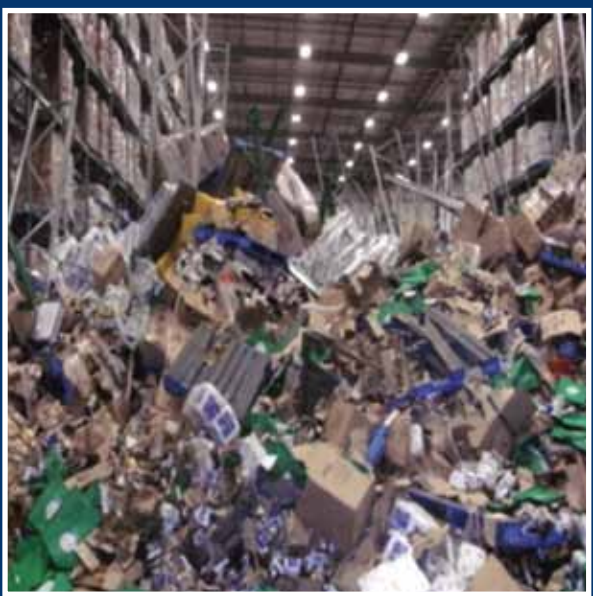
USER'S GUIDE FOR INSPECTION OF DAMAGED STORAGE RACK SYSTEMS



DON'T WAIT UNTIL IT'S TOO LATE!

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The purpose of this document is to provide owners/operators a **simple**, educational pictorial resource to aid in their timely identification of the most common types of pallet rack damage.

INTRODUCTION

Warehouse Pallet Rack Systems are engineered, high performance structures that are designed to support product loads many times their weight. Each pallet rack component is designed, manufactured, and tested against rigorous quality controls. These standards ensure that the rack system will safely perform with designed load applications corresponding to specific configurations.

Although The Rack Manufacturer's Institute (RMI) design specifications include safety factors, these calculations do not consider additional requirements that are imposed as a result of post-manufacture damage. Therefore, it is critical that pallet racks be routinely inspected and maintained correctly so they can continue to perform as originally designed.

Component damage reduces the pallet rack's carrying capacity and may ultimately lead to a catastrophic pallet rack collapse. The total cost of a rack collapse is staggering and typically far exceeds the value of the entire rack structure and stored product. Even worse a collapse often times leads to:

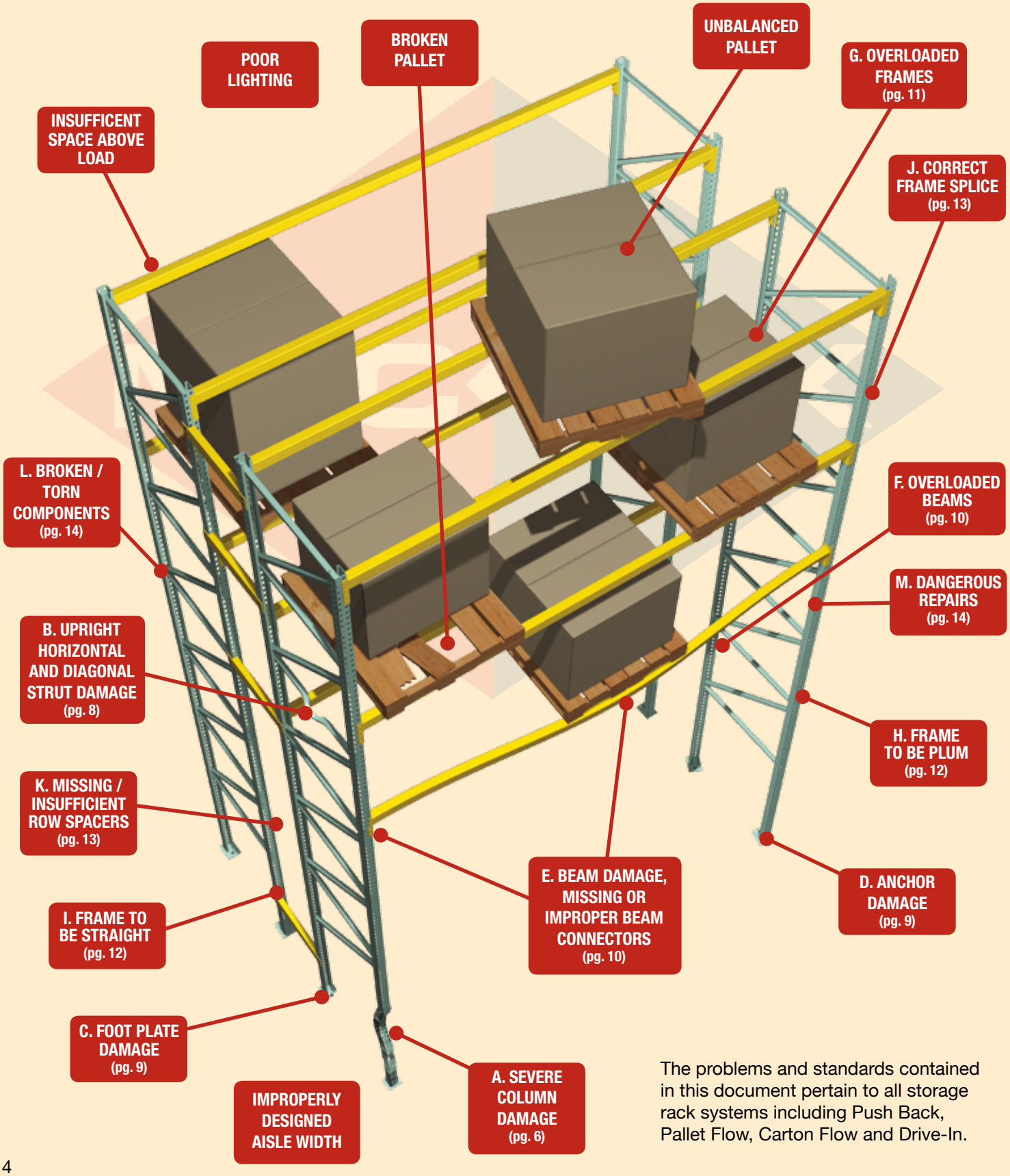
- **Serious injury or death**
- **Higher insurance premiums, fines and legal expenses**
- **Product, equipment and business loss**
- **Expensive cleanup and replacement costs**

This document is by no means intended to replace regular pallet rack system evaluations performed by qualified, trained professionals. This document specifically does not provide any engineering or legal opinion on this subject matter.

Modifications to pallet rack systems located in geographical areas that are in danger of seismic activity need to be reviewed by a qualified professional engineer.

COMMON SAFETY PROBLEMS

Many conditions converge to impact the operational safety of pallet rack systems. Some of the most common conditions include:



The problems and standards contained in this document pertain to all storage rack systems including Push Back, Pallet Flow, Carton Flow and Drive-In.

INDUSTRY STANDARDS

Pallet Rack safety is becoming increasingly scrutinized by OSHA, Federal and State agencies and insurance companies, and comes with substantial legal and moral liabilities. ANSI/RMI MH16.1 the industry standard for industrial pallet rack has recently been incorporated into the more general International Building Code. The I.B.C. includes the requirements and governs the construction of all warehouses in the United States. I.B.C. standards must be met in order to obtain local municipal building permit approval during construction and upon final completion. Therefore ANSI/RMI 16.1 requirements are now subject to the same enforcement requirements as the I.B.C.

EXCERPTS FROM ANSI/RMI 16.1

1. The storage rack system operator is responsible for maintenance and repair of storage systems.
2. Upon visible damage, the pertinent portions of the rack shall be unloaded immediately and removed from service by the user until the damaged portion is repaired or replaced.
3. Adjusting beam elevations or operating beyond approved work load limits on pallet rack frames and or support beams without regard to published manufacturers load tables is not allowed and will lead to rack failure.
4. Altering / modifying components without the direction of a proper supervisory engineer is not allowed and will lead to rack failure.
5. Proper aisle width and bay width must be maintained based on storage requirements.

OSHA 1926.250 (a) (1)

- All materials in tiers shall be stacked, racked, blocked or otherwise secured to prevent sliding, falling or collapse

OSHA General Duty Clause - Section 5 (a) (1)

- Employers are required to provide their employees with a place of employment that is “free from recognizable hazards that are causing or likely to cause death or serious harm to employees.”

Far too often, damaged rack remains in operation because it is ignored or mistakenly assumed to be safe. The reality is that many damaged systems are at the critical “TIPPING POINT” where just one more damaged component, or just one more seemingly non-significant impact will push the system into collapse. While no official standards have been adopted in the United States regarding rack damage, we are referencing the SEMA standards that are enforced throughout Canada and Europe.

DAMAGED RACK IS UNSAFE, DANGEROUS AND UNACCEPTABLE.

It is imperative that management create an environment with operators that ensures timely reports and immediate remedial action.

Owners/Operators should inspect their pallet rack systems on a regular basis. Particular attention should focus on damaged or missing rack system components listed on the following pages.

RACK INSPECTION COMPONENTS

A. SEVERE COLUMN DAMAGE

Damage under beam level

Damage above beam level

Damage behind beam connector

Ripped column

Outrigger damage

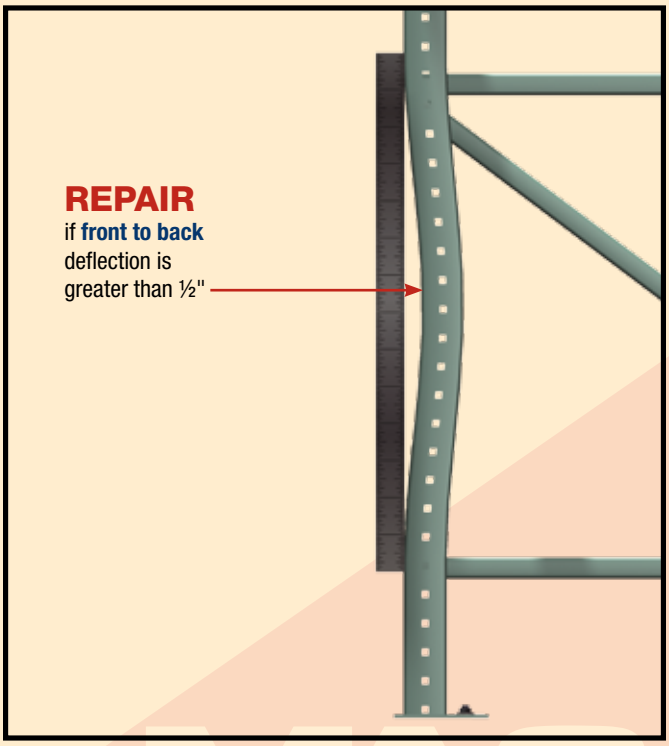
Closed tube damage

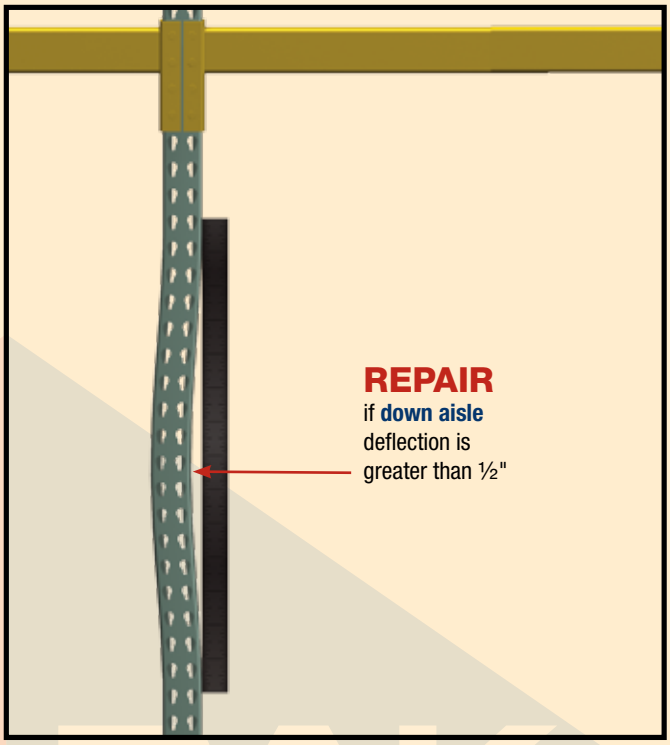
Structural column damage

Structural column damage

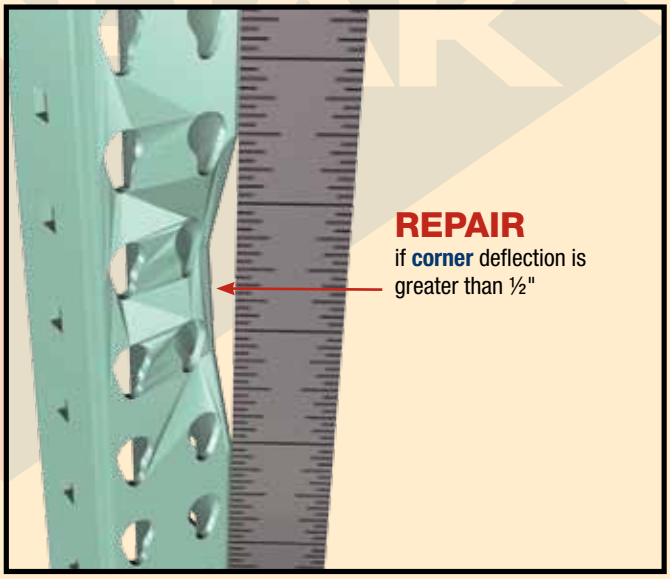
Structural column damage

COLUMN DAMAGE INSPECTION CRITERIA





Reference Standard:
Columns with rips, tears or deflection beyond the following limits need to be repaired. Column deflection greater than ½" in either the down aisle or front to back direction must be repaired.



Corner column damage is relatively more critical than damage to the front and sides of columns.

All things being equal, rack damage to free standing single rows is more dangerous than the same damage on back to back rows with row spacers.

Helpful Hint:
Inspect both front and back leg columns. Inspect for possible deformation BEHIND beam connectors as pictured on page 6, upper right hand corner.

B. HORIZONTAL AND DIAGONAL STRUT DAMAGE

Roll formed horizontal strut damage

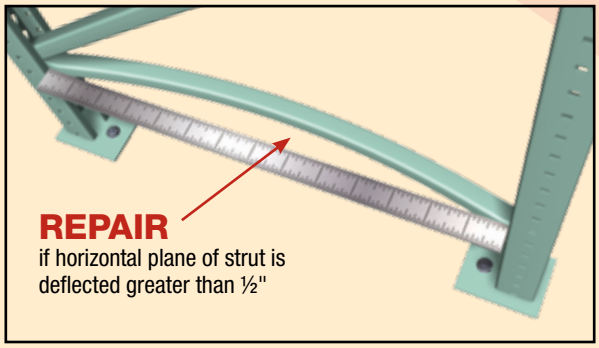
Roll formed closed tube horizontal strut damage

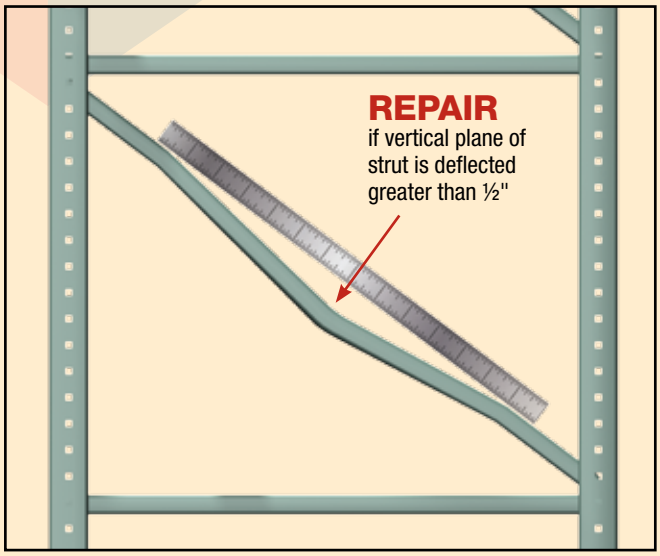
Broken diagonal weld

Missing horizontal struts

Ripped / torn horizontal and diagonal

Damaged roll form diagonal





Reference Standard:
Missing horizontal or diagonal braces or braces with any rips, tears or braces with deflection in either plane beyond ½" must be repaired.

Helpful Hint:
Any torn, broken or missing welds – the strut must be repaired.

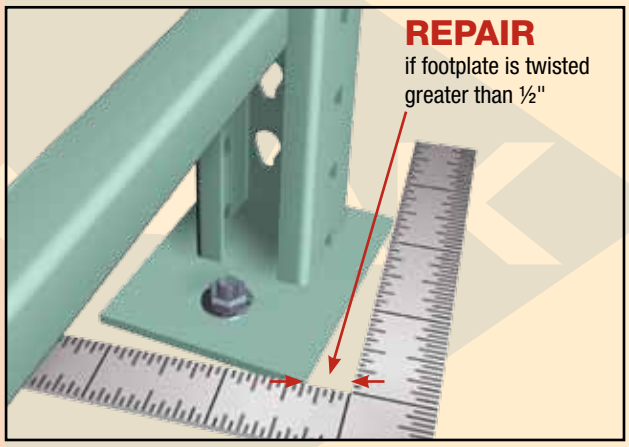
C. FOOT PLATE DAMAGE

Sheered footplate

Sheered footplate

Sheered footplate

Reference Standard:
Front and back footplates which are torn, ripped or twisted past ½" require repair.



D. ANCHOR DAMAGE

Missing anchor

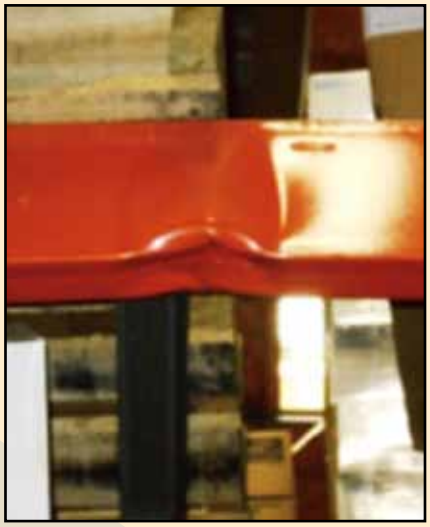
Loose anchor

Reference Standard:
Each footplate of the upright (front and back) must be anchored to the floor. Check for missing, loose and sheered anchors.

E. BEAM DAMAGE, MISSING OR IMPROPER BEAM CONNECTORS

Disengaged beam clip

Missing / damaged beam clips

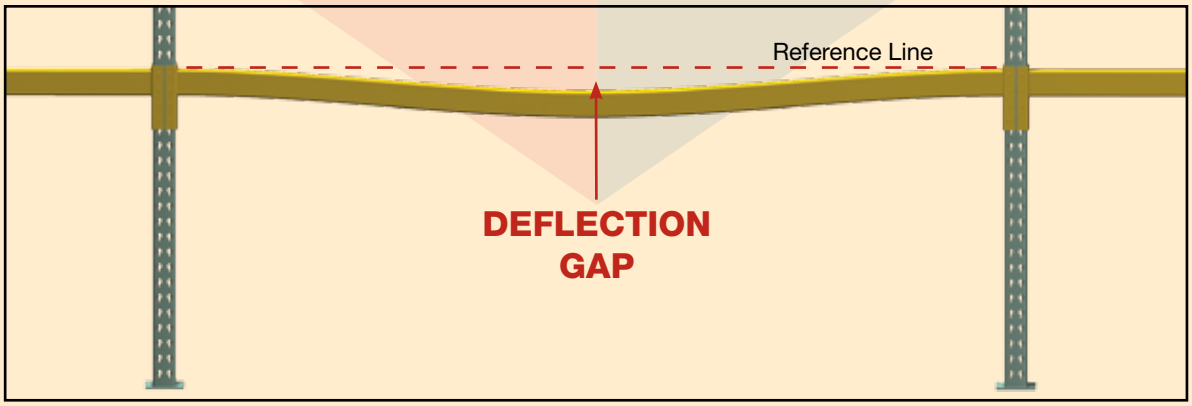


Damaged beam

Reference Standard:
Load beams must be secured to withstand 1,000 lbs. of uplift force.

Helpful Hint:
O.E.M. Beam connector hardware may be purchased and installed or standard grade 5 bolts and nuts may be used if applicable. Be sure both the left and right sides are secure.

F. OVERLOADED BEAMS



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

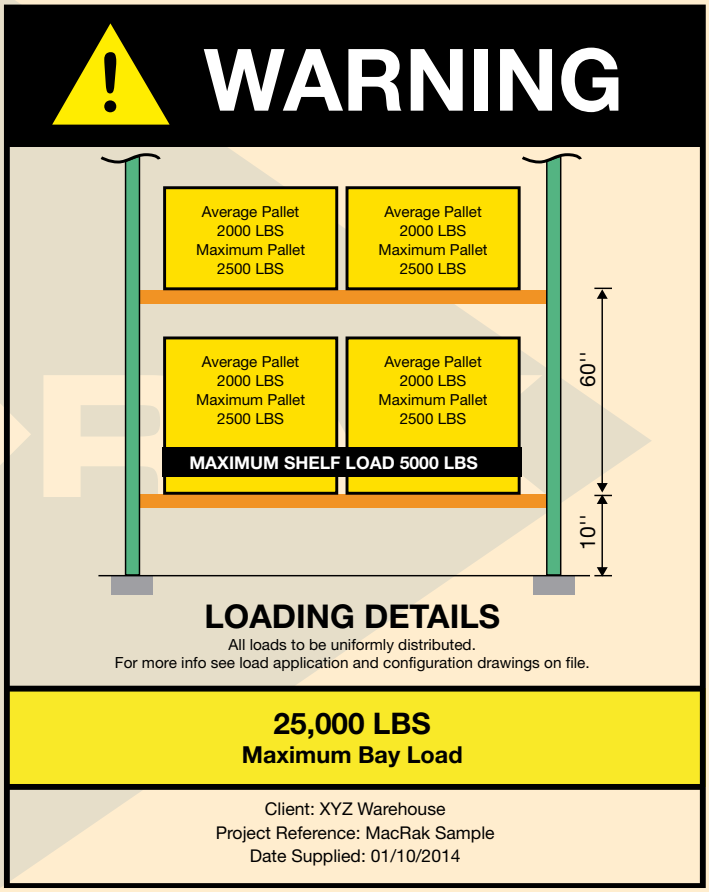
Example: $\frac{\text{96" BEAM}}{180}$ **= .53" ALLOWABLE DEFLECTION**

Residual vertical deformation should not exceed 20% of normal deflection under load.
Residual lateral deformation should not exceed 40% of the normal vertical deflection under load.

Helpful Hint:
Any beam with visible deformation or cracking of the beam end connectors should be unloaded and replaced. Be sure beams are fully engaged and installed with proper safety locks.

G. OVERLOADED FRAMES

Reference Standard:
Each manufacturer publishes frame capacity charts. Applicable information to your system should be prominently displayed on a placard at the end of an aisle.



Placard examples of acceptable format / content
Actual appearance may vary

Helpful Hint:
Be sure capacity plaques include beam elevations and design loads.

DO NOT CHANGE ORIGINAL CONFIGURATION OR WEIGHT LOAD WITHOUT ENGINEERING APPROVAL.

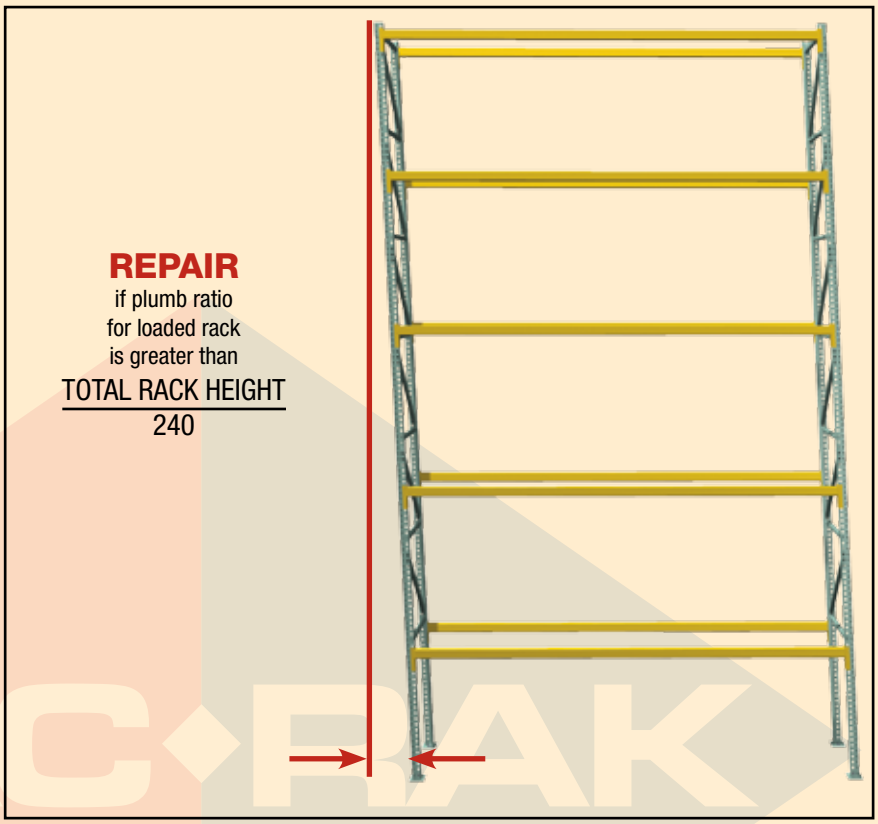
Plaques need to be changed whenever there are modifications to the rack configuration or load.

H. FRAME TO BE PLUM

Reference Standard:
Maximum top to bottom out of plumb ratio for loaded rack is 1/240 (for example ½" per 10' feet in height). Measured from the centerline of the column at the floor to the centerline of the column at the top of the shelf elevation.

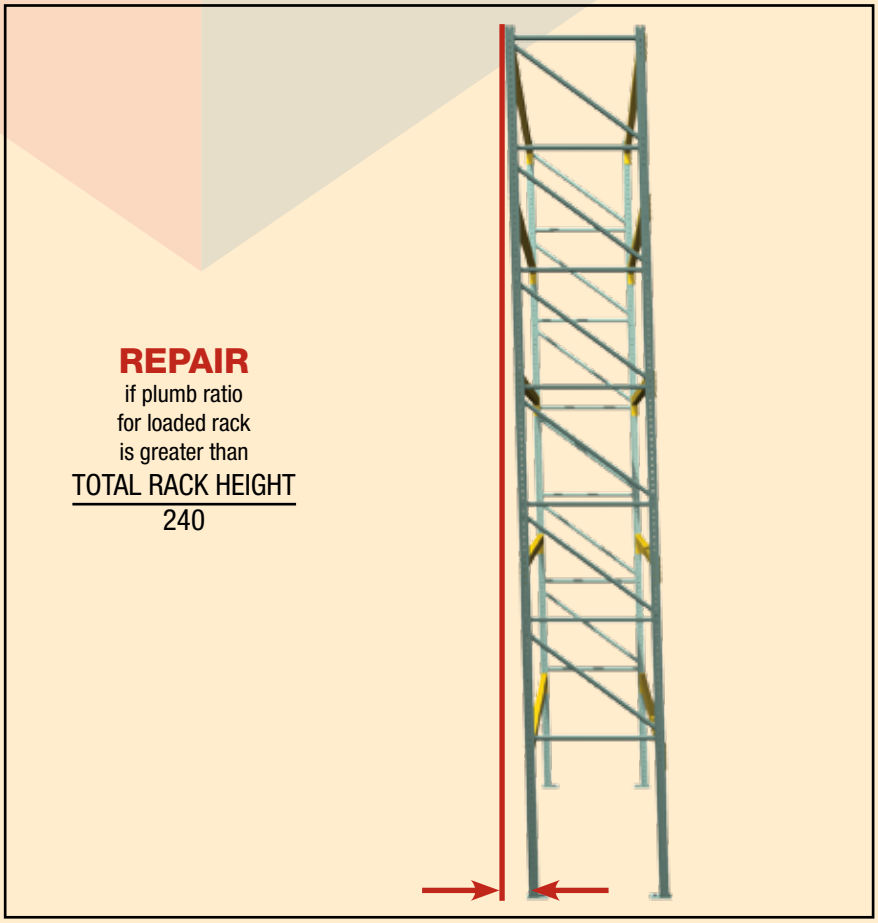
Columns exceeding this limit should be offloaded and re-plumbed.

Damaged parts must be repaired.



I. FRAME TO BE STRAIGHT

Reference Standard:
Maximum horizontal distance from centerline at any point on column to a plumb line from any other point on the column cannot exceed ½" per 10 feet in height.



J. CORRECT FRAME SPLICE

Improper splice installation

Dangerous connections

Reference Standard:
Although splices are an accepted practice, extreme care should be exercised to ensure that splices are approved by the various frame manufacturers and within their installation and performance limits.

CRITICAL:
All modifications to frames, including frame splices, must have engineering approval per applications.

K. MISSING / INSUFFICIENT ROW SPACERS

Example of roll formed row spacer

Example of structural row spacer

Reference Standard:
Back to Back frames with height to depth ratio 6:1 or greater need row spacers minimum of 10’ apart from each other.

L. BROKEN/TORN COMPONENTS

Torn column

Torn footplate weld

Broken strut connection

Reference Standard:
Any component with broken or torn welds needs to be repaired.

M. DANGEROUS REPAIRS

Non-engineered repairs

Non-engineered repairs

Improper installation

Multiple issues

Reference Standard:
Rack repairs must be approved by a supervisor rack engineer.

EXAMPLES OF PROPERLY ENGINEERED RACK REPAIR SOLUTIONS

Reinforced Column Kit

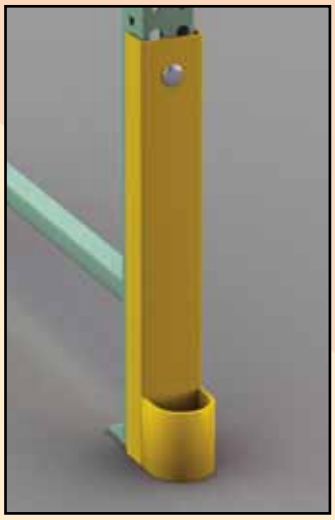
Reinforced Column Kit with Outrigger Deflector

Single Leg Frame Kit

Double Leg Frame Kit

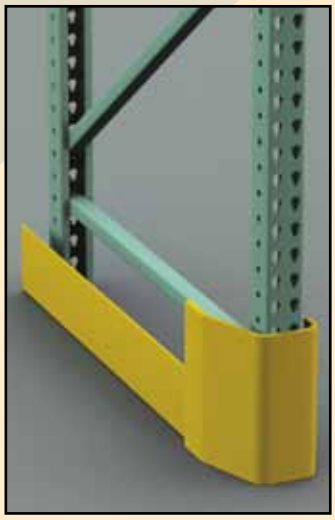
EXAMPLES OF PROPERLY ENGINEERED RACK PROTECTION PRODUCTS

Outrigger Protection



Bolt-on Column Protector

Heavy-Duty Impact Protection



End of Row Guard

IMPORTANT FINAL WORD:
When choosing a pallet rack repair vendor be sure that their products and installation procedures have been reviewed and approved by a qualified supervisory engineer. Repair solutions and installation procedures that do not conform to accepted industry standards may often be as dangerous as the damaged rack component.

Engineered Rack Repair & Protection Solutions

WE REPAIR ALL TYPES OF STORAGE RACKS.

Mac Rak Inc. Repair Kits are Engineered to the Highest Standards.

Mac Rak Inc. manufactures the highest quality, highest future impact protection products available.

Mac Rak Inc. offers a lifetime warranty for all our products and installations against defects in manufacturing or material workmanship.

Elite repair kits also have a limited lifetime impact warranty.

Our repair products are powder coat painted and include all necessary hardware and anchors. All repair products may be installed without complete unloading of the rack when a rack-lifting jack is used.

Read our complete warranty information at www.macrak.com

(Information contained in this brochure is subject to change without notice.)

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