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**CODE OF  
PRACTICE FOR  
THE USE OF  
STATIC PALLET RACKING**

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**CODE OF  
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**PREFACE**

SEMA has produced a number of documents giving guidance on various aspects of storage. A list of publications can be obtained from the Secretaries at the address below:

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# 1. GENERAL

## 1.1 Scope

The purpose of this Code is to provide information for Users of adjustable pallet racking, drive-in and drive-through racking, to ensure the effective use of the equipment and that appropriate safety standards are maintained.

Other types of storage systems such as shelving, cantilever, dynamic live storage, rack supported floors and crane racking are not within the scope of the document, as the issues regarding the use of these storage systems are different from adjustable pallet racking, drive-in and drive-through racking. However, some of the general principles of this code can be applied to other storage systems.

It is important that the User understands how to safely operate, inspect and maintain the storage equipment. This not only concerns the racking system, but also involves the quality and type of pallets and the correct use of the mechanical equipment to load and off-load the racking system.

This document should be read in association with other relevant documentation, including the SEMA publications noted in the Bibliography.

## 2. GLOSSARY OF TERMS

### **adjustable pallet racking (APR)**

A system of upright frames connected by horizontal beams to provide pallet storage levels that can be adjusted vertically.

### **aisle width**

The minimum dimension across the aisle, at any level, between either unit loads located in their nominal position, or between the rack structure components.

### **allowable loading**

The safe load capacity of a certain area of loading. This may, for example, apply to a beam, shelf, compartment or frame.

### **bay load**

The total allowable weight of all the unit loads in a bay of racking, not including any unit loads that can be stored on the floor of the bay.

### **compartment load**

The load, which can be loaded into one storage level in a bay of racking from one side.

### **competent person**

A person who by means of a combination of training, experience and education has the knowledge to carry out the task safely and effectively.

### **drive-in racking (DIR)**

A system of racking that provides blocks of static storage where pallets are stored two or more deep. By driving a lift truck into a lane, access is gained to pallets supported along their sides on pallet rails, which may be cantilevered from the frames. The lift truck has to reverse out of the lane.

### **drive-through racking**

Similar to DIR, except the truck can drive into a lane on one side of the block and out of the other, if there are no obstructing pallets.

### **installers**

The people who assemble and build the racking at the site location.

### **intrusive stacking (not recommended)**

The placement or retrieval of a pallet where the turning radius or length of the fixed fork lift truck is greater than the aisle width, so that part of the storage location for that pallet is used by the truck forks when placing or retrieving a pallet.

### **narrow aisle racking**

Pallet racking with a reduced aisle width compared to wide aisle racking, which is for use with more specialist types of lift truck. Aisle widths are generally in the range of two to three metres wide for use with particular type 1 and type 2 trucks.

### **pallet or stillage**

A portable platform, with or without superstructure, for the assembly of a quantity of goods to form a unit load for handling and storage by mechanical appliances (often used as a generic term).

### **pallet safety back stop**

A safety back stop to either prevent accidental collision of a pallet or its load with other equipment, such as sprinklers, or to prevent loads from protruding or from falling into an aisle or into an area accessible to people. The clearance between the backstop and the nominal pallet position should be large enough to ensure that the safety pallet stop will only be impacted accidentally.

### **pallet buffer back stop**

A buffering back stop specified as an aid for use by forklift truck drivers to deposit a unit load in the correct position in the racking.

### **person responsible for racking safety (PRRS)**

A person, nominated by the User, to be responsible for all aspects of racking safety.

Previously known as the Racking Safety Officer.

## 2. GLOSSARY OF TERMS

### **pick up and deposit stations (P & D)**

Pick up and deposit positions are usually installed at the ends of racking aisles.

The P & D serves two main functions:

1. As an interface between unit load handling equipment that is dedicated to the rack aisle (such as VNA trucks) and the conveyors or free ranging trucks which service the installation.

2. As an accurately fixed locator of the unit load relative to the racking, used by trucks having a fixed length of fork stroke, to ensure a high degree of accuracy in the cross-aisle and down-aisle directions when placing the unit load onto the rack beams.

### **specification**

A detailed description of the User's requirements. All details affecting either the design of the installation or its construction must be included in the specification, including data such as the ambient storage conditions, the floor construction, Local Authority requirements, etc.

### **Specifier**

The person or company that provides the Supplier with a detailed specification of the User's requirements. The Specifier may be a consultant or other specialist, the User or the equipment supplier acting as the Specifier.

### **Supplier**

The company that supplies the storage equipment. The company may be the original equipment manufacturer or an intermediate company acting as a distributor.

### **truck operator**

Person trained and responsible for the safe use of an individual forklift truck or a range of mechanical handling equipment.

The mechanical handling equipment would normally be rider-controlled equipment but could also include pedestrian-controlled equipment.

### **truck types**

Trucks generally fall into 3 groups as follows:-

Type 1. Trucks required to turn through 90° within the aisle to load and off-load the racking and designed to operate within a wide aisle.

Type 2. Articulated trucks designed to operate within a wide or narrow aisle.

Type 3. Trucks designed to operate within a very narrow aisle and which remain parallel to the aisle with the forks operating at 90° to the direction of travel.

### **unit load**

A single load, which can be placed in one operation i.e. a pallet in a racking system or the weight of a single load.

### **User**

The company or person who, either now or in the future, will manage and operate the installation and be responsible for the continuing safety of the installation.

### **very narrow aisle racking (VNA)**

Racking with an aisle width only wide enough for a truck, the unit load and clearances, where the truck cannot make a 90° turn to face the rack during the placement or retrieval process. Very narrow aisle racking is generally for use with type 3 trucks.

### **wide aisle racking**

Racking with an aisle width wide enough for the trucks to make a 90° turn to face the rack during the placement or retrieval process. Wide aisle racking is generally for use with type 1 and type 2 trucks.

### **90° stacking**

The placement or retrieval of a pallet where the forklift truck makes a 90° turn to face the rack during the placement or retrieval process. In making this turn no part of the truck or load intrudes into the racking.



## 3. SYSTEM SPECIFICATION

### 3.1 General

Before the racking equipment is purchased, it is important that adequate information is provided to the Supplier to enable the design of a safe storage system.

The specification of a storage system is provided by the Specifier. The Specifier may be a consultant or other specialist, the User or the equipment supplier acting as both the Specifier and the Supplier.

### 3.2 Pallet or stillage

The specification should include the pallet or stillage type, size, construction, quality, orientation of use and load carrying capacity.

The Specifier should be aware that not all pallet types are suitable for use in racking without appropriate accessories, such as pallet support bars or close boarded timber shelving.

For drive-in and drive-through racking installations, the bearing area of the pallet or stillage on the racking is reduced compared to adjustable pallet racking and, therefore, the above information is even more critical for the safe design of the structure.

### 3.3 Unit load

The specification should include the weight (including weight of pallet), overall dimensions, security and stability of the unit load. Unless specified otherwise a uniform distributed load is assumed.

### 3.4 Pallet handling equipment

The specification should include the truck details including the maximum lift height and the aisle width. For drive-in and drive-through racking installations, the manufacturer, model and physical dimensions of the mechanical handling equipment will be necessary to ensure adequate operating clearances.

### 3.5 Storage area

The specification should include information regarding the access, egress and goods flow for the site.

Particular attention should be given to fire escapes and escape routes, to ensure that these are not compromised by the storage equipment layout and operation.

The specification should include the dimensions of the storage area and any obstructions within the area.

The specification should include the floor type (ground bearing or suspended), construction (concrete or bituminous), and the locations of floor joints and any obstructions, such as manhole covers.

The specification should include the floor details, including the thickness of the floor construction and any particular fixing constraints.

The warehouse floor must be capable of withstanding the upright loads. It must have a suitable degree of surface level tolerance and flatness (see Bibliography reference TR34).

The storage area is assumed to be a dry, unpolluted internal warehouse at ambient temperature unless specified otherwise.

### 3.6 Operating conditions

The specification should include the type of goods to be stored, frequency of movement and fire protection requirements, including any planned future changes.

## 3. SYSTEM SPECIFICATION

### 3.6 Operating conditions (continued)

Certain User industries and operational practices are particularly prone to inflict accidental damage to the racking. Such conditions occur where high throughput and rapid movement of goods form the main activity, particularly where reach and counterbalance trucks are used in aisles that are wider than necessary. Unit loads and pallets in poor condition can also be a hazard, whilst floor cleanliness, operator skill level and condition of the forklift trucks have a considerable influence on the ability to maintain a safe racking installation. The Specifier should discuss this with the User, and areas, which are likely to be prone to accidental damage, should be identified to the Supplier.

The standard of training of the operatives is assumed to be such that the racking is not likely to be hit during the use of the mechanical handling equipment.

### 3.7 Aisle width

Truck manufacturers provide recommended aisle widths for specific truck types and load sizes. These recommendations often provide varying allowances of clearance, and it is worth considering whether sufficient clearance has been allowed.

The aisle width is the dimension between the racking, or between the stored pallets, whichever gives the minimum dimension.

Note: Any change in truck type or load size used in the installation will require a check to determine that the aisle width and clearances are still adequate.

### 3.8 Gangway width

Gangway widths are generally larger than the minimum requirements and should be large enough to allow for any particular operating requirements. For instance, a very narrow aisle truck which can only pick from one face of the aisle, may have to exit the aisle, turn through 180° and then return and pick from the opposite face of the aisle.

In all cases, the truck manufacturers' recommendations should be followed in determining the gangway dimensions.

### 3.9 Rack protection

Rack protection is generally for accidental damage only and shall not be used as an aid for pallet placement, unless specifically designed for pallet placement loads.

### 3.10 Pallet back stops

The use of pallet back stops attached to the racking structure is not widespread because of the danger of structural damage and is not recommended.

If racking layouts are correctly designed to give adequate clearance between back to back pallets or loads, or alternatively, between a pallet or load and any other obstructions at the back of a rack, then back stops are unnecessary for a trained driver to deposit a pallet correctly and safely (see Appendix 5).

## 3. SYSTEM SPECIFICATION

### 3.10 Pallet back stops (continued)

If back stops must be provided then they should be designed either:

1. As a replaceable warning device which will give way without structural damage to any structural rack members. This type of pallet stop is known as a safety back stop.

or

2. For a load or thrust stated by the Specifier, which can be regulated. A pallet stop designed for this load or thrust is known as a buffering back stop. The racking structure shall also be designed for the load or thrust. Recent research shows that this load or thrust is very difficult to define.

### 3.11 Accessories

Any accessories required should be noted in the specification.

Typical operational accessories include:-

1. Shelving panels
2. Pallet support bars

Typical safety accessories include:-

1. End frame protectors
2. Upright guards
3. Under guarding of bridge bays
4. Sacrificial legs

End frame protectors are recommended, in truck operated racking, for all end frames between a gangway and an aisle and also for all end frames between a bridge bay and an aisle.

Other racking protection requirements should be the result of a risk assessment for the particular installation.

### 3.12 Truck types

Different types of trucks are shown in Appendix 1.

## 4. SUPPLIERS RESPONSIBILITIES

### 4.1 Information required

The information, provided by the Supplier of the storage system to enable the User to safely use the storage system, should include the following items:-

1. The technical limitations of the use of the racking including the load carrying capacities.
2. The dangers of altering the rack configuration without prior consultation with the Supplier.
3. The requirements for inspecting and maintaining the racking.

### 4.2 Load notice

The Supplier should provide a load notice for the racking system.

The notice should indicate the maximum unit loads and should be displayed prominently in the warehouse.

A full set of load notices is provided in the SEMA publication 'Load Notices' and an example of a typical load notice is provided in Appendix 2.

Loading notices shall be changed if the configuration of the racking is modified.

### 4.3 Rack protection

The Supplier should, where appropriate, provide information on the rack protection equipment provided with the storage system.

### 4.4 Design

The Supplier should ensure that the design and layout is in accordance with the relevant SEMA and manufacturers requirements as appropriate.

### 4.5 Installation

If it is specified that the installation work is not to be carried out by the Supplier, then the Supplier should provide written assembly and installation instructions, including tolerance requirements. It is assumed that all installation is carried out by SIERS registered installers in accordance with SEMA guidelines, including the installation and erection tolerance guidelines.

No damaged components should be installed and any components damaged during installation should be replaced prior to handover.

Handover documentation should confirm that the installation has been installed in accordance with SEMA guidelines.

### 4.6 Quality control

The design, manufacture and installation should be subject to the SEMA QAS (SEMA Quality Assurance Scheme).

# 5. USERS RESPONSIBILITIES

## 5.1 National and Local regulations

The User is responsible for compliance with the appropriate National and Local regulations.

## 5.2 Installation

When the installation of the equipment is undertaken either by the User or a contractor appointed by the User, the installation erection instructions provided by the Supplier shall be implemented in accordance with section 4.5.

The installation of equipment by the Supplier or Manufacturer is the preferred option.

## 5.3 Person responsible for racking safety

The User should nominate a competent person to be responsible for racking safety (PRRS).

The PRRS is responsible for ensuring that the racking is used, inspected and maintained in accordance with the appropriate regulations and guidelines.

## 5.4 Use of the racking

The use of the equipment should be in accordance with the system specification.

The use of the storage system should be in accordance with the load notice provided by the Supplier.

## 5.5 Use of the load notice

The loads on the load notice assume that the racking is used in accordance with SEMA guidelines.

Where loading patterns vary within a bay or a run of racking, the User should have clearly identified load notices showing the safe operating criteria for each area of racking.

## 5.6 Inspection

Regular inspections of the storage system are required to:-

1. Maintain safety in the workplace.
2. Prevent and minimise the effect of accidents.
3. Comply with the requirements of 'The Workplace Health Safety and Welfare Regulations' or 'The Provision and Use of Work Equipment Regulations (PUWER)'.

## 5.7 Maintenance

Any damaged component, noted during inspection as requiring repair or replacement, should be taken out of use in accordance with SEMA guidelines and repaired or replaced by suitably trained personnel as required.

## 5.8 Trained personnel

Personnel should be trained and competent in the use of the materials handling equipment and the storage capabilities of the racking, to enable the safe operation of the storage facility. This should include the recognition of pallet types, checks on suitability, the correct method of loading and unloading the racking and the recognition of defects or damage that could adversely affect safety.

## 5.9 Use of pallets

The User must ensure that the pallets are in good condition, are appropriate for the racking system provided, and the loads are correctly stacked on the pallets.

Pallets can collapse if they are damaged, poorly constructed or incorrectly loaded. A single pallet collapse at high level can cause the collapse of pallets and beams at lower levels and have serious consequences. Further information on pallets is given in Appendix 3.

# 6. USERS OPERATIONAL REQUIREMENTS

## 6.1 General

The previous sections of this Code of Practice advise the User on the responsibilities of the various parties. The purpose of this section is to stress the importance of ensuring that the racking installation continues to be both serviceable and safe throughout its operational life.

Good management, operational practices and operator training form the basis for minimising rack damage.

Racking components are generally produced from thin gauge steel sections and this limits the amount of accidental damage which can be absorbed without a risk of structural failure.

## 6.2 Operator training

The User shall ensure that the operators are trained in the appropriate use and limitations of the storage equipment.

It is the responsibility of the User to maintain the racking in reasonable condition. Comprehensive and effective driver training will minimise the possibility of any accidents.

## 6.3 Alterations

The User shall not alter the rack configuration without reference to the Supplier or Manufacturer.

If the height to the first beam level or the space between beams is increased or, if racks are altered such that they have less than 2 bays or 2 beam levels, then the safe load capacity of the rack will be reduced.

Physical alterations to racking beams, such as welding additional bearers or cleats, etc., or a change of use from timber pallets to post pallets, should not take place without the agreement of the Supplier or Manufacturer.

## 6.4 Pallets

Details of pallets are shown in Appendix 3.

Pallets supported on the front and rear beams should be located with an equal overhang to the front and rear beams. Details of pallet location clearances are shown in Appendix 4.

Stillages and other caged pallets usually require the provision of additional accessories to ensure safe location within the racking. It is usual for such pallets to be stored within the depth of the frames.

## 6.5 Clearances

Horizontal clearances refer to either the pallet or, when the load overhangs the pallet, the load. Vertical and horizontal clearances should be increased in proportion to the height of the rack. This latter recommendation can be overruled when a 'rising cab' type of truck, where the operator is elevated to the placement levels, or CCTV is used.

It is important to maintain operating clearances to ensure safe working practices, as a loss of clearance leads to an increased risk of damage to the rack structure, and/or a reduction in the efficiency of the fork truck operation.

The following can cause reductions in clearances:-

1. Storing an oversized pallet.
2. Storing a pallet with load overhang, which was not allowed for in the original design.
3. Misplacing the first pallet, thereby not allowing sufficient space for subsequent loads.
4. Misplacing floor level pallets so that they protrude into the operating aisle.
5. Storing a pallet that has been picked up out of alignment.

## 6. USERS OPERATIONAL REQUIREMENTS

### 6.5 Clearances (continued)

The User should be aware of the implications of a change of the mechanical handling equipment on the operating clearances. If the truck is changed or replaced, even with trucks of the same designation, then the aisle and gangway widths should be checked to ensure that they are still adequate.

Goods stacked in an aisle or gangway may reduce the clearance below the minimum requirements.

Drive-in and drive-through racking require special consideration in order that the pallets should not fall between the beam rails. Where pallet rails are used with side guards, the clearances should be as shown in the lower section of the figure in Appendix 4. For pallet rails without side guards, the clearances should be as shown in the upper section of the figure. In all cases, these clearances should take into account the lateral deflection of the racking under load.

Note:-

1. Where side guards are provided, fork truck operator training should highlight the dangers of side forces distorting the uprights in the system.
2. 2-way entry, single sided and wing type pallets are not normally suitable for use with drive-in and drive-through racking installations.

### 6.6 Cleanliness and tidiness

The User is responsible for the cleanliness and tidiness of the warehouse. Items such as loose stretch wrap or banding are a safety hazard.

### 6.7 Damaged pallets

The operators should be trained to identify damaged pallets and not to store them in the storage system (see Appendix 3).

The procedures for damaged pallets should be such that damaged pallets cannot accidentally be re-introduced into the storage system.

### 6.8 Rack protection

End frame protectors are recommended, in truck operated racking, for all end frames between a gangway and an aisle and also for all end frames between a bridge bay and an aisle.

Other racking protection requirements should be considered as identified by the risk assessment.

The User should be aware of the implications of retrofitting protection devices which reduce operating clearances and can, in some circumstances, lead to an increase in the amount of damage.

### 6.9 Pedestrian access

Wherever possible, pedestrian and traffic should be segregated. Where it is not possible to fully separate pedestrians and trucks, a risk assessment should be undertaken and control measures implemented as required.

Personnel are not permitted to climb on racking structures.

## 6. USERS OPERATIONAL REQUIREMENTS

### 6.10 Warehouse lighting

The warehouse should be adequately lit to allow the safe use of forklift trucks and the handling of pallets.

Guidance on warehouse lighting is given in HSE document HSG 76- Warehousing and storage- A guide to health and safety (see Bibliography).

### 6.11 General pallet placement

Standard practice for the placement and retrieval of pallets and clearances between adjacent pallets and between the pallet and the rack structure are given in Appendices 4 and 5.

It is not acceptable practice to:-

1. Position a pallet against the rack upright or beam end connector.
2. Nudge one pallet with another, in an attempt to move or re-align loads.
3. Drag or slide pallets on or against the support beams or structure.

All of these are dangerous practices that impart additional loads on the rack structure, and could lead to damage and a reduction in safety.



# 7. USERS INSPECTION REQUIREMENTS

## 7.1 Inspection requirements

Regular inspection of the pallet racking is required. The inspection should follow a hierarchical approach using 3 levels of inspection as follows:-

### 1. Damage inspection by warehouse operatives

Warehouse staff and forklift truck operators should be trained to report all damage immediately it occurs to ensure appropriate action is taken to ensure the safety of operatives and others.

### 2. Weekly inspections as a visual check from ground level

Regular documented inspections of all racking should be undertaken by warehouse supervisors at weekly intervals to identify, and act upon, any damage. This inspection should generally be carried out weekly, although the frequency may be varied to suit particular operating conditions.

This inspection should be carried out by a suitably trained individual. The SEMA one day rack safety awareness training course is considered appropriate training for the weekly inspection.

### 3. Annual or bi-annual inspection by a 'technically competent' person

This inspection should be carried out by a technically competent individual such as a SEMA Approved Rack Inspector (SARI).

For further information on these matters see SEMA Guideline No.6 Guide to the Conduct of Pallet Racking and Shelving Surveys and the HSE publication Warehousing and storage, A guide to health and safety (see Bibliography).

The PRRS is responsible for ensuring that the inspections and the associated maintenance are carried out as required and that all work is undertaken by technically competent personnel.

## 7.2 Damage requiring attention

Damage that requires attention includes:-

1. That which significantly changes the shape of a structural component, such as a local buckle due, for example, to a fork impact.
2. That which significantly bends a structural component, such as a rear truck impact on a low level beam.
3. That which significantly weakens jointed members, such as a weld breakage or a failure of a bolt.
4. Damaged pallets (see Appendix 3).
5. Out of verticality of the uprights.

Other safety items that should be checked include:-

1. Incorrect location of beam connectors.
2. Looseness of floor fixings.
3. Dislodgement of accessories.
4. Spillage of goods.
5. Floor soiling.
6. Forklift truck deficiencies.
7. Missing beam connector locks.
8. Missing row spacers.
9. Wrong type of pallets.
10. Incorrect location of the loads on the pallet.
11. Incorrect location of the position of the pallets on the racking or on the floor.
12. Incorrect load and information notices.
13. Overloading.
14. Instability of the unit loads.
15. Incorrect size of the unit loads.

Any damage to a rack upright will reduce its load carrying capacity. The greater the damage to the upright, the greater the reduction in its strength until the upright will collapse at, or below, its allowable working load.

# 7. USERS INSPECTION REQUIREMENTS

## 7.3 Damage classification

Any damage will result in a reduced safety factor in the structure and deviations in excess of the SEMA limits should result in the affected area of the racking being offloaded.

Damage should be classified as follows:-

### **Red risk**

Areas where a high level of damage is identified of over twice the SEMA limits. This warrants immediate offloading and isolation of the affected area until repair work is carried out.

### **Amber risk**

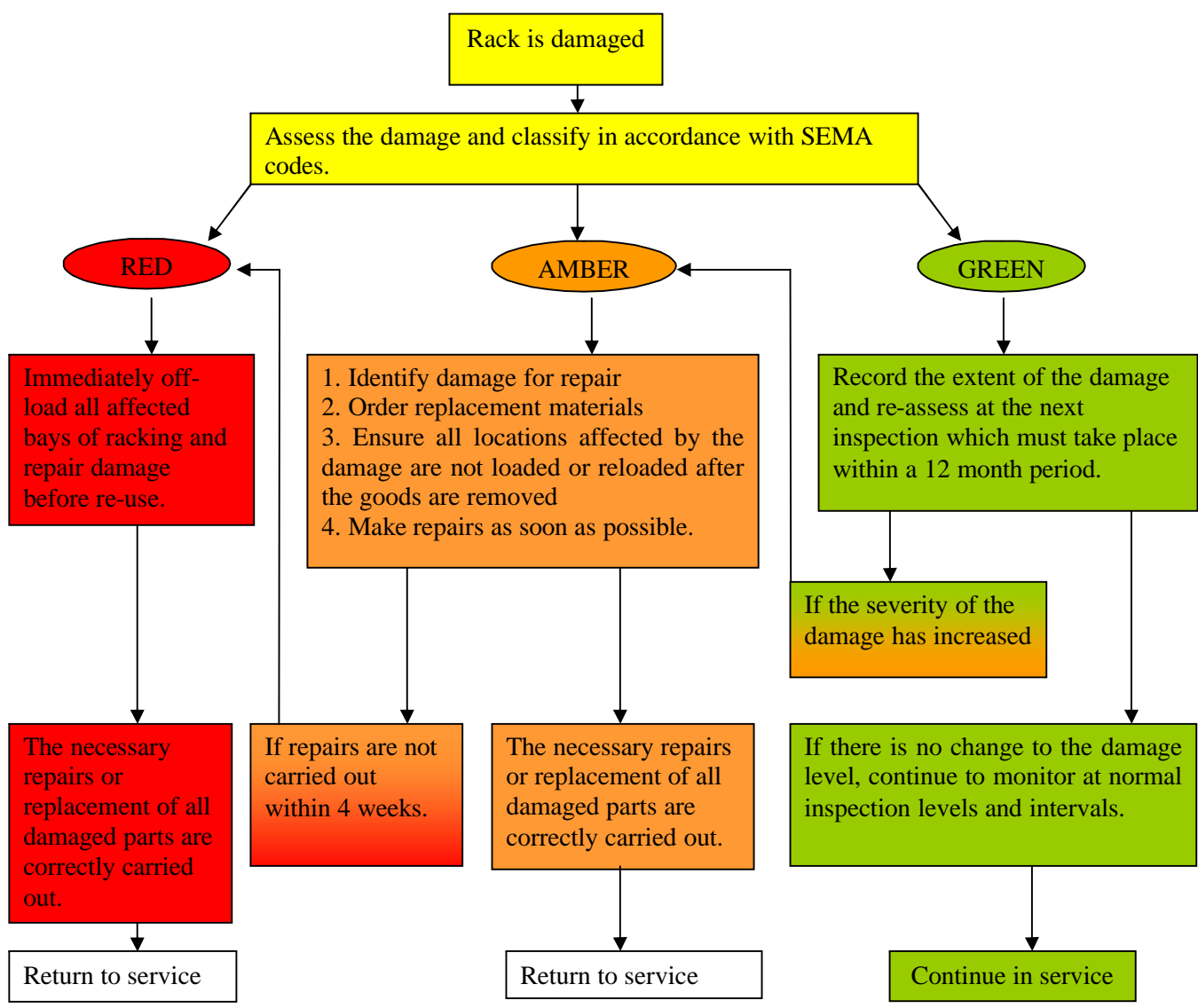
Areas where the damage identified is greater than the SEMA limits. This warrants remedial work to be carried out. However, the damage is not sufficiently severe to warrant the immediate offloading of the area. No additional loads shall be placed in the affected area and, once the pallet positions in this area are emptied, they should not be refilled until the repairs are carried out. If repairs are not carried out within 4 weeks, an Amber risk item automatically becomes a Red risk item.

### **Green risk**

Areas where damage is present, however, the level of damage is within the SEMA limits and should be recorded for further consideration at the next inspection.

# 7. USERS INSPECTION REQUIREMENTS

7.4 Damage classification flowchart



# 7. USERS INSPECTION REQUIREMENTS

## 7.5 Beam inspection

Beams are usually designed on the basis of the load being a uniformly distributed load (UDL) over the length of the beam and on the basis that the load is shared equally between the front and back beams in a compartment.

Manufacturers usually state the safe UDL which can be supported by a pair of beams. For timber pallets supported directly by a pair of beams, the UDL condition is usually met. For post pallets, pallets with skids, etc., the beam is subjected to a series of concentrated point loads. These conditions of loading can result in higher stresses and/or deflections and the manufacturer's advice should be sought regarding the beam size to be used.

Beam deflection should be measured by using a string line below the beam. The deflection is the average of the two end measurements minus the central dimension.

## 7.6 Vertical beam deflection when loaded

Beams will deflect under loading to a maximum permissible deflection of span/200. See Figure in clause 7.11.

For example, for a beam with a clear entry of 2700mm, the maximum permissible deflection is:-

$$2700/200 = 13.5\text{mm.}$$

With some types of handling equipment, a lower deflection limit may be necessary.

## 7.7 Vertical beam deformation when unloaded

Residual vertical deformation when the beam is unloaded should not exceed span/1000. See Figure in clause 7.11.

For example, for a beam with a clear entry of 2700mm, the maximum permissible residual vertical deformation is:-

$$2700/1000 = 2.7\text{mm.}$$

## 7.8 Lateral beam deformation when unloaded

Residual lateral deformation in the cross aisle direction when the beam is unloaded should not exceed span/500. See Figure in clause 7.11.

For example, for a beam with a clear entry of 2700mm, the maximum permissible residual lateral deformation is:-

$$2700/500 = 5.4\text{mm.}$$

## 7.9 Beam end connector damage

Beam end connectors which show any clearly visible deformation should be unloaded and expert advice sought from the Supplier.

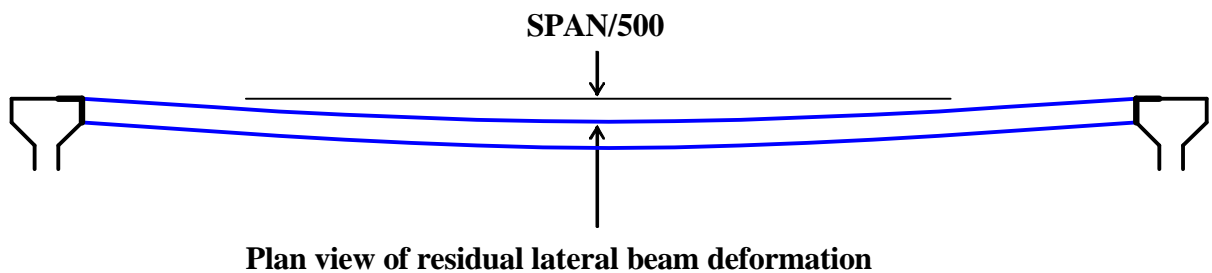
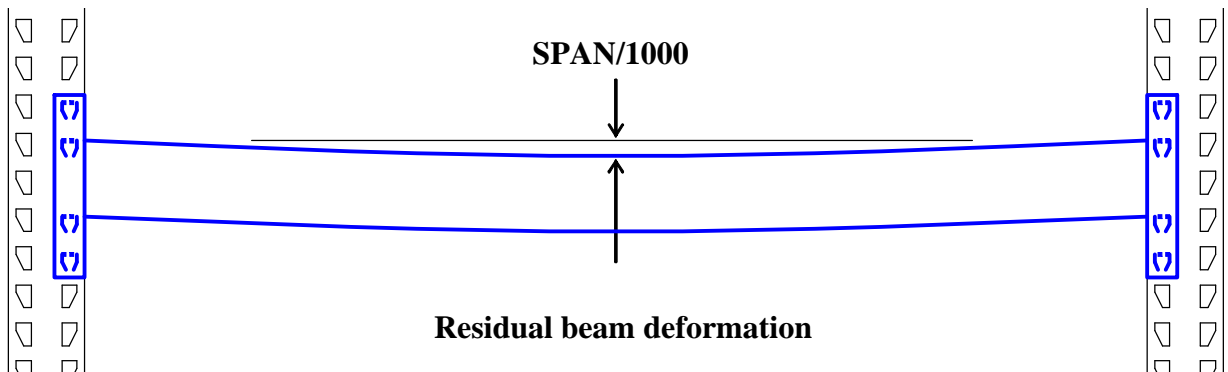
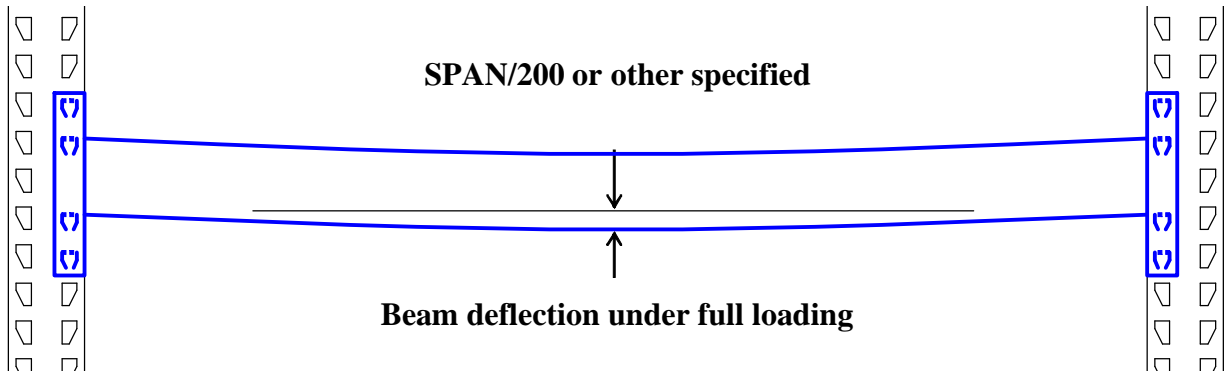
Welded connections between the beam section and the end connector should not show any signs of cracking.

## 7.10 Beam end connector locks

Any missing locking devices should be replaced immediately to prevent the accidental dislodging of the beams. It is recommended that a supply of beam locking devices is held on site.

# 7. USERS INSPECTION REQUIREMENTS

## 7.11 Figures for beam deflection and beam deformation



## 7. USERS INSPECTION REQUIREMENTS

### 7.12 Upright inspection

Uprights should be inspected as follows:-

1. A straight edge, 1.0m in length, should be placed in contact with a flat surface on the concave side of the damaged member, such that the damaged area lies centrally, as near as possible, to the length of the straight edge.
2. For an upright bent in the direction of the rack beams, the maximum gap between the upright and the 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 the 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 deformation should be measured separately, as noted in items 2 and 3, and the appropriate limits observed.

These rules only apply to damage which produces an overall bend in a member. They do not apply to highly localised damage such as dents, buckles, tears and splits. Members subjected to these defects should be replaced.

Localised bends over a length of less than one metre may be judged pro-rata to the 1.0m limits e.g. over a 0.5m length half of the prescribed limits apply.

### 7.13 Upright inspection for verticality

For all rack installations, the out of verticality when loaded should not exceed 1/300. Any displacement in excess of this level should be investigated.

### 7.14 Bracing inspection

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

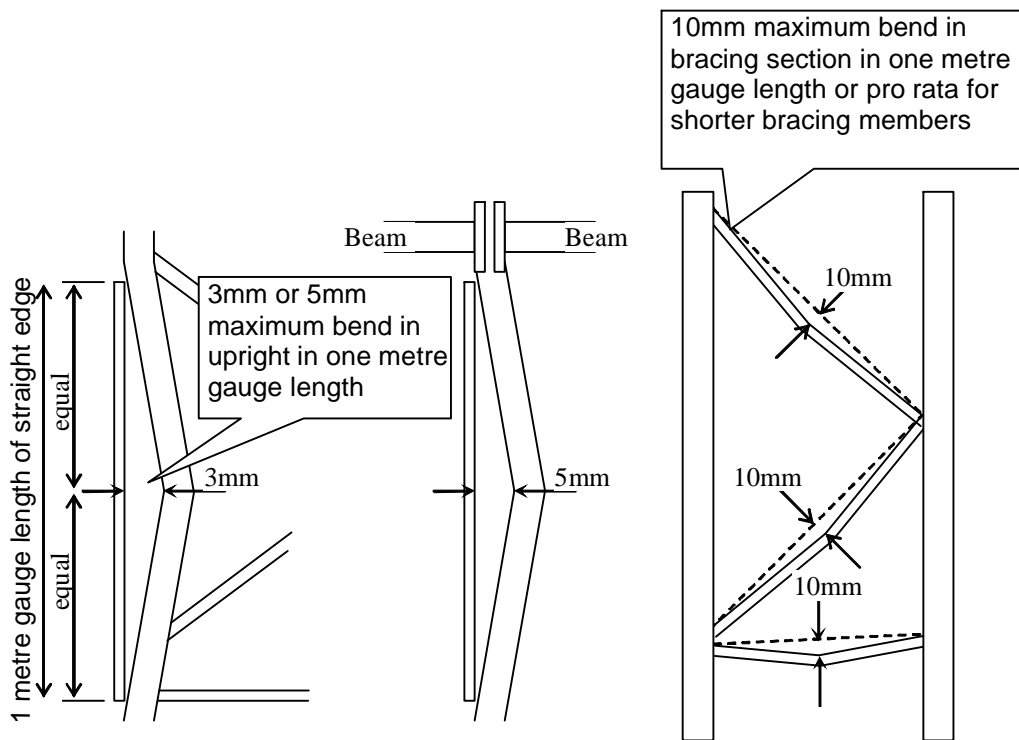
Bracing should be inspected using the same method as measuring upright damage.

For bracing members bent in either plane, the gap between the 1.0 metre straight edge and the bracing member should not exceed 10mm.

Localised bends over a length of less than one metre may be judged pro-rata to the 1.0 metre limits.

# 7. USERS INSPECTION REQUIREMENTS

## 7.15 Figures for damage measurement of upright and bracing sections



# 7. USERS INSPECTION REQUIREMENTS

## 7.16 Base plate inspection

All base plates on storage systems, which are subject to loading or unloading by mechanical handling equipment, should be fixed to the floor slab with at least a single fixing bolt.

Note:- Perimeter fixing, allowing the internal rear uprights to be left unbolted, was an option under previous SEMA codes. It is not intended that the fixing of all uprights to the floor slab shall be a retrospective requirement.

Note:- Alternative fixing holes may be provided in the base plates.

All shims should be under the entire upright profile.

## 7.17 Row spacer inspection

Row spacers should be spaced at not more than every second node or 3.6 metres, with a row spacer at the top bracing node.

Row spacers should be within 225mm of a bracing node point.

## 7.18 Rack protection inspection

Rack protection should be inspected for damage. A deformed guard can lead to a reduction of the clearance between the guard and the member being protected, increasing the risk of damage.

An impact on a loose or damaged guard can result in a point load on an upright and, therefore, a damaged guard may be more dangerous than no protection at all.

## 7.19 Height to depth ratios

For a single sided run, the height to depth ratio is the height of the top loaded beam divided by the frame width.

For a double sided run, the height to depth ratio is the height of the top loaded beam divided by the overall dimension of the two frames and the row spacer, provided that the row spacers are in accordance with clause 7.17.

Where single sided racks exceed a height to depth ratio of 10:1 but do not exceed 20:1, each frame should be restrained by connections to a structure capable of providing the necessary support. This provision will be met if the single sided rack frame is connected, at the top, to a double sided rack frame.

For more specific details, or for information on applications where the racking is subjected to specific horizontal forces such as cranes or trucks which have mast-steady devices, the advice of the Supplier should be sought.

## 7.20 Ties to the building

Restraining ties to the building structure are not recommended. However, if ties are fitted, the User should confirm with the Supplier that the ties have been correctly designed and installed.

When such ties are required, checks should be made that the loads transmitted through the ties, are within the safe capacity of the building structure and the racking.



## 8. USERS MAINTENANCE REQUIREMENTS

### 8.1 General

The maintenance of the racking is important to ensure the safe operation of the storage system.

### 8.2 Trained personnel

Personnel, trained in the replacement of storage system components, shall be used to maintain the storage facility.

A training course, for the maintenance of racking, is available from SEMA.

### 8.3 Repair verses replacement

The repair of damaged rack components is not generally recommended due to problems of quality control and the possibility of hidden damage to the material.

Any component no longer fit for use, should be replaced on a like for like basis with the manufacturers approved part.

Repairs should only be carried out if authorised by the racking manufacturer and should be carried out in strict accordance with the manufacturer's recommendations.

Note: The User should be aware that any repair not authorised by the manufacturer is likely to invalidate the manufacturer's warranty.

Never apply heat in an attempt to straighten bent components.

### 8.4 Cleaning

Cleaning, either as part of a routine, or as a result of a spillage, should comprise of a wipe down with a damp cloth, using a mild detergent.

# APPENDIX 1 FORKLIFT TRUCKS



**Hand Pallet Truck – Manual Operation for Pedestrian**



**Powered Pallet Truck – Electric Operation for Pedestrian**



**Powered Pallet Stacker – Electric Operation – Man Rider**

# APPENDIX 1 FORKLIFT TRUCKS



**3 Wheel counterbalance truck (type 1)**



**4 Wheel counterbalance truck (type 1)**



**Articulated narrow aisle truck (type 2)**



**Narrow aisle reach truck (type 1)**

## APPENDIX 1 FORKLIFT TRUCKS








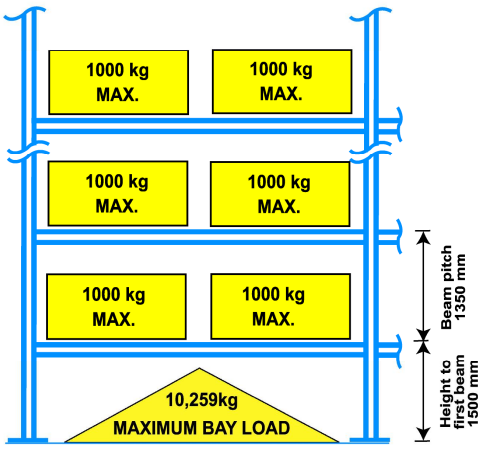


**Very narrow aisle side loading truck (type 3)**



**Order picking trucks (type 3)**

# APPENDIX 2 EXAMPLE OF A TYPICAL LOAD NOTICE

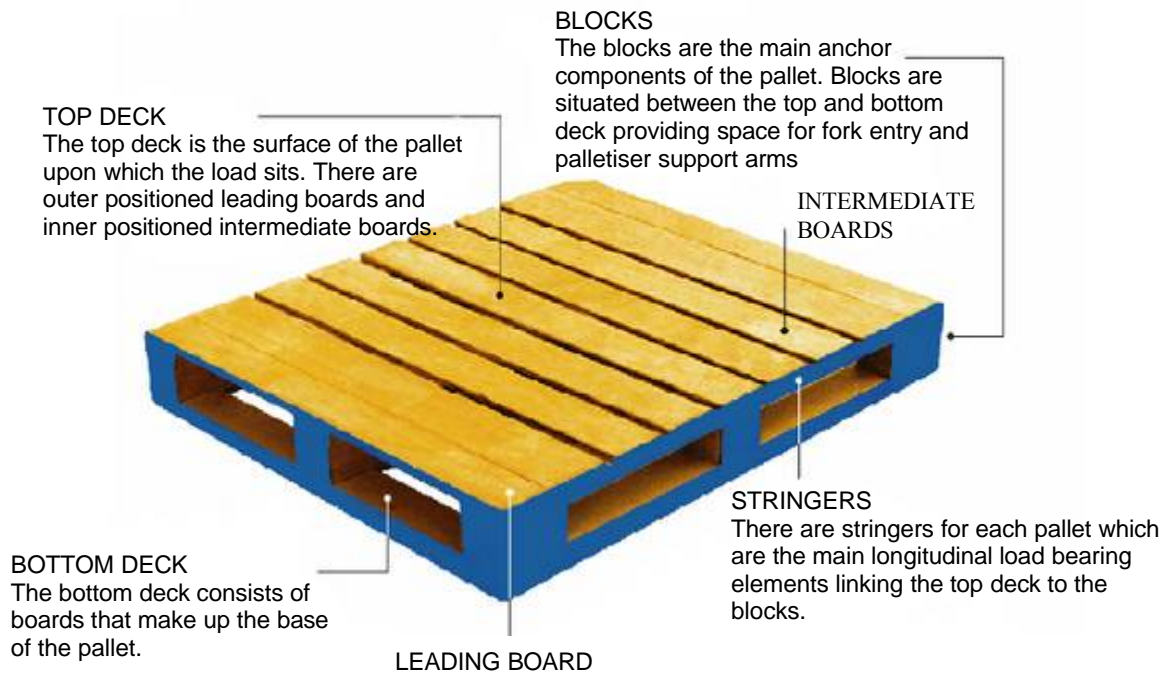
     	<p>Conduct regular inspections to check for:</p> <ul style="list-style-type: none"> <li>* correct application and use;</li> <li>* loads within allowable safe limits;</li> <li>* accidental damage, or dislodgement of structural components</li> </ul>	<p>Date supplied: 01.01.2003</p>	<p>Project ref: 1234</p>	 
	<p><b>REPORT ALL DAMAGE TO THE RACKING SAFETY OFFICER</b></p>	<p>All Loads To Be Uniformly Distributed</p>		
	<p>Do not alter the structure without either:</p> <ul style="list-style-type: none"> <li>* checking effects against manufacturers' technical data;</li> <li>* obtaining approval from supplier</li> </ul>	<p>Equipment Supplied By:</p>		
	<p><b>DO NOT CLIMB PALLET RACKING</b></p>			
	<p>Refer To SEMA 'Code of Practice for the Use of Static Pallet Racking'</p>			
	<p>If in doubt <b>ALWAYS</b> contact supplier</p>			

Typical pallet racking load notice

# APPENDIX 3 PALLETS

## A3.1 Pallets

There are a number of different types of pallets used throughout Europe. The most common sizes are 1200 x 1000mm and 1200 x 800mm and the common terminology used for a timber 4-way entry reusable pallet is given below:-



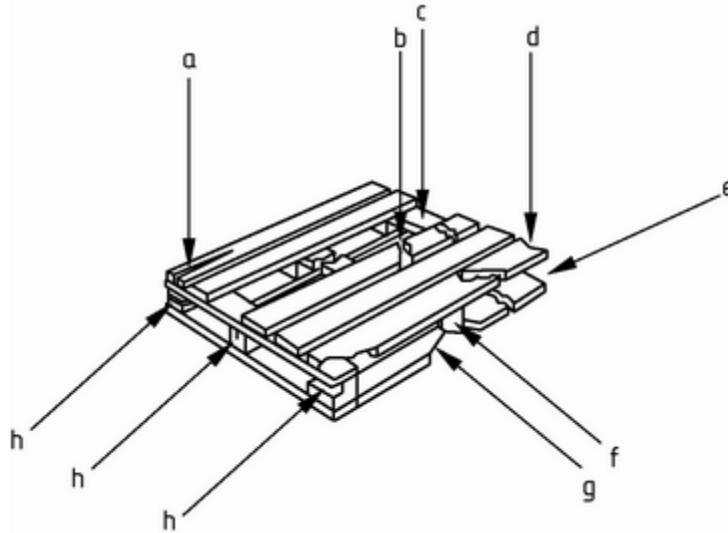
## A3.2 Single use pallets

The one way, one trip or single use pallet may be useful for exporters for loading goods into shipping containers, because the pallet's dimensions may allow for additional storage, however, these pallets may not be suitable to be used in racking.

## APPENDIX 3 PALLETS

### A3.3 Pallet damage

Manufacturers have different damage criteria for use for their particular pallets, however, the general items which make a pallet unacceptable for use in pallet racking are given below:-



#### **Key**

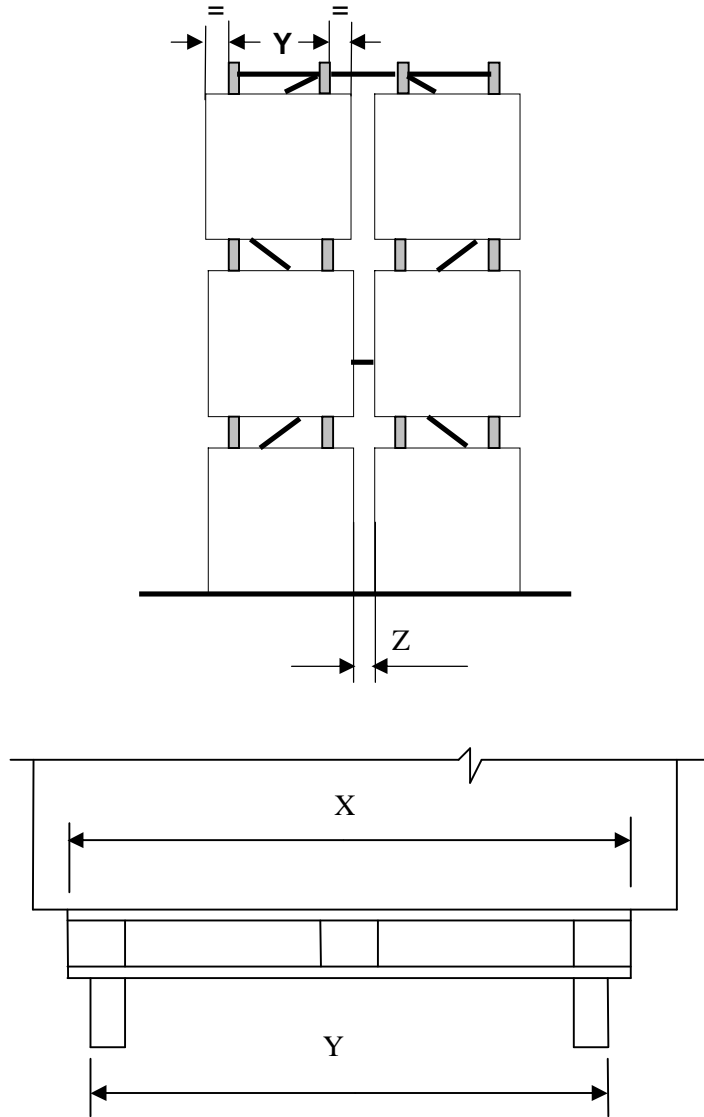
- a Splits on boards of more than half of the width or the length of the board
- b Broken board
- c Missing board.
- d Missing wood on a board of more than a third of the width of the board
- e Missing block or split block to the point where more than one nail shank is visible
- f Block turned more than 30°
- g Missing wood on a board between two blocks of more than a quarter of the width of the board or if nails are visible
- h Missing wood or splits on a block of more than half of the width or height of the block

### A3.4 Detailed pallet information

Detailed pallet information may be obtained from either the manufacturer of the pallets i.e. [www.chep.com](http://www.chep.com) or industry organisations i.e. [www.epal-pallets.org](http://www.epal-pallets.org) (see Bibliography).

# APPENDIX 4 CLEARANCES

## A4.1 Pallet locations, end elevation



**Key**

- X Maximum overall depth of the pallet
- Y Dimension from the outside faces of the beams,
- Z Minimum clearance back to back of the pallet or load

**Typical Dimensions**

X	Y	Z
1000	900	100
1200	1100	100

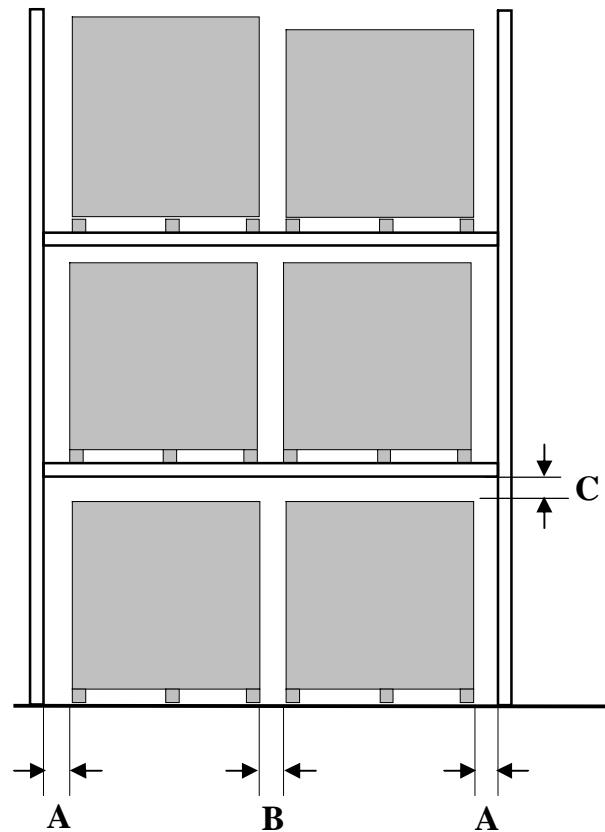
All dimensions are in millimetres.

Note: Previous SEMA codes of practice had different dimensions for 2 and 4-way pallets. Racking constructed prior to the issue of this code may, therefore, have different frame widths.



# APPENDIX 4 CLEARANCES

## A4.2 Pallet locations, front elevation



### Key

- A Nominal clearance between the pallet/load and the upright
- B Nominal clearance between adjacent pallets/loads
- C Minimum clearance between the underside of the beam and the top of the load  
This dimension may need to be increased to allow for any sprinkler system requirements

### Minimum clearances

#### Man-down truck

Beam height up to:	A	B	C
3000	75	75	75
6000	75	75	100
9000	100	100	125
12500	100	100	150

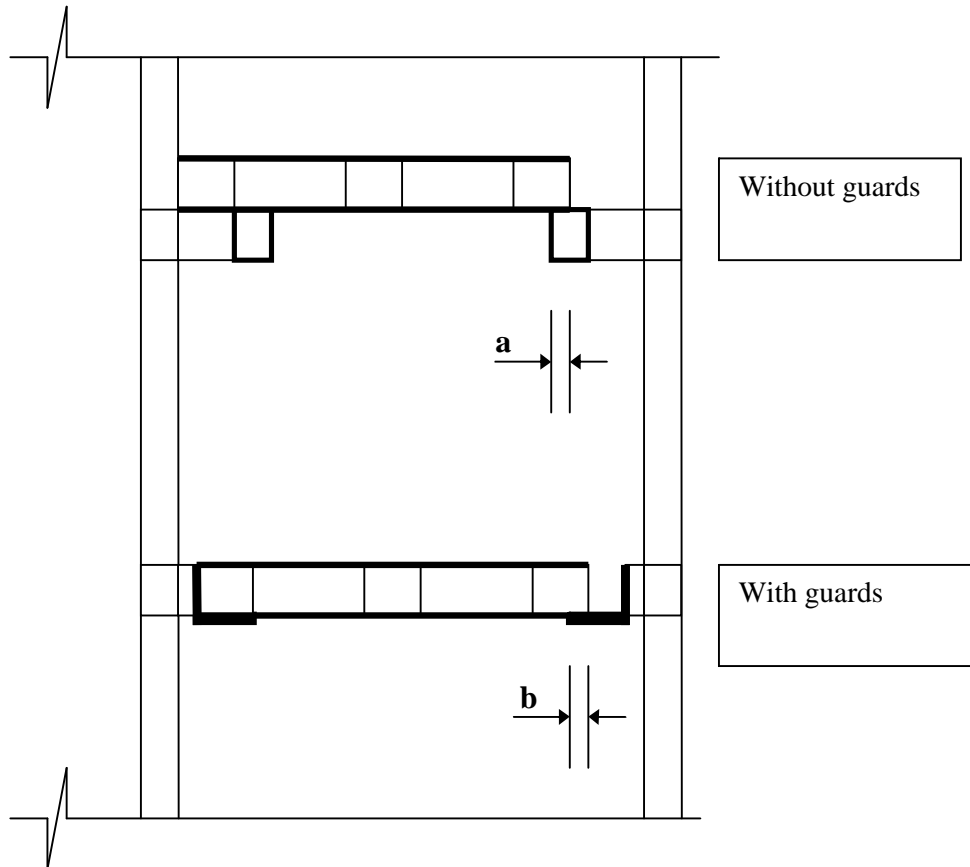
#### Man-up truck or truck with CCTV

Beam height up to:	A	B	C
15000	75	75	75

The beam height is the dimension from the floor to the top of the beam.  
All dimensions are in millimetres.

# APPENDIX 4 CLEARANCES

## A4.3 Drive-in pallet locations, front elevation



**Key**

**Minimum pallet bearing**

a = 25mm without guards

b = 20mm with guards

# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

## A5.1 Fork truck operation

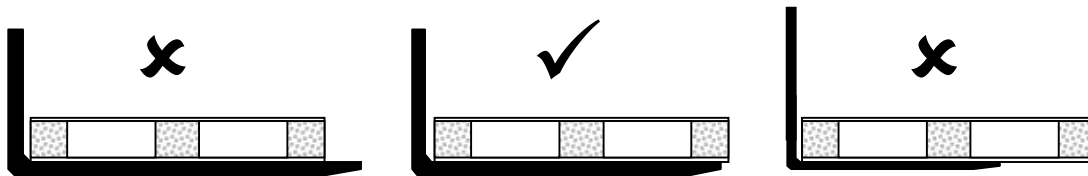
Truck operators must receive adequate training and supervision to ensure safe systems of work and must be appropriately qualified for the truck operation and the operating conditions of the storage installation.

The driver should:

1. Where possible, travel with the fork arms lowered to within 150 mm of level ground and mast tilted slightly back. With some attachments, e.g. barrel clamps, the mast should be kept vertical. Always follow the manufacturer's instructions for use of the attachment.
2. Before raising a load, always ensure there is sufficient clearance overhead to do so and that objects which could fall and injure people nearby will not be dislodged.
3. Ensure that the pallet size and type is correct for the rack beam spacing and for any accessories used such as pallet support bars.
4. Not move a load that appears unsuitable. The operator should mark the load appropriately and report its condition to the supervisor.
5. Not operate with the load raised, because of the risks of overturning, except at creep speed as part of a loading or unloading manoeuvre.
6. Not carry a load that blocks forward visibility. If it is absolutely necessary to carry bulky loads which block visibility, then the lift truck should be driven in reverse. If this is not possible, for example when travelling up a slope, a banksman should be used to assist the operator.
7. Check that the unit load weight and size is within the capacity of the lift truck and the rack storage position to be accessed.

## A5.2 Loading and unloading with all types of lift trucks.

The fork tips should not extend beyond the load or pallet. If they do, make sure that they do not contact other loads in the rack or the rack structure. The loads should be against the vertical face of the fork arms or load backrest extension. The fork spread should be correctly adjusted to suit the load.



The paragraphs that follow refer to loading and unloading racking with lift trucks equipped with fork arms. Similar procedures should be followed when loading or unloading using attachments, except that, with some attachments, the mast should remain vertical at all times.

In all cases, the operating instructions of the truck manufacturer or authorized representative of the manufacturer should be followed.

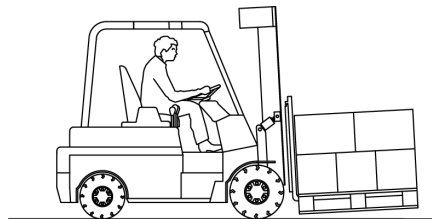
# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

## A5.3 Counterbalanced lift trucks

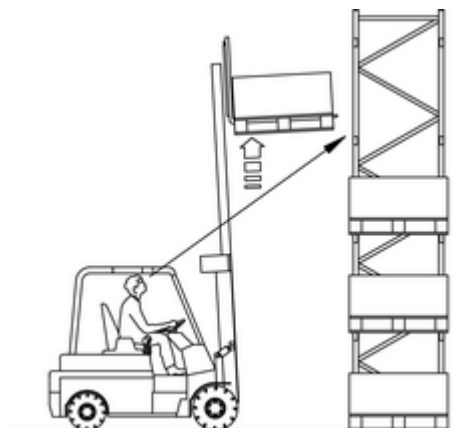
### A5.3.1 Rack loading cycle with counterbalanced lift trucks

The procedure for loading with counterbalanced lift trucks is as follows:

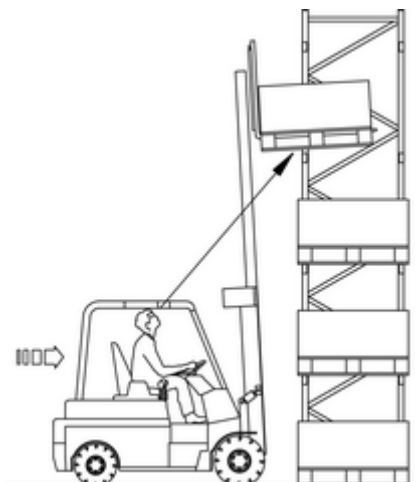
1. Before lifting, assess the weight of the load and its centre of gravity to ensure that the load does not exceed the capacity of the lift truck.
2. Approach the rack with the load low and tilted backwards.



3. Slow down and stop at the face of the rack, apply the parking brake and reduce the backward tilt to an amount just sufficient to stabilise the load.
4. Look up, check for obstructions and that the chosen rack storage aperture is large enough to receive the load and then raise the load to the desired beam height.

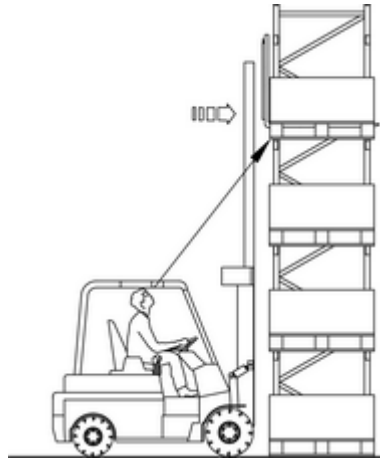


5. When the load is clear of the top of the beam level selected move slowly forwards, taking care not to dislodge adjacent loads or to touch the racking structure.

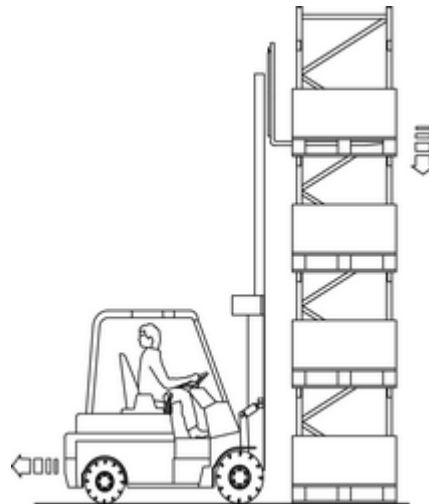


## APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

- When the load is correctly positioned above the beams, stop, apply the parking brake and bring the mast to the vertical position, then slowly and smoothly lower the load onto the beams. Do not lower the load onto the front beam and then attempt to slide the load into position. This method will cause structural damage and will affect the safety of the storage equipment.



- When the load is securely placed lower the fork truck arms until free of the pallet. A slight forward tilt of the fork arms may be of assistance. After ensuring the way is clear, withdraw by reversing the lift truck, keeping a lookout front and rear.



- When clear of the rack, apply the parking break, tilt the fork arms backwards and lower them to just above the floor level, checking that the way is clear before moving off.

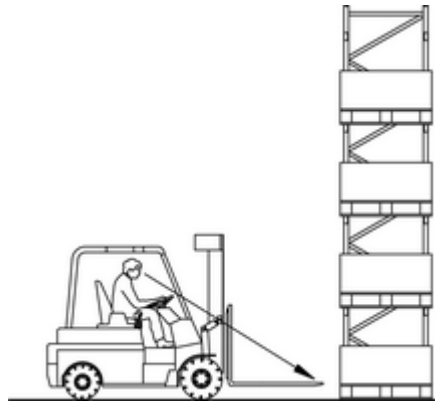


# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

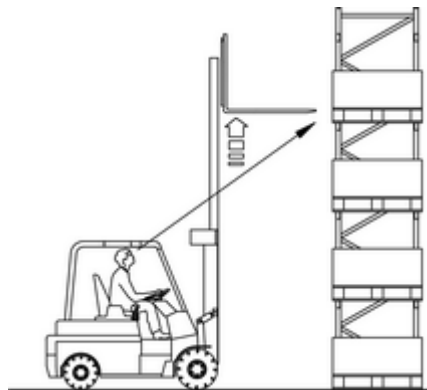
## A5.3.2 Rack unloading cycle with counterbalanced lift trucks

The procedure for unloading with counterbalanced lift trucks is as follows:

1. Halt at the face of the rack and apply parking brake. Bring the mast to the vertical position. If necessary adjust the fork spread to suit the width of the pallet and ensure that the weight of the load is within the capacity of the lift truck.



2. Look upwards, check for obstructions, then level and raise the fork arms to a position permitting clear entry into the pallet.

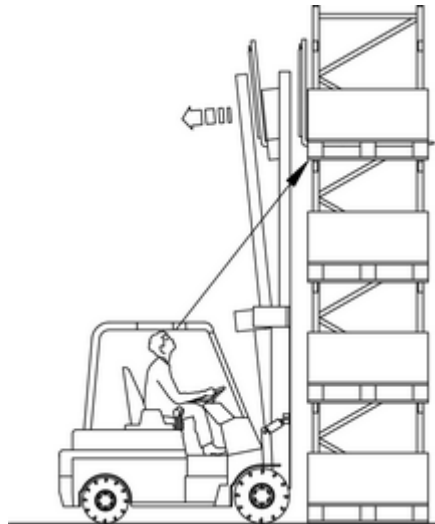


3. Fully insert the fork arms by slowly driving forward until the guard almost touches the load or pallet base, and apply the parking brake. The tips of the forks should preferably not extend beyond the back edge of the pallet to prevent damage to adjacent loads or the rack structure.

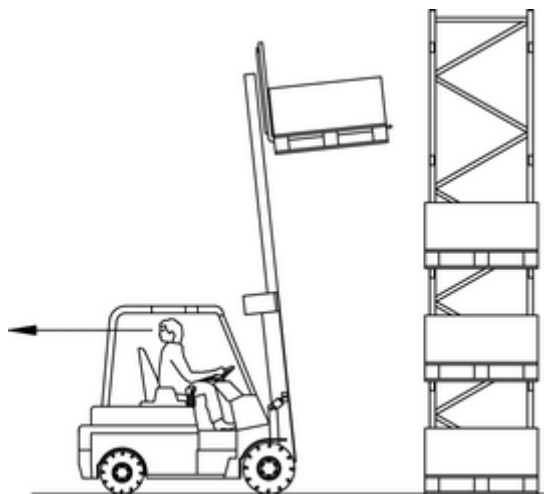


# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

4. Lift the load clear of the beams and carefully apply backward tilt just sufficient to stabilise the load and taking care not to lift the load too high and strike the rack or any other structure above.



5. Check that the way is clear and then move slowly backwards until the load and forks are clear of the face of the rack and other pallet loads and apply the parking brake.



6. Lower the load carefully and smoothly to the correct travelling position, applying further backward tilt as necessary. Check to see that the way is clear before moving off.



# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

## A5.4 Reach trucks

Reach trucks shall not be driven, whether loaded or not, with the reach mechanism extended except when inching up to the face of the rack.

The parking brake should be applied before operating the reach mechanism.

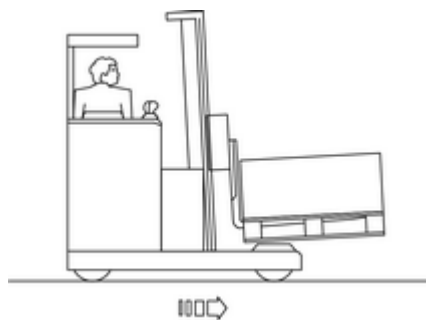
Do not step over the reach legs

The area between the mast and power unit should be considered as inaccessible if the reach truck is capable of being operated.

The reach movement should not be used for pushing or dragging loads and the load should be carried on the fork arms and not resting on the reach legs unless the reach truck is specifically designed for the purpose.

### **A5.4.1 Rack loading cycle with reach trucks**

1. Before lifting, assess the weight of the load and its centre of gravity to ensure that the load does not exceed the capacity of the lift truck.
2. Approach the rack with the load low, reached in and tilted backwards.

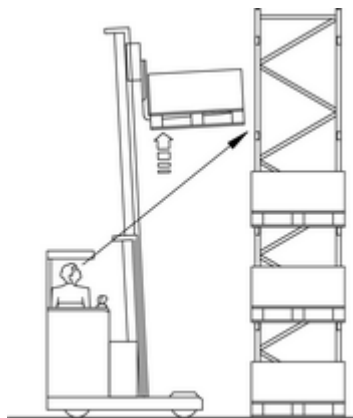


3. Slow down, stop, then inch up to the face of the rack, apply the parking brake and reduce backward tilt to an amount just sufficient to maintain the load stability.

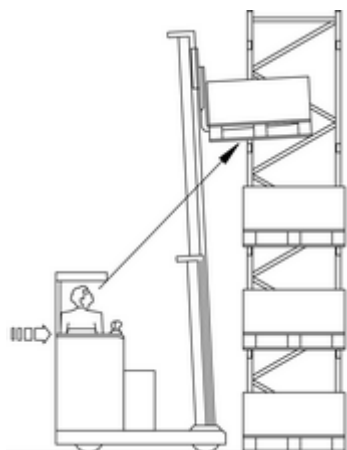


# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

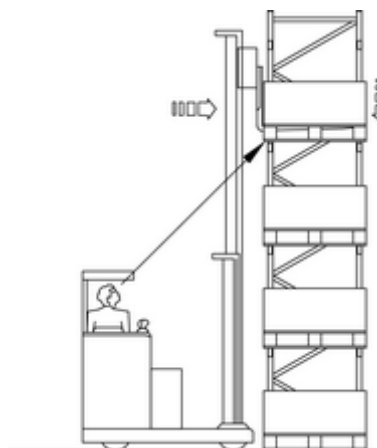
4. Look up, check for obstructions and that the chosen aperture is large enough to receive the load, then raise the load to the desired beam level.



5. When the load is clear of the top of the beam level selected, reach out smoothly with the load, taking care not to dislodge adjacent loads or to strike the racking structure.

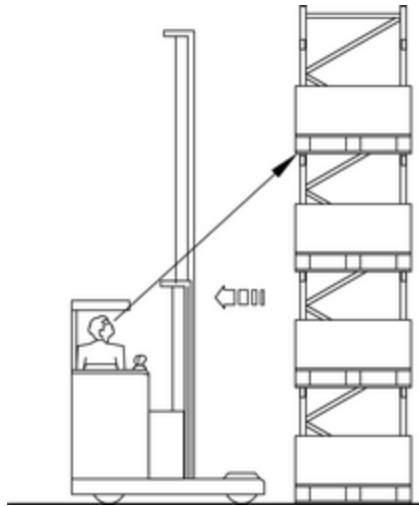


6. When the load is correctly positioned above the beams bring the mast to the vertical position, then slowly and smoothly lower the load onto the beams. Do not lower the load onto the front beam first and then attempt to slide the load into position. This method will cause structural damage and will affect the safety of the storage equipment.

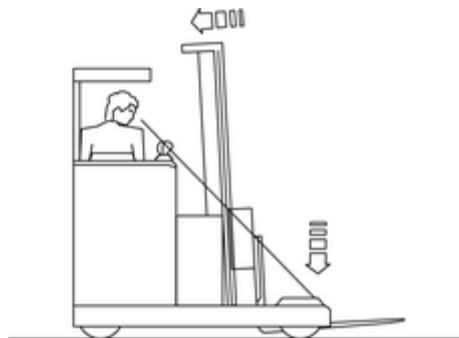


## APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

7. When the load is securely placed, lower the fork arms until free of the pallet and retract the reach mechanism. When freeing the fork arms, a slight forward tilt may be of assistance; otherwise it should seldom be necessary to use forward tilt. (If the fork arms are not fully clear of the rack the reach truck should be moved back a short distance, after ensuring the way is clear.)



8. When the fork arms are clear of the rack, re-apply the parking brake if the truck has been moved. Tilt the fork arms backwards, lower them to just above ground level and check the way is clear before moving off.

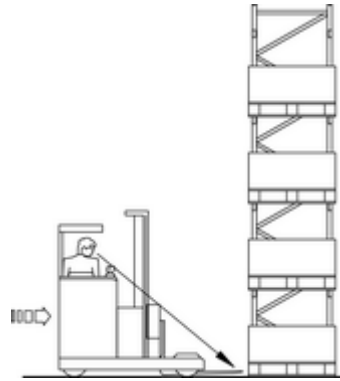


# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

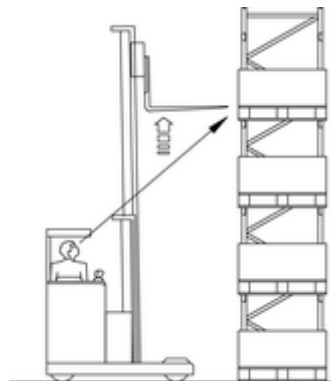
## A5.4.2 Rack unloading cycle with reach trucks

The procedure for unloading with reach trucks is as follows.

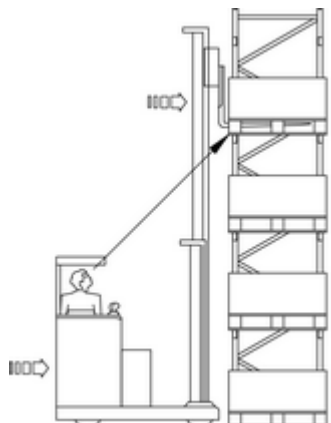
1. Halt at the face of the rack and apply the parking brake. Bring the mast to the vertical position. If necessary, adjust the fork arm spread to suit the width of the load and ensure the weight of the load is within the capacity of the reach truck.



2. Look up, check for obstructions and then raise the fork arms to a position permitting clear entry into the pallet.

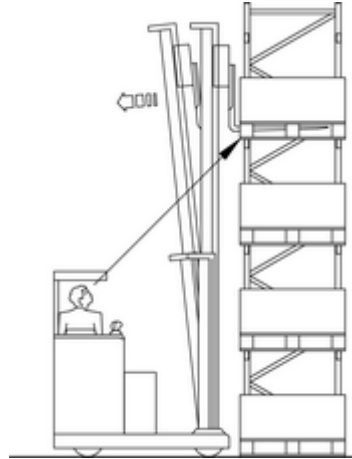


3. Move forward if necessary to bring the reach truck close to the rack and re-apply the parking brake. Fully insert the fork arms by reaching out until the load guard almost touches the load or pallet base. The fork tips should preferably not extend beyond the back of the pallet to prevent damage to adjacent loads or the rack structure.

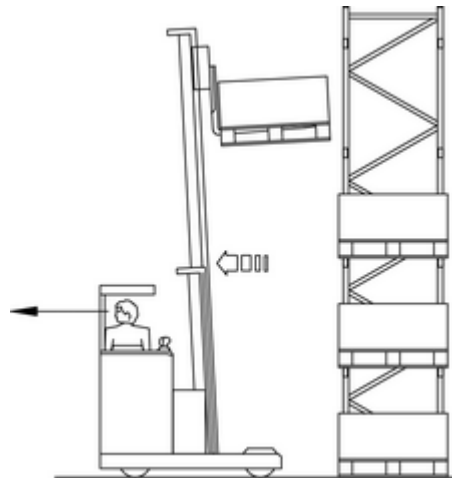


## APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

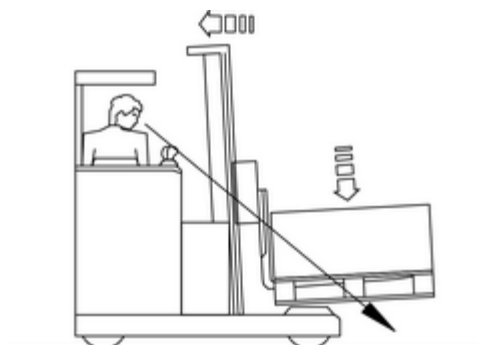
4. Lift the load clear of the rack beams, taking care not to lift the load too high and strike the rack or any other structure above, then carefully apply backward tilt just sufficient to stabilise the load.



5. When the load is clear of the rack beams, retract the reach mechanism. When necessary move the truck slightly backwards away from the rack, ensuring that it is safe to do so. Re-apply the parking brake if the truck has been moved.



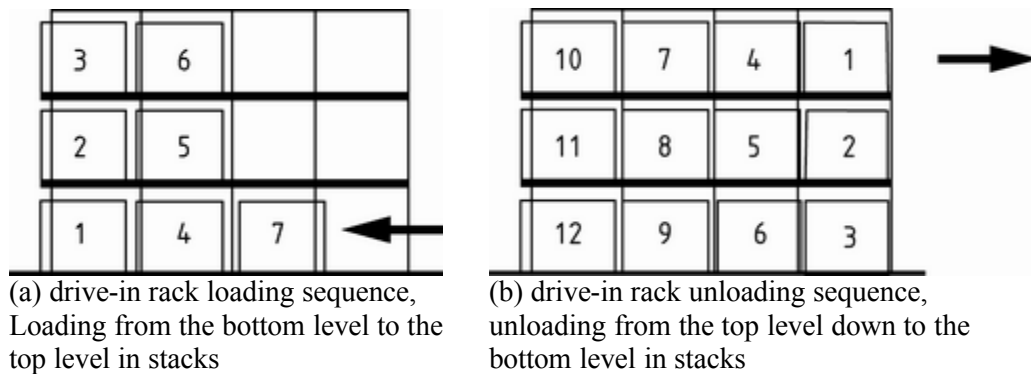
6. Lower the load carefully and smoothly to the correct travelling position, applying the requisite backward tilt before checking the way is clear and moving off.



# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

## 5.5 Pallet placement for drive in racking

The forklift truck enters the rack to deposit a pallet at the rear of the storage lane. Subsequent pallets are then stored sequentially above and in front of the original pallet, thus providing a high density of storage within a given area. Pallets are retrieved sequentially in reverse order with the truck entering the rack to access the pallets at the rear of the installation.



Drive-in racking is a “Last In, First Out” storage system.

It is not safe to either work or drive a truck beneath a pallet that is being stored above. Adhering to the correct loading/unloading sequences will prevent these unsafe situations occurring.

### 5.5.1 Rack unloading cycle for drive in racking

The procedure for loading drive-in racking is as follows:-

1. Check that the pallet is the correct type and is not damaged.
2. Insert the forks into the pallet, and pick the pallet up ensuring that it is square and that the forks are evenly spaced within the pallet.
3. Drive with the pallet and approach the rack squarely, aligning the truck centrally with the required storage lane.
4. Stop the truck at the entrance to the lane. Reduce any tilt on the mast and raise the pallet to the required storage level ensuring the pallet is still central between the pallet rails.
5. Drive slowly into the storage lane towards the intended storage location, keeping the pallet and truck mast clear of contact with the pallet rails or any other part of the rack structure.
6. Stop the truck before making contact with previously positioned pallets.
7. Carefully lower the pallet onto the pallet rails, ensuring no contact with the sides of the pallet rail or the pallet behind. There should be a minimum 20mm bearing on the beam rail.
8. When the pallet is correctly positioned, lower the forks until the pallet is supported on the rails and the forks are released. Reverse the truck carefully out of the storage lane, checking the aisle is clear.
9. When clear of the rack, lower the forks to just above ground level before driving off.

# APPENDIX 5 PALLET PLACEMENT AND RETRIEVAL

## 5.5.2 Rack unloading cycle for drive in racking

The procedure for un-loading drive-in racking is as follows:-

1. Approach the rack squarely, aligning the truck centrally with the required storage lane.
2. Stop the truck at the entrance to the lane. Reduce any tilt on the mast and raise the forks to the required storage level ensuring the truck is still central between the pallet rails.
3. Drive slowly into the lane up to the desired pallet location. Stop the truck just clear of the load and adjust the forks if required before entering the pallet.
4. Lift the pallet clear of the pallet rails and slowly reverse the truck out of the storage lane ensuring the way is clear.
5. When clear of the rack, lower the forks to the correct travelling position before moving off.

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Advanced Course

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Mezzanine Course

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