

Pallet rack basics

From traditional single-deep rack to dynamic, high-density rack systems, pallet racks are a tool for optimizing the use of cubic space in the warehouse and help to maximize turnover. However, a rack system that is not attuned to the future needs of clients, cannot handle a wide range of products/commodities, and is unable to perform all the required services creates unnecessary operational costs during the lifetime of the warehouse. Therefore, a good analysis of the requirements and a sound projection is a must, preferably by independent consultants and not by the rack supplier.

Pallet racking systems are among the most basic and yet useful materials handling tools. Variations of these simple steel structures create order and maximize storage density in a warehouse, making good use of floor space and ceiling height.

Basic pallet rack consists of upright steel frames connected by horizontal steel beams. Pallets rest on the beams between the upright frames. Two frames and the corresponding beams form a bay. The number of pallet positions in a bay depends on the height of the frames and the spacing of the beams.

High-rise storage systems reach heights of 30 meters or more, but a typical rack height is 6 to 7.5 meters.

The components of the upright frames—their steel posts and cross braces—can either be bolted together or welded together. Welded frames are more common in the United States, while bolted construction is more common in Europe.

There are also two choices for connecting frames and beams. Beams can be bolted to frames, or the two components can snap together using a slotted connection system.

Rack components can be made of structural steel or of roll-formed steel. Which type of steel is most suitable for which applications is often a point of discussion within the rack industry?

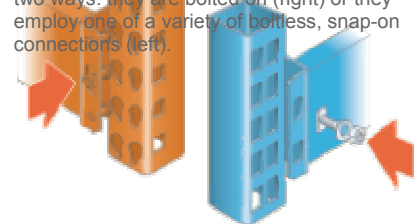
Several types of rack are available, from low-density systems that allow easy access to products to high-density systems that make more efficient use of space but limit access to what they store.

Low-density rack Single-deep rack

Single-deep pallet rack, also known as selective rack, is by far the most common type of rack used in warehouses today. Because loads are stored only one pallet deep, single-deep rack provides the lowest-density storage of any pallet racking system.

Single-deep remains popular, however, because it permits unimpeded access to every pallet it stores. Additionally, single-deep rack can

The horizontal beams in a pallet rack system are connected to the upright frames in one of two ways: they are bolted on (right) or they employ one of a variety of boltless, snap-on connections (left).



be used in a variety of aisle configurations, can be paired with any type of lift truck and is the least expensive style of rack.

Double-deep rack

As its name implies, double-deep rack stores one pallet load behind another in a rack structure that's twice as deep as single-deep rack. While doubling storage density, this design limits access and flexibility.

To access the rear pallet in a double-deep rack system, the front pallet position must be empty. Double handling is necessary unless pallets are stored on a last-in/first-out basis. And in most cases, two pallets of the same product are stored in a slot of double-deep rack, which limits the flexibility of a warehouse's storage space. Putting away and retrieving loads in the rear position of a double-deep system requires a deep-reach lift truck.

High-density rack

Drive-in rack

Drive-in rack can be configured to store loads three, four or more deep, creating extremely dense storage. A drive-in system that stores pallets four high and five deep, for example, can hold 20 pallets in each bay.

In a drive-in system, lift trucks drive into the front of a storage bay, place a load in the desired position and then back out. To allow lift trucks into the bays, drive-in systems are designed without traditional beams placed across the bays. Instead, pallets rest on rails that run along the insides of the bays, perpendicular to the aisles.

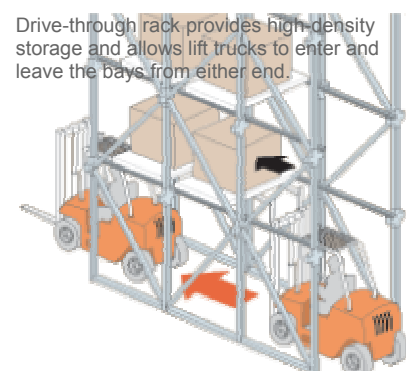
Pallets in a drive-in racking system are stored on a last-in/first-out basis. Each bay is typically dedicated to a single product, so drive-in rack is best used in warehouses storing large quantities of the same product.

Drive-in systems severely limit access to products stored in rear positions. As a result, say experts, this type of storage is best suited for situations in which an entire bay of products would be moved at once, such as in staging products for shipping.

Drive-through rack

In all ways but one, this design is the same as drive-in rack. The difference is drive-through rack allows lift trucks to enter the bays from either end. This considerably increases access to pallet loads, but requires an aisle on both ends of the racking system.

Drive-through rack can be loaded from one end and emptied from the other, allowing first-in/first-out product rotation.



Drive-through rack provides high-density storage and allows lift trucks to enter and leave the bays from either end.

Dynamic storage

Gravity flow rack

Gravity flow rack combines a stationary rack structure with skate wheel or roller conveyor to create a dynamic storage system. Pallets are loaded into the back end of the rack and then travel down the slightly inclined lane of conveyor until they are retrieved from the front of the system.

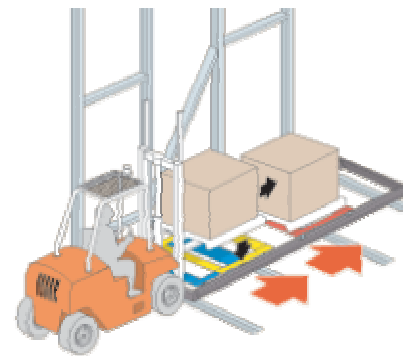
Flow rack systems provide high-density storage by storing products many pallets deep. Because each layer of flow rack is typically dedicated to a single product, these systems offer less storage flexibility than selective rack but more flexibility than drive-in or drive-through rack where an entire bay is dedicated to one product.

Flow rack allows easy rotation of inventory on a first-in/first-out basis, making it a good choice for storing dated products. It can be used for picking by the piece, carton or pallet. Many rack manufacturers also offer carton flow rack that stores individual cartons rather than entire pallets.

Push-back rack

Push-back rack combines a stationary rack structure with nested carts that move along inclined rails. Pallets are loaded from the front. The first pallet is placed on the top cart; when the second pallet is delivered, it pushes back the first pallet, exposing the second cart, and so on.

Push-back racking systems are usually configured two to five pallets deep. Like flow rack, they offer dense storage without requiring a lift truck to enter the racking system or requiring an entire bay be dedicated to one product. Unlike flow rack, push-back rack manages inventory on a last-in/first-out basis. Push-back rack requires less space than flow rack because rear access is not necessary.



Nested carts moving along inclined rails provide last-in/first-out storage in a push-back rack system.

Source: Modern Materials Handling

Rack systems and their material handling systems used in fully automated warehouses were not discussed here, but are becoming more common due to the increasing costs of land, energy and labor. De specialists of ColdStoreDesign.com can give advice on these and all the other systems.