



## Summary: Determining the Required Size and Capacity of Pallet Rack

### Step 1: Size and Weight of Pallets and Loads

- Pallet Size
- Load Dimensions
- Load Weight

### Step 2: Upright Depth

- Pallet Depth minus 6" for overhang (3" front and back)

### Step 3: Upright Height

- Overhead Clearance
- Forklift Reach
- Load Height and Number of Beam Levels

### Step 4: Beam Size

- Length = load widths + min 3" clearance between load and uprights (x2) + 4" clearance between loads (also number of loads per level)
- Beam Height (Capacity) = weight of pallets x number of pallets

### Step 5: Upright Capacity

- Number of Beam Levels
- Weight per Level
- Beam Spacing

### Step 6: Wire Decks

- Styles: for teardrop step beam vs box beam or structural
- Capacity = greater than load weights
- Depth = upright depth
- Width and Number per Level – based on beam length

### Other Considerations

- Single vs Back-to-Back Rows
- Row Spacers
- Height to Depth Ratio
- Aisle Width
- Anchors
- Seismic and Permitting
- Post Protectors and Row Guards

## How to Know What Size and Capacity Pallet Rack You Need

### Step 1: Identify the size and weight of your pallets and loads

Pallet rack is built around the size and weights of the loads that will be stored on it as well as the physical space where the pallet rack will be located. The first step is to determine the load info.

**1A. Identify Pallet Size:** The standard pallet is 48-inches deep by 40-inches wide, though pallets come in a variety of dimensions. So, measuring your pallets is a critical first step.

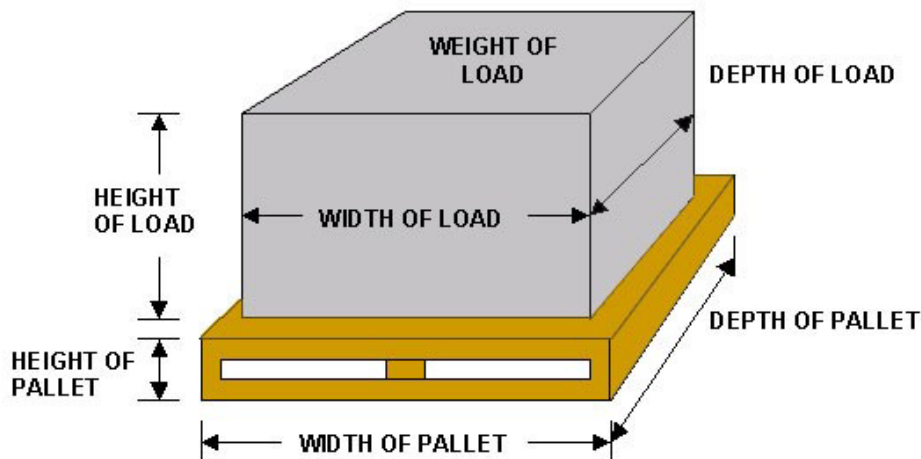
**2A. Identify Load Dimensions:** The load includes the pallet plus the product stored on the pallet. In addition to the pallet dimensions, you will also need the load dimensions: depth X width X height.

- **Load Depth and Width:** If the load does not overhang the pallet, then the depth X width will be the same as the pallet. If it overhangs, then you will need to measure from the widest and deepest parts of the load.
- **Load Height:** The load height includes the height of the pallet plus the height to the tallest part of the product stored on the pallet. This dimension will help determine the beam spacing and how many levels you can fit within your vertical space.

**3A. Identify Pallet / Load Weight:** The weight of the pallet is a key factor in determining what load capacity is right for your racks. Going over the load capacity limit is a safety hazard, so be sure to get the weight accurately.

- **Average Pallet Weight:** How heavy is your average pallet?
- **Max Pallet Weight:** How heavy is your heaviest pallet?

### MEASURING PALLET LOAD (Figure 3)



## Step 2: Determine the Frame (Upright) Depth

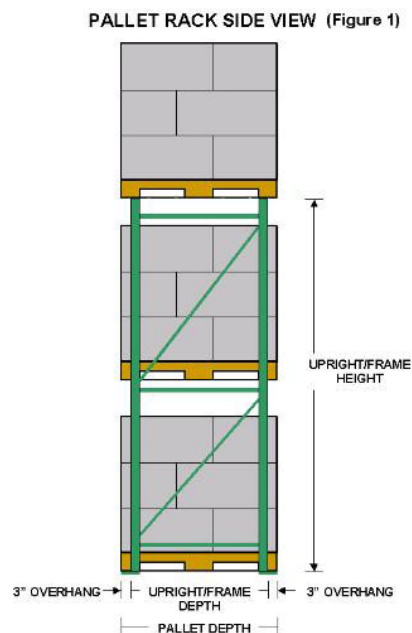
The frame (or upright) depth sets the spacing (depth) between the load beams. The upright depth is based on the depth of the pallets that will be stored on the rack.

**Overhang:** A safely stored pallet should overhang both the front and back beams by approximately three inches, allowing the beams to carry the full weight of the pallet. To easily get a proper fit, subtract six from the depth of your pallets. This will allow a 3-inch overhang on both sides.

- **Why do you want overhang?:** Load beams are designed to carry the weight of your pallet, not the wire decking, which is placed on top of the beams. The wire decking is a good safety item that helps distribute weight, but it is not intended to handle the full weight of a loaded pallet.
- **Concentrated Load:** A pallet that does not rest on the beams but between the beams on the wire deck results in a concentrated load. This can be a safety hazard, resulting in the load falling through the rack.
- **Example:** Here is an example: a standard pallet has a depth of 48 inches.  $48 - 6 = 42$ . A frame depth of 42 inches allows for a 3-inch overhang at the front and back.

**Common Upright Depths:** The most common upright depths, listed in order of popularity, are:

- **42-inch:** This is the most common frame depth in North America. It is typically used for standard 48" deep pallets, resulting in 3" overhang, front and back.
- **48-inch:** This is for 54"D pallets and sometimes used for man-up order picking applications.
- **36-inch:** This is used for 42"D pallets or when 48" x 40" pallets are turned with the 48" face to the aisle and for 40" x 32" Euro pallets, turned with the 32" face to the aisle. It may also be chosen when single-sided hand picking on shelves with wire mesh deck is used.
- **44-inch:** This is a less common variation of the 42" frame. It is often used when there is substantial product overhang in the cross-aisle direction. They are also used in deep reach systems where pallets are stored flush with the beam on the aisle face.



### **Step #3: Determine Frame (Upright) Height**

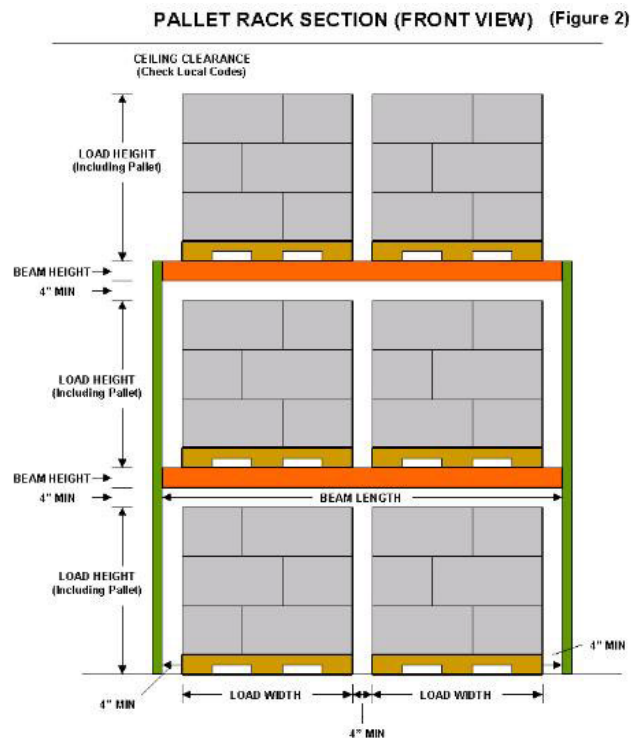
The height of the upright is determined by 1) the vertical space available, also known as overhead clearance, (from the lowest hanging object as well as factoring in sprinkler requirements) and 2) the reach-height of your forklifts. The number of preferred beam levels and height of the loads are also factors but will be discussed in Step 5.

**3A. How tall is your ceiling?** Allow at least 18" to 36" of space between the ceiling (or your sprinklers) and your product. Note that this spacing is dependent on sprinkler type, local regulations, and local Fire Marshall requirements. We always recommend that you check with local building codes. So, if you have 16-foot ceilings, and your loads are 3-feet tall, you will not want to go higher than a 12-foot-tall frame. Be sure to also consider pipes, sprinklers, or trusses below your ceiling height!

- We recommend that you go as high as you can even if it gives you more space than you need right now. Why? Because the cost difference between a 12'H frame and a 16'H frame is minor compared to the total cost of your project; we do not recommend going shorter just to save a few bucks. Pallet rack is a long-term investment, so be sure to consider your future growth. Note: as you go higher, another beam level may be required.

**3B. How high can your forklifts reach?** If your forklift has a maximum reach height of 10 feet, you will not be able to fully use a 16-foot upright until you upgrade your equipment. Planning for growth is important; just make sure you are aware of your limitations.

**3C. "High Piled Storage" and Sprinklers.** Storing products above 12 feet can trigger "high piled storage" considerations. If your local jurisdiction requires pallet rack permits, this is something they will look at. Additionally, your city/county will evaluate your fire sprinkler system and the flammability of your product. They may limit how high you can store products based on the sprinkler system and the flammability of what you are storing.



## **Step #4: Determine Beam Size**

Pallet rack beams have a length and height or “face size.” The beam length determines how many pallets you can store per beam level. The height or “face size” determines the beam’s capacity. The beam size you choose will depend on three things: two of the factors from step 1 (the width of the loads and the weight of the pallets), as well as something you will have to figure out here - the number of pallets that will be placed side-by-side on each level. But first, some background information:

### **Common Beam Lengths:**

- **96” Beams:** 8-foot-long beams are the most common beam length and allow for the storage of two standard 48”D x 40”W pallets with loads that do not overhang the sides.
- **144” Beams:** 12-foot-long beams are also common and allow for three standard pallets on each beam level. Sometimes this can be advantageous over 96” beams (especially for lighter pallets) because they can reduce the total number of uprights in a row, lowering the overall material cost and potentially allowing for more sections and pallet spaces. However, heavier pallets can require a heavier duty beam, sometimes making the 96” option cheaper.
- **108” and 120” Beams:** 9-foot-long and 10-foot-long beams are other standard options usually for two pallets per beam level when the pallets / loads are wider than the standard 40”.

**Spacing Rule:** Plan for at least 3 inches of clearance between the upright and the pallet / load, and 4 inches of clearance between pallets / loads. This allows the forklift driver enough space to safely retrieve and place loads in the rack without the loads hitting the uprights or each other.

**Beam Height or “Face Size”:** Beam faces generally range from 3-inch to 6-inch. The bigger the face, the higher the capacity. See the chart below.

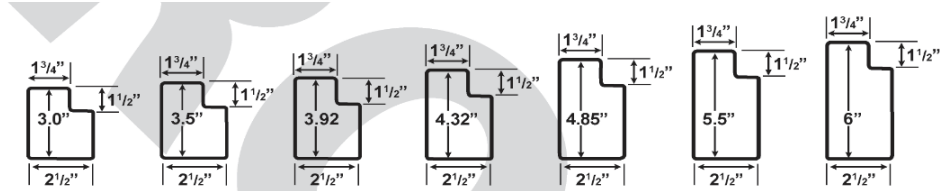
**Beam Capacity is Per Pair:** Beam capacities are always stated per beam level, which is every pair of beams.

### **4A Select Beam Size: How wide and how heavy are your loads?**

- 1) Get your load width from step 1.
  - 2) Get your max pallet / load weight from step 1.
  - 3) Starting with two pallets per beam level, use the spacing rule to determine if you need a 96”, 108”, or 120” long beam.
  - 4) Starting with two pallets per beam, determine the total load per beam level (number of pallets times x load weight).
  - 5) If you have 40”W loads, decide if three pallets per level may be an option.
- **Example 1:** You have 40” wide loads that are 2,250 lbs each. You can fit two of these on a 96”W beam, creating a total weight of 4,500 lbs per beam level. Using the chart below, you need the 4” beam that has a capacity of 5,210 lbs. You could also consider doing three of these pallets on the 144” beam, which would be a total of a 6,750 lbs load weight (2,250 x 3).
  - **Example 2:** You have 40” wide pallets but the loads overhang the sides, so the load width is 48”. Using the spacing rule, there would not be enough room on the 96” beam for these. The 108” long beam is the better option. Each load weighs 2,000 lbs, so the total load weight is 4,000 lbs. Using the chart below, you need at least the 4” beam, which has a capacity of 4,220 lbs.

### Husky Beam Capacity Chart:

IBX = 16 GA  
 IBN = 14 GA  
 IBH = 13 GA



### CAPACITY PER PAIR

BEAM SIZE	48"	60"	72"	84"	92"	96"	108"	120"	144"	LONGER BEAM OPTION
<b>3.0"</b>	IBX-30048 6,840#	IBX-30060 5,680#	IBX-30072 4,900#	IBX-30084 4,010#	IBX-30092 3,430#	IBX-30096 3,190#	IBX-30108 2,610#	IBX-30120 2,190#	IBX-30144 1,610#	CALL
<b>3.5"</b>	IBX-35048 8,180#	IBX-35060 6,740#	IBX-35072 5,780#	IBX-35084 5,090#	IBX-35092 4,520#	IBX-35096 4,190#	IBX-35108 3,410#	IBX-35120 2,840#	IBX-35144 2,080#	CALL
<b>3.92"</b>	IBX-39048 9,440#	IBX-39060 7,740#	IBX-39072 6,600#	IBX-39084 5,790#	IBX-39092 5,350#	IBX-39096 5,210#	IBX-39108 4,220#	IBX-39120 3,500#	IBX-39144 2,540#	CALL
<b>4.32"</b>	IBX-43048 10,670#	IBX-43060 8,720#	IBX-43072 7,400#	IBX-43084 6,460#	IBX-43092 5,980#	IBX-43096 6,270#	IBX-43108 5,060#	IBX-43120 4,190#	IBX-43144 3,020#	CALL
<b>4.85"</b>	IBX-48048 12,590#	IBX-48060 10,240#	IBX-48072 8,660#	IBX-48084 7,540#	IBX-48092 6,950#	IBX-48096 7,430#	IBX-48108 6,510#	IBX-48120 5,360#	IBX-48144 3,840#	CALL
<b>4.85"</b>	IBN-48048 14,610#	IBN-48060 11,850#	IBN-48072 10,010#	IBN-48084 8,700#	IBN-48092 8,010#	IBN-48096 8,560#	IBN-48108 7,380#	IBN-48120 6,060#	IBN-48144 4,330#	CALL
<b>5.5"</b>	IBN-55048 17,560#	IBN-55060 14,190#	IBN-55072 11,950#	IBN-55084 10,340#	IBN-55092 9,520#	IBN-55096 10,150#	IBN-55108 9,100#	IBN-55120 8,000#	IBN-55144 5,680#	CALL
<b>6.0"</b>	IBN-60048 20,010#	IBN-60060 16,140#	IBN-60072 13,560#	IBN-60084 11,730#	IBN-60092 10,760#	IBN-60096 11,480#	IBN-60108 10,280#	IBN-60120 9,330#	IBN-60144 6,910#	CALL
<b>6.0"</b>	IBH-60048 24,760#	IBH-60060 19,950#	IBH-60072 16,750#	IBH-60084 14,460#	IBH-60092 13,260#	IBH-60096 14,130#	IBH-60108 12,650#	IBH-60120 11,460#	IBH-60144 8,300#	CALL

## **Step #5: Determine Frame (Upright) Capacity**

The capacity of an upright depends on two factors: 1) total load weight of the rack section that the uprights are supporting, and 2) the beam spacing of the beam levels on that section.

**Total Load Weight per Section:** This is the max weight per level times the number of beam levels. See the steps below to determine each of these. Note, if the upright is connected to two sections with varying total weight loads, then use the one with the higher load.

**5A. Maximum Weight Per Level:** You determined this earlier in step four. It's the max weight of the pallets times the number of pallets on the beam level.

- **Use the Maximum Capacity of the Beam Level:** Generally, you should use the manufacturer's stated maximum beam capacity for the next steps. For example, even if the actual load weight is only 4,000 lbs but the maximum possible load capacity of the beams is 5,210 lbs, then you should use the higher 5,210 lbs for the calculations below.

**5B. Determine the Number of Beam Levels:** The number of beam levels depends on the height of the loads (Step 1), the height of the upright (Step 2), and the building's overhead clearance space (Step 2). Remember to also factor in the face of the beams and the minimum space required between the top of the load and the bottom of the beam (to allow the forklift to retrieve and lift out the pallet).

- **Minimum Two Beam Levels:** Pallet rack requires a minimum of two beam levels for safety to prevent a "domino" like collapse. Sometimes users only plan to use one beam level. In those cases, we usually recommend adding the additional beam level at the bottom or the very top of the upright.
- **Example:** Your loads are 60"H. Your uprights are 144"H. The overhead clearance from the floor to the maximum height under the sprinklers is 20'. The beam face is 4". This totals 196" or 16'-4". You can have a total of two beam levels (not counting the floor).

**5C. Calculate the Total Maximum Weight that Will be on Each Rack Section:** This is the max weight per beam level (5A) X the number of beam levels (5B).

- **Note:** Do not count pallets on the floor or the first beam level if it is less than 12" from the floor.

**5D. Determine the Beam Spacing:** Beam spacing is a crucial factor in upright capacity. The rule of thumb is that the further apart the beams are spaced, then the less capacity the frame can hold. Alternatively, the closer the beams are spaced, then the more weight the frame can support. Therefore, the upright's capacity depends on how far apart the beams are.

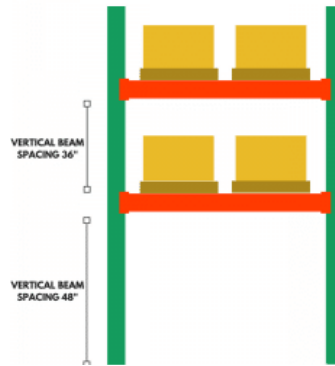
If you are planning on double stacking pallets on the floor level or using tall pallet loads, then your first beam would be higher, resulting in decreased capacity. Another important item to note is that your beam capacity depends on whichever point has the highest unsupported span. So, for instance, if you have multiple beam levels at 36 inches apart, but one that is 96 inches apart, then your overall frame capacity would be based on the 96-inch beam spacing, even if there is only one.

Imagine a section of racking with one beam level at 48" from ground level and a second beam level at 84" from ground level. The vertical beam spacing between beam levels is 36" and the vertical beam spacing between the ground and first beam level is 48".

What makes frame capacities tricky is that the 48" of unsupported column can bear less weight than the 36" span. This is because weight can exert more torque over longer distances.

Because vertical beam spacing changes from one application to another, each manufacturer must set a standard vertical beam spacing at which all their frames will be rated. For many manufacturers, this length is 48". For example, a 42" x 144" IU18 Husky Upright is rated at 18,160#, assuming 48" beam level spacing. If the user were to change the vertical distance between beam levels, the capacity would change along with it. If they added beam levels, for example, it would increase. If they subtracted beam levels, it would decrease.

**Top of Beam:** Beam spacing is measured from the floor to top of beam and top of beam to top of beam. It is not the clearance between beams.



**5E. Putting it All Together – Total Weight per Section and Beam Spacing = Upright Capacity:** Once you have the total weight per section and the beam spacing, use the manufacturer’s chart to select the correct capacity upright. See the sample Husky chart below.

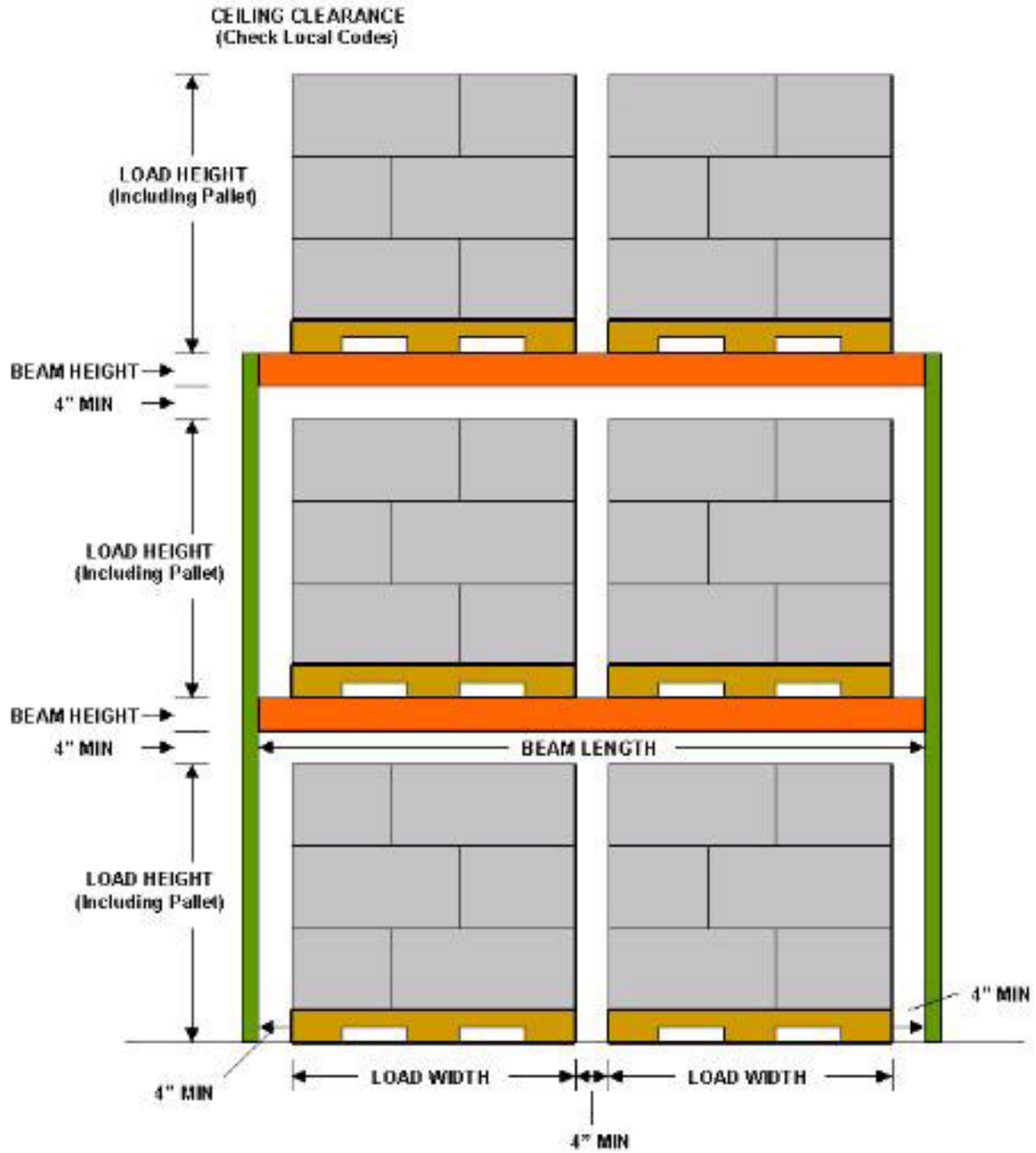
**UPRIGHT CAPACITIES**

VERTICAL BEAM SPACING	ANSI MH 16.1 2012 UPRIGHT FRAME			
	IU18	IU24	IU29	IU35
36	21,450	29,410	39,040	46,140
42	19,880	27,490	36,280	42,770
48	18,160	25,390	33,290	39,130
54	16,350	23,170	30,170	35,360
60	14,510	20,890	27,010	31,550
66	12,690	18,600	23,870	27,800
72	10,960	16,330	20,800	24,150
78	9,540	14,280	18,100	20,950
84	8,370	12,570	15,870	18,330
90	7,390	11,140	14,010	16,160
96	6,570	9,930	12,460	14,340

- For vertical beam spacing greater than 96", please contact your distributor.
- Beam spacing (vertically) is measured from top of beam to top of beam starting from the floor to the top of the first beam and so on.
- Uprights and beams constructed of HSLA prime, U.S. made, high-strength steel. (Documented verification available on request).
- Standard baseplates are 4" x 4.25" x 0.13". Oversized baseplates available upon request.
- PE stamped drawings with calculations available for projects with permitting requirements.
- Capacities for static loads only
- Anchors must be provided per ACI-318 Appendix D
- Maximum upright height available is 46'. For more information on additional upright frame configurations please contact your Regional Manager or inside sales at 704-483-1900.



# PALLET RACK SECTION (FRONT VIEW) (Figure 2)



## **Step #6: Determine Wire Deck Size and Type**

Wire decking is a popular and recommended accessory for most pallet rack applications. Wood or metal crossbars are also options but do not provide the same level of protection to ensure that pallets and products do not fall within the rack. Additionally, insurance companies are increasingly requiring the use of wire decks versus wood supports or decking because they are not flammable and allow sprinklers to flow water through the rack.

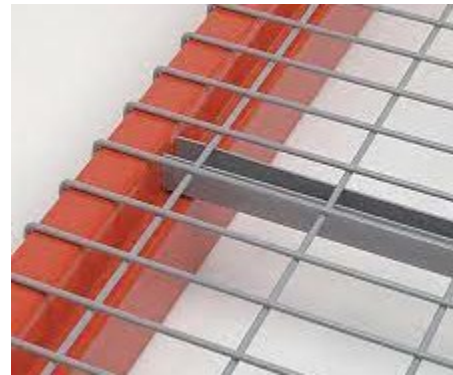
There are different wire deck styles, sizes, and capacities depending on the type of rack and the product stored.

**Styles:** The two most common styles are Flared decks and Standard U-Channel Waterfall decks.

- **Flared Decks:** the bars or channels on these flare to a flat surface to rest on top of the beam. These are for structural rack or for box beams.
- **Standard U-Channel Waterfall Decks:** the bars or channels on these end before the waterfall to fit on the step portion of a teardrop style stepbeam.



**Flared Deck: for Structural or Box Beams**



**Standard U-Channel Waterfall Deck:  
for Teardrop Stepbeams**

**6A: Determine the deck style:** Choose the style deck to match the type of rack. See above.

**6B: Determine the deck capacity:** The deck capacity should be greater than the weight of the pallet stored. Generally, the total capacity of the decks used on a beam level should be equal to or greater than the beam level's capacity. (Manufacturers vary deck capacity by changing the number of support bars or channels, changing the gauge of steel of the wires, and the size of the mesh spaces.)

**6C: Determine the deck depth:** The depth of the wire deck should match the depth of the upright. For example, a 42"D upright requires a 42"D wire deck.

**6D: Determine the width and number of wire decks:** Here's an easy guide for the most standard sizes:

- 96" beams: (2) 46"W decks
- 108" beams: (2) 52"W decks
- 120" beams: (2) 58"W decks
- 144" beams: (3) 46"W decks

## Other Considerations

**Single Rows versus Back-to-Back Rows:** Back-to-back rows that are connected by row spacers are more stable than single rows. They also have a space-saving benefit, reducing the number of aisle ways and maximizing the amount of rack and thus the number of pallet spaces. Back-to-back rows should ALWAYS be connected with row spacers.

**Row Spacers:** Row spacers come in various lengths and are used to secure two back-to-back rows together. The rule is generally a minimum of two row spacers per pair of back-to-back uprights that are 16' high and under. Uprights over 20' high require three row spacers and then add an additional spacer for every 8' vertical feet.

**Depth to height ratio:** A single row of rack should generally not be 6 times higher than it is wide. This is the 6:1 ratio. For example, a 36" wide single row should not exceed 180" (18'). If a single row exceeds the 6:1 ratio, additional support like wider baseplates or cross ties may be required. As noted above, back-to-back rows are more stable and offer a better layout option.

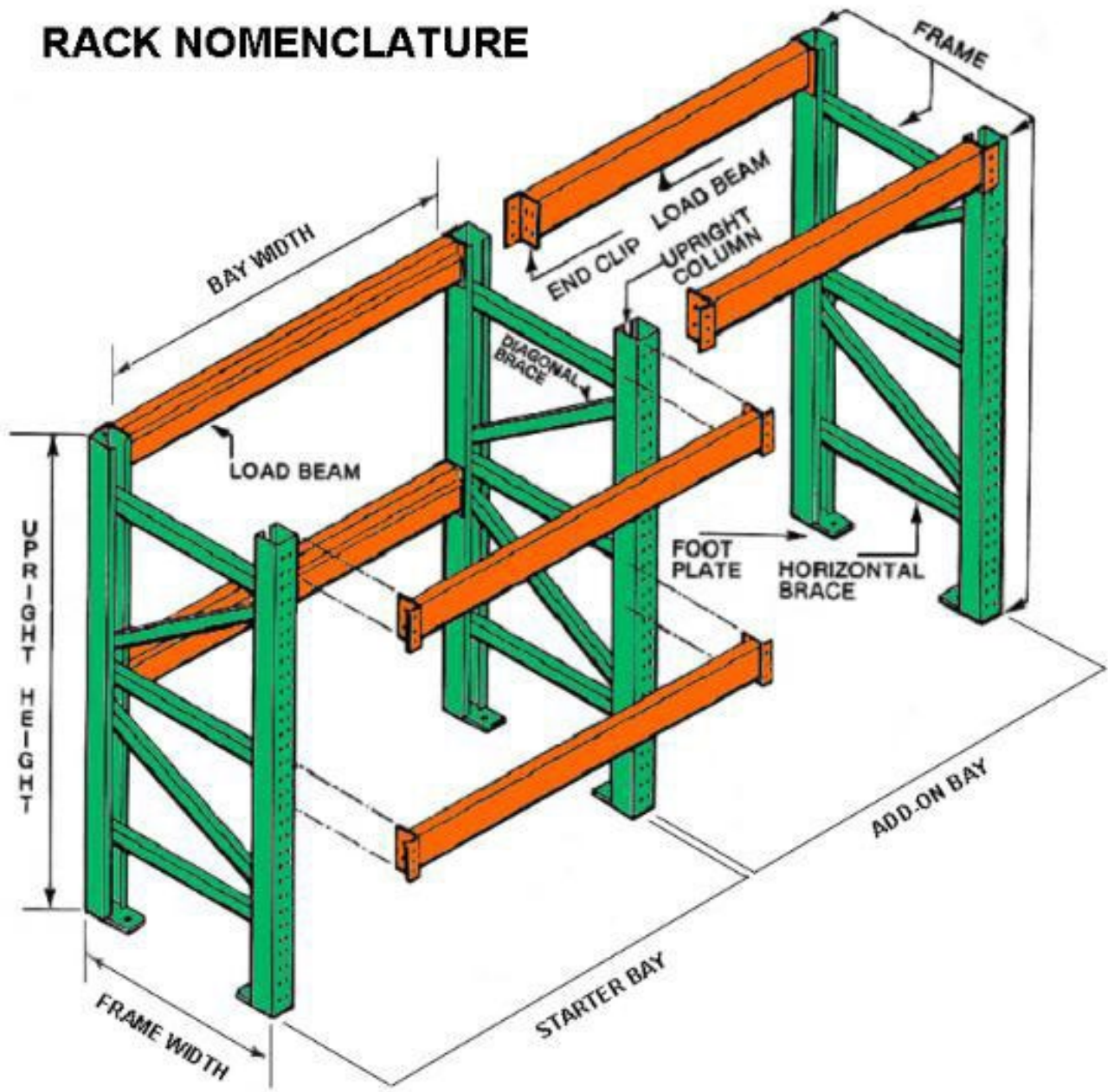
**Aisle Width:** When designing a rack layout, the aisle must be wide enough to allow a forklift to safely retrieve the pallet within the rack and turn in the aisle. For most sit-down lifts, this requires a minimum of a 12' wide aisle. However, different style lifts – like stand-ups – can operate in narrower aisles. Thus, forklift type can determine aisle spacing.

**Anchors:** Pallet rack is intended to be loaded / un-loaded via forklift and should be anchored to the floor. (The only exception is for shorter, light-weight pallet rack that a customer is hand-loading and using like shelving.) Concrete wedge anchors should be a minimum of  $\frac{1}{2}$ " x 4-1/2". Most standard teardrop uprights require one anchor per footplate for a total of two anchors per upright. However, rack with larger baseplates or as indicated by engineering for seismic or other special requirements may require additional and longer anchors.

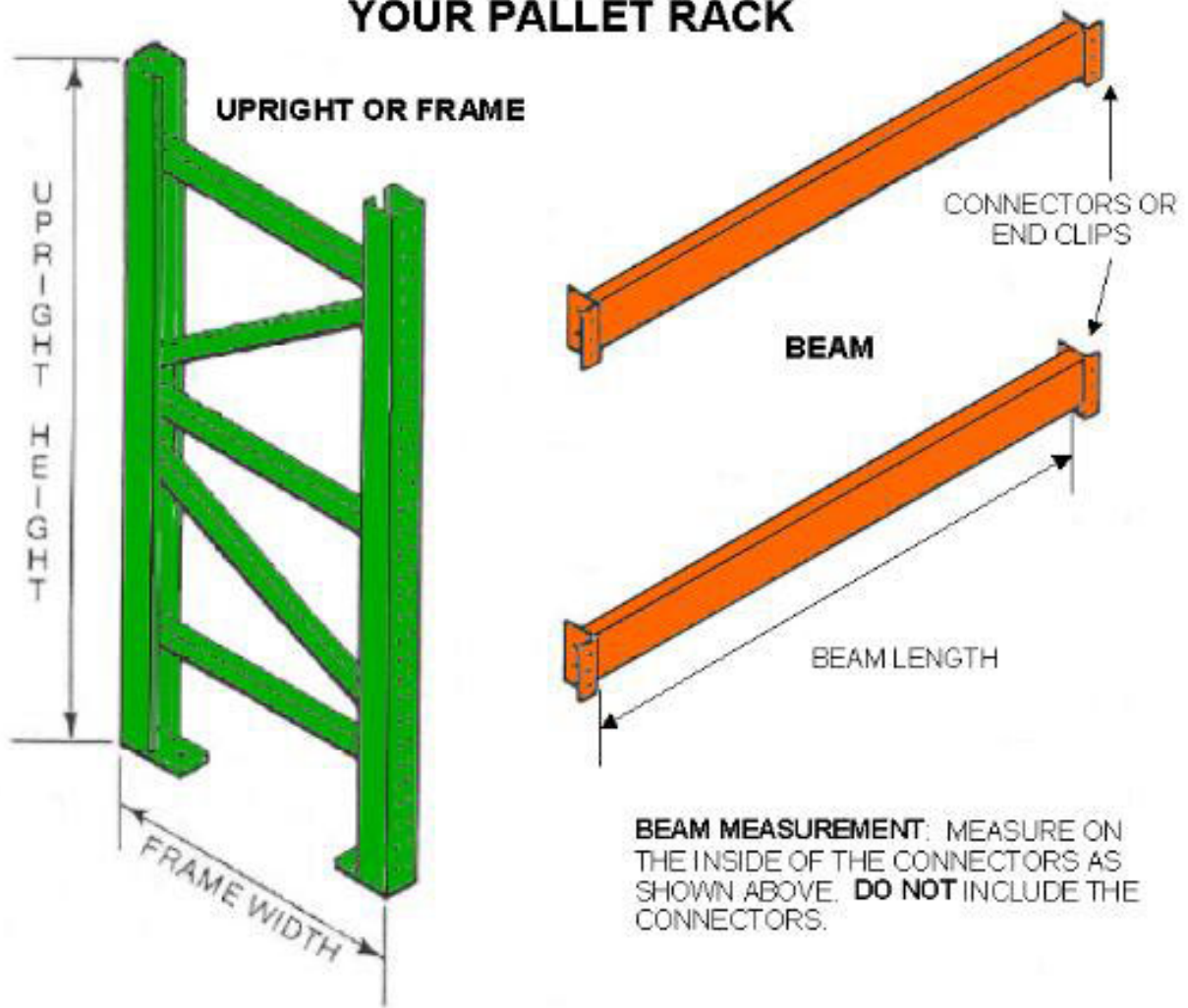
**Seismic and Permitting:** Pallet rack should be designed and engineered for the specific seismic area where it will be installed. Additionally, certain localities require pallet rack to be permitted. The majority of our customers in the middle Tennessee area do not require seismic or permitting reviews. However, for any rack that is for outside of middle Tennessee, you should first check if either will be required. The rack manufacturer's sales and engineering team can assist with this.

**Post protectors and End-of-Row Guards:** Rack can easily be damaged from forklift strikes. In a battle between a forklift and rack, the forklift will always win. It's recommended that post protectors be installed in front of every upright and end-of-row guards installed at the end of rows. There are varying types and manufacturers of each.

# RACK NOMENCLATURE



# HOW TO MEASURE YOUR PALLET RACK



**BEAM MEASUREMENT:** MEASURE ON THE INSIDE OF THE CONNECTORS AS SHOWN ABOVE. **DO NOT** INCLUDE THE CONNECTORS.

**FRAME MEASUREMENT:** **HEIGHT.** MEASURE FROM THE TOP OF THE FRAME TO THE BOTTOM. **WIDTH.** MEASURE FROM OUTSIDE EDGE TO OUTSIDE EDGE