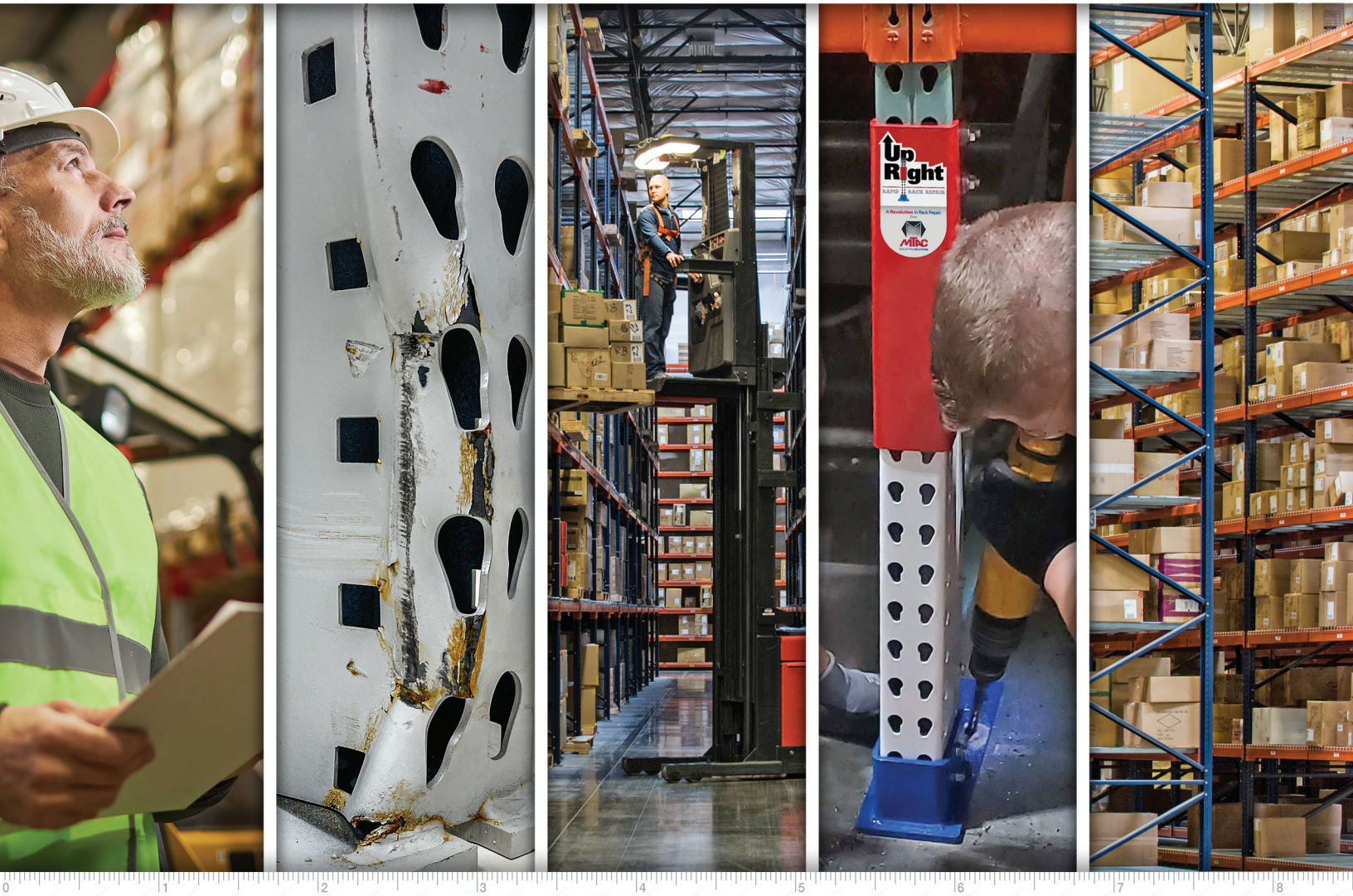




DAMAGE ASSESSMENT GUIDE



INDUSTRY BEST PRACTICES FOR EVALUATION & REPAIR OF PALLET RACKS

TABLE OF CONTENTS

Introduction	3
Industry Standards	4
Owner Responsibilities Compliance Matters	5
Disaster Prevention	6
Rack Repair in Record Time	6
Damage Assessment Criteria	7
Reporting, Response & Evaluation	8
Critical Damage Response	10
MTAC Responsibilities	12
The MTAC Family of UpRight Rapid Rack Repair Solutions	13
References and Disclaimers	14

INTRODUCTION

Today, there are more than a million warehouses in the United States with a combined floor space exceeding 21 billion square feet, with many operating 24/7. Laid end to end, the storage racks in the U.S. would likely span more than 400,000 miles—***literally a bridge reaching the moon and back!***

This guide provides facility owners and operators with an improved capability to assess rack damage and to know how to respond when an incident is reported. No matter when damage happens, the response has to be immediate.

Often, damaged racks must be unloaded, either partially or in total. The emptied space is then identified with tape or signage advising employees not to place any goods in these spaces until the damaged members are repaired or replaced.

In some cases, rack damage has caused at least one structural member to lose all of its load-bearing capability. This is a critical scenario that requires an extreme response for the safety of everyone on site as a collapse could be imminent.

Outside experts, with the experience and expertise required to properly evaluate potentially perilous damage and threats to workplace safety, are typically trusted to perform damage assessments and itemize needed repairs. **MTAC Industrial Solutions** is an industry leader in this space with the specialty tools required, a full understanding of the risks and liabilities involved, and the expertise and refined processes to perform the work safely—with unparalleled speed and efficiency.

Facility owners and operators have the ***ultimate responsibility*** in regard to training their employees, minimizing risk through compliance, and properly responding to all rack damage as soon as it occurs.¹



INDUSTRY STANDARDS

OSHA does not address storage rack safety *directly*. Their General Duty Clause - Section 5(a)(1) broadly states that employers must furnish a place of employment which is “free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.” While this would include maintaining safe racks, their specifics mostly address other housekeeping matters.

ANSI, the American National Standards Institute, has published ANSI MH 16.1 which is the Specification for the Design, Testing, and Utilization of Industrial Steel Storage Racks. Last updated in 2021, this standard provides key guidance relevant to the repair and maintenance of these structures, including:

Owners of industrial steel storage racks shall implement inspection, maintenance, and reporting procedures to identify any visible damage or other conditions that could affect the load capacity or structural performance of the rack system. Upon identification of such conditions, the owner shall immediately isolate the affected portions and initiate a mitigative response, such as repair or replacement of the damaged components. (Section 4.4)

Regardless of the presence or absence of safeguards, regular inspections are also required to identify damage, remove damaged rack from service, and make necessary repairs. (Section C4.4)

An out-of-plumb or out-of-straight condition will cause axial load eccentricity that will reduce the load carrying capacity of a rack column. The reduction can be significant. A storage rack that is out-of-plumb from top to bottom, or a rack column that is not straight, is likely to become further out-of-plumb or out-of-straight when it is loaded. (Section C4.11)

RMI, the Rack Manufacturers Institute, was formed as a consortium of original equipment manufacturers (OEMs) in 1958. This group has published Guidelines for the Assessment and Repair or Replacement of Damaged Rack which was built upon the ANSI standards. It is an excellent reference which includes this warning:

It is important that racks be regularly inspected and correctly maintained to retain the system’s design capacity and factors of safety. Owners of industrial pallet rack systems need short-term and long-term strategies for damage assessments, executing repairs, and record keeping.

OWNER RESPONSIBILITIES

MTAC **strongly** recommends each facility have a **Rack Safety Officer (RSO)** assigned to every shift, and in charge of overseeing all matters related to storage rack safety. This is essential to evaluating and responding to damage in real-time.

Owners Should Develop a Strategic Site Safety Program for: ²

- ❖ Maintaining a safe pallet rack system, including load capacity plaques
- ❖ Retaining up-to-date drawings and engineering documentation
- ❖ Conducting regular in-house inspections and scheduling third party inspections
- ❖ Ensuring that all employees are educated in, and abide by, rack safety rules
- ❖ Making decisions about priority and timelines for recommended repairs

COMPLIANCE MATTERS

Although numerous safety matters are typically covered by the OEM during original installation, any time a rack is reconfigured, a safety evaluation must be performed, preferably by the OEM or a structural engineer.³

The load-carrying capability of any rack section is determined by the largest span between the shelves or that between the floor and the first shelf above it, whichever is greater.⁴ It is imperative that **everyone** understands that removing or repositioning any shelf beams **may severely compromise the rack's structural integrity**.⁵

Routine inspections by on-site personnel should be performed at least weekly, if not more often. The following are key irregularities to be caught and remedied.

- ❖ Any damage not marked or otherwise documented
- ❖ Reconfigured or overloaded beams, shelves or frames
- ❖ Aisleways that are constrained by something left unattended
- ❖ Frames not appearing plumb or straight
- ❖ Damaged rack space not properly marked to prevent reloading of shelves
- ❖ Heavy loads improperly placed on the higher shelves
- ❖ Pallets that are broken, damaged, unbalanced or without adequate clearance
- ❖ Diminished or inadequate lighting
- ❖ Capacity plaques that are missing, obscured or contain inaccurate information
- ❖ Missing or insufficient row spacers or beam safety locks



DISASTER PREVENTION

Decades of real-world experience have demonstrated that rack components with relatively minor damage can be kept in service without limitation. Although a rack's design safety factors may provide some operating margin to help prevent failure if damage is minimal, any assumption that a minor deformity has not compromised a rack's structural integrity ***is generally not true***.

However, small dents are often not fixed because they appear relatively inconsequential—but they are not. The accumulation of minor damage in multiple locations can quickly turn into a major disaster once enough force is applied to the already-compromised structure. The risk of collapse from minor damage also increases substantially as the total load in the affected area approaches the maximum rated capacity. Therefore, it is wise to stay below the rated maximums wherever possible.

Configuring racks so **heavier pallets are always on the floor or the lower shelves**, and lighter loads are at higher levels, reduces the tendency for them to overturn. Top-heavy racks present a greater risk, and ***any*** damage to a member only increases the potential for structural failure. The threat is even greater if the rack is out of straight or out of plumb.

Additionally, the greater the span of time between a rack sustaining damage and that damage being repaired, the greater the chance of a potentially catastrophic structural failure. **Damage left unrepaired — or not repaired quickly enough — is an invitation to a sitewide disaster.**

RACK REPAIR IN RECORD TIME

Industry lead times from damage recognition to completed repairs have stretched from weeks to sometimes as much as several months. In response, **MTAC** has developed a revolutionary approach to the entire process! Clients move from a detailed **CrunchTime Damage Assessment™**, to a **Waitless Estimate™** delivered to their inbox the same day, to completed pallet rack repairs with the patented **UpRight Rapid Rack Repair™** Solution — **Not in Months — But DAYS!**

DAMAGE ASSESSMENT CRITERIA

A trained eye is required to properly evaluate potentially perilous damage and to identify what immediate actions must be taken. In most cases, these defects indicate substantial structural compromise and warrant repair or replacement to mitigate safety risks and maintain the load-bearing capacity of the racking. These defects include:

-  **Tensile Rupture** – Failure caused by tensile forces acting perpendicular to the material's plane, leading to the material being pulled apart.
-  **Buckle** – An instability failure in a racking component under axial compression, leading to sudden lateral deflection and potential crippling, localized collapse, or significant yielding.
-  **Missing** – The complete absence of a structurally significant component or fastening hardware required for the racking system's stability and load-bearing capacity.
-  **Kink** – A localized, abrupt, sharp bend in a component, often associated with impact damage. The presence of a tear or weld failure indicates severe structural stress.
-  **Rip** – A significant tearing, fracture or forceful separation in the parent material of a racking component, typically due to impact or overloading.
-  **Crush** – A significant deformation resulting from excessive, often repeated, compressive forces, leading to bulging, flattening, or crumpling of the racking member.
-  **Weld Failure** – A defect or break within or adjacent to a welded connection.
-  **Twist** – A rotational deformation of a frame, typically at a baseplate, caused by side impact forces.
-  **Bow** – A gradual deviation from the intended straight or vertical alignment of a component.
 - Beams may exhibit slight bowing under load; however, if the vertical deflection exceeds **L / 180** (where "L" is the beam's span in inches), then the beam is overloaded and must be immediately unloaded, replaced and correctly reloaded to be below placarded limits.⁶
 - Posts, struts (i.e., braces) and other structural members should not exhibit any significant deflection. Any component with permanent deflection exceeding a ratio of **one-quarter inch (1/4") over five (5) feet**, must be repaired or replaced.⁷
-  **Localized Dent** – A smooth, shallow indentation affecting a limited area of a component without impacting its overall straightness. Dents up to **one-half inch (1/2")** in depth are usually acceptable if no associated secondary damage is present.

REPORTING, RESPONSE & EVALUATION

It is incumbent on the pallet rack owner to have a reliable program in place that includes routine evaluation of the structures, along with a safe, repeatable plan to respond to and remedy damage when it does occur, ***as quickly as possible***.

THE GOLDEN RULE • All rack damage must be reported to the RSO as soon as it happens

An employee must never fail to report any damage they have caused or observed because this disclosure is the catalyst that prompts the RSO to investigate. As such, it is the foundation of all rack safety. The RSO's responsibility is to evaluate the damage and grade its severity. There are three damage categories to consider:

∴ **Minor damage** such as localized dents and slight bows in a structural member that fall below allowable tolerances do not merit component replacement and are not typically repaired.

∴ **Major damage** such as rips, tears, cracks, kinks, twists, or significant deformities that exceed allowable tolerances needs immediate repair or replacement.

Rack that is anchored to the floor greatly assists in preventing the structure from overturning. Therefore, any damage to a base plate that includes compromised welds or missing, sheared, or loose anchors, is also considered major damage.



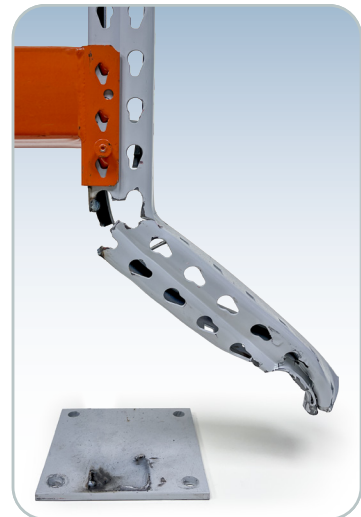
The RSO should examine all **major** or **minor damage** to determine severity. Major damage will likely require the unloading of affected rack bays to avoid possible collapse. In such cases, shelves should always be **unloaded from the top down**.

All shelves which have been unloaded for safety purposes should be taped off or labeled appropriately to prevent other pallets from being placed there until repairs have been completed. Placement of safety cones adjacent to the damaged section can help direct traffic away from compromised components.

Additionally, the RSO should affix a dated, color-coded sticker or label indicating the damage category to ***all*** damaged components. All damage should be promptly logged into a database to monitor status and subsequent corrective actions. These steps will prove beneficial for an OSHA audit or when interfacing with a third party for rack repairs.

CRITICAL DAMAGE designates a pallet rack post which has lost most or all of its load-carrying capability and a rack collapse may be imminent – ***despite*** the fact that everything is still in place.

If damage appears critical, the affected area and surrounding aisles should be immediately evacuated and a **Critical Damage Response** initiated (see pgs 10-11).



THE BOTTOM LINE • Rack damage can occur at any time, and employees must be prepared 24/7 to react quickly

CRITICAL DAMAGE RESPONSE

The **moment** a pallet rack sustains critical damage a catastrophic collapse is a real possibility. A rack collapse can happen suddenly and without warning. In this event, the damaged rack becomes the first domino in a disaster that threatens the entire facility, and the lives of the workers in it. Critical damage is a unique and urgent threat that requires a unique and urgent response.

1

PROTECT YOUR PEOPLE

First and foremost, **ALL personnel should IMMEDIATELY vacate** the aisle where the critical damage occurred, and at minimum, the adjacent aisles on each side. These aisles should remain clear until the threat is fully mitigated.

2

SECURE THE SCENE

Without placing yourself or anyone else in jeopardy, immediately close the designated aisles to both pedestrian and equipment traffic by deploying safety cones, retractable barriers, or other available means.

MTAC offers the **Collapse Prevention ARK™ (Accelerated Response Kit)** which contains everything needed to quickly secure the immediate area, including six (6) safety cones and six (6) magnetic base retractable barriers to cordon off three aisles, and six (6) Damaged Structure Warning Signs to alert approaching traffic.

3

DETERMINE THE DANGER

The **RSO** should cautiously assess the damage from a safe distance. In this critical moment with so much at stake, what's needed is not a hero, but rather a cool head with a careful response to what the threat assessment reveals. A wrong move at this point can easily trigger a catastrophic collapse, and that reality should govern every step.

MTAC recommends a member of your staff use a caged forklift to safely take pictures of the damaged structure. Those photos, along with other information, will help determine the correct solution for your specific situation.

If a collapse threat is imminent, you may want to alert local authorities of the situation. Should a 911 call be needed, be sure to mention potential “Structural Collapse” and/or “Hazmat Threat” (if it applies) to ensure the appropriate apparatus and response strategy is provided.

4

HOLD OFF UNTIL HELP ARRIVES

The rack structure is **fully** compromised when the load-carrying capability of one of its columns has been destroyed. We **strongly** recommend that you do **NOT** try to offload materials from a highly unstable structure. Instead, you should call on your pallet rack repair group to quickly respond to the situation and repair the damage.

RAPID RESPONSE



The **MTAC Rapid Response** offers one-day emergency service to repair a critically damaged teardrop roll-formed (3", 4", or metric) or structural frame within **24 hours*** of your purchase order and authorization to proceed.

Preventing a collapse is all about speed. Having quickly moved to secure the area, you now need the damage repaired **FAST**—and there is no faster solution than the **MTAC Rapid Response!**

MTAC professionals have the experience and expertise to respond quickly and safely to the emergency. In-stock **UpRight** repair kits are rapidly installed utilizing specialty tools and equipment, including the proprietary **UpHold Tower Jack™** to stabilize the structure and mitigate the threat of collapse. In this potentially life and death scenario, trust **MTAC** – and keep your team members out of harm’s way.

* 24 hour service dependent upon site location, specific type of rack involved, and assumes baseline data from site has been obtained.



MTAC RESPONSIBILITIES

Headquartered in America's heartland, **MTAC** inspects, repairs, and maintains hundreds of thousands of frames, and the hugely diverse rack systems they support, in facilities all across the United States. Perhaps the greatest factor in ensuring a damaged rack component doesn't lead to a disastrous collapse is how quickly the damage can move from being revealed to being remedied. In the mitigation of this potentially catastrophic, facility-level threat **there is no substitute for speed!** Knowing this, **MTAC** has developed innovative rack repair solutions that greatly accelerate the **entire process** — from assessment to estimate to finished repair. Now, frustratingly long, and potentially hazardous, wait times are a thing of the past.

It's About Time – MTAC Speeds the Process by Providing:

CrunchTime Damage Assessments™

- ⌘ A timely and detailed summary report of the locations where damage exceeds the tolerances and concerns expressed in this *Damage Assessment Guide*

Waitless Estimates™

- ⌘ A same-day quote to address the damaged frame members in need of repair – delivered to your inbox the same day

UpRight Rapid Rack Repair™

- ⌘ This revolutionary, patented rack repair solution has been engineered to fit your racks and is customizable to fix specific damage at each location. See next page for full details. In most cases goods can remain on shelves, while operational staff do their normal work. Average on-site repair time, from start to finish, is **LESS THAN 1 HOUR!**

US Patent No. 10,974,352 (process) | US Patent No. 11,691,229 (parts)

Scheduled Assessments

- ⌘ While recommended quarterly, **MTAC** can work with you to custom design a schedule that suits your unique needs based on facility traffic, forklift operator experience, and any other factor which may be important for you
- ⌘ MTAC maintains an archive of assessment and repair data in support of the owner's commitment to employee safety

Available for **many** frame styles – from a family of **three** unique **UpRight** Solutions!



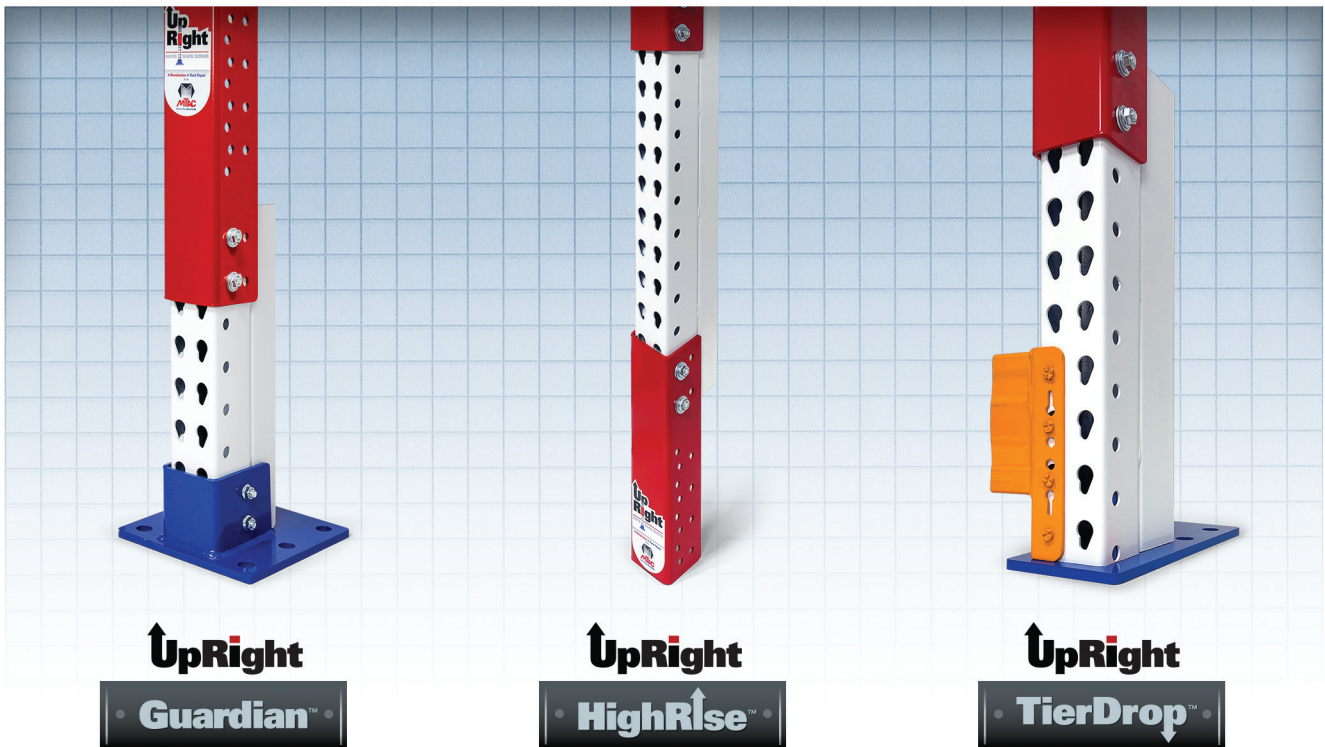
Teardrop 3" or 4"

Metric

Structural 3" or 4"

T-Bolt

THE **UpRight** FAMILY OF SOLUTIONS



UpRight

Guardian™

UpRight

HighRise™

UpRight

TierDrop™

The modular design of **UpRight** allows repair components to be instantly customized. The standard solution features a guarded, narrow or wide footplate design.

The fastest rack repair solution on the planet!

For damage that rises high above floor-level elevations, the unmatched flexibility of UpRight engineering allows repairs up to the top of your highest frame.

Rapid rack repair truly reaches new heights!

Without the built-in, exterior impact guard of its counterparts, this open-faced, narrow or wide footplate design allows for easy installation of floor line beams.

Drop bottom storage tiers to the lowest level!

REFERENCES

Page 3

1. ANSI 4.1 and 4.4

Page 5

2. ANSI 4.4 and 4.5
3. ANSI 4.12
4. As per *Load Capacity Charts* published by various producers

5. ANSI 4.12

Page 7

6. ANSI MH16.1 Section 5.3
7. ANSI MH16.1 Section 4.11.1, 4.11.2 and C4.11-1

DISCLAIMERS

The contents of this **Damage Assessment Guide** are recommendations based on industry best practices. **MTAC** makes no claims and is not responsible for how your facility chooses to enact, or disregard, these recommendations.

MTAC reserves the right to make discretionary recommendations to repair a structure based on the observed site conditions of damage and load.

MTAC field assessors and repair technicians are not responsible for checking routine inspection items that are typically the owner's responsibility (see page 5).

MTAC shall not be liable for failing to note any such irregularities during assessment or repair work. However, if any of them are noted, they will be included in a separate addendum to our report. Should an owner desire **MTAC** to inspect for such items, a full **Compliance Audit** can be performed which would be in addition to our **CrunchTime Damage Assessment™**.

The steps outlined in the **Critical Damage Response** are recommendations. Your situation may require different and/or additional steps depending upon specific on-site conditions, as well as the actual threats involved. **MTAC** offers these steps as considerations to be factored into your own response planning based on what you are storing, how you are storing it, and the experience level of your operations and safety personnel alike.



It's About Time



All **UpRight** components are made in the USA from high-quality steel for maximum strength and durability

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