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WHICH RACK DO I NEED?

An overview of pallet storage racking styles.

There are many factors involved in selecting the best pallet storage system for your needs. The information presented here will help in selecting the best system for your warehouse.

Factors that influence the ability to satisfy a plant's storage objectives are the ***type of storage system*** used, the ***unit load dimensions***, the type of ***pallets*** in use, the storage ***warehouse dimensions***, ***fire protection*** and ***seismic conditions***, and the ***material handling equipment*** being used.

The storage objectives of your warehouse storage system are defined by: unit load throughput, accessibility requirements, product rotation requirements, storage density per aisle, stock keeping unit (SKU) openings per aisle, and cost considerations. Once the objectives and the system's design parameters have been clearly defined, selection of the appropriate system can begin. To satisfy these storage objectives, there are many types of systems available. A thorough understanding of the characteristics of these basic unit load storage systems makes it possible to create a single style or hybrid system that will accommodate your storage objectives.

Note that national fire protection code requirements vary with the storage system type, the product type and the system elevation. Requirements should be checked with local authorities for each unit load type and storage configuration.

Floor stack or block storage uses no racking or stacking frames. Unit loads or containers are placed on the floor to a maximum of 6 to 10 unit loads deep per storage lane. A storage lane may be a single row or back-to-back rows. Longer storage lanes reduce lift truck deposit and withdrawal productivity due to irregular load stacks and variance of unit load placement on the floor. For cube (air space) utilization, unit loads are stacked on top of the floor unit loads. This method of stacking requires that the unit load or case goods on the floor be capable of supporting the stacking weight.

Floor stack storage can be one of two basic designs: pallets placed at a 90-degree angle to the aisle or at a 45-degree angle. The 90-degree angle method is the most common. It provides the greatest number of SKU openings and storage positions per aisle. The 45-degree angle method (like angled parking) offers fewer openings, but it permits narrower aisles. To deposit or withdraw a unit load, the lift truck enters the storage lane from the aisle, travels to the lane's unit load position, performs the required activity, and backs out from the storage lane to the same aisle. In designing the floor stack storage system's row and aisle layout, the number of unit loads deep per storage lane is often varied to bury the building columns within storage lanes.

Floor stack storage provides high storage density but poor unit load accessibility. The SKU in the front of the storage lane is usually the SKU for the entire storage lane. The utilization factor for a floor storage system is estimated at 60% of the provided unit load positions. Unit load rotation is last in, first out (LIFO) and throughput volume is considered high.

Tier racks or stacking frames are used in a block storage configuration when the SKU that is to be placed into floor is crushable, not self-supporting or varies in size & shape. These devices provide for uniform-size, stackable unit loads that help optimize cube space.

A tier rack or stacking rack has a solid base platform with an upright post on each corner. The four posts may be removable or permanently welded to the base. Stacking frames are two steel frames

that are connected at the top. The frame's legs are secured to the corners of a pallet. The SKUs are placed on the solid base to a predetermined height to fit under the posts or rack frames. The racks or frames are then stacked on top of each other, usually up to 4 or 5 racks high.

Tier rack and stacking frame storage systems have the same operational and design characteristics as floor storage systems. Space utilization is 60%. Unit load rotation if LIFO. Throughput volume is medium. The storage system provides high storage density, but load accessibility from the aisle is poor.

Selective pallet rack consists of vertical upright frames joined by pairs of horizontal load beams. A rack bay consists of two vertical upright frames designed to hold the bay's total unit load weight and two or more pairs of horizontal load beams designed to hold the weight of the unit loads that can fit in each opening. The connection method of the upright frame and load beams allows adjustment of the rack opening's vertical height. Usually the unit loads in the first level are placed on the floor and unit loads in other vertical openings are placed on pairs of load beams. If aisles must be narrow and a straddle truck is used, the bottom rack opening may be raised onto a pair on load beams that provide clearance for the straddle legs.

Whenever possible, all building columns and fire sprinklers are buried in the flue space (9 to 18 in. clear space) between back-to-back rack rows.

With standard single-deep pallet racks the unit load utilization factor is 85%. Unit load rotation can be either first in, first out (FIFO) or LIFO. Throughput volume can be high, and accessibility is excellent. Storage density is low because of the large number of aisles required.

Double-deep or two-deep rack systems are very similar to standard rack systems. Components and design characteristics are the same as for standard pallet rack with a few exceptions. The storage system consists of two sets of upright frames and the required pairs of load beams. One rack bay is placed behind the other. This double-deep rack bay design allows four conventional-sized unit loads per bay opening. The bottom rack opening is usually raised above the floor to provide easier unit load deposit and withdrawal. Double-deep rack requires the use of a vehicle with a reach system for placing and removing loads in the interior position.

Unit load rotation is LIFO, and throughput volume is medium. Storage density is medium, and unit load accessibility is fair. Utilization factor of available unit load positions is 80%.

Drive-in rack systems offer high-density storage for large volumes of similar unit loads. The rack structure includes upright frames and posts, support arms, support rails and back braces. Bottom loads are placed on the floor, and others rest on support rails typically 3 or 4 pallets high. Each storage lane may be two to ten load positions deep; six to eight positions is common. Vehicles travel in the lanes with the loads elevated to the available storage level. Lanes are filled on all vertical levels in the rear. Then the second position from the rear is filled and so on to the front. Rows may be single or back to back. Each storage lane must be wide enough for handling vehicle to drive between the support rails. Aisles must be wide enough to permit a loaded vehicle to turn into or back out of each lane.

Because each unit load position on a lane should contain the same type of SKU, the utilization factor is just 66% and throughput volume is medium. Unit load accessibility is relatively poor and load rotation is LIFO.

Drive-through rack systems are very similar to drive-in rack systems. The same components are used for construction, but there are no back braces. Each storage lane is accessible from both sides. So, either LIFO or FIFO stock rotation is possible. The design utilization factor is 66%, and throughput volume is medium. Storage density is high, although not quite as high as with drive-in racks, because rows cannot be placed back to back or around building columns. Unit load accessibility is rated as poor.

Gravity flow or flow-through rack systems use the rear aisle for SKU loading and the front aisle for unloading. The racks are similar to other types of racks except that the pallets rest on inclined skatewheel or roller conveyors. Unit loads are placed on the skatewheels or rollers at the entry end of the storage flow lane. The conveyor is pitched slightly to allow the load to flow to the exit end of the storage lane. The weight of the unit load determines the slope or pitch of the flow rack system. Brakes are installed in the conveyor line to control the speed that the pallets move. When a load is removed from the exit end, the next unit load in the flow lane moves forward to the exit position. Another type of flow-through storage rack system is the air-flow rack. These racks are similar to gravity flow racks except that air forced through tiny holes in the pallet rails is used to float the pallets for movement instead of skatewheels or roller conveyors. Normally, captive pallets or slave boards are required to ensure smooth flow on these systems.

Because unit loads in flow-through rack systems can move, the addition of various transfer devices and controls can be used to provide highly automated storage systems.

In conventional facilities, gravity flow pallet storage lanes are three to four levels high. In hybrid or high-rise facilities, the storage lanes may be designed to eight levels high. Lanes may be three to 20 loads deep. Stock rotation is FIFO. Utilization factor is 90%, and throughput volume is high. This storage system has high storage density and fair unit load accessibility.

Push-back rack systems are a variation of gravity flow racks. System components are the same, but load brakes are not needed. Push-back systems are normally designed as single rack rows for installation against a wall. Both loading and unloading of pallet loads is accomplished from the front of the rack. Unit loads are deposited by placing the inbound unit load against the unit load in the storage lane's aisle position and pushing it back into the storage lane. When a load is withdrawn from the system, the next unit load in the lane flows into the aisle position. It is possible to create a variety of hybrid systems with a wide range of levels of automation**.**

Push-back rack is designed for three to four unit loads high and three to four unit loads deep per storage lane. The system's unit load utilization factor is 66%, and product rotation is LIFO. Throughput volume is low, but storage density is rated as good. Load accessibility from the aisle is good.

Cantilever racks consist of heavy upright columns with legs bolted or welded to the base of the upright. Uprights can be single or double sided. The uprights are bolted in a row with braces that create a space between the upright columns. Arms are bolted to the uprights to create the shelf levels and can be straight for flat loads or inclined to capture round items. Cantilever racks with open arms are well suited to the storage of long unit loads, such as piping, bar stock, and lumber. With solid decking on the support arms, they are suitable for large, oddly shaped or non-palletized unit loads, such as furniture. Access to all unit load positions is excellent, and the cantilever rack system offers an 85% utilization factor. The system is able to handle a medium throughput volume. Storage density is relatively low.

For questions or help with any Pallet Storage Rack Application:

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