

BREA FIRE DEPARTMENT

Fire Prevention Bureau

1 Civic Center Circle, Brea, CA 92821
714-990-7655 • www.cityofbrea.net

High-Piled Combustible Storage



May 2020

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PURPOSE

The intent of this guideline is to provide the requirements for the protection of high-piled storage (HPS) for a variety of commodities. HPS increases the potential fire hazard within a structure by increasing the vertical height of storage and by providing stability of storage (e.g., rack and automated storage) in a fire situation. 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 32 of the 2019 California Fire Code (CFC), the 2019 California Building Code (CBC) and locally adopted ordinances enforced by Brea Fire Department (BFD).

SCOPE

This guideline provides the requirements for all HPS within the jurisdiction of the Brea Fire Department (BFD).

For the purposes of this guideline, certain terms are defined, per CFC 202:

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.

High-Piled Storage Area

An area within a building that is designated, intended, proposed, or actually used for high-piled combustible storage. Used for purposes of selecting the applicable fire protection requirement row in Table 3206.2:

- 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 15-foot 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 15-foot spaces, the individual arrays shall be considered separate storage areas with their own footprint calculation.
- Each storage area shall also include a 48-inch 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 3206.2, unless such areas are separated from each other by a one-hour rated fire barrier wall constructed in accordance with Section 707 of the California Building Code (CBC). Openings in such walls shall be protected by fire assemblies having a one-hour fire-protection rating. CFC 3206.3.2.

Rack Storage

A combination of vertical, horizontal, and diagonal members that support stored materials. Racks can be fixed or portable. NFPA 13 Section 3.9.3.7

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*. 2016 NFPA 13 Section 3.9.2.6

Solid Shelving

Shelving that is solid, slatted, mesh, or grated located within racks that obstructs sprinkler water penetration through the racks. Solid shelves having an area equal to or less than 20 ft² and shelves of wire mesh, slates, or other materials more than 50 percent open and where the flue spaces are maintained shall be defined as open racks. 2016 NFPA 13 Section 3.9.3.8

SUBMITTAL REQUIREMENTS

1. General

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 32 may be of great assistance. All new plan submittals and revisions will consist of **3** plan hard copies and 1 electronic copy in pdf format. All electronic copies may be submitted on CD, DVD, or Memory Stick. Plans shall be submitted with the following information per CFC 3201.3 Items #1-14:

- 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. CFC 3206.6.
- 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.

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- 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. CFC 3203.
 - J. The location of commodities that are 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 2016 NFPA 13, Chapter 12 (e.g., .45/3000 with 286- degree heads). A complete sprinkler design shall be submitted under a separate permit number by a C16 licensed contractor.
 - 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 2016 NFPA 13, Section 16.1.4.
 - N. The location, make, model, type, listing, and automatic link temperature of the manual mechanical smoke removal system. Exhaust fans that are part of this system shall operate at a temperature of 221 degrees Fahrenheit. Manual control devices shall be located so as to be accessible to the fire service from an exterior door of the building, and protected against interior fire exposure by not less than 1-hour fire barriers, constructed in accordance with CBC 707.

Note: Required smoke vents in existing structures (constructed under the 2010, 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 BFD 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 temperature rating, the presence of a manual release mechanism, and the operational status of each vent. Prior to submitting the report to BFD, all identified deficiencies must be corrected and included within the report.

If the smoke vents do not contain manual release devices, and BFD 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. BFD staff will evaluate all other conditions on a case-by-case basis during the review process. If this requirement is placed, BFD staff will indicate the requirement adjacent to the BFD approval stamp on the final approved plans from the proposed operation. The vent inspection report shall be copied onto the plans prior to BFD 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.

2. California Fire Code Permits—CFC 3201.2

Plans and specifications shall be submitted to the City of Brea Building Department as indicated elsewhere in this document. All permits will be issued following plan approval and completion of corresponding inspections of the HPS installation. A 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.

3. Commodity Classification—CFC 3203

Commodities shall be classified as Class I, II, III, IV, or High Hazard, in accordance with CFC Chapter 32 and referenced standards.

Plastics shall be classified as Group A, B, or C in accordance with CFC Chapter 32. To determine the proper commodity classification of products with limited quantities of Group A plastics in mixed commodities, use CFC Figure 3203.9. 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 3204.2.

Note: Flammable liquids, flammable solids, flammable gasses, aerosols, explosives, oxidizers, and reactive materials fall under the category of hazardous materials and have additional codes that apply. Storage of hazardous materials often shall require submittal and approval of additional plans prior to further review of the high-piled storage plan.

4. General Fire-Protection Provisions—CFC 3206

Fire-protection features for high-piled storage areas shall be in accordance with CFC Chapter 32 and other nationally recognized standards approved by the BFD. 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. CFC 3206.2 The aggregate of all high-piled storage areas within a building shall be used to design the fire protection features found in CFC Table 3206.2 (attached), unless such areas are separated from each other by a one-hour fire barrier wall constructed in accordance with CBC 707. Distinct occupancy groups shall be separated according to CBC 508.

5. Fire Sprinkler Systems—CFC 3206.4

When fire sprinklers are required by CFC Table 3206.2 or the CBC (or if otherwise provided), the sprinkler system shall be installed in accordance with 2016 NFPA 13. A full description of the tables, figures, and curves in NFPA 13, Section 12 (Storage), shall be used to determine the design criteria required.

6. 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 2016 NFPA 72 standard throughout the high-piled storage area. This system shall be installed and monitored as required by CFC 907.

7. Fire Department Access—CFC 3206.6

When building access is required by CFC Table 3206.2, access roadways shall be provided to within 150 feet of all portions of the exterior walls of the building used for high-piled storage. When access doors are required by CFC Table 3206.2, they shall be provided in each 100 lineal feet of exterior wall and shall face the required access roadway.

8. Smoke and Heat Removal—CFC 3206.8

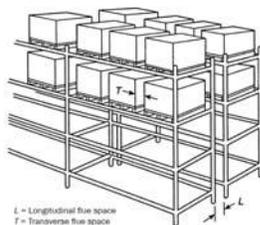
When smoke and heat removal are required by CFC Table 3206.2, smoke and heat vents shall be of an approved type shall be in accordance with CFC Section 910.

Smoke and heat vents are not required when storage areas are protected by early suppression fast response (ESFR) sprinkler systems installed in accordance with 2016 NFPA 13.

9. Rack Flue Spaces—CFC 3208.3

Requirements for flue spaces within the rack storage are provided in CFC Table 3208.3 (attached). Single and double row racks shall be equipped with a pallet/commodity stop along the transverse flue space at each level which shall be by a mechanical means as approved. Double-row racks shall be equipped with a pallet/commodity stop along the longitudinal flue space at each level. The stop along the longitudinal flue space shall be steel or other ferrous material $\frac{1}{4}$ " thick and, in the mounted position, shall extend a minimum of 4 inches above the shelf or cross member, or other method (i.e., 9 gauge chain link) approved by the fire code official (CFC 3208.3; see Attachment 5). In double row racks, where products are hand-stacked, chain link shall be securely attached to the rear of both racks. The chain link shall be a minimum of 12 gauge. Attachment method shall be in compliance with Figure 3208.3 (Attachment 6) or other methods as approved by the fire code official.

Alternative acceptable designs are outlined in Attachment 1 through 7. If an alternate design outlined in the attachments is used, the appropriate detail or details shall be copied onto the plan.



3208.3.1 Flue space protection.

Flue spaces required by Table 3208.3, in single-, double- or multiple- row rack storage installations shall be equipped with approved devices to maintain the required flue spaces. The device and its installation method shall be identified on the plan.



Note: Flue space is measured as the distance between the loads, not the distance between the racks. A flue space's net width is a measure of its gross width minus any horizontal obstructions, such as rack uprights, located within the flue space. In other words, a rack upright (typically 3 in. wide) is not considered a flue space, due to the cross bracing used.

If these flue spaces are not present, then this storage should be protected as solid-shelf storage. Solid-shelf storage protection would require a more robust sprinkler system design.

Solid Piled and Shelf Storage

Shelf storage, storage in solid piles, solid piles on pallets, and storage in binboxes not exceeding five feet in any dimension shall be in accordance with CFC 3206 and 3207.

10. Rack Storage

Rack storage shall be in accordance with CFC 3206 and 3208. Racks with solid shelving having an area greater than 20 (32 prior to 2010) square feet measured between approved flue spaces at all four edges of the shelf shall be in accordance with CFC 3208.2.2.

11. Automated Storage

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

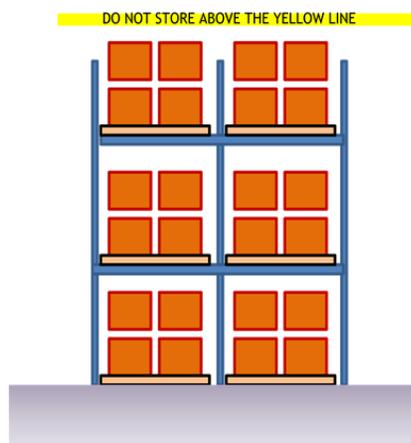
12. Specialty Storage—CFC 3210

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.

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.

The responsibility for inspections, maintenance of the HPS areas as approved, and all fire and life safety equipment and systems required by the CFC shall be the ultimate responsibility of the owner provided that this responsibility has not been transferred in written form to a management company or other party.



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

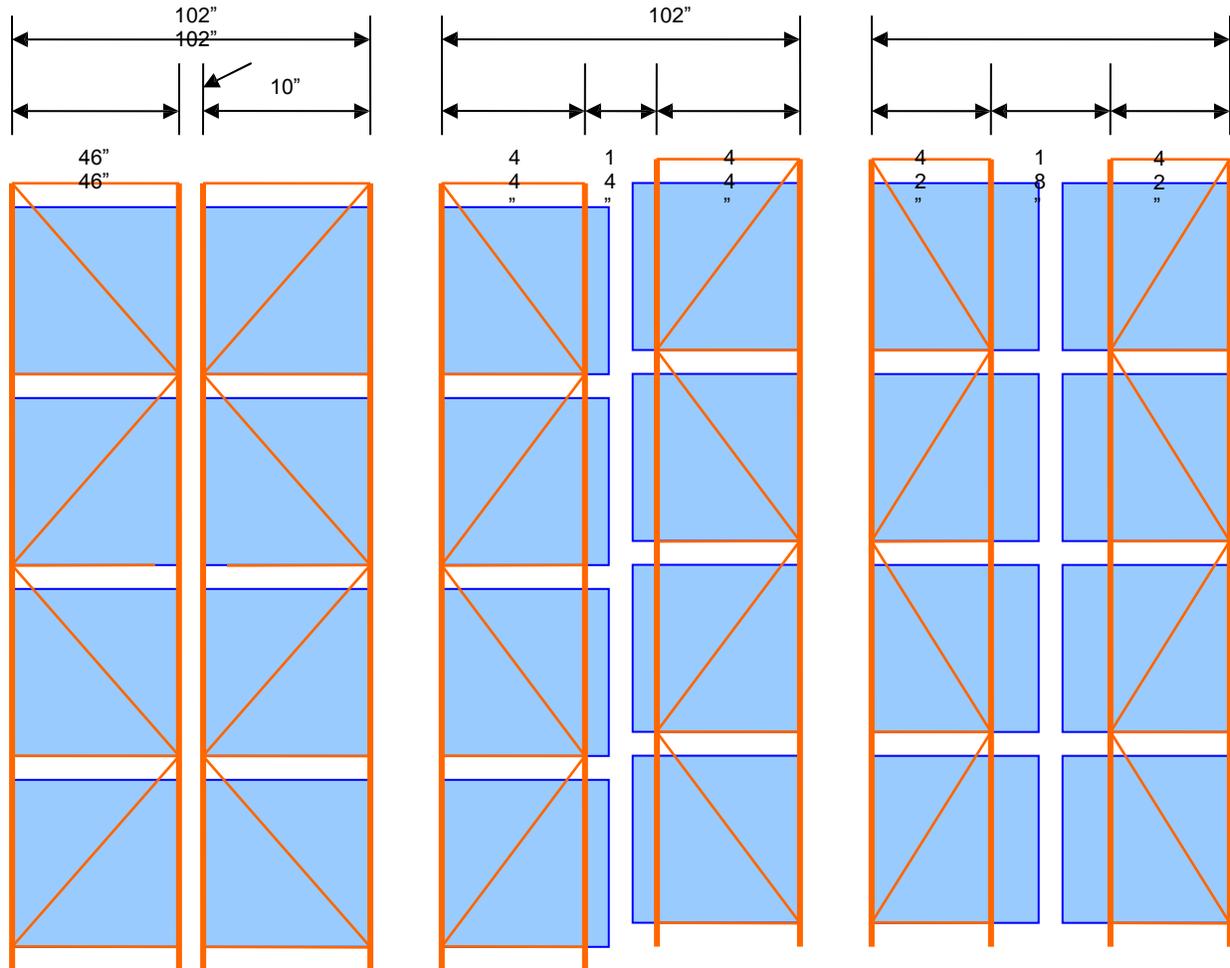
A copy of the approved HPS plans shall be signed by the Brea Fire Inspector upon issuance of the permit. This copy of the plans shall be maintained on site for the life of the HPS system. The Brea Fire Department shall be consulted prior to any changes in the approved/existing/permitted HPS system(s).

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.

ATTACHMENT 1

LOAD BEAM CONFIGURATION NOT REQUIRING PALLET STOPS



NOTES:

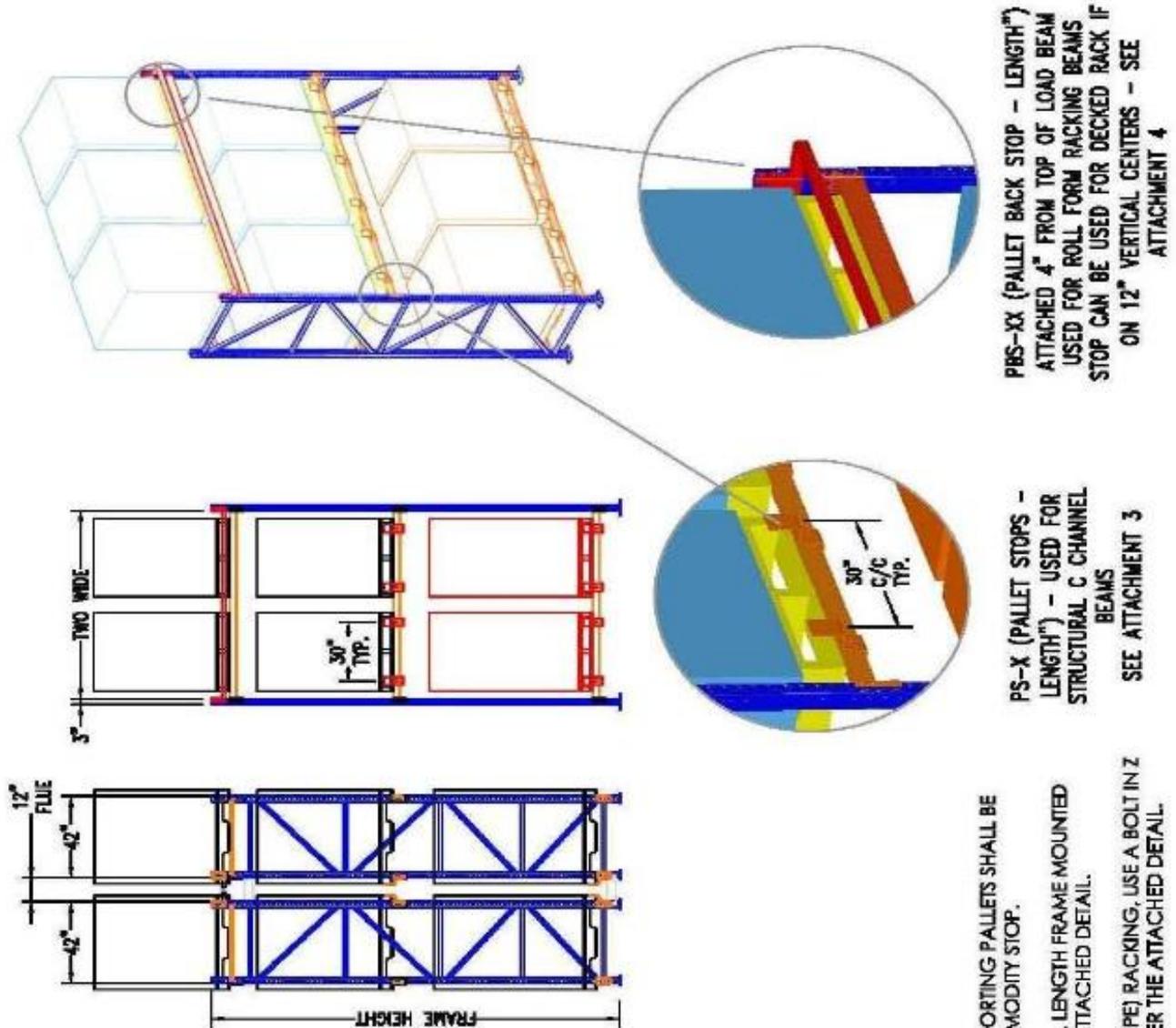
1. MAXIMUM PALLET DEPTH 48"
2. STORAGE ON LOAD BEAM ONLY, NO SHELVING, WIRE MESH GRATING, OR PALLET SUPPORTS.
3. 6" FLUE SPACE SHALL BE MAINTAINED AT ALL TIMES.
4. CHANGE TO THE STORAGE CONFIGURATION REQUIRES PRIOR BFD APPROVAL.

NOTES:

1. WHEN 42" UPRIGHTS ARE UTILIZED WITH AN 18" ROW SPACER AND A TYPICAL 48"x40" PALLET IS USED, NO PALLET STOPS ARE REQUIRED.
2. WHEN 44" UPRIGHTS ARE UTILIZED WITH A 14" ROW SPACER AND A TYPICAL 48"x40" PALLET IS USED, NO PALLET STOPS ARE REQUIRED.
3. WHEN 46" UPRIGHTS ARE UTILIZED WITH A 10" ROW SPACER AND A TYPICAL 48"x40" PALLET IS USED, NO PALLET STOPS ARE REQUIRED.

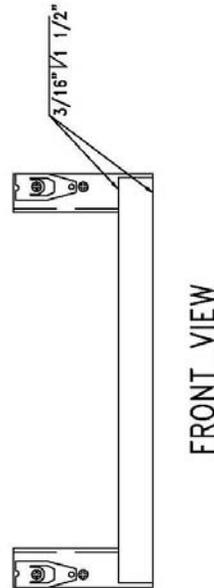
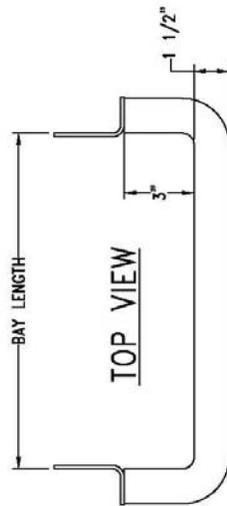
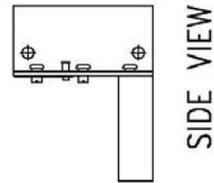
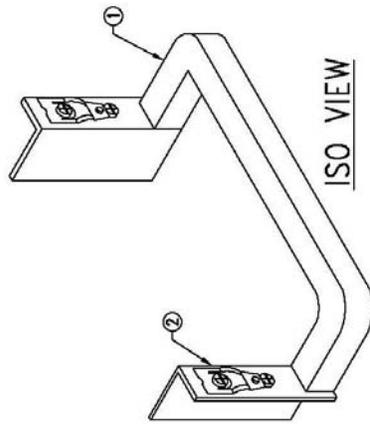
ATTACHMENT 2

STORAGE CONFIGURATION REQUIRING PALLET STOPS



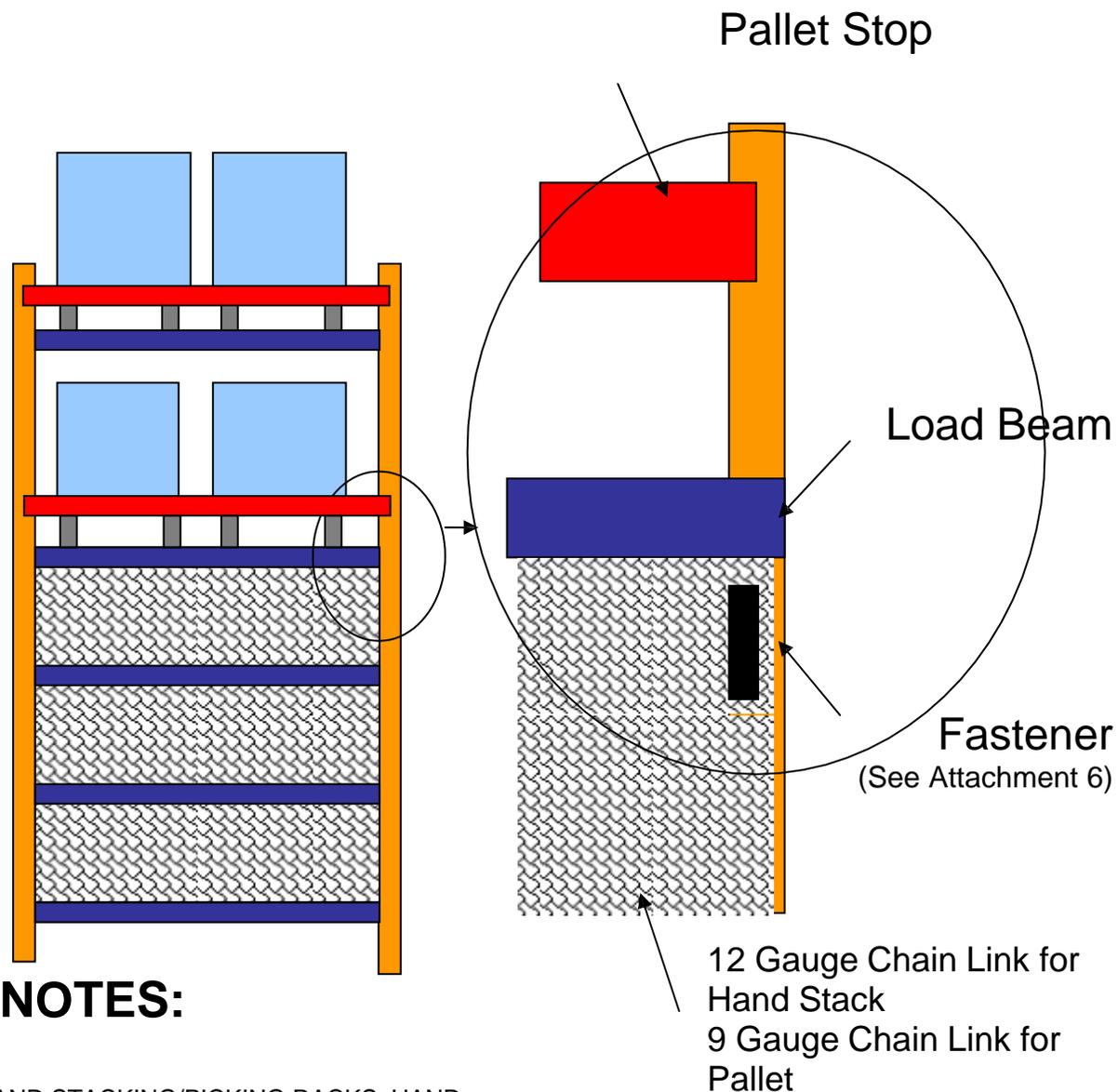
NOTES:

- RACKS WITH OPEN SHELVES SUPPORTING PALLETS 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.



ATTACHMENT 5

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.

ATTACHMENT 6

CHAIN LINK ATTACHMENT METHOD DETAIL

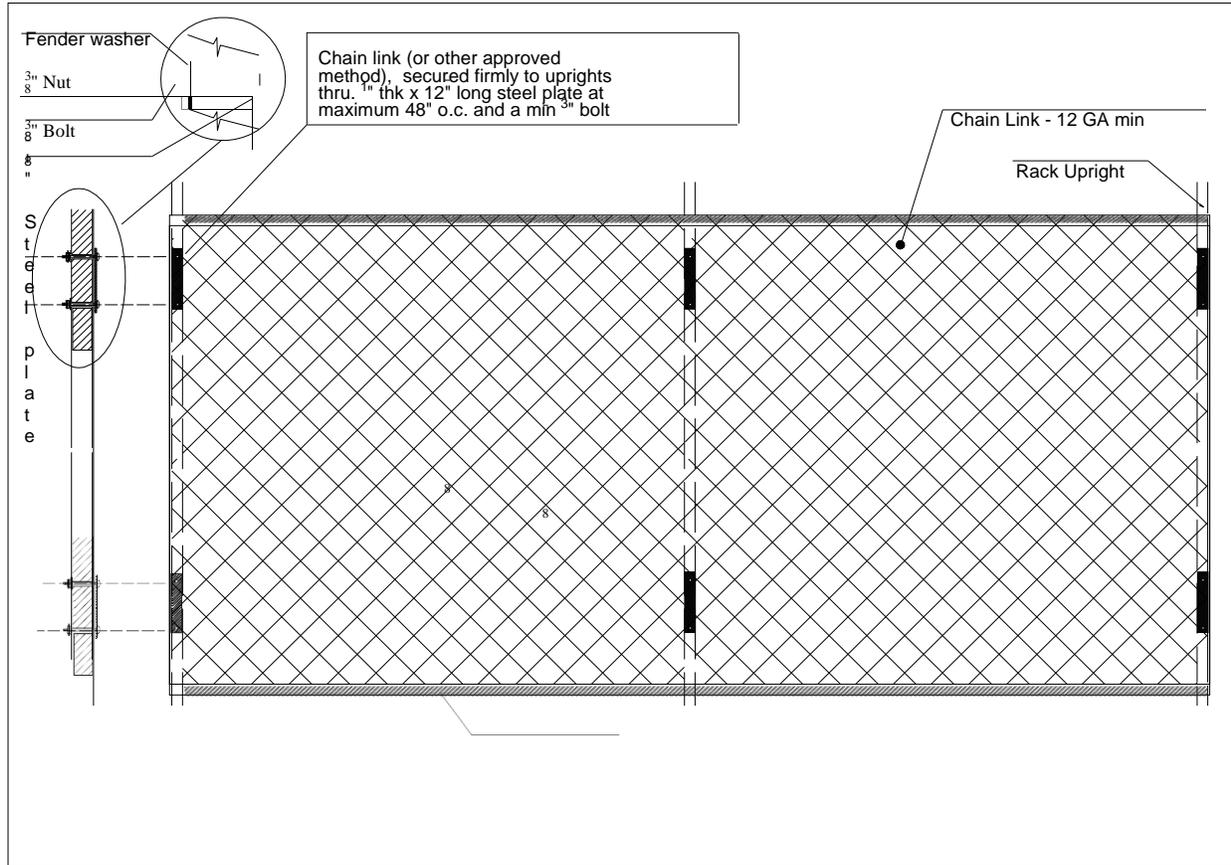
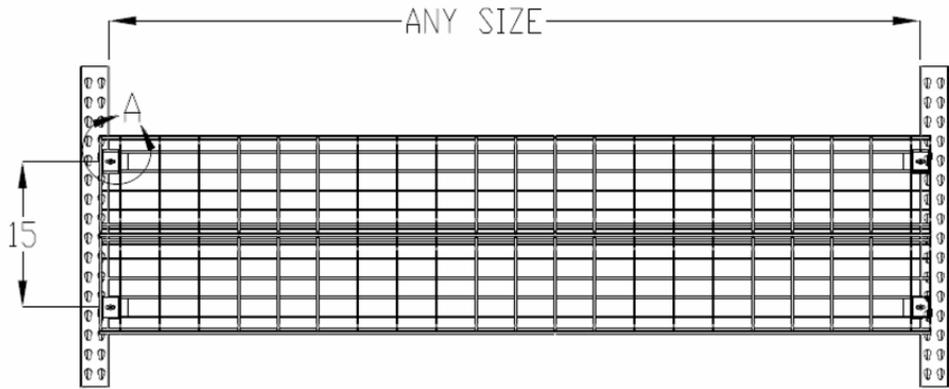
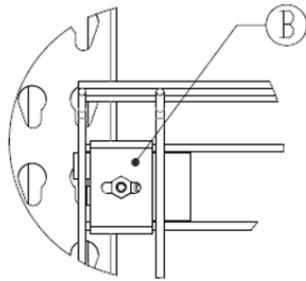


Fig 2308.3 - Chain Link Attachment Method Detail - NTS

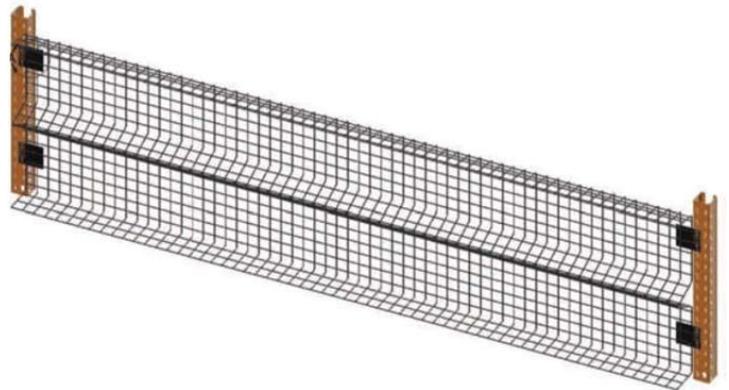
ATTACHMENT 7



AISLE SHIELD



Method 1



Method 2