



PALLET RACK SAFETY

A CLOSER LOOK AT SIGNS OF RACK DAMAGE



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RACK SAFETY



Pallet rack can be a great asset to your company, helping you make the most of your storage space and optimize the organization of your products.

However, when rack is damaged or incorrectly loaded or installed, it can become dangerous. Periodic visual inspections will not only help you comply with safety regulations and work more safely, it will help you spot poor practices in your operation that might otherwise go unnoticed.

Even the best-built pallet rack can sustain damage. When racks are overloaded or are damaged, it can compromise a rack's capacity and put your system at risk. Let's face it, drivers are not likely to report collisions, so you may not know in a timely manner if a rack has been compromised.

It's well worth your time to schedule regular inspections. The sooner you know about a damaged upright, the sooner you can replace or repair it. Don't wait for an inspector to tell you. New uprights are relatively inexpensive; a rack collapse is not.



The RMI (Rack Institute of America) has many resources for rack users:

www.mhi.org | www.rm racksafety.org

ANSI MH16.1:2012; Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks

RMI Considerations for the Planning and Use of Industrial Steel Storage Racks 3-21-2018

RMI Guideline for the Assessment and Repair or Replacement of Damaged Rack

RMI Safety Blog Pallet Beam Deflection: How Much is Acceptable? Dated April 30, 2018

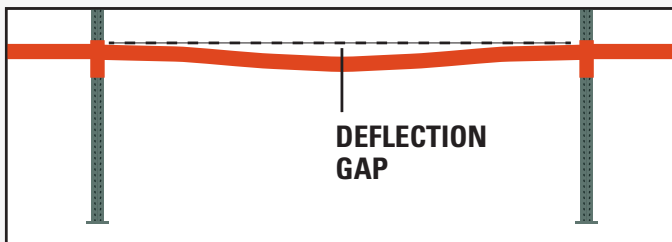
Source: RMI Considerations for the Planning and Use of Industrial Steel Storage Racks 03-21-2018



When is Beam Deflection a Problem?

Manufacturer's beam tables are generally based on uniformly distributed loads. Both the capacity and the beam deflection will vary if the load is not uniformly distributed on the load shelf beams. While some degree of deflection is normal for a loaded rack system, how can you tell when the amount of deflection indicates a reduction in beam capacity?

OVERLOADED BEAMS



Reference Standard: $\frac{\text{LENGTH OF BEAM}}{180} = \text{ALLOWABLE DEFLECTION}$

Example: $\frac{96" \text{ BEAM}}{180} = .52" \text{ ALLOWABLE DEFLECTION}$



Helpful Hint:

Any beam with visible deformation or cracking of the beam end connectors or welds should be unloaded and replaced. Be sure beams are fully engaged when installed and the safety locks are properly seated.

How to Determine if Beams are Overloaded

1. Observe the Beam Deflection

The maximum allowed deflection is beam length divided by 180. Deflection greater than this is an overloaded beam. Max deflection is located at beam midpoint for a uniformly distributed load.

Certain AS/RS or automated systems typically specify a tighter deflection limit for load beams, such as the length of the beams divided by 240 (or 0.42%). This tighter deflection requirement minimizes the risk of the automation (or the load) coming into contact with the beams during placement or removal.

Is there permanent deflection when beam is unloaded? If "yes," the beam has been overloaded and needs to be replaced.

2. Check the Connection at the Frame

Inspect the area where the beam connects to the frame. If any of the following conditions are present, the beam should be replaced.

- > Any visual deformation of the column and/or clip indicating that the beam was either damaged by impact or overload.
- > Any cracks in welded joints.
- > Safety clip cannot be properly connected and fully engaged.



Rack Damage and Capacity

A damaged beam or frame will reduce the rack capacity. Damaged components should be replaced, according to the RMI guideline for the assessment and repair or replacement of damaged rack.

Steel King strongly recommends replacing any damaged rack components.

About Rack Capacities

It is crucial to check that your rack is not carrying more load than it's designed for.

Beam Capacity Requirement

Calculating the required capacity of a pallet rack beam is fairly straight forward. Start with the heaviest possible load you'd be storing in a given pallet position. For example - 2,500 lbs.

Multiply this number by the number of pallet positions per beam level. If the number of pallet positions per beam level is two, your required beam capacity would be at least 5,000 lbs.

What Factors Affect System Capacity?

To determine the approximate frame capacity, you will need to measure the maximum vertical beam spacing that is being used. The beam spacing is found by measuring from the top of one beam level to the top the next beam level, so it includes the height of the beam plus the space between the beams.

To get a precise calculation, you will also need to account for the rack upright height, width, gauge, pattern, and foot plate size, as well as beam properties - length, width, gauge, beam connector. Load distribution along your beam will also affect capacity.

There are a number of other factors that affect pallet rack capacity - from your seismic zone to you floor properties (thickness, strength), and soil all impact your capacity.

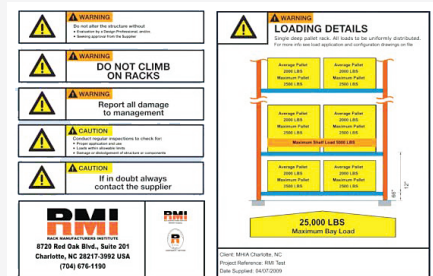
Capacity Plaques

Capacities for each bay type should be stated on load capacity plaques in one or more conspicuous locations.

NSI MH16.1:2012; Clause 1.4.2



CONSIDERING THE MANY VARIABLES THAT AFFECT RACK CAPACITY, IT IS ALWAYS ADVISABLE TO HAVE A MATERIAL HANDLING PROFESSIONAL CONFIRM YOUR CAPACITY CALCULATIONS.



Rack Inspections: Where to Start?

While the following checklist does not replace a formal rack inspection, it is a good way to spot potential problem areas.

RACK ENVIRONMENT

Is lighting adequate?	Installing adequate lighting in your facility is an easy way to help forklift operators see rack uprights and other obstacles that may be in their path.
Are aisles clear of clutter?	Keeping traffic areas free of obstacles allows your vehicle operators to take the safest path, maintaining a safe distance between forklifts and rack structures.
Is rack protection in place?	Rack protectors are relatively inexpensive and can significantly extend the life and safety of your rack. These can take the form of guard rails, aisle-end guarding, or column protectors that strengthen rack uprights or deflect impact at high risk areas.

RACK CONDITION

Are the racks plumb and level?	Collisions by a forklift may have a greater impact on racks that aren't set level. And an uneven surface can affect load distribution. This can occur with rack that has been reconfigured or where the foundation may have settled. Rack should be shimmed and plumbed appropriately.
Are components rusted or corroded?	This may indicate a couple of potential issues. If paint appears scraped, a rack may have suffered a collision. If rust has formed or is allowed to progress, it may weaken the capacity of your system.
Is the rack overloaded?	Along with dislodged beam and forklift damage, overloading is the other primary cause rack failure. This can happen inadvertently when changes are made to the rack load or profile without checking capacities. Remember that beams have a rated capacity per pair when equally loaded, and that uprights depend to a great degree on beam spacing for their capacity ratings.
Are rack load ratings posted?	Rack capacity may be hard to assess if load ratings are not posted. OSHA recommends that load ratings be present which provide the maximum permissible unit load and/or maximum uniformly distributed load per level, the average unit load, and maximum total load per bay. See ANSI/RMI MH16.1.



UPRIGHTS

Are they bent or damaged?	<p>Check the horizontal braces for any bending, twisting, or broken welds. Are there paint scrapes that might indicate an impact? Even minor damage can reduce the upright capacity. Replace or repair these uprights immediately.</p> <p>To check the degree of damage, measure the gap by placing a straight edge along the surface of the concave side of a damaged rack upright. Center the straight edge on the damaged section's length as completely as possible. Measure the gap between the upright and the straight edge. If the damage that produces an overall bend in the upright (not just a dent) of more than a few millimeters, this may be cause to replace or repair it.</p>
Check your foot plates	Are they properly lagged to the floor? Are shim stacks nested squarely under the foot plates?
Are column protectors installed?	Most often, the best way to address rack damage is to prevent it. Well-placed guard rails and aisle-end protection can prevent a great deal of damage to your system and ensure the safety of your equipment and your workers. If you have column protectors and notice damage, further inspection is warranted. Often, these items are painted safety yellow for greater visibility.
Check bracing	Are any braces missing. Check thoroughly for any bending or other damage.

ASSEMBLY

Correct components	Check for incompatible or incorrectly assembled components or improper repairs.
Are any components missing, damaged or improperly aligned	Check to make sure there are no components that are missing or improperly aligned or nested. Are any components loose? This includes baseplates, shims, spacers, safety clips and pins, anchors, bolts, and safety bars.
Safety equipment; load restraint	Are there pallet stops or safety netting adjacent to service aisles? Is there overhead guarding at tunnel bays?



BEAMS

Are the beams properly attached to the uprights?	Are the beams seated tightly into uprights? Has there been impact to the area? Are there broken welds or other signs of damage? Are safety clips still tight; are bolts still tight?
Inspect beam surface	Are there any dents, distortion, or evidence of an impact? Be sure to check the beam face and flanges.
Are the clips, bolts, or safety pins, or beam attachment pins missing or damaged?	Most racks use some kind of connector hardware aside from the teardrop or keyhole to ensure tight fit and safety. Some even utilize more than one method. Inspect yours to make sure they are all securely fastened and undamaged.
Check for deflection clearance	Beams naturally deflect beneath a load, and a certain amount of deflection is acceptable, but it should disappear when you unload the beams. If it doesn't, the beams need to be replaced, as they have been deformed by overloading or impacts. Beams shouldn't bow more than 1/180th of the total length of the beam (for a 96" beam, that's half an inch).

USAGE

Pallets	Check for any overhanging, double-stacked, or damaged pallets. Are all pallets the correct size for the rack?
Safety equipment; load restraint	Are there pallet stops or safety netting adjacent to service aisles? Is there overhead guarding at tunnel bays?

High Risk Areas

Some storage areas are inherently more prone to rack damage. These should be inspected more frequently and more thoroughly:

Product Value. Did you know that the less expensive the product stored in an area, the more likely the rack is to be damaged? Damages can add up. These areas need additional protection.

Aisle Width. The narrower the aisles, the more likely material handling equipment is to impact the rack.

Transfer Aisles. Rack rows with transfer aisles are more prone to damage.

Previous Damage. Areas that have been damaged in the past are more likely to be damaged again.



Frequently Asked Questions

How frequently do racks need to be inspected?

The answer to those questions is highly situation dependent. Recognizing that every storage rack application and operation is different, RMI's publication Considerations for the Planning and Use of Industrial Steel Storage Racks recommends only that the system owner establish and implement a program of regularly scheduled inspections, offering guidelines to determine frequency. Additionally, the guidelines advise that a system should be inspected immediately after any event increases the likelihood of damage to the rack - such as a forklift collision or a seismic event.

At a minimum, inspections should be performed annually. A best practice rule of thumb, however, is that inspection frequency should correspond to the higher the velocity of inventory throughput, traffic or activity in the racking.

What type of training or qualifications should an inspector have?

Internally performed inspections should be conducted by a qualified team member who is familiar with the storage rack's design and installation requirements. The first step in the inspection is to ensure that the rack configuration and components match the original design documentation. Once that has been confirmed, damage assessments can be conducted.

Additionally, it can be advantageous to engage an independent inspection professional. Team members who routinely work around a rack structure may overlook subtle signs of damage or unapproved changes to the configuration. Hiring an outside inspection service to perform an in-depth review and detailed measurements helps to ensure an unbiased evaluation.

Regardless of who performs the rack safety inspection, the schedule and results should be documented and retained on file each time for future reference.

When is it okay to repair a rack instead of replace it?

For systems with the original design documentation that have not been modified or reconfigured, damaged components can normally be replaced with identical new components from the same manufacturer.

The same does not hold true for undocumented or reconfigured systems. For that reason, rack owners and facility managers should not attempt to undertake a rack repair without first engaging the services of a qualified, professional engineer to supervise and direct the assessment of the system's condition, as well as design and oversee the ultimate repair or replacement.

Beyond the Walk-Through

While a visual review is not a thorough inspection, it's a valuable first alert!

Be sure to document and take action when needed. Documentation helps you track the regularity and thoroughness of the inspection process.

These tips provided here are for informational purposes; see a rack inspection professional for a thorough rack inspection. When hiring a inspectors, be sure they adhere to industry or local code standards, and that they also document and retain the records of their inspections.

Protecting Your Investment

Pallet rack is not only a substantial investment in itself, but it also serves to keep your business running efficiently and your inventory safe. When investing in a system, there are many things you can do to ensure the maximum useful life of your rack system.

Reinforce Areas Most Exposed to Impact

Roughly one in ten forklifts are involved in accidents every year, and many are never reported by drivers. This exposes your company to liability and costly losses if undiscovered rack damage compromises the integrity of your rack.



Rub Rails



Snap Guard®
Rack Protector



Free-Standing
Column Protectors

Add-on Crash Protection

Angled for maximum deflection, Steel King manufactures replaceable guard components for additional crash protection.

Steel King's rub rails are designed to protect vulnerable surfaces in narrow aisles and high traffic areas. They are often installed as protection for the end of rack aisles, in-plant offices, and exposed equipment.

Load Protection

Steel King's pallet load stop beams not only protect inventory from being pushed off the back of your rack, they also help you maintain flue space for optimal fire suppression.



Aisle & Work Area Protection

Whether you need to protect aisle ends or to keep foot and vehicle areas separate, Steel King has a solution.



MegaGuard® Guard Rail



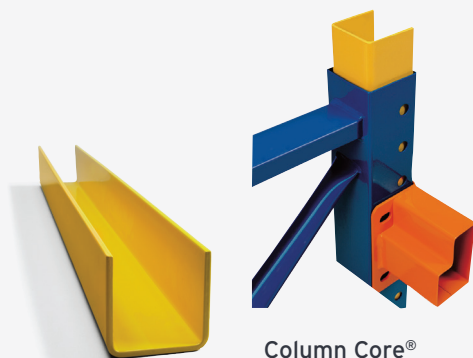
Guard Dawg® Row End Guard



Steel Guard® & Armor Guard®
Guard Rail Available with
Safety Gate

Starting Strong

If you are installing new rack, reinforce your frame uprights where they need it most - at the base - where forklift contact is most likely. From reinforced frame components and welded-on column protectors to drop-in reinforcements for roll-form rack, there are a variety of options that will reduce the down-time and rack replacement costs over time.



Column Core®



Double reinforced post and
heavy horizontal bracing



Welded Column
Protectors

Learn more at www.steelking.com/product-category/safety



DESIGNED TO PERFORM PRODUCTS BUILT TO LAST

For over 50 years, Steel King Industries, Inc. has produced high-caliber material handling racking, storage, and safety systems that improve, fortify, and protect company's supply chains nationwide. With unparalleled standards of safety and quality, we manufacture storage solutions ranging from the industry's top containers, work platforms, and rack systems, to highly engineered distribution facility systems that are foundational for an automated supply chain. Steel King's reliability, strength, and support have earned recognition and loyalty as one of the top rack manufacturers in North America, as we proudly contribute vitality, efficiency, and value to supply chains worldwide.

Support for Support

At Steel King, we stake our reputation on supporting people—not just inventory. We're here to help you specify the high-density solutions to meet the needs of your operation, space, and budget.

Scan to learn about
our complete solutions
and why our products
are BUILT TO LAST.



Rack and Systems

The ultimate in design and execution, customized for your space and requirements. Built tough, forklift-friendly, and ready to store any inventory.

- > Pallet Racks
- > Cantilever Racks
- > Drive-In / Drive-Through Racks
- > Flow Rack / Pushback Racks
- > Pick Module Racks
- > Specialty Racks
- > Portable Racks
- > Custom Shipping Racks
- > Support Structures / Work Platforms

Safety Products

Steel King's safety products extend the life of your facility and have been setting industry standards in safety, protecting your people, product, and plant.

- > Guard Rails
- > Safety Gates
- > Pallet Load Stops and Supports
- > Lift-Out Rails
- > Rub Rails

Containers

Steel King manufactures a full line of industrial storage containers for heavy-duty stackable storage, scrap handling, line assembly dispensary, parts distribution, and other uses. We offer essential, industry-standard designs as well as fully-custom containers suited to your storage requirements.

- > Transportable Containers
- > Bulk Containers
- > Collapsible Containers
- > Work in Progress (WIP) Containers
- > Steel Pallets



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