

## Technical bulletin 12 - A GUIDE TO RESPONSIBLE RACK SAFETY PRACTISES

This guide to responsible rack safety practises has been provided by Iain Sherwood, Managing Director of LGA Logistics. LGA are an internationally regarded Logistics consulting company based in Johannesburg, South Africa. LGA are also distributors of Protect-it rack protection products in South Africa. Racking and rack protection standards vary from country to country, but you can be assured that ALL countries are moving towards mandatory rack protection, so please read this bulletin to understand your obligations. Many thanks Iain for sharing his knowledge with us.

### INTRODUCTION to RACK SAFETY

Very few warehouse operators have aggressive in-house rack inspection programs in place. Forklift accidents, collisions, dropped or misplaced loads, and other incidents that result in rack damage may not get promptly reported. But even when a reach truck or forklift hits the front end corner of rack row BX / bay № 22 gets reported, a typical management response never goes beyond "let's go take a look," as if a quick visual inspection alone will confirm that load limits and structural integrity of the rack have not been affected by the accident. It's as if, while other hazards "stand out" to otherwise reasonable and prudent supervisors, there often is an absolute lapse in concern for the thousands of tons of rack and product collapsing in a pile across the tight confines of a busy warehouse. It is especially important to have trained, competent and **CONCERNED** rack safety personnel when there is a high degree of activity in the warehouse, where there is the greatest risk of rack damage due to mechanical materials handling equipment.

### RACK SAFETY

When a rack has been struck by a reach truck or other materials handling equipment, one of the first priorities should be to identify any unsafe components in order to reduce the dangers of collapse. Specific precautions and taking damaged segments out of service immediately may be the only prudent response to prevent possible risk of injury to personnel caused by continued use of damaged racking.

***Rack safety is first and foremost, the employer's responsibility, and failure to provide a safe working environment can carry substantial legal liabilities (civil and criminal).***

But supervisors should also realize the hidden costs of a rack collapse including:

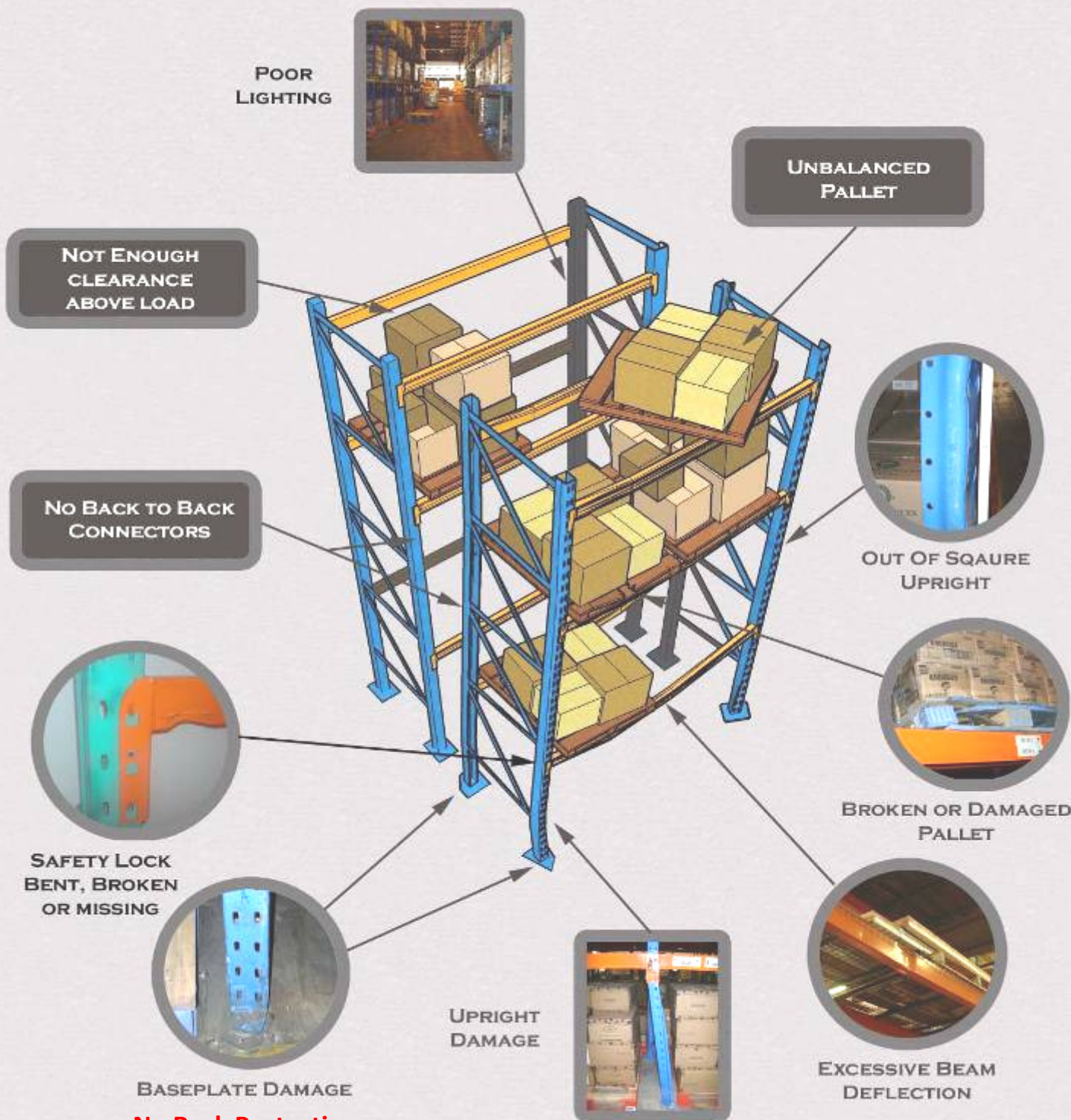
- Replacing materials and damaged goods.
- Use of temporary storage facilities.
- General disruption.
- Workman's compensation, general liability and other insurance rate hikes following the loss.
- Legal expenses from defending actions resulting from an accident.
- Potential fines relating to violations of statutory safety requirements



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## RESPONSIBLE RACK SAFETY PRACTICES

### Racking design and Materials Handling Equipment

Storage racking for products on pallets should be designed specifically for the size, shape and weight of the products being stored. The racking design should be compatible with the pallets and the materials handling equipment in use within the warehouse. Aisle width should be matched to the turning circle of the reach truck or other materials handling equipment used to put-away, replenish or pick.

### Observe Safe Working Loads

Regular inspection of racking should be conducted both in-house and independent to check its integrity, identify maintenance requirements and to ensure racking is not overloaded. Do not exceed the Safe Working Limit (SWL) for the unit load or the safe working total load per bay for the racking.

There should be some means of ensuring that workers using the racking are aware of its SWL; e.g. having one or more signs in conspicuous locations, such as at the end of all aisles, which contains the following information:

1. racking manufacturers name, contact details and trademark.
2. safe working unit load.
3. safe working unit load for each shelf beam level.
4. safe working total unit load for each bay.

### Altering the racking design or components

Any alterations to the racking should be scrutinised by a competent person, or original supplier / manufacturer and should take into account the effects on the safe working limit. Operating procedures, signs and drawings should be amended accordingly.

Warehouse racking will indicate signs of physical alterations to the rack uprights. It must not be done unless supported by drawings and calculations to validate the alterations. Where possible, any physical alterations to uprights, bracings, beams or components, such as welding on additional cleats or bearers, should not be made.

Replacement of uprights, bracings, beams, clips or other components should be with compatible parts. If not practicable, an engineering report should be obtained confirming the integrity and safe working limit of the racking with these alternative replacement parts.

### Operating Procedures

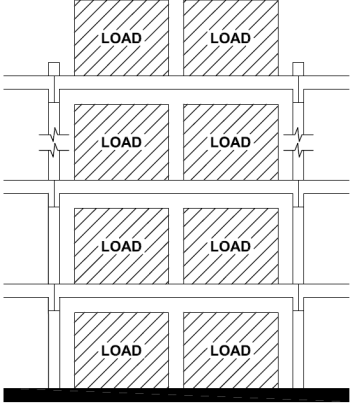
Procedures need to be in place within the workplace to ensure that operations are conducted safely with regard to the racking design, the load and capability of lifting equipment.



Figure 1. shows the procedures which are used to remind managers and employees of workplace procedures for the safe use of racking. Operating instructions need to be provided which include but are not limited to:

- The correct application and use of the equipment.
- The safe working loads to be adhered to.
- Prohibitions on unauthorized alterations.
- The requirement to report any damage incurred due to impact so that its effect can be inspected and assessed.

## SAFETY INSTRUCTIONS

**ADJUSTABLE RACKING**  
**MAXIMUM LOAD PER STORAGE LEVEL**  
**UNIFORMLY DISTRIBUTED**  **Kg**




DO NOT CLIMB ON EQUIPMENT

REPORT ALL ACCIDENTS

**PROCEDURES FOR THE MAINTENANCE OF RACKING STRUCTURES**

- 1: **MAXIMUM SAFE LOAD**  
ALWAYS refer to supplier's drawings or technical information.
- 2: **ALTERATIONS TO STRUCTURES**  
DO NOT alter any structures without
  - (a)Checking the effects against the equipment technical specification.
  - (b)Obtaining approval from manufacturer / supplier.
- 3: **TRAINING**  
Train operator in the correct use of equipment.
- 4: **INSPECTION PROCEDURES**  
Conduct REGULAR inspections for:
  - (a)Correct use and application.
  - (b)That loads are within the allowable and safe limits.
  - (c)Any damage to or movement of structure components.
- 5: **CODE OF PRACTICE**  
Refer to "SEMA Codes of Practice" for more detailed information.
- 6: **IF YOU ARE IN ANY DOUBT OR HAVE A PROBLEM**  
ALWAYS Contact your manufacturer / supplier.

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C.T. 021 534 4040  
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Figure 1



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## Goods On Pallet To Be Stored In Racking

Goods stored on pallets destined for storage are termed Unit Loads. The design of the pallet should take into account the nature of the goods in the unit load. A change in the pallet design should not be permitted unless the:

- Racking design is suitable to support the weight of the unit load.
- Pallet design keys into the racking and so prevents the unit load from being dislodged.

The photographs indicate examples of dangerous pallets

An assessment of any change to the pallet design should be conducted by a competent person to prevent storage problems arising, such as:

- Changing from timber pallets to post pallets i.e. stillages, meaning that the legs do not key into racking.
- Using pallets larger than allowed for in a double pallet row, as they can overlap pallets behind or push them off their supports
- Using pallets smaller than allowed for in the racking, as they can drop through.
- Using skid pallets in racking without timber decks, as they can drop through. Boxes, cartons and other such items stored on pallets should not overhang the pallet. Unit loads on upper levels containing boxes, cartons and other loose loads should be effectively prevented from falling by stretch wrapping, strapping or by some other means.

## Collision Protection

Bottom portions of those frames that are exposed to possible collisions by reach trucks or other moving equipment should be protected. As an example, the “SEMA Code of Practice for the Use of Static Pallet Racking” gives the following general guidance:

### Clause 8.4 – Rack Protection

“Where necessary, steps should be taken to protect uprights from being struck by forklift trucks and other vehicles. A first line of defence should be incorporated, such as renewable column guards or guide rails, which prevent the trucks getting too close to the main racking structure. Column protection in other areas likely to incur damage should also be considered”.

Please check for similar clauses in the applicable standards used in your region.

## Damage Reporting

Employees should report any damage or near miss occurrences, however minor, to the supervisor so that its effect on safety can be immediately assessed and the hazard eliminated or risks reduced.



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## INSPECTIONS: WHAT TO LOOK FOR?

### Safe working limits

- Are rack load signs posted?
- Check that the bays conform to the SWL signs provided by
- The designer / installer, and that the racks have not been altered.

### Uprights and footplates

- Are uprights damaged?
- If the upright shows significant damage, or is twisted or contains splits or cracks, then replace it or splice a new section in. If the upright is damaged and is to be replaced, ensure the footplate is also replaced as it will also have sustained damage.
- Are splices in good condition?
- Check the condition of any splices. Ensure that they are in accordance with manufacturer's technical specification.

### Out of Plumb Racking

- Is the racking vertical?
- Out of plumb racking is usually due to incorrect installation. Contact the manufacturer or installer.

### Braces

- Are racking braces damaged?
- Replace bent horizontal or diagonal braces. For bracing, the member deviation from a 1 m long straight edge in either plane should not exceed 10 mm.

### Floor fixing

- Are floor fixings installed?
- Check that floor fixings are installed and are not damaged. Replace as required. If the floor fixing has been damaged, it is likely that the footplate will have also received damage and may need replacing.

### Beams

- Are beams overloaded? A large amount of beam deflection indicates overloading of the racking (the maximum deflection of a beam should not exceed 1/200 of the box sections length). Where two beams connect at an upright, the beam connectors should remain reasonably parallel. If racking is overloaded or has occurred previously, the beam connectors will form a 'V'. This is a quick and easy guide.
- Are beams damaged? Check for obvious signs of beams being hit by a pallet or reach truck. Damaged beams should be replaced.
- Are beam connectors or safety clips missing? Examine beams for damage and replace missing clips immediately. If clips are regularly being dislodged, contact the manufacturer or installer to determine why they are being dislodged and implement corrective action.
- Has a beam popped out of its upright? Check that beams have not popped out of the upright and are suspended on one end connector only.
- Are welds damaged? If a beam has been hit and may only show minor damage, ensure welds are checked by a competent person for cracking.



## REFERENCE TO SEMA CODE OF PRACTICE

The SEMA (Storage Equipment Manufacturers Association) is the national body representing the British storage industry. Being the UK's voice in Europe, the Association has been adopted as the best code of practice for the application of design and installation specifications and tolerances in many countries and is widely used as a contributor to other standards including the European FEM code and AS 4084. LGA Logistics Consultants in South Africa refer to the SEMA Code of Practice for Safety Audit purposes. Whilst we consider the SEMA code to represent current good engineering discipline and practice, it is not mandatory in South Africa and should, without prejudice to any legal requirements from time to time in force, be regarded only as a consultative document on the safety aspects of static racking. **For other countries, other standards may apply so please refer to your local standards and workplace safety laws.**



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## APPENDIX A EXTRACT FROM CODE OF PRACTICE FOR THE USE OF STATIC RACKING 1986. (THESE RECOMMENDATIONS APPLY EQUALLY TO SHELVING STRUCTURES)

### Damage To Racking

Any damage to a rack upright will reduce its load carrying capacity. The greater the damage the greater will be the reduction in its strength until the upright collapses at its normal working load.

Damage to bracing sections will reduce the capacity of racking frames to withstand accidental frontal impacts and may also reduce the axial load carrying capability of frame uprights.

In order to minimise the possibility of collapse occurring through damaged members, the following rules for the measurement of damage are recommended. In using these rules the normal margins of safety will, however, be reduced, and the supplier should therefore be consulted.

### **Assessment Of Damage to Uprights and Bracing Members**

1. A steel straight edge 1.0 metre long is placed in contact with a flat surface on the concave side of the damaged member such that the damaged area lies central as near as possible to the length of the straight edge (see Fig. 2).
2. For an upright bent in the direction of the rack beam spans the maximum gap between the upright and straight edge should not exceed 5.0mm.
3. For an upright bent in the plane of the frame bracing the maximum gap between the upright and straight edge should not exceed 3.0mm.
4. For an upright which has been damaged such that there is a simultaneous bend in both longitudinal and lateral directions the left to right and front to back deformation shall be measured separately as in 2 and 3 and the appropriate limits observed.
5. For bracing members bent in either plane, the gap between straight edge and bracing member should not exceed 10mm.
6. These rules apply only to damage which produces an overall bend in a member. They do not apply to highly localised damage such as dents, buckles, tears, splits. Localised bends over a length of less than one metre, may be judged pro-rata to the 1.0 metre limits e.g. over a half metre length half of the prescribed limits apply. Members subjected to tears and splits should be replaced.
7. Under maximum permissible loading conditions with maximum deviation from straightness in any upright a reduced margin of safety will exist.
8. Where the deviations are in excess of the above, the damaged members should be unloaded and the supplier consulted.

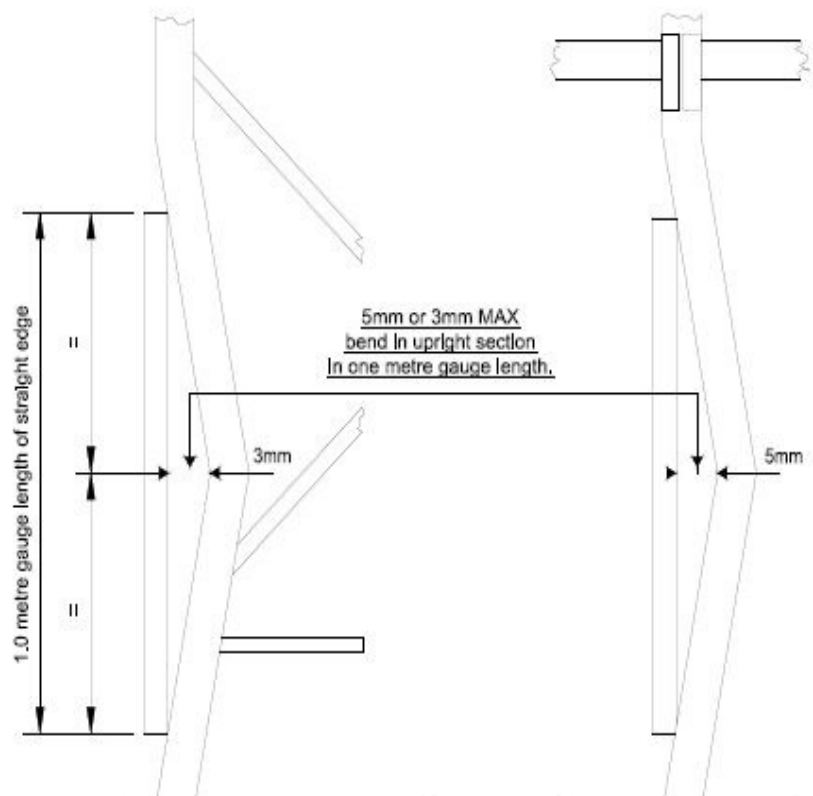
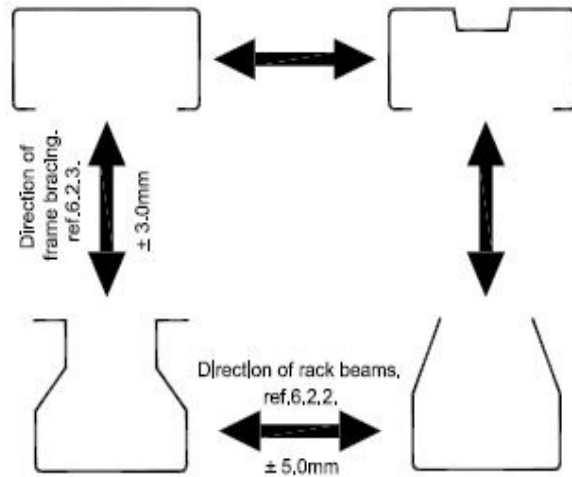


Fig. 2 Showing Typical Upright Sections & Method of Measurement



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## Assessment of Damage to Beams

1. Beams will naturally deflect under normal loading conditions to a maximum permitted of span/200. This deflection should disappear when beams are unloaded and should not be confused with permanent deformation caused by overloading or impact damage. Damage should be measured against the following criteria:
2. Residual vertical deformation should not exceed 20% of normal deflection under load as defined above. Residual lateral deformation should not exceed 40% of the normal vertical deflection under load as defined in 1.
3. Beam end connectors which show any clearly visible deformation should be unloaded and expert advice sought from the equipment supplier.
4. Welded connections between beam section and end connector should show no signs of cracking.
5. NOTE: Deflection is the difference in level of the top or bottom surface of a beam at midspan relative to a straight line drawn between the same surfaces at each end of beam.

## Some Potential Causes of Racking Damage

1. Inadequate driver training. Drivers must be instructed in the correct use of the equipment – Truck, racking, and the general layout in terms of any requirements for rotating pallets or directions for entering aisles etc.
2. Carelessness. Carelessness is usually an attitude of mind and should be corrected by retraining plus management awareness and supervision.
3. High speed of operation to meet targets. All drivers differ in their ability to operate quickly and safely. Input / Output cycle requirements must be compatible with the abilities of the drivers.
4. Inadequate design of layout. Layouts giving good access and adequate aisle/lane dimensions must be considered at a very early stage in planning. People who will eventually have responsibility for the operation should be involved in the planning.
5. The use of a truck not intended for use in the particular installation – Aisle/clearances too small or perhaps too wide. The choice of truck is an integral part of the installation design and must be considered at the planning stage. Arbitrary changes in the truck used can lead very quickly to extensive damage.
6. Use of wrong or damaged pallets. Not all pallets are suitable for use in pallet racking and even fewer are suitable for use in drive-in racking. Broken or sagging pallets can cause premature beam failure by outward pressure on the inside faces of the beams.
7. Floor guide rails failing to constrain trucks in their correct attitude to the equipment. Commonly either due to failed floor fixings – often due to poor flooring material or to excessive forces from trucks (can be caused by failure to compensate for truck mounted guide rollers by adjustment or by reversing trucks into aisles – a practice which negates steering before the trucks is aligned).
8. Housekeeping. Poor housekeeping in allowing aisles and access ways to be obstructed by pallets, rubbish etc. The most usual result of 1-8 above is impact damage to the front upright in the first metre of height and to the beams at the first level.

## Some Methods of Storage Equipment Protection

First Line of Defence – Active	Second Line of Defence – Passive
<ul style="list-style-type: none"> <li>• Good installation design – Layout, lighting, trucks, clearances etc.</li> <li>• Driver training on the job and safety education.</li> <li>• Correct pallets – good condition</li> <li>• Floor markings.</li> <li>• Loading/Safety notices</li> <li>• Good housekeeping – maintenance etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Physical barriers</li> <li>• Column guards</li> <li>• Guide Rails</li> </ul>



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## The Importance & Frequency of Racking Audits

The likelihood of damage to a racking installation varies initially by its type, function, and extent of use. These factors will, in part, influence the frequency of audits e.g.

- The height of the deposit/retrieval operation above the operator's eye level and the general level of visibility afforded by the truck design are factors effecting potential damage. Another factor is the intricacy of the task e.g. locating a pallet on to dynamic system tracks or driving an unguided truck into drive in racking.
- A variety of pallet types/sizes being handled within an installation may lead to placement errors leading to damage as will unstable or badly tolerated units of load.
- Trucks required to turn through 90° to access racking will do so more safely the greater the aisle width is as compared to the truck manufacturer's minimum specification.
- The accuracy of pallet placement in racks by very narrow aisle trucks will be more consistent (and therefore present less risk of accident/damage) if the pickup/set down stations are designed to orientate pallets as part of their function.
- Extra components such as back stops or pallet entry guide-ins (dynamic storage) may improve operation and prevent some kinds of accident/damage but they also present extra items to sustain damage. (refer to the accepted racking standards in your country)

The degree of activity in a store affects the risk of damage. An even greater variable is the comparison between the work rate required and the skills/capacities of the personnel to achieve that rate.

An audit frequency is not fixed for all time but may need reviewing periodically for various reasons e.g.

- Wear and tear on peripheral items such as guide rails, pallets, floor fixings, floor screeds etc., will affect the interface between trucks and racks as will wear and tear on truck guide rollers, bearings and tyres.
- Changes in the unit of load may impact on clearances particularly if securements such as film wrapping or banding are changed / discontinued.
- New operators or supervisors may produce different standards/capabilities.
- (d) Changes in operating conditions such as lighting.
- Introduction of bonus schemes or changed shift patterns.

The actual frequency of audit should be based initially on risk assessment and subsequently on reviewing those risks plus evaluating any trends as surveys take place.



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