YOUR GUIDE TO DETECTING RACK DAMAGE

Pallet Rack Safety

HTI

Storage Solutions for Today and Tomorrow

RACK SAFETY IS CRITICAL TO YOUR COMPANY'S SECURITY

Pallet racks offer tremendous advantages, including optimization of storage space and organization of supplies and products. But when a rack is incorrectly installed, overloaded, or damaged, it can quickly become a liability for your process and company.

Even the most well-constructed pallet racks can have a hidden flaw or malfunction or sustain damage that compromises capacity. And you can't always rely on your drivers to report collisions or outside inspectors to catch potential pallet rack risks or problems.

Improper racking is your responsibility—the sooner faulty racking is replaced, the better. No one wants to pay a fine for violating safety regulations, risk injuring a team member, or absorb the costs, lost productivity, or damages caused by a rack collapse. It's always more cost-effective to install new uprights than to recover from a rack collapse.

The best way to protect your company and avoid the risks of rack problems is to perform regular visual inspections.

Following the safety and inspection recommendations in these guidelines will help you:

- ✔ Work safely
- ✔ Stay in compliance with safety regulations
- ✔ Identify problems that could affect your productivity and profitability

For additional resources, download the following from the Rack Manufacturers Institute (RMI) at mhi.org or rmiracksafety.org:

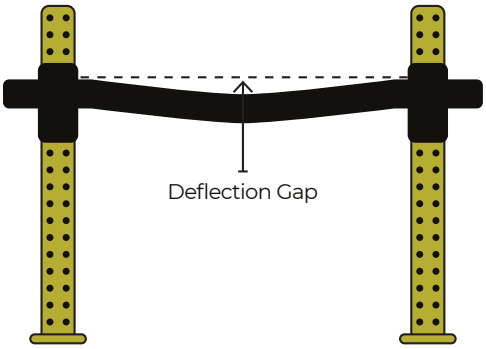
- ANSI MH16.1:2012 Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks
- RMI Considerations for the Planning and Use of Industrial Steel Storage Racks 3-21-2018
- RMI Guideline for the Assessment and Repair or Replacement of Damaged Rack – Version 1.00
- RMI Safety Blog Pallet Beam Deflection: How Much is Acceptable? Dated April 30, 2018

BEAM DEFLECTION PROBLEMS

Manufacturers' beam tables are based on uniformly distributed loads. It's normal for a loaded rack system to show some deflection, but an unevenly distributed load on the shelf beams could indicate a reduction in beam capacity.

Check Beams for Signs of Deflection

- ✓ During installation, ensure that the beams are fully engaged and that the safety locks are properly seated.
- ✓ Unload/replace any beam showing deformations, cracked beam end connectors, or damaged or missing welds.



Deflection Gap Reference Standard:	$\frac{\text{Length of Beam}}{180}$ = Allowable Deflection
Example:	$\frac{\text{96" Beam}}{180}$ = .52" Allowable Deflection

How To Identify Overloaded Beams

1. Check the Beam Deflection

- ✓ To determine the maximum allowed deflection, divide the beam length by 180.
- ✓ If the deflection is greater than this number, the beam is overloaded.
- ✓ The maximum deflection for a uniformly distributed load is located at the beam's midpoint.

Some Automated Storage and Retrieval Systems (AS/RS) or automated systems specify tighter deflection limits for load beams, such as the length of the beam divided by 240 (or 0.42 percent). This minimizes the risk of the automation (or the load) encountering the beams during loafing or removal.

If there's permanent deflection when the beam is unloaded, the beam is 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:

- ✓ Visual column or lip deformation—this indicates that the beam was damaged by impact or overloading
- ✓ Cracks in welded joints
- ✓ Safety clips that can't connect properly or fully engage

DAMAGED RACKS DIMINISH CAPACITY

Damage to beams or frames reduces the holding capacity of a rack

Handling Technologies strongly recommends replacing any damaged rack components according to the RMI Guideline for the Assessment and Repair or Replacement of Damaged Rack.

Check Your Rack Capacity

No rack should carry a greater load than it's designed for.

Calculate the Beam Capacity Requirement

Start with the heaviest possible load stored in each pallet position, for example, 2,500 lbs. Multiply this number by the number of pallet positions per beam level. Following the example, if you have two pallet positions per beam level, the required beam capacity would be no more than 5,000 lbs.

Measure System Capacity

To determine the approximate frame capacity, measure the maximum vertical beam spacing. Measure from the top of one beam level to the top of the next beam level. This includes the beam height plus the space between the beams.

Measure the following properties to calculate the precise capacity:

- ✓ The height, width, gauge, pattern, and footplate size of the upright beam
- ✓ The length, width, and gauge of the beam connector
- ✓ The load distribution along the beam

Other factors that affect the pallet rack capacity:

- ✓ Seismic zones
- ✓ Floor thickness and strength
- ✓ Soil composition and density

Capacity Plaques

Load capacities for each bay type should be clearly stated on plaques placed in one or more prominent locations.

ANSI MH16.1:2012, Clause 1.4.2

Given all the variables that affect rack capacity, we advise you to consult with a material handling professional to confirm your capacity calculations.

HOW TO PERFORM RACK INSPECTIONS

The following checklist is not a substitute for a formal rack inspection but provides additional methods to identify potential problems.

RACK LAYOUT

Is There Sufficient Lighting?	Having sufficient lighting throughout your facility makes it easier for forklift operators to view rack uprights and other objects in their path.
Are the Aisles Clear?	Clearing obstacles out of traffic aisles enables forklift operators to maintain a safe distance from rack structures.
Is Rack Protection in Place?	Rack protectors are an inexpensive way to improve the life span and safety of your rack. **Adding the following protective items will help make rack uprights stronger and/or reduce the impact of collisions in high-risk areas:** ✓ Guardrails ✓ Aisle-end guards ✓ Column protectors

RACK CONDITION

Is the Rack Level?	Uneven surfaces, such as racks that have been reconfigured or set on settled foundations, affect the rack's load distribution. Forklift collisions also have a greater impact on racks that aren't level. Shimming and plumbing the rack as needed should keep it level.
Are Any Rack Components Rusted or Corroded?	Rust or corrosion may be signs of an underlying problem. Untreated rust also weakens the structural integrity of the racking system. Scraped paint may indicate that the rack has experienced a collision.
Is the Rack Overloaded?	**The primary causes of rack failure are:** ✓ Dislodged beams ✓ Improper beam spacing ✓ Damage from forklift collisions ✓ Overloaded racking These conditions are often the result of changes made to the rack load or profile without checking the capacity. Keep in mind that the beam capacity is per pair when loaded equally.
Have Rack Load Ratings Been Posted?	**OSHA recommends that the following load ratings be posted in plain view:** ✓ Maximum permissible unit load ✓ Average unit load ✓ Maximum uniformly distributed load per level ✓ Maximum total load per bay See ANSI MH16.1:2012 for additional details.

UPRIGHTS

Are the Uprights Bent or Damaged?	**Even minor damage can reduce upright capacity—if the horizontal braces show any of the following signs, then repair or replace the uprights immediately:** ✓ Bent, twisted, or broken welds ✓ Paint scrapes that might indicate a collision **To check the severity of the damage:** ✓ Place a straight edge along the concave side of a damaged rack upright ✓ Center the straight edge along the length of the damaged section ✓ Measure the gap between the upright and the straight edge ✓ If the upright is bent more than a few millimeters, you may need to repair or replace it.
Check the Footplates	Ensure the footplates are properly lagged to the floor and that the shim stacks are nested squarely under the footplates.
Are Column Protectors Installed?	**Install strategically placed guardrails and end-of-aisle protection to:** ✓ Prevent damage to your system ✓ Ensure the safety of your equipment and your team members ✓ Provide greater visibility with a safety yellow paint scheme **NOTE:** Inspect your column protectors immediately if they are damaged.

ASSEMBLY

Correct Components	Check for incompatible or incorrectly assembled components or improper repairs.
Are Any Components Missing, Damaged, or Improperly Aligned?	**Check the following components to ensure that they are not loose, missing, or improperly aligned or nested:** ✓ Case plates ✓ Spacers ✓ Anchors ✓ Safety bars ✓ Shims ✓ Safety clips and pins ✓ Bolts
Safety Equipment—Load Restraint	**Ensure you have the following safety equipment in place:** ✓ Pallet stops or safety netting adjacent to service aisles ✓ Overhead guarding at tunnel bays

BEAMS

Are the Beams Properly Attached to the Uprights?	**Check the beams for the following:** ✓ Beams are seated tightly into uprights ✓ Signs of collision ✓ Broken welds or other signs of damage ✓ Tight safety clips and bolts
Inspect the Beam Surface	**Check the beam face and flanges for:** ✓ Dents ✓ Distortions ✓ Signs of collision or other damage
Is Any Connector Hardware Missing or Damaged?	**Along with the teardrop or keyhole, most racks use one or more of the following types of connector hardware to ensure tight fits for safety:** ✓ Clips ✓ Bolts ✓ Safety pins ✓ Beam attachment pins **NOTE:** Inspect these connectors regularly to see if they are missing or damaged.
Check for Deflection	All beams naturally deflect under a load. Beams shouldn't bow more than the beam's total length divided by 180 (for example, no more than half an inch for a 96" beam). Normal deflection should disappear when the beams are unloaded. If the deflection doesn't disappear when the beam is unloaded, it needs to be replaced—it may have been damaged by overloading or collision.

USAGE

Clearance	
Pallets	**Check for any of the following:** ✓ Overhanging pallets ✓ Double-stacked pallets ✓ Damaged pallets ✓ Pallet sizes that are incompatible with the rack
Safety Equipment—Load Restraint	**Ensure you have the following safety equipment in place:** ✓ Pallet stops or safety netting adjacent to service aisles ✓ Overhead guarding at tunnel bay

High-Risk Areas

The following characteristics of storage areas can increase the probability of rack damage and warrant more frequent and thorough inspections:

Low Product Value
Racks storing less expensive products are damaged more frequently.

Aisle Width
Narrow aisles are often damaged by material handling equipment.

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

Previous Damage
Areas that have been damaged previously are more likely to be damaged again.

PROTECT EMPLOYEES

Handling Technologies provides a variety of solutions to protect aisle ends and separate foot and vehicle areas.

Build on Strong Foundations

When installing new racks, reinforce the frame uprights at the base where forklift contact most frequently occurs to reduce downtime and rack replacement costs.

Frame upright reinforcement options include:

- ✓ Reinforced frame components
- ✓ Welded-on column protectors
- ✓ Drop-in reinforcements for roll-form racks

CHOOSING BETWEEN RACK REPAIR AND REPLACEMENT

Unmodified Systems with Their Original Design Documentation

Damaged components should be replaced with new components from the same manufacturer.

Reconfigured Systems Without Their Design Documentation

Do not attempt to undertake a rack repair without hiring a qualified professional engineer to:

- ✓ Personally assess the system's condition
- ✓ Oversee and direct the design, repair, and installation of the replacement component(s)

Walk-Throughs and Inspections

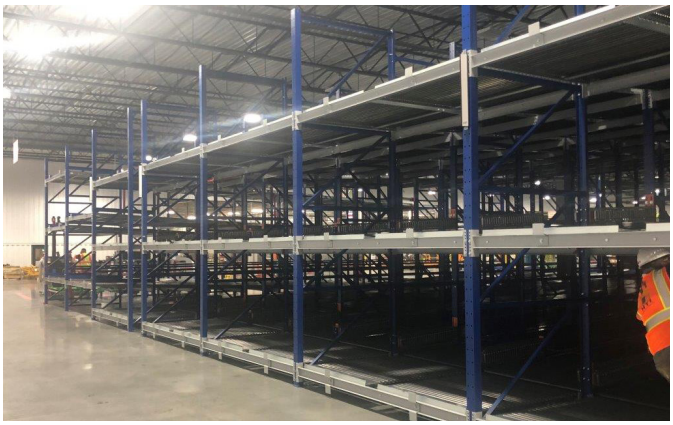
Do not attempt to undertake a rack repair without hiring a qualified professional engineer to:

- ✓ Frequently perform a personal visual review to remain aware of the condition of your rack system
- ✓ Document any actions taken to monitor the frequency and thoroughness of the inspection
- ✓ Regularly hire a rack inspection professional to conduct a thorough rack inspection
- ✓ When hiring an inspector, make sure they:
    - Adhere to all industry or local code standards
    - Document and archive the records of their inspections

MAXIMIZE YOUR INVESTMENT

Handling Technologies offers a variety of products engineered to:

- ✓ Keep your business running smoothly
- ✓ Protect your inventory and your investment
- ✓ Extend the service life of your rack system



Reinforce High-Impact Areas

Racks in any area where forklifts operate should be reinforced to prevent damage from collisions. Every year, approximately one in ten forklifts are involved in accidents. Most accidents are never reported by the drivers. Reinforcing pallet racks protects your company against liabilities and expensive losses because of system failures resulting from undetected rack damage.

Supplemental Crash Protection

Handling Technologies manufactures replaceable rub rails angled for maximum deflection.

These replaceable guard components are designed to:

- ✓ Protect vulnerable surfaces in narrow aisles and high-traffic areas
- ✓ Provide protection for end-of-rack aisles, in-plant offices, and other exposed equipment

Ensure Rack Load Integrity

The Handling Technologies pallet load-stop beams are engineered to:

- ✓ Prevent inventory from being pushed off the back of the rack
- ✓ Maintain flue space to provide optimal fire suppression

FREQUENTLY ASKED QUESTIONS

1. How Often Should Racks be Inspected?

Storage rack application and operation depends on each rack.

According to the RMI's Considerations for the Planning and Use of Industrial Steel Storage Racks, system owners should:

- ✓ Establish and implement a program of regularly scheduled inspections—at least one per year
- ✓ Perform inspections more frequently in areas with high rates of inventory throughput, traffic, or racking activity
- ✓ Immediately and thoroughly inspect the system following any event that increases the risk of rack damage, such as a forklift collision or an earthquake

2. How to Conduct Internal Inspections

Internal inspections should be conducted by a qualified team member experienced with the storage rack's design and installation requirements.

They should:

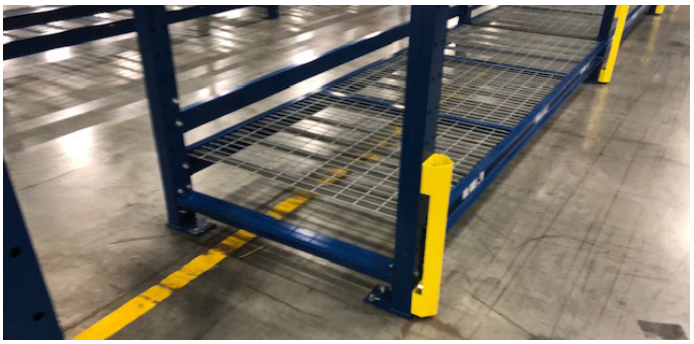
- ✓ Ensure that the rack configuration and components match the original design documentation
- ✓ Conduct damage assessments only after confirming the original design documentation
- ✓ Document and keep the inspection records on file for future reference

3. Consider Hiring a Third-Party Inspection Professional

The downside of internal inspections is that team members who work with a rack structure every day may overlook damage or unapproved modifications. Hiring a professional inspection service ensures thorough and objective evaluations and results.

The external inspector should:

- ✓ Conduct an in-depth review
- ✓ Take detailed measurements
- ✓ Document and provide the inspection records to keep on file for future reference



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