon receiving a waterflow signal from the alarm system.
19. Where required, column protection in accordance with NFPA 13, §16.4.1.

### **Classification of Commodities (CFC §3203)**

Commodities shall be classified as Class I, Class II, Class III, Class IV or high hazard, in accordance with CFC Chapter 32.

Plastics shall be classified as Group A, B or C in accordance with CFC §3203.7. To determine the proper commodity classification of products with limited quantities of Group A plastics in mixed commodities, use CFC Figure 3203.7.4. 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".

### **Designation of High Piled Storage Areas (CFC §3204)**

The designation of a high-piled combustible storage area, or portion thereof intended for storage of different commodity class, shall be based on the highest hazard commodity class stored except as provided in CFC Section §3204.2; *designation based upon engineering analysis*.

**Note:** Flammable liquids, flammable solids, flammable gases, aerosols, explosives, oxidizers, and reactive materials, etc., fall under the category of hazardous materials and have additional requirements that apply. Storage of hazardous materials often require review and approval of additional plans and/or a chemical classification package prior to further review of the high piled storage plan. Coordination of these reviews is necessary.

### **Housekeeping & Maintenance (CFC §3205)**

Clearance between ignition sources and the combustible storage shall be maintained in accordance with CFC §305.1.

Smoking shall be prohibited. Approved "NO SMOKING" signs shall be conspicuously posted in accordance with CFC §310.

## **Aisle Maintenance (CFC §3205.4)**

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 shall be maintained in 48 inch 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. During mechanical stocking operations, a minimum unobstructed aisle width of 44 inches shall be maintained in accordance with CFC §3206.9.

## **General Fire & Life-Safety Provisions (CFC §3206)**

Fire-protection and life safety features for high-piled storage areas shall be in accordance with CFC Sections §3206.2 through §3206.10 and other nationally recognized standards approved by the Corona Fire Department.

### **Extent & Type of Protection (CFC §3206.2)**

Where required by Table 3206.2, fire detection systems, smoke and heat removal, draft curtains, and fire sprinkler design densities shall extend to 15' beyond the HPS area, or to a permanent partition, whichever is least. For fire protection of mixed commodities, the fire protection required by Table 3206.2 shall be for the most restrictive design requirements.

### **Separation of High-Piled Storage Areas (CFC §3206.3)**

High-piled storage areas shall be separated from each other or other portions of the building where required by Sections §3206.3.1 through §3206.3.2.2.

### **Automatic Sprinklers (CFC §3206.4)**

Automatic fire sprinkler systems shall be provided in accordance with Sections §3207, §3208 and §3209. The sprinkler system shall be designed in accordance with NFPA 13 or other applicable nationally recognized standards. A complete description of the tables, figures and curves in NFPA 13, §12 through 18 (storage) shall be provided to confirm the design criteria.

**Pallets:** Automatic sprinkler requirements based upon the presence of pallets shall be in accordance with NFPA 13.

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

### **Fire Detection Systems (CFC §3206.5)**

When fire detection is required by CFC Table 3206.2, an approved automatic fire detection system shall be installed in accordance with NFPA 72 throughout the high-piled storage area. The system shall be monitored and be in accordance with CFC §907.

## **Building Access (CFC §3206.6)**

When building access is required by CFC Table 3206.2, fire apparatus access roads shall be provided to within 150 feet of all portions of the exterior walls of the building used for high-piled storage.

**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.

When access doors are required by CFC Table 3206.2, they shall be provided in each 100 lineal feet, or fraction thereof, of the exterior walls which face the required fire access roadway. Access doors shall not be less than 3 feet in width and 6 feet 8 inches in height. Roll-up doors shall not be used unless approved. Access doors shall be accessible without the use of a ladder. Only approved locking devices shall be used.

## **Smoke & Heat Removal (CFC §3206.7)**

Where smoke and heat removal is required by CFC Table 3206.2, it shall be provided in accordance with CFC Section §910. Smoke and heat vents shall be listed and labeled to indicate compliance with UL 793. They shall be capable of being operated by approved automatic and manual means. If mechanical smoke removal is proposed in accordance with CFC §910.4, it shall be of an approved type and shall operate automatically by a heat response device and contain a manual release roof handle. Vent area shall be calculated per CFC §910.3.3 and equations 9-4 or 9-5. The fusible link temperature shall be rated as specified in #15 under Plans and Specifications, above.

Smoke and heat vents are not required per this chapter, when the storage areas have an exit travel distance of 250' or less and are protected by an Early Suppression Fast Response (ESFR) sprinkler system installed in accordance with NFPA 13. Smoke vents shall be inspected and maintained per NFPA 204.

## **Draft Curtains**

Where ESFR sprinkler systems are installed adjacent to sprinkler systems with standard response sprinklers, a draft curtain of noncombustible construction of at least 2' in depth shall separate the two areas, as required by NFPA 13.

## **Fire Department Hose Connections (CFC §3206.8)**

Where exit passageways are required by the California Building Code for egress, a Class I standpipe system shall be provided in accordance with CFC Section §905.

## **Aisles (CFC §3206.9)**

Aisles providing access to exits and fire department access doors shall be provided in high-piled storage areas exceeding 500 square feet. 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.

Aisles in Sprinklered Buildings: Aisles in sprinklered buildings shall be a minimum of 44 inches wide. Aisles shall be a minimum of 96 inches wide in high-piled storage areas exceeding 2500 square feet in area, which are accessible to the public and designated to contain high-hazard commodities. Aisles shall be a minimum of 96 inches wide in areas accessible to the public where mechanical stocking methods are used, per CFC 3206.9.1.1.

Aisles in Nonsprinklered Buildings: Aisles in nonsprinklered buildings shall be a minimum of 96 inches wide, per CFC 3206.9.1.2.

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 above finished floor level, provided that such supports do not interfere with fire department hose stream trajectory, per CFC 3206.9.2.

Dead ends: Dead end aisles shall not exceed 20' in Group M occupancies, per CFC 3206.9.3. Dead end aisles shall not exceed 50' in length in other occupancies.

### **Portable Fire Extinguishers (CFC 3206.10)**

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

### **Fire Sprinkler Systems for Protection of High Piled Combustible Storage (CFC §3206.4, §3207, §3208, §3209)**

#### **Solid-Piled and Shelf Storage (CFC §3207.2)**

Where fire sprinklers are required by CFC Table 3206.2, an approved automatic sprinkler system shall be installed throughout the building or to one-hour fire barriers constructed in accordance with Section 707 of the California Building Code. Openings in such fire barriers shall be protected by opening protectives having 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 California Building Code, and NFPA 13.

#### **Shelf Storage (CFC §3207.2.1)**

Shelf storage greater than 12' but less than 15' in height shall be in accordance with the fire protection requirements set forth in NFPA 13. Shelf storage 15' or more in height shall be protected in an approved manner with special fire protection, such as in-rack sprinklers.

#### **Rack Storage (CFC §3208.2)**

When fire sprinklers are required by CFC Table 3206.2, an approved automatic sprinkler system shall be installed throughout the building or to one-hour fire barriers constructed in accordance with the California Building Code. Openings in such fire barriers shall be protected by opening protectives having a 1-hour fire protection ratings. The design and installation of the automatic sprinkler system and other fire protection shall be in accordance with CFC Section §903.3.1.1 and the California Building Code.

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



Racks with solid shelving shall meet the requirements of CFC §3208.2.2.

### **Rack Flue Spaces (CFC §3208.3)**

Flue Spaces shall be provided and maintained per CFC Table 3208.3. Single and double row racks shall be equipped with a transverse flue space. A mechanical means shall be provided to maintain the transverse flue space at the uprights. The device and method shall be identified on the plans. Transverse flue spaces between uprights shall be marked with a 3" or 6" yellow strip on the load beam with words in red that read "Keep Clear". Durable vinyl tape, paint or other methods may be approved. Transverse flue space is measured as the distance between loads, not the distance between racks. The net width of the flue space is a measure of its gross width less any horizontal obstructions, such as rack uprights, located within the flue space. A rack upright (typically 3" wide) is not considered a flue space, due to the cross bracing used.



### **Solid Piled and Shelf Storage**

Shelf storage, storage in solid piles, solid piles on pallets, and storage in bin boxes not exceeding 5' in any dimension shall be in accordance with CFC §3206 and §3207.

### **Rack Storage**

Rack storage in a non-sprinklered building shall be in accordance with CFC §3206 and §3208. Rack storage in a sprinklered building shall be in accordance with CFC §3206 and §3208; however, the sprinklered protection for solid shelves shall be based on the NFPA 13 definition for solid shelves.

Where sprinklers are required for reasons other than those in Chapter 32, the portion of the sprinkler system protecting the HPS area shall be designed and installed in accordance with CFC §3207 and §3208.

### **Column Protection**

Where fireproofing of building columns is not provided and storage heights are in excess of 15', protection of building columns located wholly or partially within the rack footprint inclusive of flue spaces or within 12" of the footprint shall be protected in accordance with one of the options in NFPA 13, §16.4.1. Such protection shall be specified on the plans.

**Extra-high-rack storage systems shall be approved by the fire code official prior to installation.**

### **In-Rack Sprinklers**

Where in-rack sprinklers are required per NFPA 13, §16.1.8.4, they shall be located at an intersection of transverse and longitudinal flue spaces.

### Automated Storage (CFC §3209.2)

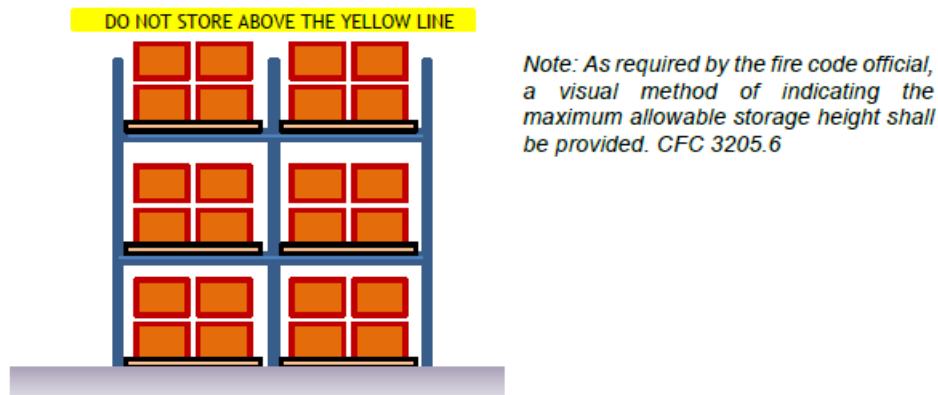
Automated storage, similar to carousel storage shall be in accordance with CFC §3209.

### Specialty Storage (CFC §3210)

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 §3206, §3208 and NFPA 13. Palletized storage of records shall be in accordance with CFC §3207.

### System Maintenance (CFC §901.6)

Fire detection, alarm, and extinguishing systems shall be maintained operable at all times, and shall be replaced or repaired where defective. Equipment, devices, and systems shall be regularly tested in accordance with nationally recognized standards, manufacturers' recommendations and adopted regulations. Non-required fire protection systems and equipment shall be inspected, tested and maintained or removed.



### TECHNICAL ASSISTANCE

Due to the complex building design of the requirements specified within the CFC and adopted standards, it is often necessary to obtain the service of a fire protection design professional to assist with developing a protection scheme that meets the requirements of both the business and the California Fire Code.

The reference tables for High-Piled Combustible Storage are as follows:

**Table 3206.2  
General Fire Protection and Life Safety Requirements**

Commodity Classification	Size of High Piled Storage Area <sup>a</sup> (sq. ft.) (See sections 3206.2 and 3206.4)	All Storage Areas (see Section 3206, 3207 and 3208) <sup>b</sup>				Solid pile, shelf and palletized storage (see Section 3207.3)		
		Automatic Fire Extinguishing System (see Section 3206.4)	Fire-detection System (see Section 3206.5)	Building access (see section 3206.6)	Smoke and Heat Removal (see Section 3206.7)	Maximum Pile Dimension <sup>c</sup> (feet)	Maximum Permissible Storage Height <sup>d</sup> (feet)	Maximum Pile Volume (cubic feet)
I-IV	0-500	NR <sup>a</sup>	NR	NR <sup>e</sup>	NR	NR	NR	NR
	501-2500	NR <sup>a</sup>	Yes <sup>i</sup>	NR <sup>e</sup>	NR	100	40	100,000
	2501 – 12,000 Public Accessible	Yes	NR	NR <sup>e</sup>	NR	100	40	400,000
	2501 – 12,000 Nonpublic accessible (Option 1)	Yes	NR	NR <sup>e</sup>	NR	100	40	400,000
	2501 – 12,000 Nonpublic accessible (Option 2)	NR <sup>a</sup>	Yes	Yes	Yes <sup>j</sup>	100	30 <sup>f</sup>	200,000
	12,001 – 20,000	Yes	NR	Yes	Yes <sup>j</sup>	100	40	400,000
	20,001 – 500,000	Yes	NR	Yes	Yes <sup>j</sup>	100	40	400,000
	Greater than 500,000 <sup>g</sup>	Yes	NR	Yes	Yes <sup>j</sup>	100	40	400,000
High Hazard	0-500	NR <sup>a</sup>	NR	NR <sup>e</sup>	NR	50	NR	NR
	501-2500 Public accessible	Yes	NR	NR <sup>e</sup>	NR	50	30	75,000
	501-2500 Nonpublic accessible (Option 1)	Yes	NR	NR <sup>e</sup>	NR	50	30	75,000
	501-2500 Nonpublic accessible (Option 2)	NR <sup>a</sup>	Yes	Yes	Yes <sup>j</sup>	50	20	50,000
	2501 – 300,000	Yes	NR	Yes	Yes <sup>j</sup>	50	30	75,000
	300,001 – 500,000 <sup>a,h</sup>	Yes	NR	Yes	Yes <sup>j</sup>	50	30	75,000

<sup>a</sup> 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.

<sup>b</sup> For aisles, see Section 3206.9.

<sup>c</sup> Piles shall be separated by aisles complying with Section 3206.9.

<sup>d</sup> 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.

<sup>e</sup> Section 503 shall apply for fire apparatus access.

<sup>f</sup> For storage exceeding 30 feet in height, Option 1 shall be used.

<sup>g</sup> 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.

<sup>h</sup> High-piled storage areas shall not exceed 500,000 s.f. A 2-hour fire wall constructed in accordance with the California Building Code shall be used to divide the high piled storage exceeding 500,000 s.f. in area.

<sup>i</sup> 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.

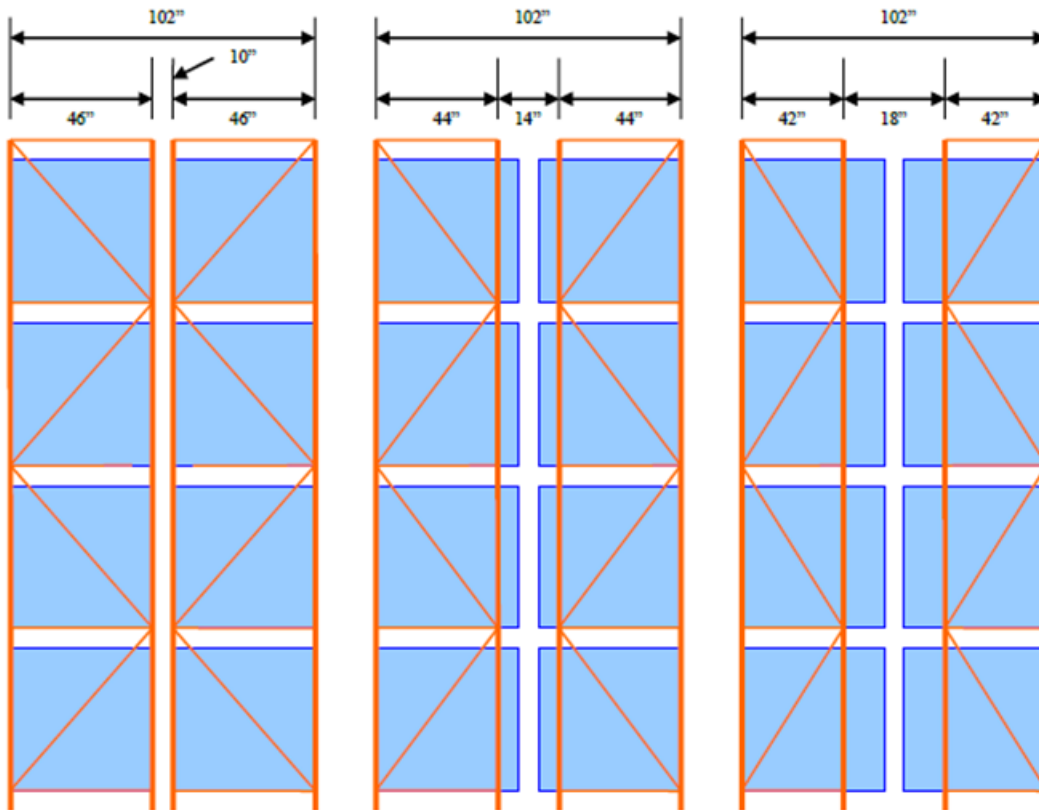
<sup>j</sup> Not required when storage areas are protected by early suppression fast response (ESFR) sprinkler systems installed in accordance with NFPA 13.

**Table 3208.3  
Required Flue Spaces for Rack Storage**

Rack Configuration	Automatic Sprinkler Protection		Sprinkler at the Ceiling with or Without Minimum In-Rack Sprinklers			In-Rack Sprinklers at Every Tier	Nonsprinklered
			≤ 25 feet		> 25 feet		
	Storage Height		Option 1	Option 2		Any height	Any height
Single-row rack	Transverse flue space	Size <sup>b</sup>	3 inches	Not applicable	3 inches	Not required	Not required
		Vertically aligned	Not required	Not applicable	Yes	Not Applicable	Not required
	Longitudinal flue space		Not required	Not applicable	Not required	Not required	Not required
Double-row rack	Transverse flue space	Size <sup>b</sup>	6 inches <sup>a</sup>	3 inches	3 inches	Not required	Not required
		Vertically Aligned	Not required	Not required	Yes	Not Applicable	Not required
	Longitudinal flue space		Not required	6 inches	6 inches	Not required	Not required
Multi-row rack	Transverse flue space	Size <sup>b</sup>	6 inches <sup>c</sup>	Not applicable	6 inches	Not required	Not required
		Vertically Aligned	Not required	Not applicable	Yes	Not Applicable	Not required
	Longitudinal flue space		Not required	Not applicable	Not required	Not required	Not required

- 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.
- c. Transverse flue spaces shall be maintained by methods as approved. (See NFPA 13, §16.1.6.3 for situations where transverse flues spaced at maximum of 5' intervals can remove the consideration as solid shelving and the need for in-rack sprinkler protection.)

## LOAD BEAM CONFIGURATION NOT REQUIRING PALLET STOPS



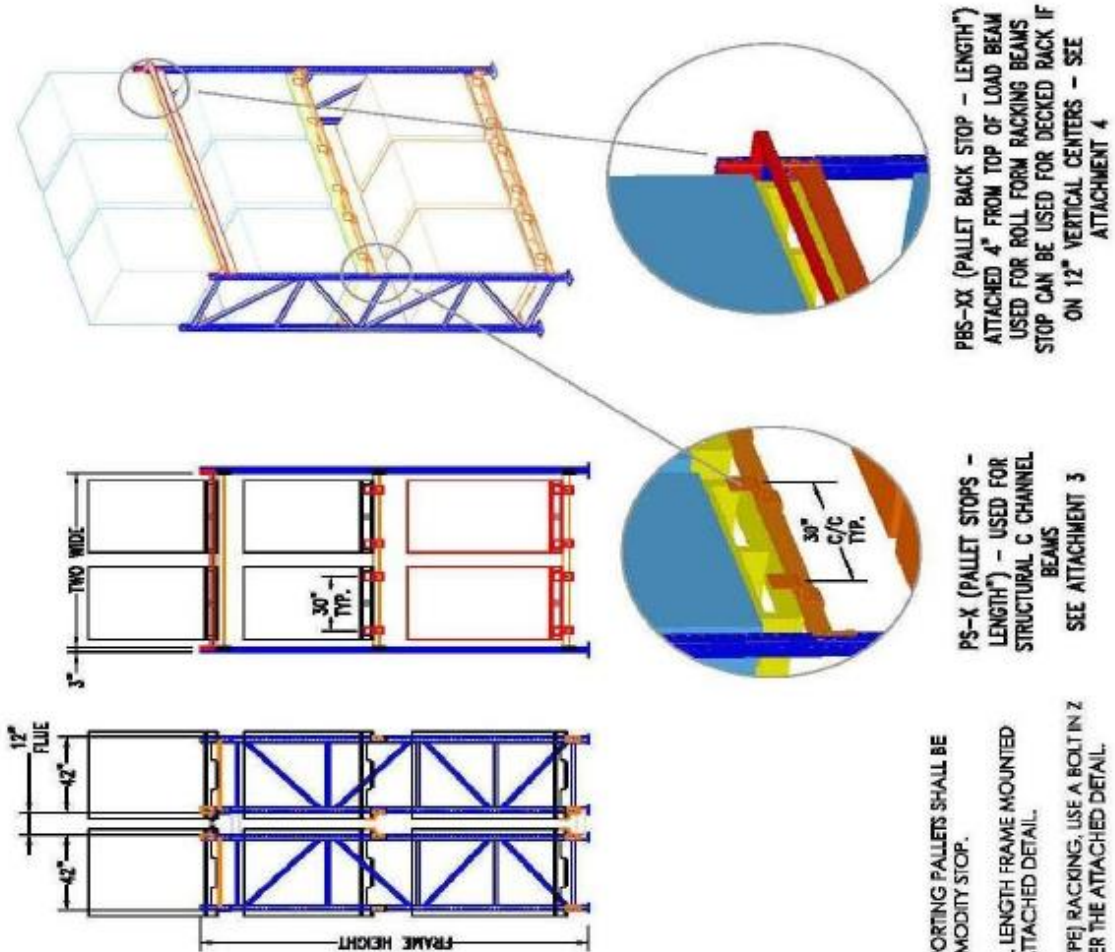
### NOTES:

1. Maximum Pallet depth 48"
2. Storage on Load Beam only, no shelving, wire mesh grating, or pallet supports.
3. 6" flue space shall be maintained at all times.
4. Change to the storage configuration requires Corona Fire Department approval.

### NOTES:

1. When 42" uprights are used with an 18" row spacer and a typical 48" x 40" pallet is used, no pallet stops are required.
2. When 44" uprights are used with a 14" row spacer and a typical 48" x 40" pallet is used, no pallet stops are required.
3. When 46" uprights are used with a 10" row spacer and a typical 48" x 40" pallet is used, no pallet stops are required.

## STORAGE CONFIGURATION REQUIRING PALLET STOPS



### NOTES:

RACKS WITH OPEN SHELVES SUPPORTING PALLET SHALL BE PROVIDED WITH A PALLET / COMMODITY STOP.

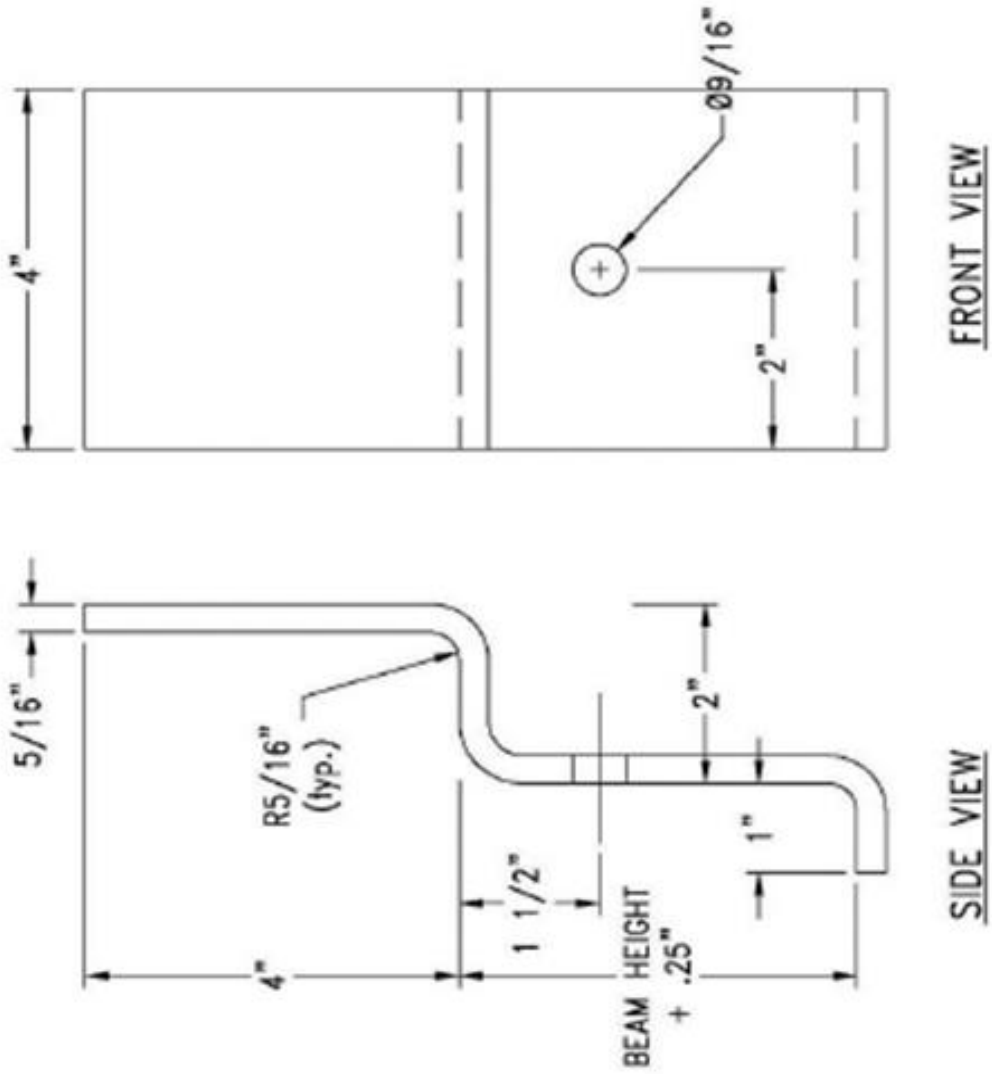
FOR ROLL FORM RACKING A FULL LENGTH FRAME MOUNTED SUPPORT IS TO BE USED PER THE ATTACHED DETAIL.

FOR STRUCTURAL (C-CHANNEL TYPE) RACKING, USE A BOLT IN Z TYPE SUPPORT ON 30" CENTERS PER THE ATTACHED DETAIL.

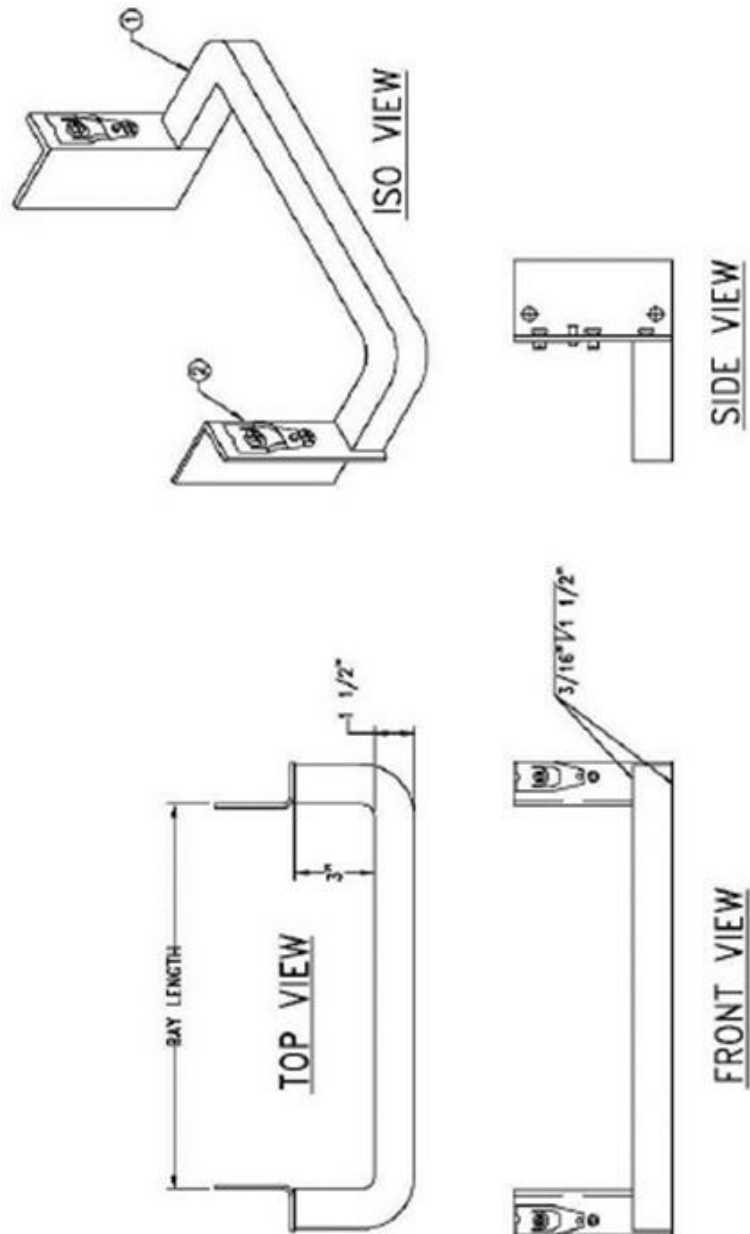
PBS-XX (PALLET BACK STOP - LENGTH") ATTACHED 4" FROM TOP OF LOAD BEAM USED FOR ROLL FORM RACKING BEAMS STOP CAN BE USED FOR DECKED RACK IF ON 12" VERTICAL CENTERS - SEE ATTACHMENT 4

PS-X (PALLET STOPS - LENGTH") - USED FOR STRUCTURAL C CHANNEL BEAMS SEE ATTACHMENT 3

## STRUCTURAL "C" CHANNEL BEAM DETAIL

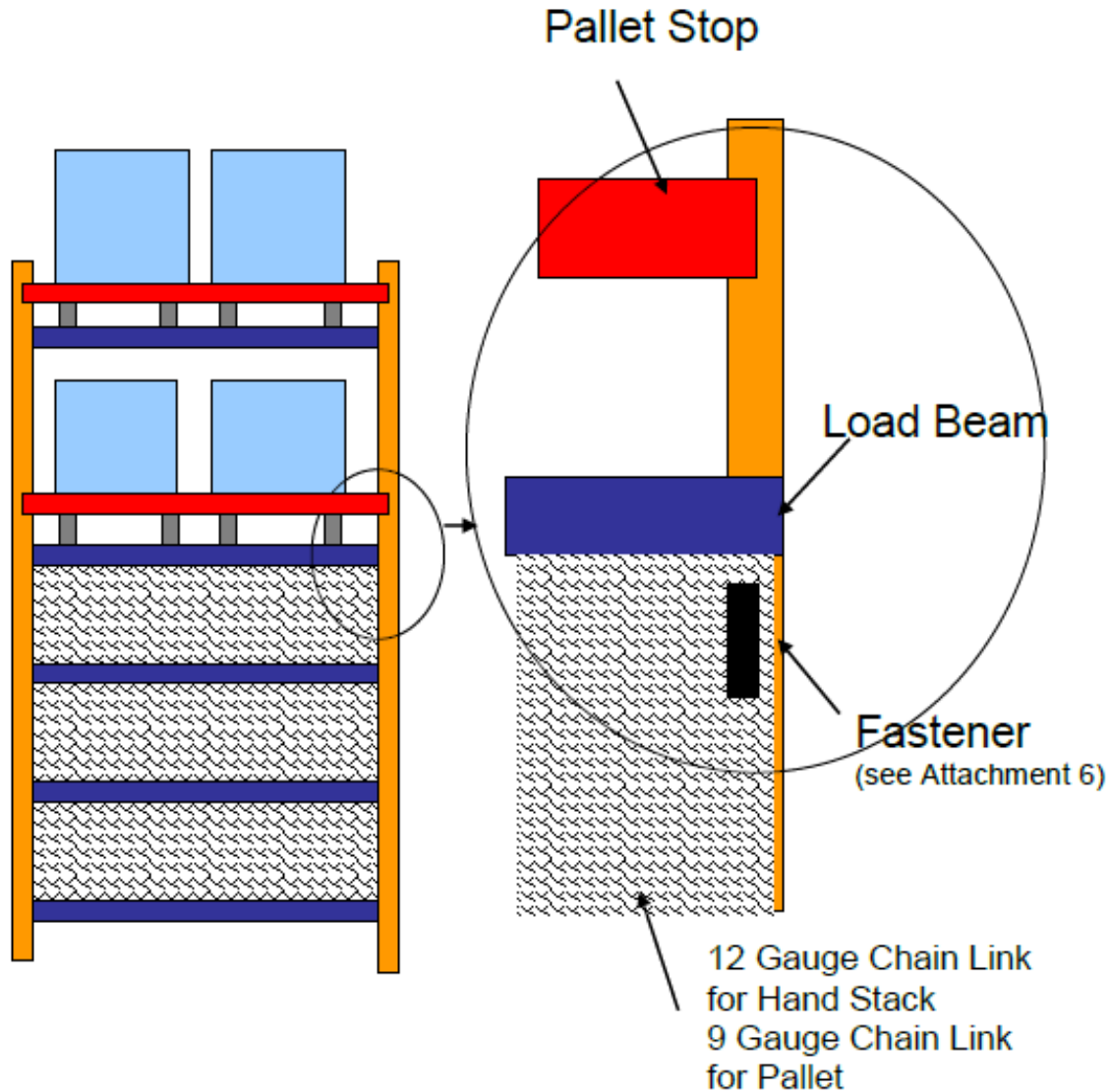


## ROLL FORM RACKING DETAIL





## STORAGE CONFIGURATION FOR HAND STACK RACK

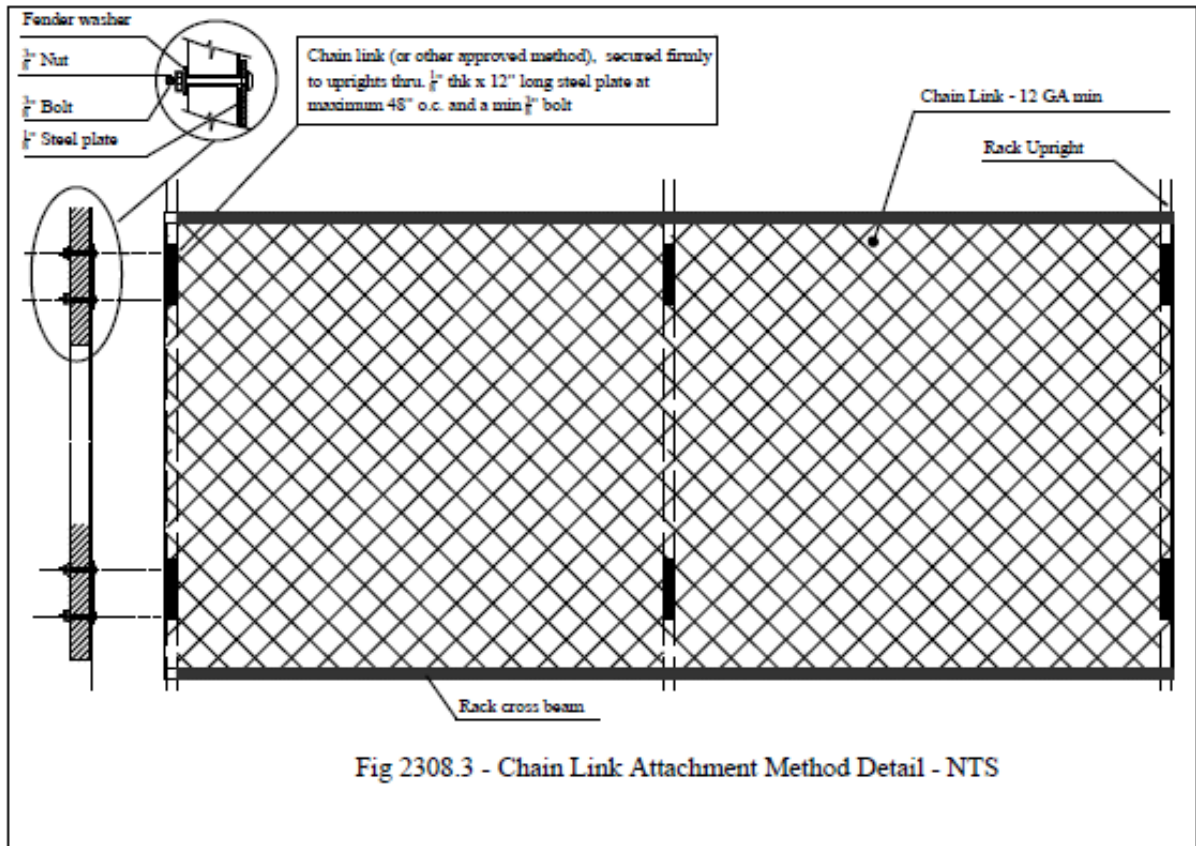


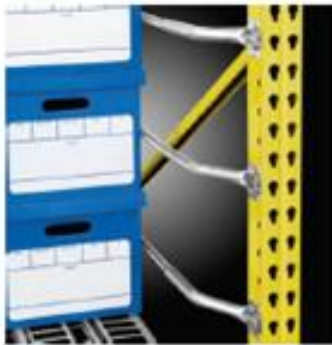
### NOTES:

HAND STACKING/PICKING RACKS: HAND STACKING NON-PALLETIZED AREAS SHALL BE PROVIDED WITH A MEANS TO ENSURE THAT THE FLUE SPACES ARE MAINTAINED. HAND STACK LOCATION WILL BE SECURED FLUSH TO THE REAR COLUMN OF EACH FRAME AS SHOWN IN ATTACHED DETAIL (SEE ATTACHMENT 6 FOR CHAIN LINK).

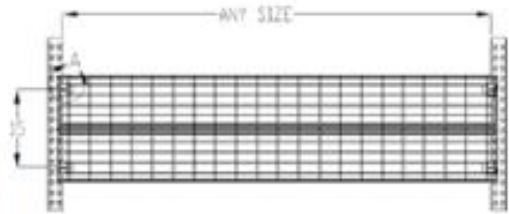
9 Gauge Chain Link Fence for Pallet Loads.  
12 Gauge Chain Link for Hand Stack Loads.

## CHAIN LINK ATTACHMENT METHOD DETAIL





Method 1

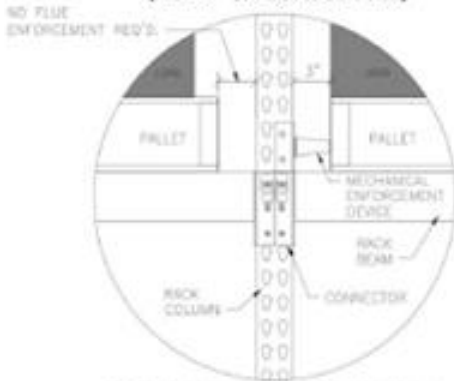


Method 2

**AISLE SHIELD**

**DETAIL 1**

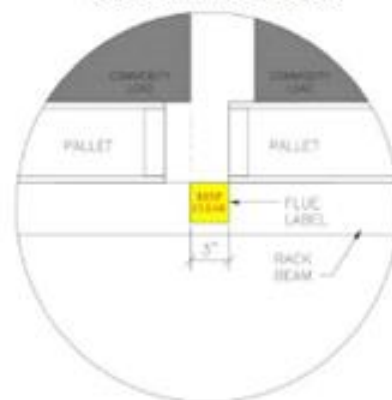
**MECHANICAL ENFORCEMENT DEVICE AT RACK COLUMN  
(NET 3" TRANSVERSE FLUE)**



NOTE: TO BE USED WITH DETAIL 2 ONLY

**DETAIL 2**

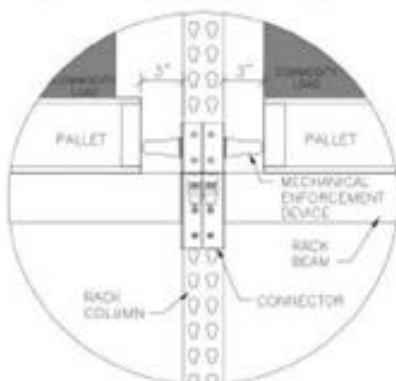
**3" TRANSVERSE FLUE LABEL  
BETWEEN PALLET LOADS**



NOTE: TO BE USED WITH DETAIL 1 ONLY

**DETAIL 3**

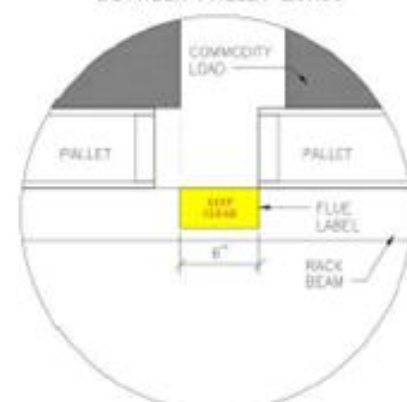
**MECHANICAL ENFORCEMENT DEVICE AT RACK COLUMN  
(NET 6" TRANSVERSE FLUE)**



NOTE: TO BE USED WITH DETAIL 4 ONLY

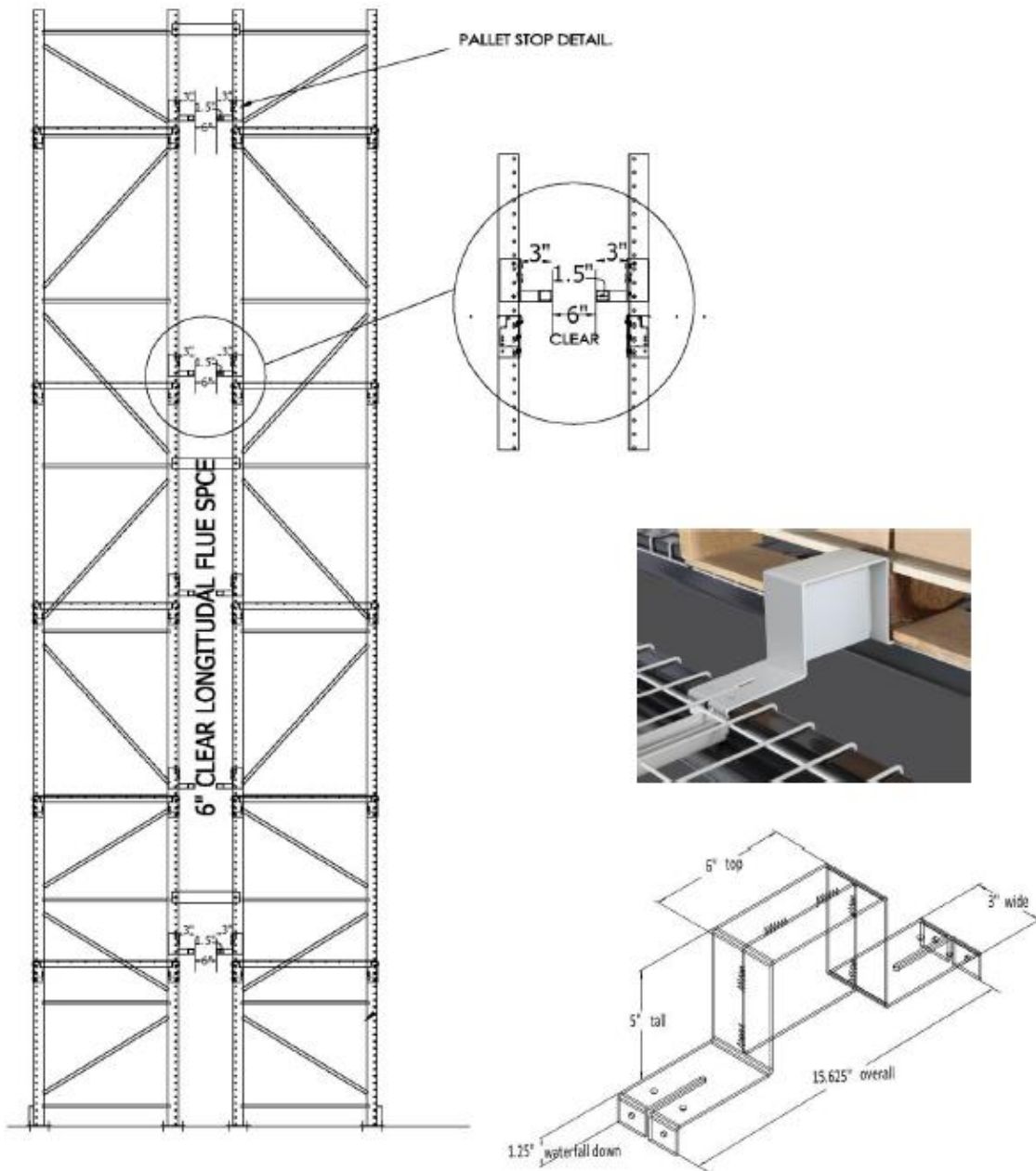
**DETAIL 4**

**6" TRANSVERSE FLUE LABEL  
BETWEEN PALLET LOADS**



NOTE: TO BE USED WITH DETAIL 3 ONLY

## Pallet Stop Longitudinal Flue Clear Space



## High Pile Storage (HPS) Required Information

The following form shall be completed for each storage configuration and/or storage area. The completed form shall be copied onto the HPS plans for all projects within the City of Corona.

Commodity Classification:

I  II  III  IV  High Hazard  Group A Plastic

Commodity Description: \_\_\_\_\_

Cartoned  Free Flowing  Non-expanding  Encapsulated  Non-encapsulated

Other: \_\_\_\_\_

The area designated in the building and used for high piled storage is \_\_\_\_\_ square feet.

Class \_\_\_\_\_ commodity, \_\_\_\_\_ sq. ft.

Class \_\_\_\_\_ commodity, \_\_\_\_\_ sq. ft.

Class \_\_\_\_\_ commodity, \_\_\_\_\_ sq. ft.

The maximum permitted storage height (solid pile: \_\_\_\_\_ rack: \_\_\_\_\_)

The following methods are employed at this facility:

Solid Pile Storage  Palletized  Single row rack  Double row rack  Multi-row rack

Other: \_\_\_\_\_

Rack Storage shelf:  N/A  Load Beam Only  Wire Mesh  Wood Slats  Plywood

Other (Describe): \_\_\_\_\_

Minimum distance between top of storage and sprinkler \_\_\_\_\_.

Smoke vents required  Yes  No

Operation of smoke vents (if applicable)

Manual

Automatic via fusible link which releases at \_\_\_\_\_ °F.

Draft Curtains required?  Yes  No

The overhead fire sprinkler system utilizes the following heads:

ESFR: K \_\_\_\_\_ at \_\_\_\_\_ PSI with \_\_\_\_\_ °F heads

Standard coverage heads: K \_\_\_\_\_  Pendant  Upright \_\_\_\_\_ °F with a density of \_\_\_\_\_ gpm over \_\_\_\_\_ square feet spaced at a maximum of \_\_\_\_\_ square feet per fire sprinkler.

Control Mode Density/Area (CMDA)  Control Mode Special Application (CMSA)

The fire sprinkler system density and area of application for the storage area is \_\_\_\_\_ gpm/ft<sup>2</sup> over \_\_\_\_\_ ft<sup>2</sup>.

In-rack sprinklers required  Yes  No

There are \_\_\_\_\_ level(s) of in-rack fire sprinkler protection.

The aisles between the racks shall be maintained at \_\_\_\_\_ feet.

Fire Doors required?  Yes  No  Flue Spaces required?  Yes  No

Flue space between racks shall be maintained a minimum of:

Transverse \_\_\_\_\_" clear  Must be vertically aligned (for storage > 25')

Longitudinal \_\_\_\_\_" clear

Column protection required?  Yes  No

Pallet stops required?  Yes  No

Longitudinal pallet stop configuration:

Chain Link  Roll form  "C" Channel  Other \_\_\_\_\_

Transverse Flue Pallet Stop Configuration:

Mechanical Means (flue keepers, etc)  Load Beam Markers "Keep Clear"

Hand Stack?  Yes  No # of tiers \_\_\_\_\_ Chain Link required  Yes  No

Idle wood pallet floor storage shall not exceed 5'  Yes  No

Storage configuration and height delineated by signage on floor or walls  Yes  No

Additional Conditions \_\_\_\_\_

Are any hazardous materials stored in the High Piled Storage Area?

Yes – Provide evidence of an approved Chemical Classification

No – Place a note on the plans stating "no hazardous material storage allowed without approval by Corona Fire Department".