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4 Calculations Needed to Build Your Ideal Cantilever Rack System

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Introduction

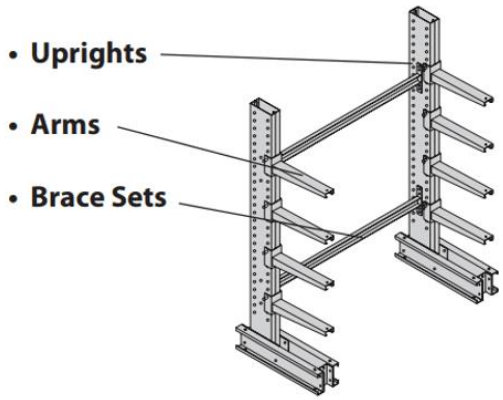
Cantilever rack is a freestanding storage unit with horizontal load carrying arms extending outward from a single vertical column. The absence of a vertical support on the outer edges permits uninterrupted storage of long lengths of material. Cantilever rack is the ideal system for storing furniture, steel bars, pipe and tubing, lumber and other long, heavy items. The modular nature of a cantilever system allows additional arms, uprights and braces to be added or removed as storage requirements change.

Cantilever rack is comprised of 3 components:

Uprights consist of a vertical column and a horizontal base which is bolted to the column. A minimum of two uprights must be ordered to form a storage bay. Uprights can be either single or double-sided.

Arms are the heart of the rack system. Proper selection can make or break a successful storage plan. ASL offers straight arms (generally used for storing stable loads such as lumber, steel sheets, cartons and skids) and inclined arms (for cylindrical objects or loads that tend to roll forward).

Brace Sets are bolted between pairs of uprights to provide lateral stability to the rack system. X-bracing is utilized to increase the stability of taller uprights (15'+).



In order to determine which combination of the three you need, determine the four following characteristics:

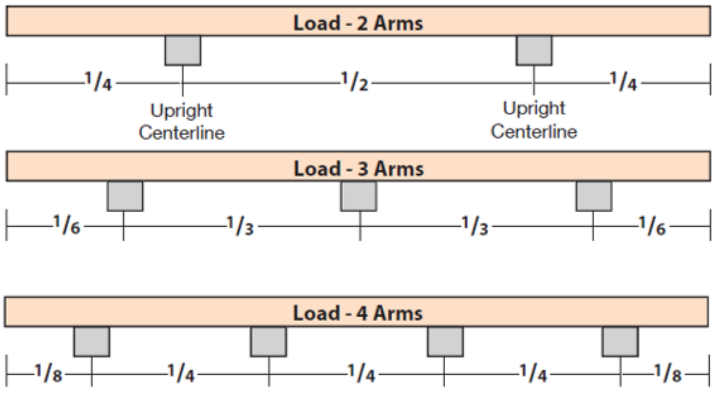
1. Quantity and Spacing of the Cantilever Arms
2. Required Length and Capacity of the Cantilever Arms
3. Correct Upright Height and Capacity
4. Cantilever Bracing Length

Determining the Quantity and Spacing of the Cantilever Arms

In order to minimize deflection of the product, you want to ensure you use enough arms to support the material in a uniform manner. Deflection can lead to product damage. In some cases, this will also damage the cantilever by increasing the pressure on the arms. In order to avoid this, there is a simple drill you can do to test deflection:

- Place 2 wooden blocks on the floor to act as cantilever arms
- Then load your product as you would intend to with the new system
- Adjust the width between the wood until you do not notice any deflection.

Brace sets generally come in 2-foot-wide increments, so it's best to run this test utilizing increments between 2 and 8 feet. A general rule of thumb is to never space the arms farther apart than 1/2 the length of the material you are storing.



The final item to consider is the width of the product itself. The product should overhang the outside of the arms by some amount. Be careful to not have it overhang too much. We recommend the load should overhang the end arms by one-half the distance from upright centerline to upright centerline. Failure to observe this measure may cause an overload condition on the arms.

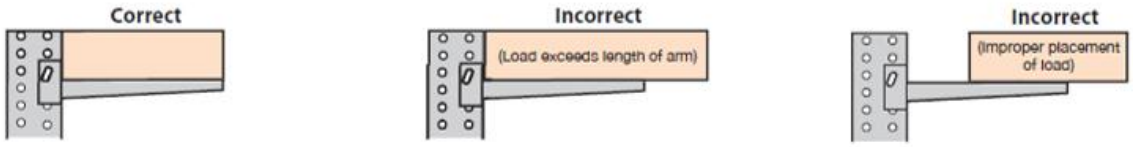
Once you've determined how many arms you need, you just need to decide if they should be straight arms or inclined.

1. Straight arms: Generally used for storing stable loads such as lumber, steel sheets, cartons and skids.
2. Inclined arms: Generally used for storing cylindrical objects or loads that tend to roll forward

The last thing to consider would be accessories such as a lip that will prevent material from rolling or sliding off the front of the arm. More detail on cantilever rack accessories is found in the Frequently Asked Questions section at the end of this guide.

Determining the Required Length & Capacity of the Arms

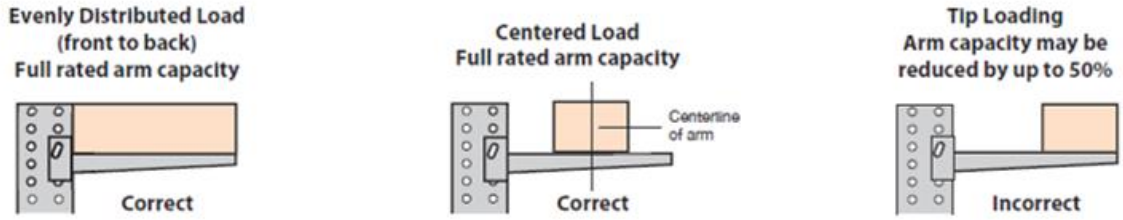
Determining arm length is straightforward as it will depend entirely upon the depth of the load you intend to store on the rack. The arm length should always be a little bit longer than the product width. Thus, a load 48" deep will require arms at least 48" long. If not, the rated capacity of the arm may severely diminish. Below are examples of how to and how not to load cantilever rack:



Once you've determined the proper arm length, you'll want to determine the required capacity. When determining the required capacity each arm will need to support, take the total weight of the product being stored in each level and divide it by the quantity of arms it will take to support the product without creating any deflection.

Weight capacity for each arm = Total product weight per level ÷ Required number of arms

Each arm supports an equal amount of the load's weight. By determining the number of arms per level and dividing it into the weight per level, the required arm capacity can be determined.



Do note that arm capacities are based upon evenly distributed and centered loads. Storing product on the end of the cantilever arm (also known as tip loading) can reduce the capacity of the arm by up to 50%.

Determining the Required Height & Capacity of the Uprights

The height of your cantilever rack system is determined by two key factors: the maximum height and the height of your product.

Maximum Height

The maximum height of the upright is determined by a host of factors including: the ceiling height, forklift reach, sprinkler systems and other factors, such as local building codes. To try and summarize all these into a simple formula, the maximum height your upright can reach is determined as follows:

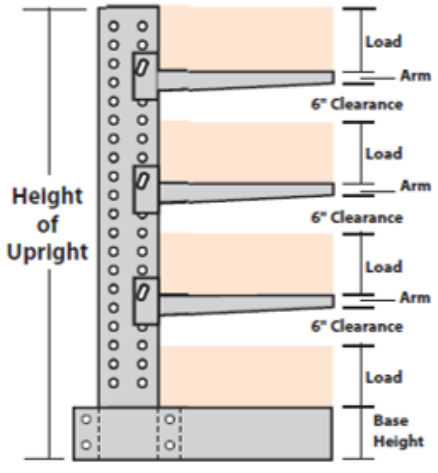
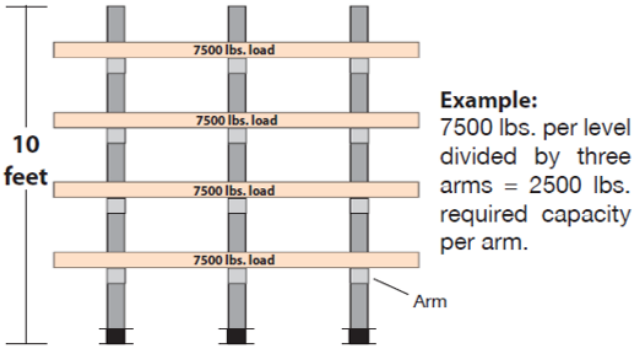
- The clear ceiling height of your building less 4" to 6"; and /or
- The maximum height your forklift will reach less 4″ (this ensures you can get enough clearance to safely lift your products up and off the cantilever arms).

Product Height

Once you have determined this height, you can determine the total height needed based upon your product specifications by adding up the following:

1. **Product Height**: Determine the height of the product you would like to store and the number of levels you would like. It is important to add a minimum of 4" between the top of your product and the bottom of each cantilever arm. This ensures that you can safely place and remove your product with your forklift.
2. **Arm Height**: Every arm level within the system will require a certain amount of space. Cantilever Arms all come in different heights because of their different capacity requirements. The average height is around 3-4 inches high. Contact your local ASL sales professional for specific rack dimensions.
3. **Cantilever Upright Height**: It is a good rule of thumb to have the top of the cantilever upright 4 to 6″ higher than the top of the highest point of the product being stored.

Adding these three elements together will give you the recommended height based off your product needs. Bear in mind that the height of your uprights cannot exceed the maximum height calculated in the first section of this page.

Exhibit 1	Exhibit 2
	

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Once you determine the required height of your cantilever uprights need to be, you will need to determine how much weight they'll need to hold, or their capacity.

Calculating the required capacity is determined by multiplying the number of arms per side by the load on each arm. The load placed on the base does not diminish the rated capacity of the upright. Thus, the heaviest loads should be placed on the base. Thus, if there are twelve arms (as in the Figure 2 above) and each arm holds 2500 lbs., the total required capacity equals 30,000 lbs., which when divided by three uprights, results in a required minimum capacity of 10,000 lbs. per upright.

$$\text{Capacity required per upright} = (\text{no. of arms} \times \text{capacity per arm}) \div \text{no. of uprights}$$

Uprights consist of a vertical column and a horizontal base which is either welded or bolted to the column. A minimum of two uprights must be ordered to form a storage bay.

Determining the Correct Width for Your Bracing

Brace sets are structural channel members that are bolted between pairs of uprights to provide lateral stability to the rack system. The width of a brace is measured from the centerline of an upright to the centerline of the next upright and is typically sold in in a set rather than individual pieces. For cantilever that is over 15’ tall, additional stability is typically required in the form of a second brace set or x-bracing.

The width of your brace set should closely match the total width calculated in the first step “Determining the Quantity and Spacing of the Cantilever Arms”. The combined width of the various brace sets will determine the total width of your cantilever system. Thus, two 60” wide brace sets would result in a run of cantilever rack that is 10’ long.

Frequently Asked Questions

STRUCTURAL VS. ROLL-FORM: WHICH IS BEST?

Roll-form cantilever rack is the preferred storage rack for light and medium storage due to its bolt-less design and lighter overall weight.

While roll-form rack is the rack of choice for light and medium storage, structural rack is often the preferred solution for higher density applications. Structural racks are thicker and the heavier construction offers improved resistance to impact from forklifts entering and exiting the racks.

Structural cantilever rack is preferred for heavier loads (1,500 lbs. or more). Structural cantilever rack is made from hot rolled c-channel structural steel. It uses additional hardware (nuts and bolts) for assembly. It is inherently heavier, stronger and can hold heavier loads than roll-form rack. It is more impact resistant than roll-form rack and best when storing traditionally heavy and bulky items such as plywood, lumber, pipe, bar stock, steel sheets and coils, sheetrock, etc.

WHAT ACCESSORIES ARE AVAILABLE?

There are numerous accessories available to customize your cantilever rack system to best support your product.

- Bolt-on pipe sockets
- Drop-in deck support saddles
- Welded axle cradles
- Roof supports
- Steel or wire decking. Ideal for storage of short lengths of materials, dies, castings and other items that require an uninterrupted length of heavy-duty decking. Steel angles can be welded to the underside of the deck for additional strength.

Now you're armed to build your own cantilever rack system…

Improve your execution and leverage a deep talent bench with ASL

With ASL's in-house design, project management and installation teams, you can focus on fulfilling customer orders and forget about managing the execution.

Let's Start a Conversation

About ASL

Founded in 1958 to provide pallet rack to local distribution centers, ASL has evolved to offer complete turnkey warehouse solutions from design to installation and teardown. Whether you require a new pallet rack layout, warehouse mezzanine system or are simply looking to reconfigure your current setup, ASL offers the materials and services needed to make warehousing easy.

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