

Variables in Space Planning Solutions

Designing the correct type of pallet rack system to properly meet your needs has become increasingly complex in recent years. There are many different types of systems now available, e.g. Selective, Double Deep, Drive-In / Thru, Push-Back, and Flow. Plus, more sophisticated handling equipment (e.g. Double Reach Trucks, Narrow Aisle Trucks, Very Narrow Aisle Trucks) require much more stringent tolerances. Thus, finding the correct rack solution is more complicated than ever. However, you will find it if you carefully consider several factors.

Operational Requirements - First and foremost, you must consider the fact that each type of rack system has inherent advantages and disadvantages. Your operational requirements will ultimately mandate the use of a particular type of system or a combination of systems. As a rule of thumb, there is an inverse relationship between storage density and the amount of SKU selectivity you will have.

Selective – Selective racking offers 100% unobstructed access to each and every pallet stored within the system. But there is a noticeable trade-off in storage density in comparison to other systems available. Based on a building size of 9630 square feet, a four (4) pallet high selective system (assuming 10' wide aisles) will yield approximately 800 total pallet positions. The greatest advantages of utilizing a selective rack system vs. floor stacking is that it accommodates the greatest number of SKUs, all stock is visible and immediately accessible, and the possibility of product damage is greatly reduced.

Double-Reach - If more storage spaces are required above what a selective system can yield, then you may want to consider a double reach system. It reduces the number of aisles, thus adding more pallet positions — but at the expense of reducing your pick selectivity. Another disadvantage is that it requires a special reach type of fork truck which, if not already a part of your truck inventory, obviously adds an additional cost.

Drive-In or Drive Thru - A Drive-In System will definitely yield many more pallet positions than a Selective or Double Reach system (approximately 1200 vs. approximately 800 for the selective system, based on a building size of 9630 square feet, four pallets high, 10' aisles). However, it again further reduces your pick selectivity and it offers little or no FIFO (First In / First Out) capabilities. A Drive-In / Drive Thru system is an excellent choice if there are no FIFO issues, if you are storing a very limited number of SKUs, and if the pallet and load heights, widths, depths, and weights remain relatively uniform to allow for consistent load rail heights.

Push-Back – Push-Back racking systems use a series of mobile carts that ride on rails within each pallet row. A loaded pallet is placed on the upper cart within the system. When another loaded pallet is loaded into the same bay, it pushes back the first loaded pallet. This process continues until all the trays (usually 3-4) are utilized. This system offers a highly dense storage solution when space is at a minimum and when the total amount of product to be stored is small and consistent in size and weight. The disadvantages are similar to that of Drive-In and Double Reach Systems — the pick selectivity is reduced, FIFO issues are compromised, and there is potential of lost pallet positions due to height loss caused by the system's carts.

Pallet Flow – Pallet Flow provides superior density over all other systems and offers superior FIFO capabilities. The product is loaded at one end of the system, then flows to the other end to be unloaded. It also offers better product selectivity than either Drive-In or Push-Back. However, as with others, this system works best with a very limited number of SKUs. Moreover, it is the most expensive rack system by far. Potential lost pallet positions again come into play because the system is not level, due to the height and pitch of the flow rails that are inherent to the system.

Regulations - To further complicate your decision, more governing bodies throughout the country now require rack systems to comply with locally adopted building codes in both design and installation. You must be able to prove that your rack components have been engineered to withstand seismic activity. That means that a seismic analysis must be done by a licensed engineer. As you may or may not know, the United States is divided into six seismic zones; some states have portions of several zones within their borders. These zones, numbered 0, 1, 2a, 2b, 3, and 4, indicate the likelihood of an earthquake along with length and severity, based on an area's proximity to a fault line. The higher the number, the more probability of seismic activity — and the more stringent requirements for man-made structures, including yours.

Seismic Ratings - A seismically designed pallet rack displays a “pattern of motion” that is substantially different from the period of the earth's movement. This is designed to cancel or counteract seismic movement and allow the system to ride out the quake. Do not assume that just because your rack system is manufactured to R.M.I. (Rack Manufacturer's Institute) or A.I.S.C. (American Institute of Steel Construction) standards that it will pass inspection for the intended loading UNDER SEISMIC CONDITIONS. As part of the quoting process, you should make sure that a licensed engineer seismically rates your system to avoid code issues — even though this will typically add 10-15% to the cost.

We can assume that these seismic building codes are meant as a preventative measure against possible catastrophic loss. However, the fact remains that most rack damage and or catastrophic failure is caused by lift truck damage, overloading, or inadequately engineered systems that can cause the center of gravity to shift away from the rack column at the base plate. This offset causes the column to bend, which creates horizontal force and pushes the column toward the load center. This cycle, called “micro-shifting,” continues until the rack structure becomes so unstable that a relatively minor impact can cause a major collapse.

Protection - With this in mind, it is highly recommended that you consider adding additional layers of protection. There are many options: Column Protectors, End Guard Rails, Off-Set Front Column Legs, Extra-Heavy Horizontal / Double Columns, Column Core Inserts, Rub-Rail (for Drive-In Systems), etc. And, you should inspect all of your pallet rack systems regularly for damage and to evaluate their overall condition. Obviously, you want to check for beams not being engaged with the columns, safety locks not engaged or missing, and damaged uprights or bracing. But you should also look for beams that are permanently deformed from load impact, and under-capacity beams (beams that deflect more than 1/80th of the span when loaded, or 1/2” for a 96” long beam).

Additional Considerations – Finally, you need to know if local fire codes require in-rack fire suppression (sprinklers) and/or fire baffles. In addition, if you decide to install a High-Bay / Narrow Aisle or High-Bay / Very Narrow Aisle system, you may need “superflat” (f100) concrete floors for the system to work properly.

More than ever, careful research and planning are prerequisites for ensuring a safe and productive racking system. Even within a given state, building codes may vary widely by individual municipalities. Therefore, it is highly recommended that you investigate local requirements carefully during the planning stages of your pallet rack project(s). Don't risk the possibility of fines and costs in addition to reworking a system that does not meet code.