



# Warehouse safety manual

Operation, use, review and maintenance  
of Drive-in pallet facilities (Drive-In and Drive-Through)  
and Radio-Shuttle

# Summary

MANUAL FOR USING AND MAINTAINING DRIVE-IN PALLET RACKING FACILITIES  
(DRIVE-IN AND DRIVE THROUGH) AND RADIO-SHUTTLE

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# Introduction

It is becoming more common to apply the concepts of productivity and working conditions to warehouses. This is why safety standards must become stricter and more rigorously applied to handling procedures related to racking. This will in turn help prevent the personnel in charge of executing any of these tasks from being exposed to any danger.

This manual covers all warehouses where load units, generally pallets or containers, are handled by either forklifts or other lifting equipment, which means we can exclude any risks derived by any manual loading that takes place in these types of warehouses.

The proper condition of a pallet warehouse helps facilitate the work carried out inside them. However, the improper use of any of the components forming part of this warehouse may result in accidents.

The basic components we find in a warehouse include:

- The slab or floor.
- Load units.
- Lifting equipment.
- Racking.

With the aim of avoiding situations that may imply the risk of injury to warehouse personnel, costly service interruption or damage to the facility or merchandise, the following measures are highly recommended:

- **Prevention:** training all personnel on properly using the facility and equipment.
- **Inspection:** ongoing checks by personnel to ensure that all operating conditions are optimal and being complied with.
- **Maintenance:** when any imperfection or malfunction arises in any area of the warehouse, it is immediately attended to and corrected.

A facility is used safely and rationally through the collaboration between the user and the manufacturers of the racking and lifting equipment.

The Mecalux Group has prepared this manual with the purpose of guiding its customers through the proper use of its racking. When drafted, several recommendations derived from European bodies (FEM, INRS) in the sector were strictly taken into account: European standard EN 15635 "Steel Static Storage Systems - Application and maintenance of storage equipment", plus the company's over 50 years' experience in the warehouse sector.

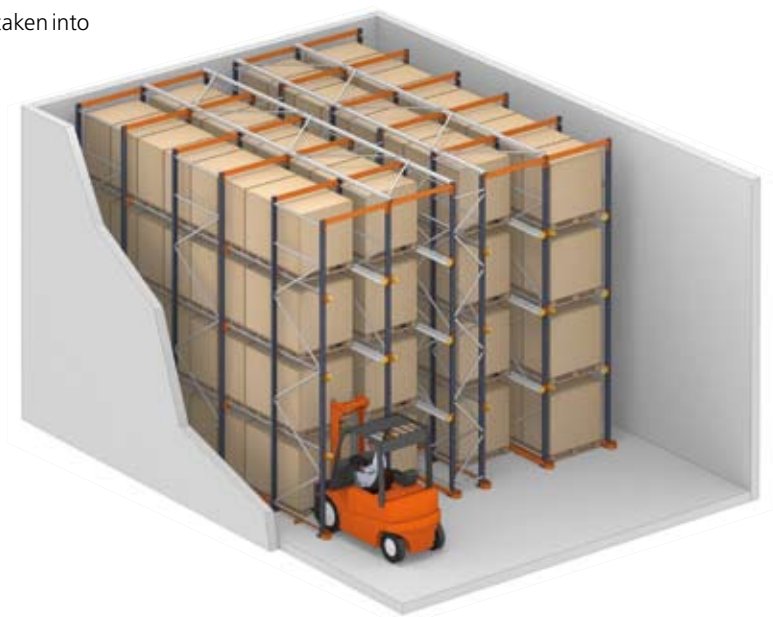
Consequently, this manual should be read carefully and its recommendations strictly applied. The Mecalux Group is available for any consultation on the material that the user may find worthwhile for their facility.

## Important Note!

The responsibility for the security, use and condition of the facility rests with the customer, who must transmit the contents of this manual to those in charge of the warehouse and its users.

This manual has been prepared complying EN Standard 15635

Users must also comply with the specific regulations in each country for this type of facilities.





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## Key warehouse components

### Load units

The load units are determined by the product to be stored and any additional elements that we require to move and store this product (pallets and containers).

These bases have different shapes and are made of different types of materials:

- Wooden pallets
- Metal or plastic pallets
- Containers

The construction of these platforms must comply with the following requirements:

- Specifications found in ISO, EN and UNE standards.
- The ability to support the deposited load.
- Appropriateness to the model planned for the facility's original design.

Any special considerations for storage regarding load units with plastic or wooden bases or crates must be established exactly at the time the facility is designed. Additional measures may be necessary which lead to a greater effort to maintain them.

Wooden pallet.



Metal or plastic pallet.



Container.



Both the weight and maximum dimensions of the pallet load units have to be predefined.  
The system can then be properly operated in terms of resistance and measurements.  
The load units can take on different shapes once the merchandise has been placed on the pallet.

The same size as the pallet and aligned with it.



Larger than the pallet, but centred over it.



Fanned.



Bowed.



## Slab or floor

This is a basic structural component in the operation of the warehouse, whose definition and construction strictly considered as to:

- Characteristics such as stability and resistance, which must be able to resist the loads transmitted by the load units and the lifting equipment. As a minimum, concrete must be C20/25 (according to EN 1992) with a minimum resistance of 20 N/mm<sup>2</sup>.
- The horizontal alignment or levelling of the slab or floor, which must be done according the specifications found in EN standard 15620.

Slabs or floors can have several finishes (concrete, bituminous materials, etc.). When using bituminous materials, special attention must be paid to the design of the racking.

The thickness and geometrical features of the slab or floor must be well-suited for installing the anchor bolts fastening the footplate to the floor or slab.

## Lifting equipment

This is mechanical or electromechanical equipment not only used for lifting merchandise in loading and unloading operations in storage systems but also transporting it from place to place.

Here we can see the most common:

- **Stacker.** Driver sits on board or at floor level.
- **Counterbalance forklift.** With three or four wheels.
- **Reach trucks.** Counterbalanced a retracting mast.
- **Multi-directional forklifts** or four-wheel steered trucks.



Stacker.



Counterbalance forklift.



Reach truck .



Choosing these tools is the key to properly handling goods. To do so, the following information must be closely considered:

- sizes,
- manoeuvring aisle needed,
- maximum lifting height,
- maximum lifting load.

The capacity of a warehouse depends in great measure on these factors, especially the manoeuvring aisle and lifting height.

The machine must have a load capacity that is perfectly suited to the load unit.

The size of the forks or the implements and accessories must be suited to the load unit.

## Storage systems

Here we explain the terminology used to refer to the parts that form the racking or storage system.

A storage system is a structural set of metal racks designed to store loading units in a safe and organised fashion.

According to EN standard 15620, and in accordance with the lifting equipment being utilised, storage systems can be classified in the following manner:

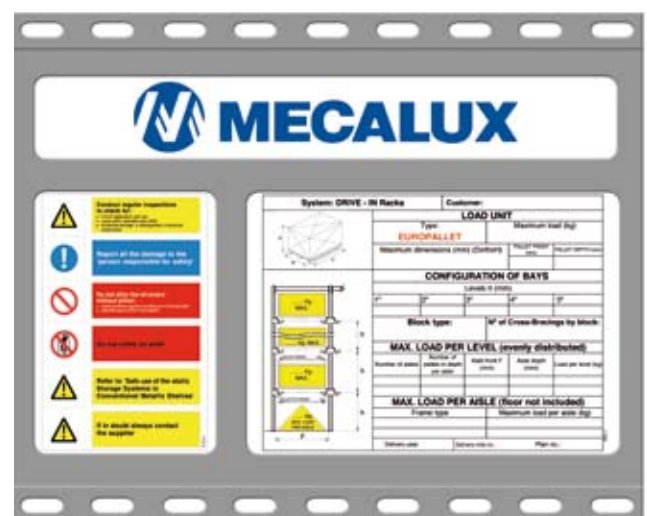
- **Class 100:** pallet loaded with a narrow aisle operated by automatically controlled hoists.
- **Class 200:** pallet loaded with a narrow aisle operated by automatically controlled hoists with additional positioning.
- **Class 300:** pallet loaded with a narrow aisle operated only by forklifts that do not have to turn in the aisle in order to load or offload load units onto or from the racking. Forklifts are driven the length of the aisle along mechanical guide rails or induction cables.
  - Class 300A:** The operator raises and lowers together with the load units and uses manual height positioning. When the operator remains at ground level, there is a closed-circuit camera display or equivalent system.
  - Class 300B:** The operator always remains at ground level and does not have indirect vision systems.
- **Class 400**
  - With wide aisles:** pallet loaded with aisles wide enough to permit the forklift to turn 90° when carrying out loading and unloading operations to the racking.
  - With narrow aisles:** pallet loaded with a narrow aisle that can be used by specialized forklifts.

This safety manual is for Drive-In (Drive-In ,Drive-Through) and Radio-Shuttle pallet racking systems, which generally use class-400 forklifts.

Its design was determined from data or specifications provided by the user or representative. To be specific, the characteristics to be considered for drive-in systems are comprised in EN standard 15629 “Steel Static Storage Systems - Specification of storage equipment”. Nevertheless, the principle data for any storage system are:

- Load units.
- Location of the facility.
- Lifting equipment used.
- Locale or space being occupied.
- Characteristics of the slab or floor.
- Intended use of the warehouse.

By defining what the characteristics are, Mecalux can design the best storage system that suits each, always keeping the instructions provided by the future user in mind. All these specifications will be reflected in the technical document of the proposal and the load sign placed at the entrance of the storage system.



### Important Note!

Any change, modification or expansion of the facility will require the study and authorization of the Mecalux Group.

## Drive-in racking system (Drive-In and Drive-Through)



A drive-in racking system consists of a set of metal racks forming interior loading tracks with rails that support the pallets. The forklifts circulate in the access aisle and drive-into the interior tracks with the load raised above the level where it will be deposited.

This type of facility is developed to store homogenous products with a large number of pallets per reference number where the direct access to each pallet is not a determining factor. Each loading aisle in a drive-in racking system has rails on either side and has several levels to place pallets on.

### Description

The basic components of a drive-in facility are:

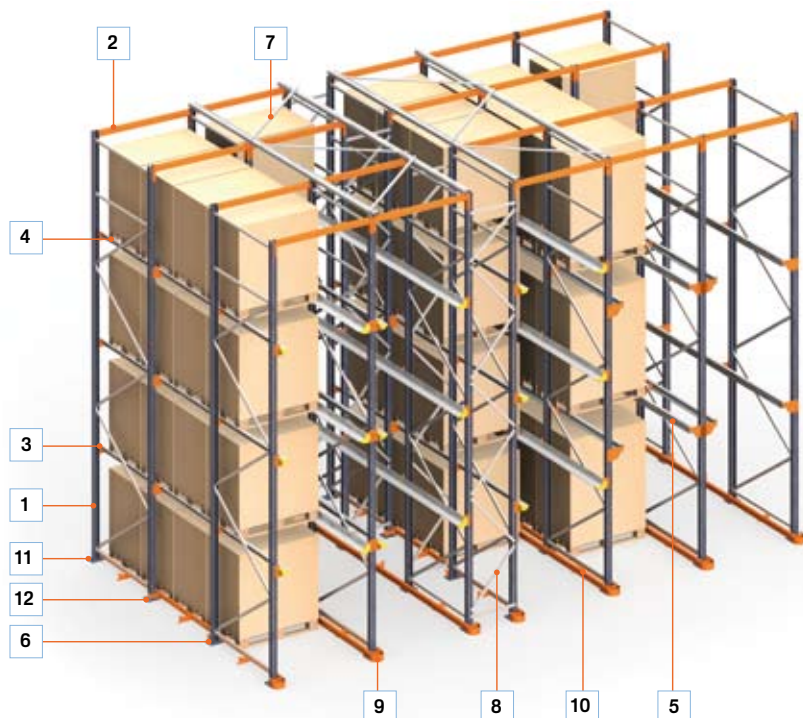
#### Frames

Vertical metal components to support the different load levels.

#### Rails arms

Overhanging horizontal metal parts fastened to the uprights. These indirectly support the load units on each level and the rails rest on them.

- 1) Frame
- 2) Drive-in crossbeam
- 3) Bracket
- 4) GP-7 rail
- 5) C rail
- 6) Upright footplate
- 7) Upper horizontal bracing
- 8) Vertical bracing or stiffening structure
- 9) Entrance protector
- 10) Guide rail
- 11) Levelling shims
- 12) Anchor bolts



Your facility may only include some of the elements mentioned above.

The delivered plans and proposal memo show the construction system installed in your warehouse.



**Rails**

Horizontal metal components arranged perpendicularly to the operating aisle that hold up the load units over each level and are fastened to the upright using the arms.

**Guide rails**

Bolted to the floor, these make the forklift operation easier in the storage track. They also reduce the time it takes to move and avoid possible collisions with the structure. They are recommended to ensure incoming and outgoing load units are handled properly on the racking.



GP-7 Arm.



C Arm.



Protector guide rail entrance.



Rail LPN.



Guide rail VGPRD.

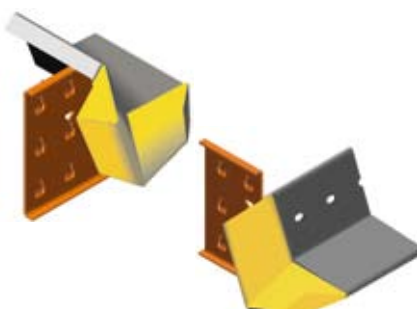
**Braces**

Metal components that make the structure sturdier and are in charge of increasing the longitudinal stability when the load and height of the facility so require

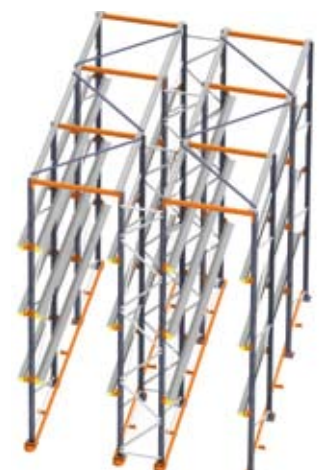
**Pallet centering devices**

Pallet centering sets are placed in the openings of the GP-7 rails on each of the loading tracks in the drive-in system to:

- Be used as a reference tool for the forklift operator.
- Guide the pallet into the entrance.
- Protect the loading rail against any impacts.



Pallet centering device.

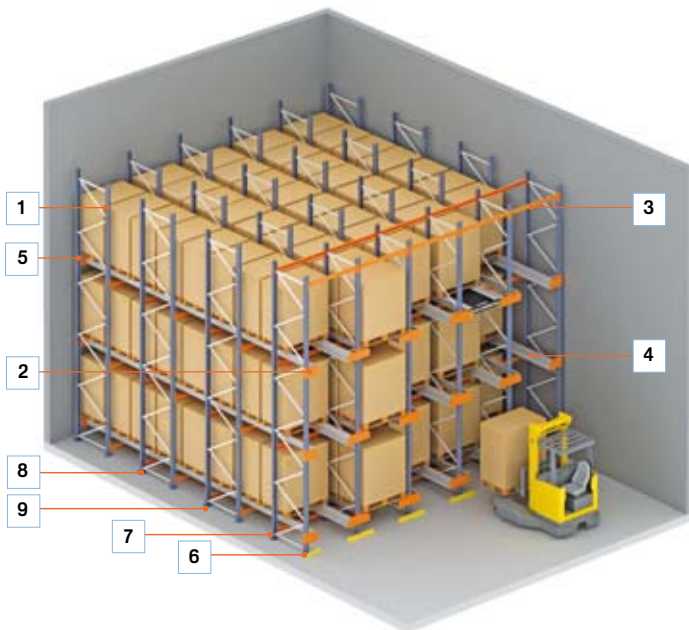


Braces.

# Radio-Shuttle racking system

This is a compact warehousing system similar to the Drive-In and Drive-Through system with the following differences:

- The forklift does not enter the warehousing system tracks.
- Each level in a track can be a different reference.
- The forklift takes or leaves a pallet from the first position. A semi-automatic shuttle previously placed on the relevant level then moves pallets in the racking system.



## Description

The basic components of a Radio-Shuttle racking system are:

### Frames

Vertical metallic structures supporting the different load levels.

### External brackets

Cantilever horizontal metallic elements fixed at the extremes that indirectly support the load units on each level and where the rails rest on.

### Crossbars

Place on the inner side to support the rails.

### Rails

Horizontal metallic elements perpendicular to the work track, supporting the load units on each level along which the Radio-Shuttle moves. They are fixed to the brackets and crossbars with screws.

### Track stoppers

Placed at the end of tracks to stop the shuttle from falling accidentally.

- 1) Frame
- 2) Exterior brackets
- 3) Crossbars
- 4) Arm-rail
- 5) Track stoppers
- 6) Ground stoppers
- 7) Upright footplate
- 8) Levelling shims
- 9) Anchor bolts

Your facility may only include some of the elements mentioned above. The delivered plans and proposal memo show the construction system installed in your warehouse.

**Important note!**  
This manual only deals with the racking system elements and must be used together with the safety and use manuals for the Radio-Shuttle.



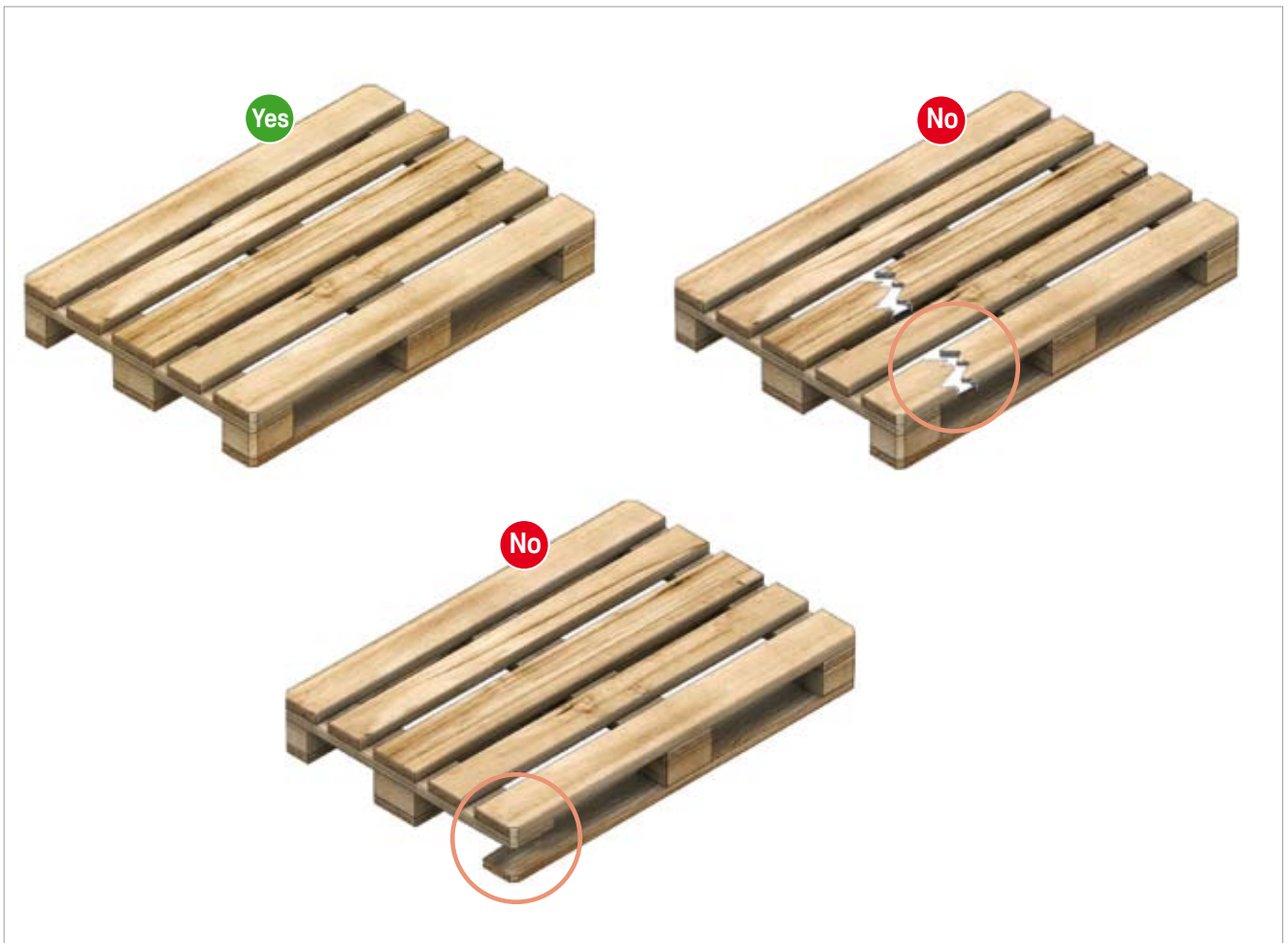
## Using the equipment and racking system

### Load units

The load units, formed by the pallet or container plus the merchandise, must adhere to the following requirements:

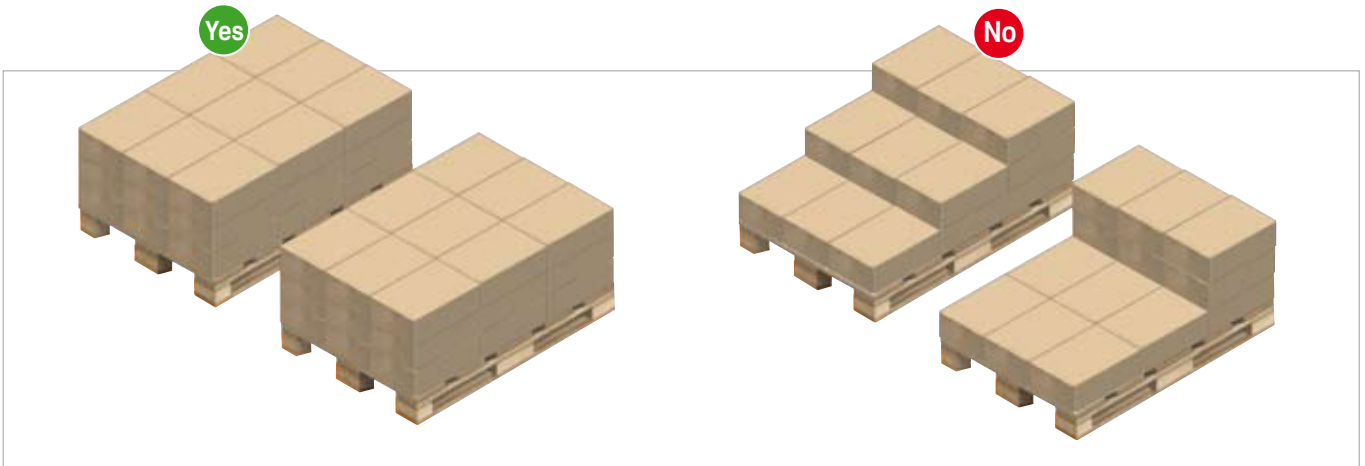
- Adjustable to the size considered in the racking design, meaning it must not surpass either the maximum defined weight or size (width, depth and height).
- The pallet or container must correspond what the design has established and not present any type of damage or wear.

Non-conforming load units are those presenting damage or wear, as defined in the section on "Checking the Load Units" in this manual. A control system must be established to prevent to the recirculation of damaged pallets in the warehouse.

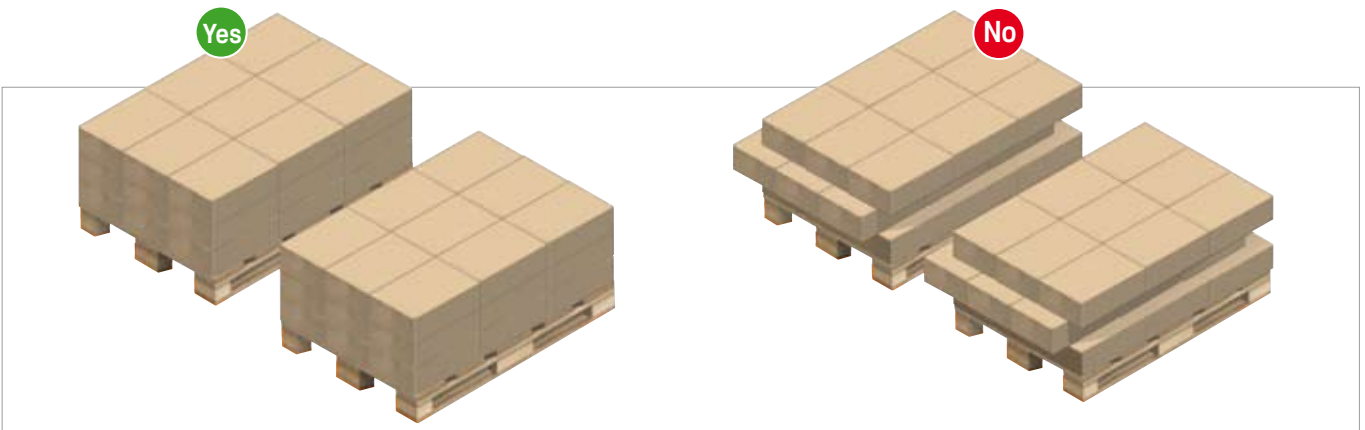


## Using the equipment and racking system

- The entire unit must be stable and compact due to its proper distribution with the merchandise being fastened or tied down via straps, shrink-wrapping...
- The merchandise must be uniformly distributed on the pallet.



- The merchandise must be correctly stacked on the pallet.



Standardised pallets adhere to the stipulations in their corresponding regulations:

- **EN 13382**  
Pallets for handling merchandise. Principal dimensions.
- **EN 13698-1**  
Specification for pallet production Part 1: specifications for building 800x1,200 mm flat wooden pallets.
- **EN 13698-2**  
Specifications for producing pallets. Part 2: specifications for building 1,000x1,200 mm flat wooden pallets.



## Forklifts

### Safe driving

- The forklift operator must be specially trained.
- The forklift must be appropriate for the load and area where it is being operated.
- Extreme prudence must be taken when turning.
- Avoid making turns on ramps or slopes.
- Do not use the forklift as a means of transporting personnel.
- Maintain a minimum distance between forklifts equivalent to the sum of three forklifts.
- Always respect the specific handling regulations for each company.
- Pay close attention to where and how the forklift is parked when not in use.
- Always face the direction the forklift is moving.
- While driving, avoid:
  - Excessive velocity
  - Abrupt movements
  - Improperly placed loads.

### Load requirements

- Loads with or without pallets must adhere to the minimum requirements that make it:
  - Capable of being handled by forks or the proper tools.
  - Stable enough to keep together during all handling and transport operations.
  - Resistant to the physical demands handling requires.
- Able to be transported between 15 and 20 cm from the floor.
- If the volume of the load impedes driver visibility, the forklift must be operated in reverse gear.
- Pay special attention while transporting and depositing cylindrical loads such as pipes or trunks as they can slide off the forklift.
- Do not take unnecessary risks when the weight distribution of a particular load is undetermined. Act prudently.
- Do not cover the safety cabin, as there will be a loss of visibility.



### Load – forklift interaction

- The forklift is similar to balanced scale, but it is possible to lose balance longitudinally by overloading it, situating the load incorrectly, or positioning it at the wrong height.
  - Consequences: tipping towards the front, a loss of steering, damage to the load being handled, etc.
- Transversal balance can be lost when carrying an off-centre load, turning at an excessive velocity or turning while the load is positioned at an improper height.
  - Consequences: tipping the forklift over on its side (a serious or fatal accident), damage to the load being handled, etc.

### Moving a load

The centre of gravity of the entire load must be kept as low as possible, which is why loads are carried on the lowest fork level around 15-20 cm from the floor, thus having plenty of visibility by limiting the size and height of the load. The maximum height of the load must be less than the height of the fork holder. If it is necessary to carry loads higher than that of the mast, first check whether this must be joined or tied to the rest of the load. Transporting loads is always done using both forks, where the load is always distributed evenly to ensure stability.

Never travel or leave the forklift parked with the forks raised (figure 1).

Always face the direction the forklift is moving.

Loads must be carried while fastened accordingly with bands, straps, shrink-wrapping, brackets, etc. Any loose material must go into containers.

In cases where visibility is difficult due to the volume of the load, use the reverse gear to transport it (figure 2).

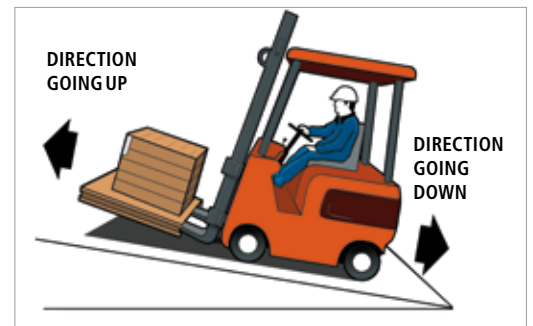
On slopes or ramps, drive forward going up and reverse going down, so the mast is always inclined backward in a straight line (figure 3).



**Figure 1**  
Do not transport with the load raised.



**Figure 2**  
Moving bulky loads.



**Figure 3**  
Driving on slopes.



**Figure 4**  
Slow down at intersections.

If there is a lack of visibility due to meteorological or environmental conditions, such as darkness, use all available lights.

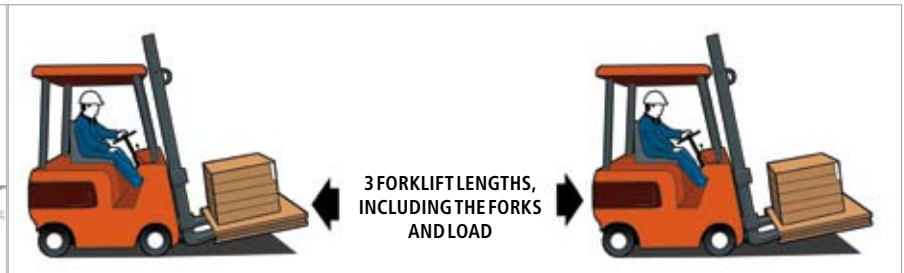
At intersections without proper visibility, use the horn to warn nearby personnel, always facing the direction the forklift is moving. At intersections and foot traffic tracks, any forklifts or pedestrians who may be travelling will have the right of way. If a forklift is executing certain manoeuvres (loading, unloading, lifting, etc) in these traffic areas, pedestrians must wait until they have finished their tasks before continuing on their way (figure 4).

Pay special attention when driving in reverse in narrow areas with stationary objects. Avoid driving excessively fast and making abrupt movements (figure 5).

When two forklifts are travelling in the same direction, a minimum distance equivalent to the sum of three forklifts, including their loads, must be kept between them (figure 6).



**Figure 5**  
Pay attention to the facility's size limits.



**Figure 6**  
The proper distance between two forklifts.



**Figure 7**  
Work centre speed limit.

Respect all rules and traffic signs. The maximum speed established at work centres is 10 km/h, which is a brisk walking speed (figure 7).

Ramps to cover small differences in floor height must be fastened to the floor to keep them from sliding.

The operator's entire body must always be kept inside the vehicle (the safety cabin). At no time may drivers operate the vehicle with their legs or arms hanging outside. Verify the quality and resistance of the floor being travelled on and check whether it can support the weight of the forklift and load.

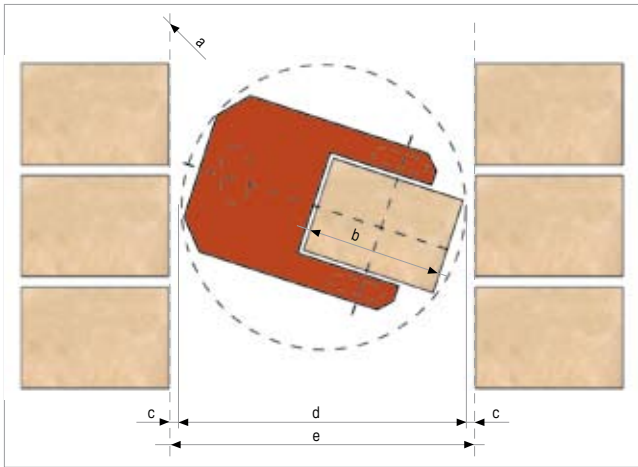
If the forklift drips oil, its motor overheats, or brakes slip, etc., it must be parked in an area which does not interfere with personnel, equipment or the work in process. These circumstances must be reported to the immediate superior.



**Figure 8**  
Losing control of the forklift.

If while transporting loads or carrying out operations an emergency occurs and the forklift goes out of control (figure 8):

- Do not jump out.
- Hold the wheel firmly.
- Press your feet firmly to the floor.
- Lean in the opposite direction to the impact.



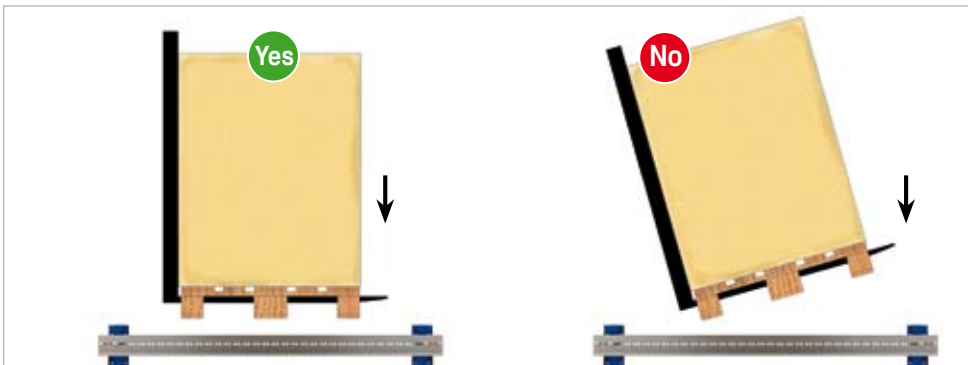
- a) Maximum line of outward-facing pallets.
- b) Maximum dimensions of pallet and load.
- c) Clearance.
- d) Forklift and load turning diameter.
- e) Open aisle area between loaded pallets.

**Loading/unloading operations**

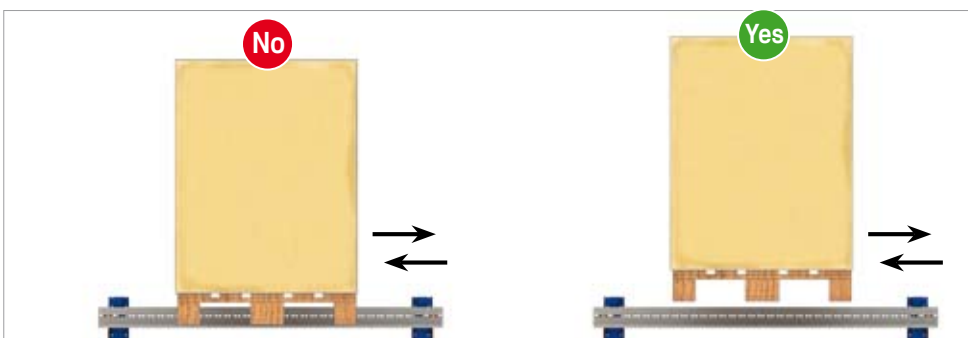
The structure forming the drive-in racking unit is calculated to work under normal service conditions (static loads). These conditions will not be complied with if forklift operations cause collisions, use pulling or pushing movements, places load abruptly, etc.

Therefore, in addition to properly training staff in the use of forklifts (which implies the prevention of accidents), the following aspects in particular must be considered:

- The aisle between loads (e) must allow for a proper turn without the forklift and load colliding into it (d), because there is the necessary clearance (c).
- The speed used to while moving, approaching and removing the load from the rack must be appropriate and adjusted to the nature of the load unit.
- No bumping, rubbing, or dragging must occur when inserting or extracting the forks from the pallet (figure 9).
- The load must be lowered and raised with the forks centred and in the horizontal position. This operation must be done at the lowest speed possible (figure 10).
- Never centre the load unit by dragging it, only by lifting it.
- There must be a clear view of the guides, tracks, supports and the frames bordering the cavity where the manoeuvre is taking place, as well as of any load units adjacent to the unit being handled.



**Figure 9**  
Placing the pallet parallel to the rail.



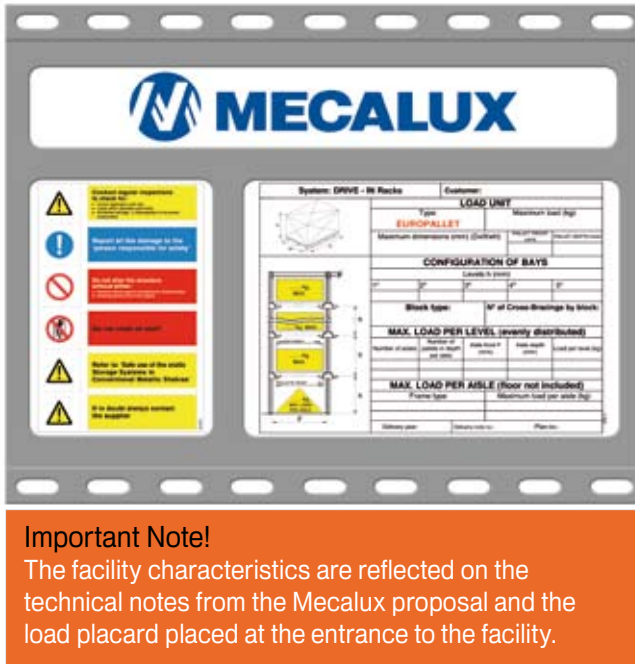
**Figure 10**  
Do not drag the pallets on the rails.



## Drive-in pallet racking system (Drive-In and Drive-Through)

For safety reasons, the pallets used in this system must be in perfect condition, as the bottom skids must withstand a high degree of applied force and any breakage may cause the stored load to topple.

The factors to bear in mind when using drive-in storage systems include:



### Factor 1. Established design

The established design must not be varied in any shape or form (load units, geometry...) without consulting Mecalux technical departments.

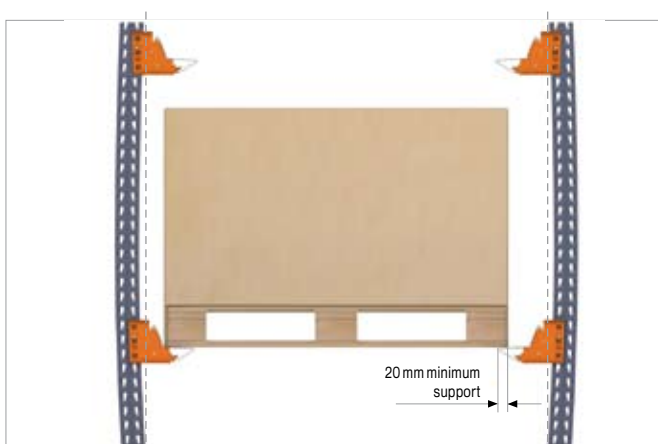
It is expressly prohibited to:

- Modify the height of the levels.
- Modify the number of levels (even when maintaining the load per frame).
- Modify the bars.
- Remove or add levels.
- Use the facility in such a way that damages its principal components (frames, beams, safety pins, braces...).
- Use the facility without its components (frames, beams, safety pins, braces...).
- Use the facility when the frame is out of alignment.

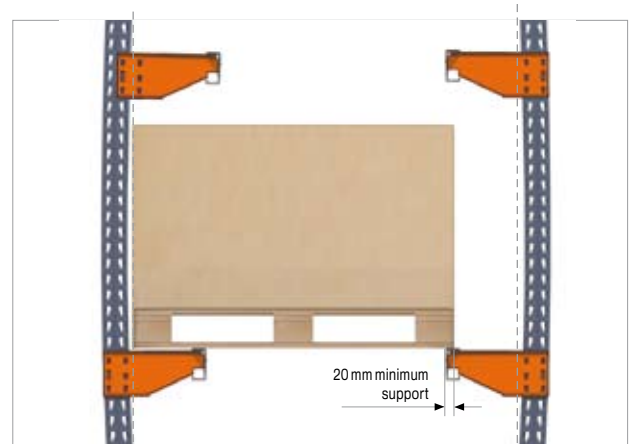
### Factor 2. Placing the load units

The load unit must be placed in the correct position.

With centering rail.



Without centering rail.

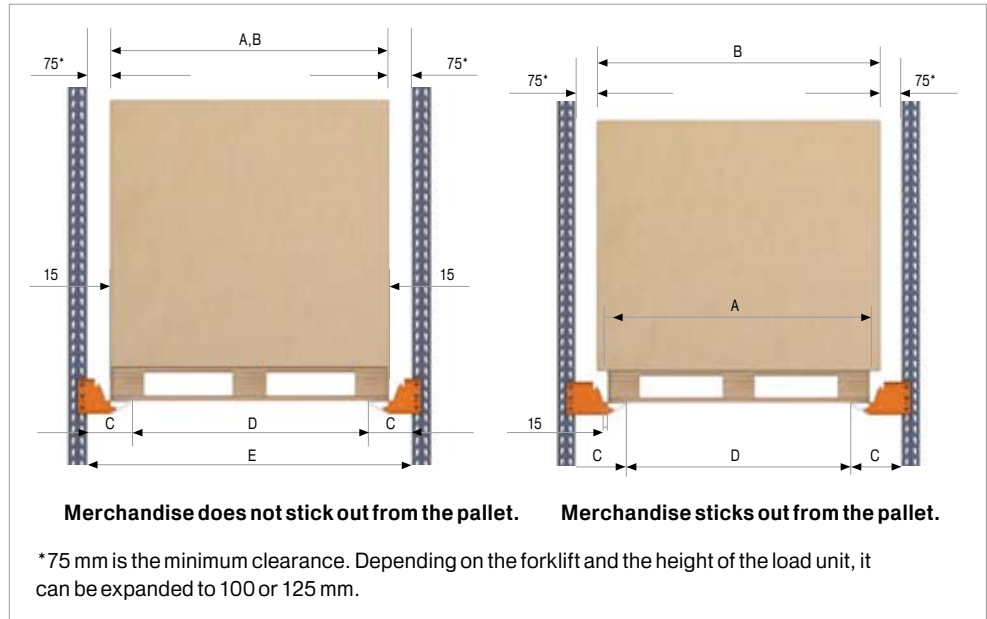


In the most unfavorable conditions, pallets are held on a rail supported by a minimum of 20 mm without a centering wall, where the pallet is placed on the extreme left.

**Factor 3**  
**Abide by clearance margins**

The most common clearances to adhere to are:

With centering rail.



Front clearances (in mm)				
A	B	C	D	E
1,200	1,200	161	1,027	1,350
1,200	1,250	186	1,027	1,400
1,200	1,300	211	1,027	1,450
1,200	1,350	236	1,027	1,500
1,200	1,400	261	1,027	1,550

**Height**

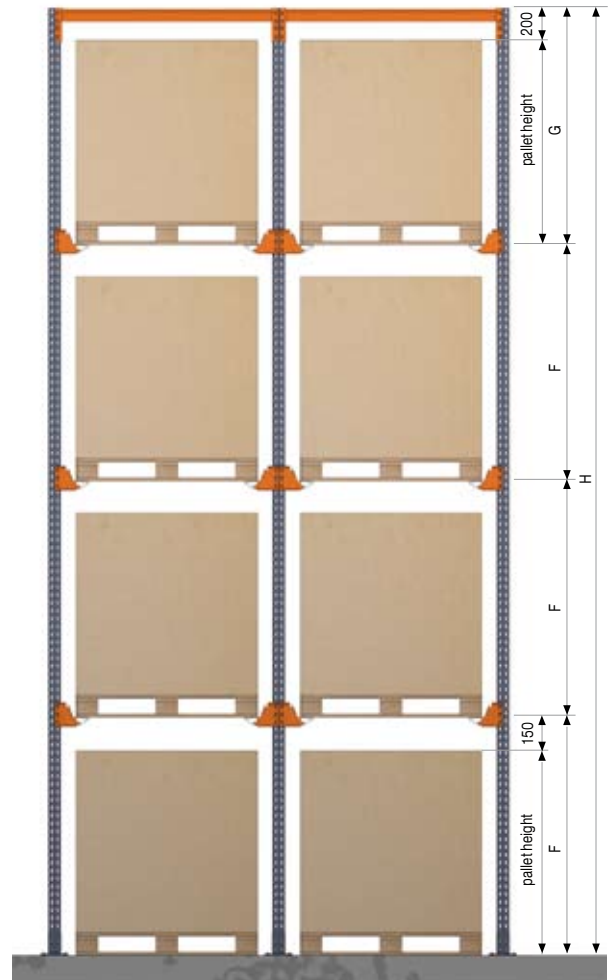
The minimum height measurements to consider are the following:

F: Lower level and intermediate level heights = pallet height + 150 mm.

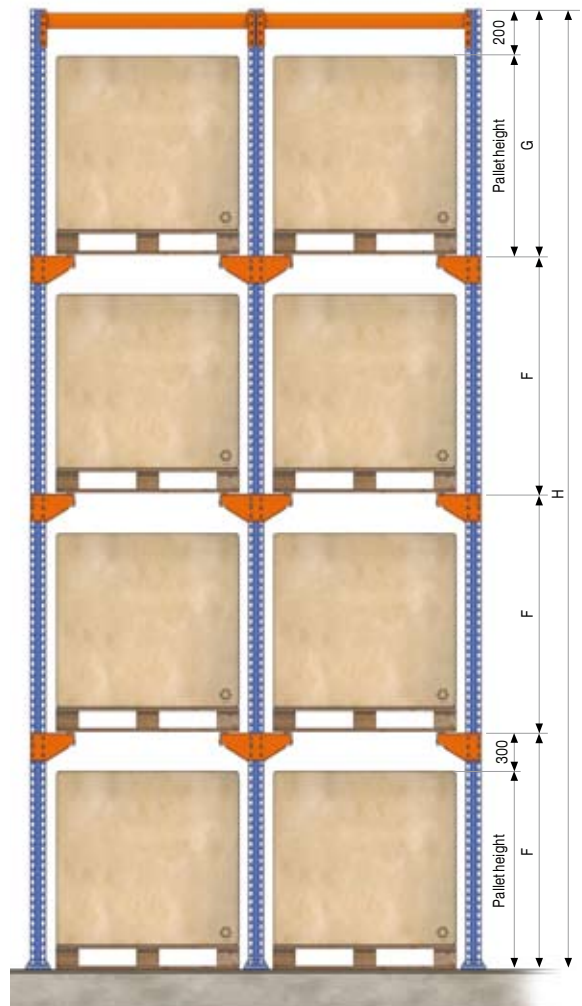
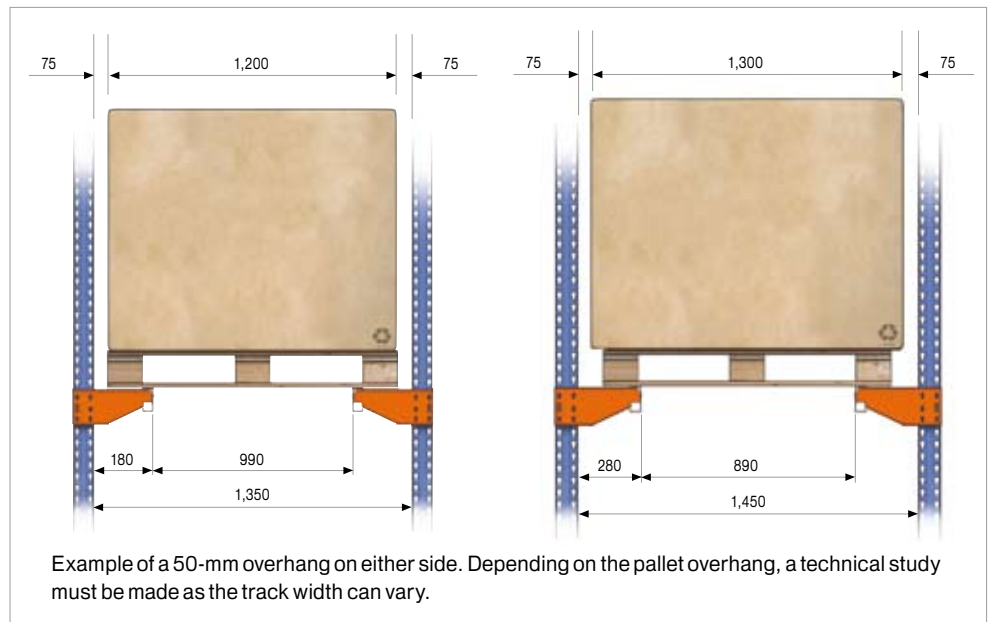
G: Top level height = pallet height + 200 mm.

H: Total height = the sum of at least all the levels.

The F, G, and H heights must always be multiples of 50 mm.



Without centering track.



**Height**

The height clearances are the following:

F: Lower level and intermediate level heights = pallet height + 300 mm.

G: Top level height = pallet height + 200 mm.

H: Total height = the sum of at least all the levels.

The F, G, and H heights must always be multiples of 50 mm.

**Factor 4**

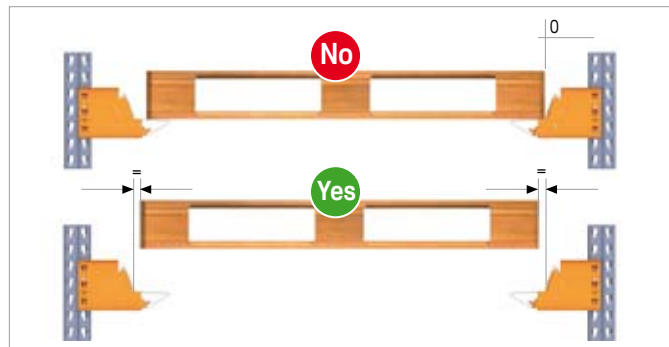
**Placing pallets on racking units**

The structural elements of compact racking units (Drive-In and Drive-Through) must not be used to guide the pallets nor for forklift masts.

When leaving a pallet on a compact racking unit (Drive-In and Drive-Through), the following steps must be taken:

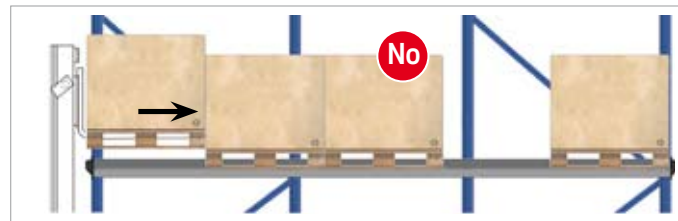
- a) The forklift carrying a pallet must be centered and placed facing the racking track;
- b) The pallet must not be tilted and must be lifted to the required racking level;
- c) The pallet must be aligned with the racking track using the centralizer, without touching the rails and with the load centered with regards to the centering rails or tracks;
- d) The forklift must move forwards from the entry to the racking position keeping the pallet and mast clear of the centering rails and other structural elements of the compact racking unit (Drive-In and Drive-Through);

Place the pallets facing the correct direction.

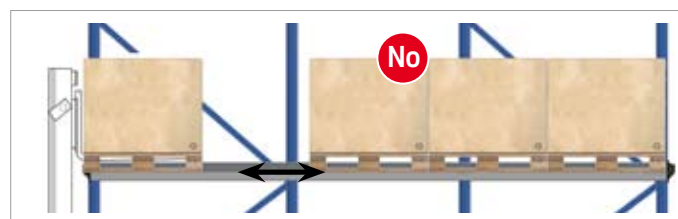


- e) The pallet must be lowered onto the centering rails carefully and without touching other pallets or elements from the compact racking unit (Drive-In and Drive-Through) and then the forks removed. Once on the centering rails, pallets must not be dragged or moved along the centering rails.

Do not push the pallets with the forklift.



Do not drag the pallets over the tracks.





f) loading and unloading sequence from the racking unit. The compact racking unit (Drive-In) must be loaded and unloaded as shown in the illustration below.

Incoming load sequence.



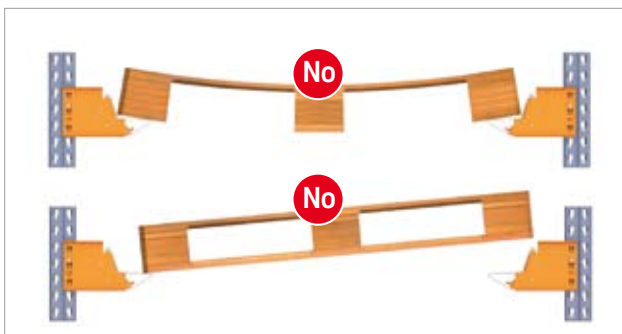
Outgoing load sequence.



g) The forks must be removed from under the pallet while the forklift pulls back carefully along the track and then forks are lowered.

h) Pallets must be adequate, placed on the right side and centered with the track.

Place the pallets facing the correct direction.



Do not move the forklift with pallet turned inside the racking.

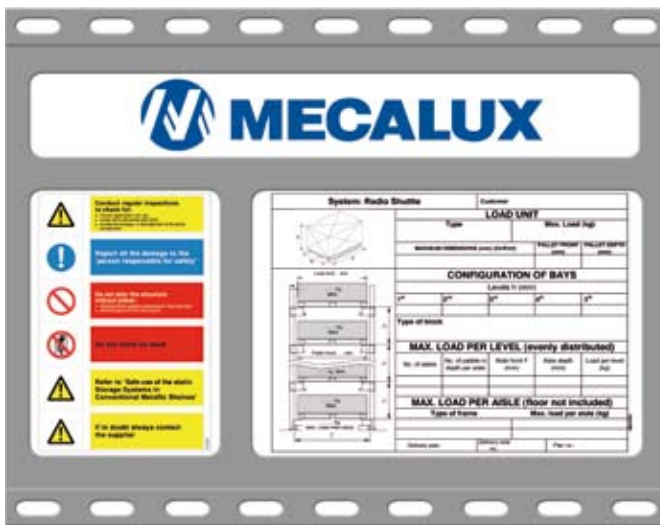


Do not use compact racking units (Drive-Through) as access routes for forklifts. The tracks in Drive-Through staking units are designed to leave or take pallets; they are not designed to be used as access routes. To access pallets use the passage or maneuvering tracks located between racking units or at the end of the units as necessary.

### Radio-Shuttle pallet racking systems

For safety reasons, the pallets used in this system must be in perfect condition, as the bottom skids must withstand a high degree of applied force and any breakage may cause the stored load to topple. Pallets with a deflection or deformation higher than 25 mm loaded should not be used and with a minimum support of 22 mm per side on supporting rails.

The factors to bear in mind when using drive-in storage systems include:



#### Important Note!

The facility characteristics are reflected on the technical notes from the Mecalux proposal and the load placard placed at the entrance to the facility.

#### Factor 1. Established design

The established design must not be varied in any shape or form (load units, geometry...) without consulting Mecalux technical departments.

It is expressly prohibited to:

- Modify the height of the levels.
- Modify the number of levels (even when maintaining the load per frame).
- Modify the bars.
- Remove or add levels.
- Use the facility in such a way that damages its principal components (frames, beams, safety pins, braces...).
- Use the facility without its components (frames, beams, safety pins, braces...).
- Use the facility when the frame is out of alignment.

#### Factor 2. Placing the load units

The load unit must be placed in the correct position.



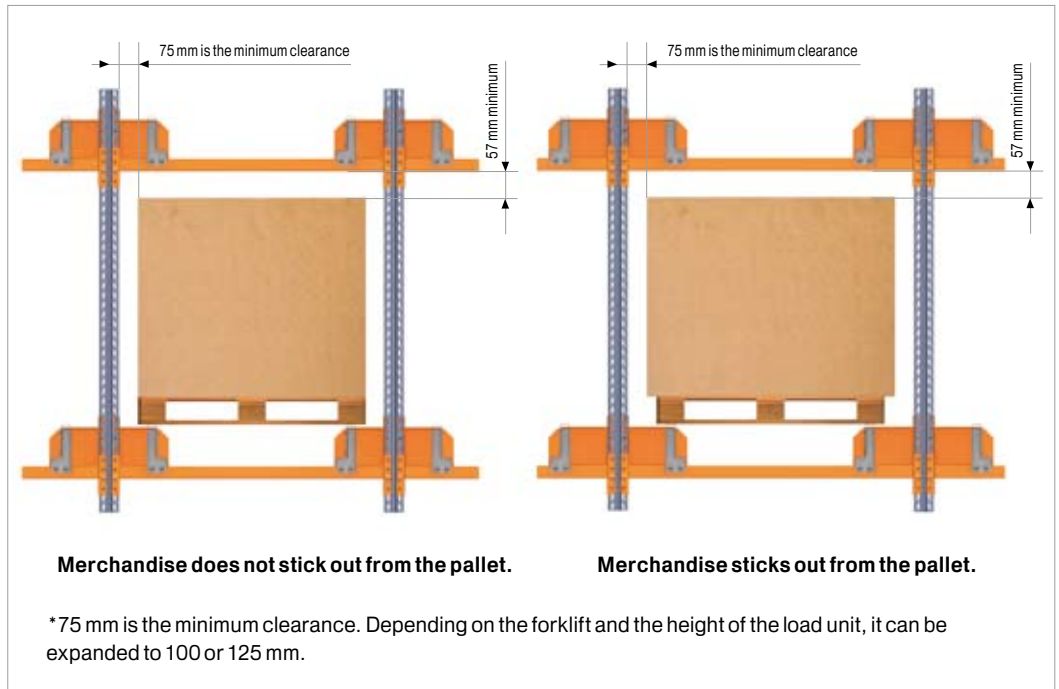
Centered



De-centered

**Factor 3**  
**Abide to clearance margins**

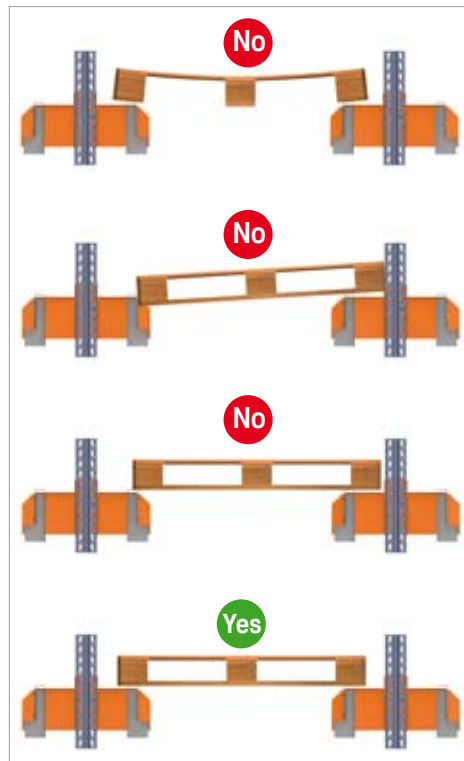
The most usual clearances to adhere to are:



**Factor 4**  
**Load shapes**

Place the pallets facing the correct direction.

Do not move the forklift with pallet turned inside the racking.



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# Inspection and maintenance

## Inspecting the storage system

### According to EN 15635:

There must always be a person responsible for the storage equipment safety (PRSES). Racking and the storage system area must be regularly inspected, and done so specifically when any damage has occurred to either.

A thorough maintenance program is to be executed for the entire facility, with the recommendation that this be carried out by or in accordance with the manufacturer of the racking system. These programs must include the following aspects, among others:

**A)** Upon the establishment of preventive maintenance programs, checklists are to be created to easily and effectively carry out inspections and report any irregularities detected.

**B)** The establishment of a periodic inspection plan to detect, report and record plainly visible irregularities, such as the order and cleanliness of storage and circulation areas, deformed structural components, defects in verticality, weaknesses in the floor, missing safety pins, deteriorated load units, etc., in order to proceed with their immediate repair.

**C)** If the degree of stock rotation and the number of working hours in the warehouse are both quite high, a specific plan of periodic inspections must be established to report any damages, which as a minimum shall entail:

- **Daily sight inspection** carried out by warehouse personnel to detect plainly visible irregularities such as: deformed crossbeams and/or frames, cracks in the floor, absence of levelling shims, broken fasteners, missing safety pins, worn load units, missing signs and placards, damage to the floor or slab, etc. and consequently proceed with their immediate repair or replacement.

- **Weekly inspection** carried out by the warehouse manager (PRSES), who shall verify the verticality of the structure and all the components on the lower levels (1st and 2nd), properly notifying, qualifying and reporting any damages.

- **Monthly inspection** carried out by the warehouse manager (PRSES), which also includes the verticality of all levels in the facility and general aspects regarding the order and cleanliness of the warehouse, properly notifying, qualifying and reporting any damages.

- **Annual inspection** carried out by an independent expert who is competent and experienced in this activity. A report shall be delivered notifying, valuing and communicating damages.

All repairs or modifications which result from the racking status reports must be carried out by qualified independent personnel or the manufacturer's own staff with the racks removed of all loads, except if a prior study has been performed on the risks of carrying out repairs with a partial or full load.

After an impact, and according to the resulting damages, any deformed structural component shall be repaired or replaced, verifying the verticality of the racking unit. The new component must be identical to the one replaced and it must never have been submitted to heat (soldering included), as this alters the mechanical performance of steel. In any case, and while the racking unit has not been repaired, it must be unloaded, removed from service, and properly indicated as such.

All potential causes of any form of damage must be investigated so as to reduce or eliminate the possibility of this problem arising and avoid the damage from re-occurring.

Any observation regarding the status of the structures and floor shall be written down in a register stating the date it was observed, the nature of the irregularity detected, any repair work done and the date thereof. It also must include any information related to the loads.

The resulting evaluation of damages or safety issues must constitute the basis for establishing damage prevention measures.

### Immediate warning

Any personnel detecting damages at the facility must immediately report them to the warehouse manager.

Consequently, all warehouse personnel will receive formal instructions on how to safely operate the system, thus guaranteeing their own safety and that of others.

**Important note on customer/user responsibility in EN 15635:**

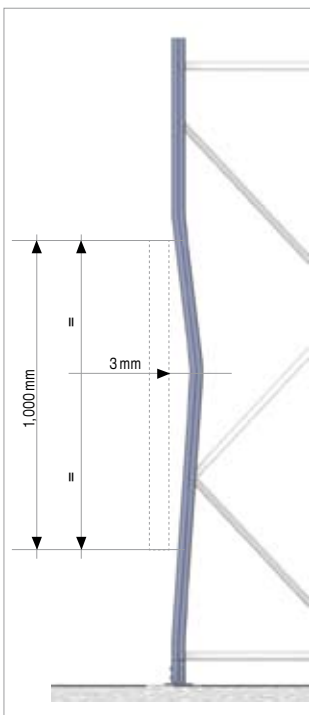
The customer/user is responsible for the safety of people and for maintaining the equipment (racking units, stackers, etc) in safe working order.

They are therefore also responsible for ensuring that inspections specified above are performed and that the information stated in the regulation is observed; this includes designating a person to be responsible for the storage equipment safety and preparing a risk prevention plan for the facility.

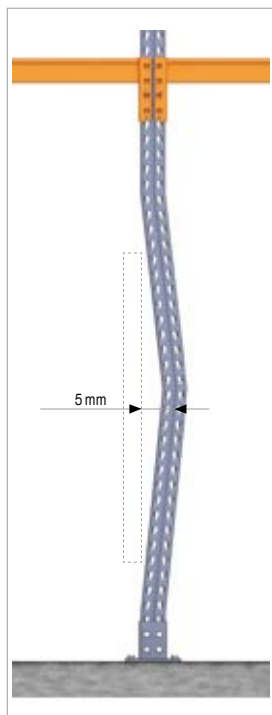
**Inspecting the frames**

Illustrations A, B and C display a few examples of critical deformation.

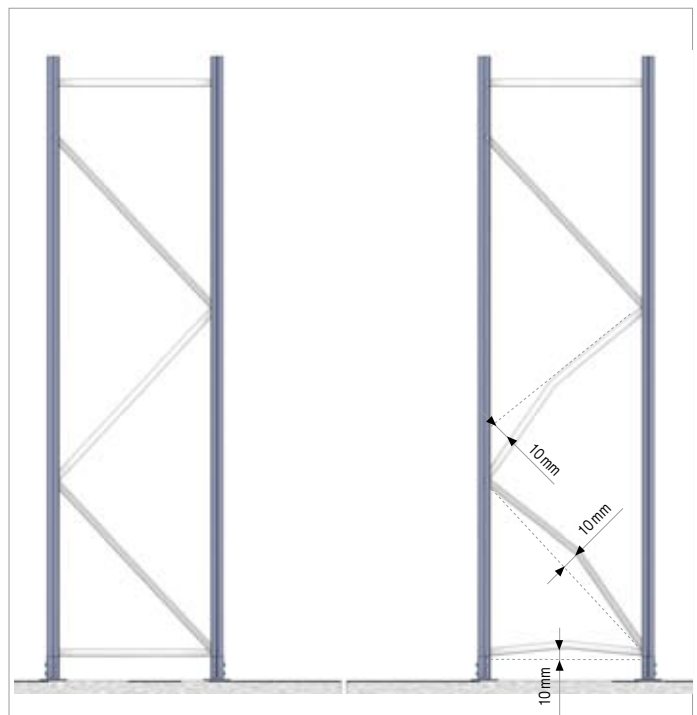
In order to properly check for structural deformations, a 1-metre rule is placed against the upright, situating its halfway point in the area of greatest deformation, as shown in drawings A and B.



**A)** Uprights bent in the direction of the frame's plane having a permanent deformation equal or greater than 3 mm, as measured from the centre of an interval 1 meter long.



**B)** Uprights bent in the direction of the crossbeam's plane having a permanent deformation equal or greater than 5 mm, as measured from the centre of an interval 1 meter long.



**C)** Permanent deformations equal to or greater than 10 mm in components of the horizontal and diagonal lattice, in any direction. For lengths less than 1 meter, the value of 10 mm can be interpolated linearly.



According to convention, bar deformation is classified in green, amber and red status.

**Green:** when deformations are not greater than the previous illustrations. This level only requires monitoring and the facility does not need to lower its storage capacity.

**Amber:** when the deformations are greater than the previous illustration but do not surpass twice this value.

**Red:** A red hazard is considered when the deformations are twice as much as those specified in the previous illustrations, or if there are creases, shearing or dents. The frame is considered out of service whatever the measured distance may be, and thus classified as the highest damage hazard level.

In any case, even when the indicated limits have not been reached, bear in mind the load capacity of the frame has been severely reduced. In the case of doubt, remove the frame from service.



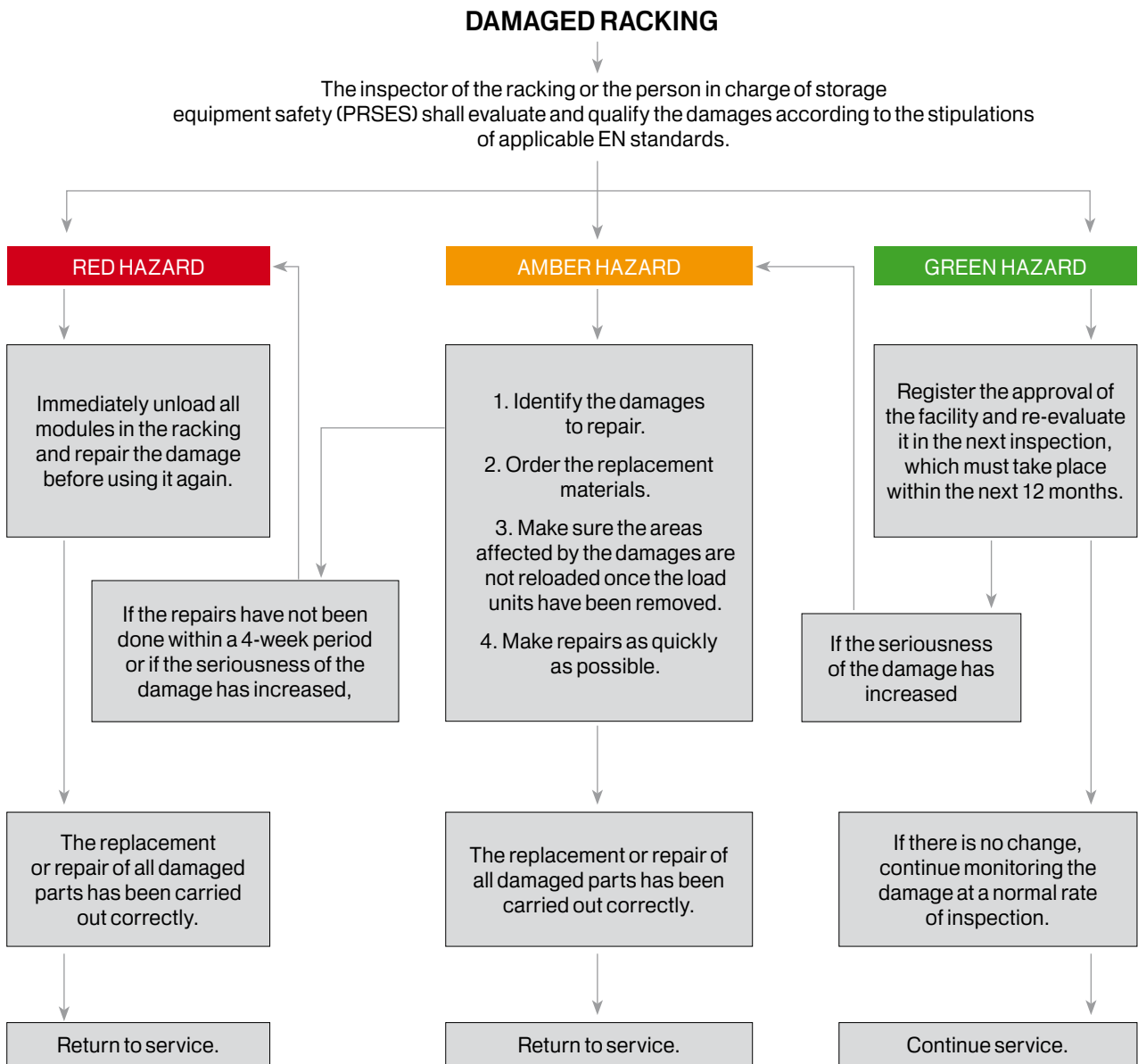
Gouged upright.



Dented upright.

### Inspecting the racking system

The following flow chart outlines the procedure to follow in the event the racking has been damaged.



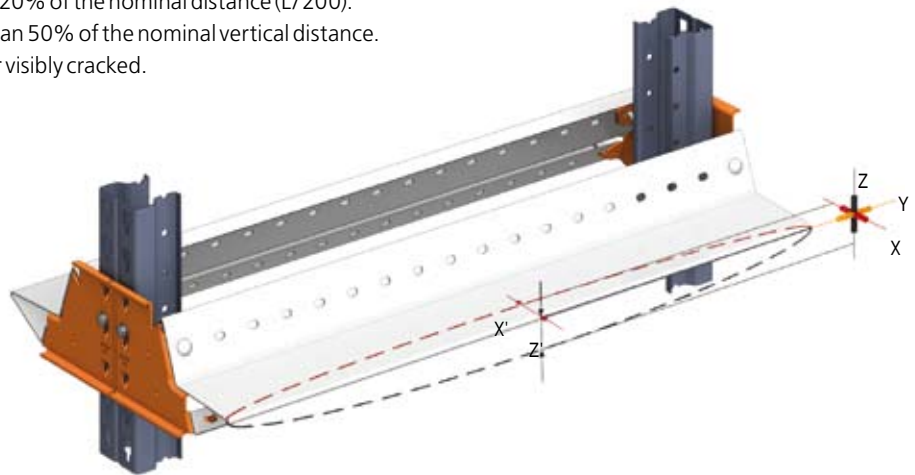
Inspection procedure for classifying damages.

## Inspecting the rails (pallet bars or pallet centering rails GP-7) and arms (brackets)

### Drive-in racking system (Drive-In and Drive-Through)

In the following cases, the arms and/or rail affected must be unloaded and replaced.

- Dents in the rail.
- Residual vertical deformation greater than 20% of the nominal distance ( $L/200$ ).
- Residual horizontal deformation greater than 50% of the nominal vertical distance.
- One or more arms tabs are torn off, open or visibly cracked.
- Deformed arms.



### Drive-in beam (crossbar)

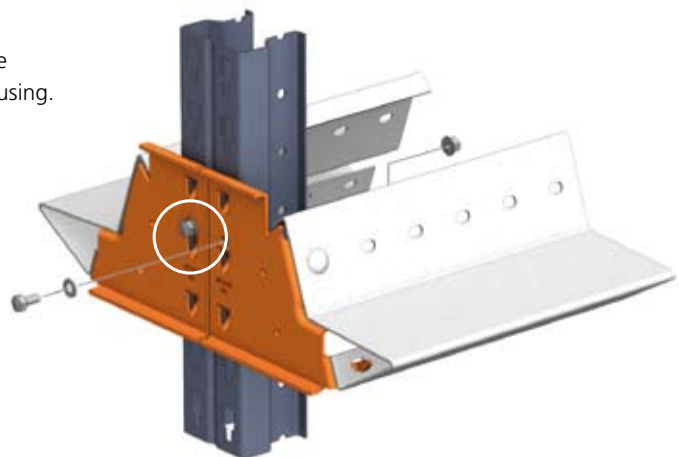
In the following cases, the crossbeams affected must be unloaded and replaced.

- The soldered bracket joints are cracked or broken.

Localized damage in the form of dents, splitting, etc. must be evaluated individually, and in the case of doubt, the level must be unloaded and the damaged crossbeam changed.

### Safety pins

It is essential that all crossbeams have both their safety pins in place to prevent the beam from being accidentally displaced from its housing.

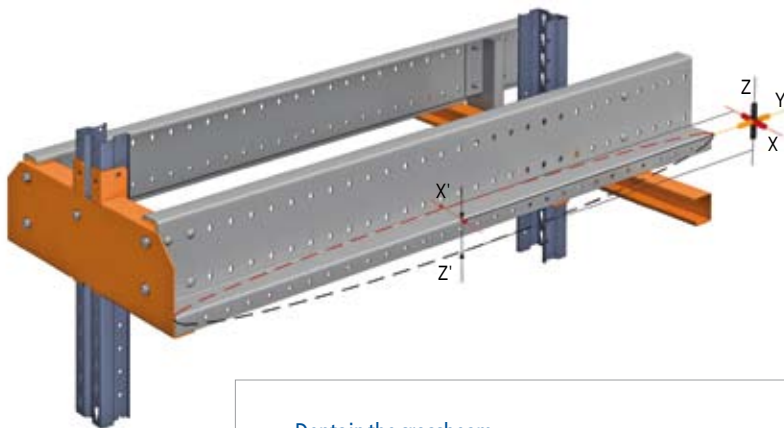


## Inspecting the rails (pallet bars or pallet centering rails) and arms (brackets)

### Radio-Shuttle pallet racking systems

In the following cases, the arms and/or rail affected must be unloaded and replaced.

- Dents in the rail.
- Residual vertical deformation greater than 20% of the nominal distance ( $L/200$ ).
- Residual horizontal deformation greater than 50% of the nominal vertical distance.
- One or more arms tabs are torn off, open or visibly cracked.
- Deformed arms.



Dents in the crossbeam



Splitsoldered joint on the bracket



### Drive-in beam (crossbar)

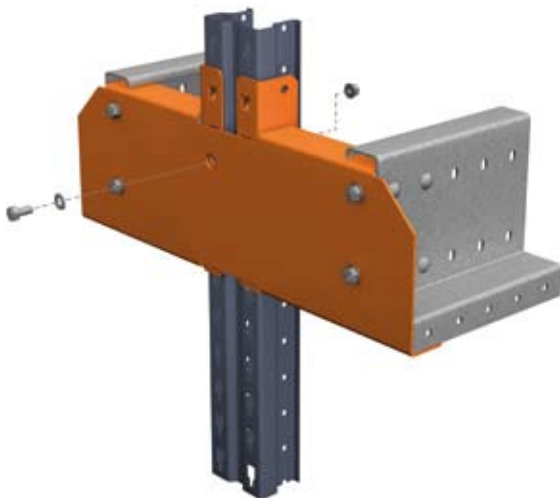
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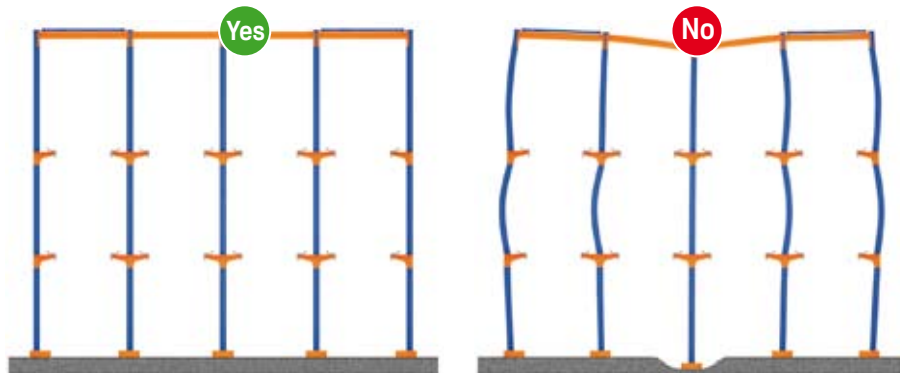
## Inspecting the floor and aisles

The floor, as a principal component of the facility, must be checked for the following aspects:

### Horizontal alignment

The floor must respect the horizontal alignment for which the warehouse has been designed. Any irregularities in the floor can be corrected by using metal shims placed below the footplates of the storage system. Make sure the placement of these levelling shims is correct.

The slab must have the proper resistance to bear the pressure transmitted by the frames footplates.

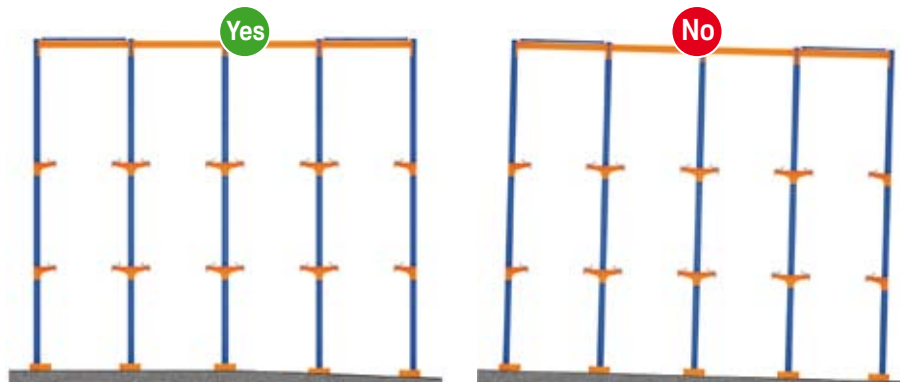


### Resistance

The floor must not have areas that appear to have sunken, as this may cause the facility to collapse. The floor must have the proper resistance to bear the loads that the storage system transmits to the footplates.

If the areas of the slab begin to sink or shift, the frame verticality may be at risk.

Any irregularities in the floor can be corrected by using levelling shims, which must be perfectly lodged beneath the footplates. An erroneous positioning of these shims will increase the pressure on the slab and even cause the frame to be out of alignment.



### Cleanliness

All walking and operating aisles and traffic areas must be kept clean and free of obstacles in the aim of creating safe operating conditions. This means avoiding at all costs:

- Placing obstacles in the middle of the aisle so as to minimize the risk of impacting the storage system.
- Oil spots, split liquid or anything else that may cause the lifting equipment to lose their traction or personnel to slip.



## Inspecting the load units

Keep a close eye on the pallets to ensure they are in good conditions, replacing any which are damaged as stipulated in EN standard 15635, annex C.

What's more, a pallet may no longer be used if:

- Its nail heads stick out above the slats.
- The wrong parts have been used (the slats or spacers are too thin, narrow or short).
- The general condition of the pallet is so poor that it cannot handle its load capacity (the slats are rotten or the slats and/or spacers are warped or bent) or there is a risk of spoiling the merchandise.

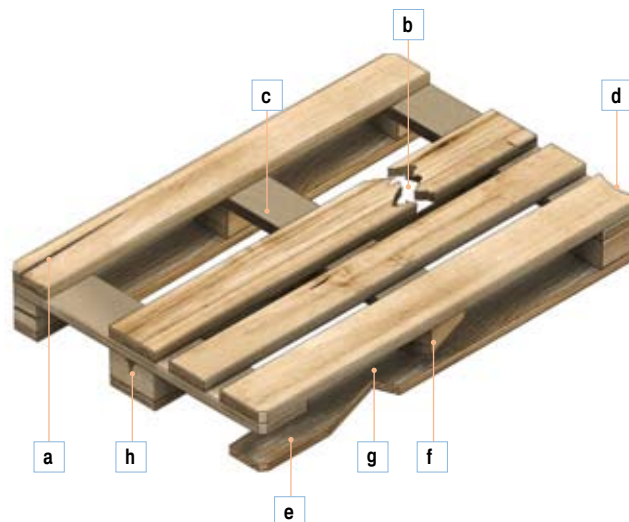
Skid pallets can no longer be used if, in addition to the previous deficiencies:

- Their slats are broken or missing.
- There is wood missing in the guide skids to such a point where in one slat, two or more nail spikes are visible, or in more than two slats, one or more nail spikes are visible.
- The spacers are missing, broken or warped, or set in such a way that a nail spike is visible.
- Its required marking is absent or illegible.

The previously mentioned indications are also valid for any type of pallet existing on the market today.

Also, the quality of the pallet must ensure that a pallet supported by 20 mm at each side doesn't deform beyond 25mm.

- a) Cracks in any of the top slats in along the width or length of its midsection.
- b) A top slat is broken.
- c) A top slat is missing.
- d) Wood is missing on a top slat over more than a third of its width.
- e) A spacer is missing.
- f) A spacer(s) is turned more than 30°
- g) Wood is missing on a top slat between two spacers and in more than ¼ of its width, or when the nails are visible.
- h) Wood is missing or there are cracks in the spacers in the mid sections or at the top of the spacer.



## Inspection and maintenance

Pallets and containers set aside due to wear shall be kept under control using a system that impedes their return to use in the warehouse.

Make sure that merchandise located on the pallets is kept in good condition, stabilized and strapped down and/or shrink-wrapped.

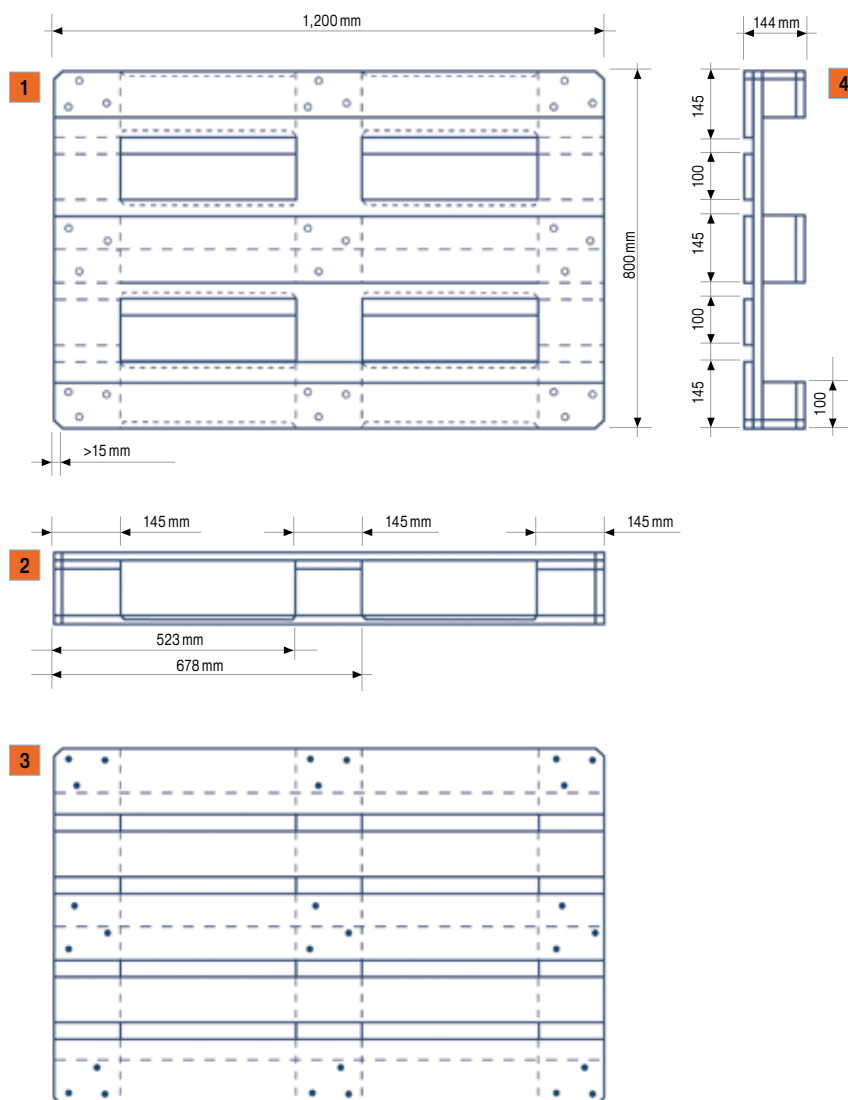
Make sure that load units do not surpass:

- The maximum nominal weight established for the design and use of the warehouse.
- The maximum nominal dimensions established for the design and use in the warehouse.

Standardised pallets shall adhere to the stipulations in the corresponding regulations:

- **EN 13382**: pallets for handling merchandise. Standard dimensions.
- **EN 13698-1**: specifications for producing pallets. Part 1: specifications for constructing 800x1,200 mm flat wooden pallets.
- **EN 13698-2**: specifications for producing pallets. Part 2: specifications for constructing 1,000x1,200 mm flat wooden pallets.

As an example, take the dimensions of an 800x1,200 mm euro-pallet.



- 1) Bottom view
- 2) Front view
- 3) Top view
- 4) Side view



Checking before operation.

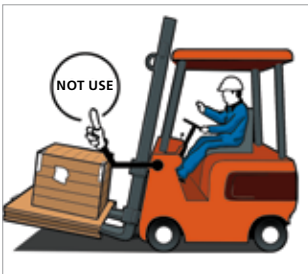
## Inspecting the lifting equipment

### When operating

In this section there is a set of general indications to consider when the lifting equipment being used is a forklift. Nevertheless, facility users must follow the specific indications provided by the manufacturer of these types of machines.

The forklift operator shall inspect the vehicle's main safety mechanism daily, checking the proper condition and operation of:

- the steering system,
- the horn,
- the turning and warning lights,
- reverse gear beeper,
- general brakes and parking brake,
- the driver retention system (safety belt),
- the structural safety equipment,
- the forks and the lifting and tipping systems,
- the condition of the pneumatic system,
- the oil levels and condition of the battery (cleaned and properly connected),
- the access areas are clean,
- the lack of signs or indication which require its immobilisation.



Disabled forklift.

If there are any irregularities, immediately report to the direct superior and stop using the forklift. If the forklift is not working, take this opportunity to label it with a description of its status. Smoking is prohibited while operating a forklift or while handling the battery.

### Parking

Once finished operating the forklift, the following instructions must be carried out:

- Park it in the area intended for this purpose. Never do so on a ramp or slope.
- Set the parking brake.
- Put the gears in neutral.
- Lower the forks as far as possible.
- Tip the forks forward.
- Stop the motor.
- Safeguard the forklift against improper use. The starting key must solely be in the possession of its authorized driver, who shall remove it when leaving the vehicle.



Parking.

### Other considerations

**Paint imperfections.** Make note of any imperfections in the body paint that leave the steel bare, especially in places with aggressive environmental factors.

**Racking related incidents.** Many of the incidents that affect storage systems can create hazardous conditions. This is why it is recommended to immediately contact the manufacturer to make a rapid evaluation of the damage and repair it to re-establish service under the maximum safety conditions.

The Mecalux Group has a **technical inspection department**, which acts on its own initiative or on prior contact by the customer. It revises those facilities where the high volume of lifting equipment may lead to the greater wear of the structural components, checks they are in proper working conditions, and ensures that the user safety guidelines are being followed. The Mecalux Group provides its customers with warehouse safety manuals so that the operators at their warehouse can use the racking systems appropriately and safely.



**Evaluation checklist for drive-in system  
(Drive-In and Drive Through) and Radio-Shuttle**

Date: ..... / ..... / .....

RACK	FRAME N°	IN FRONT	INTERIOR	FRAMES									
				Type: .....			Height..... mm		Depth ..... mm				
				Green	Uprights Amber	Red	Diagonals in poor condition	Footplates in poor condition	Anchor bolts in poor condition	Vertical Good	Bad		

RACK	MODULE	LEVEL	IN FRONT	INTERIOR	BRACKETS/BRACKETS				SUPPORT RAILS		PALLET CENTERING RAIL		BASE/GUIDE RAILS		RAIL STOPPERS	
					Type: ..... Lenght..... mm				Model		Model		Model		Model	
					Green	Amber	Red	Missingsafety pins/screws	Left	Right	Left	Right	Left	Right	Left	Right

**OTHER ELEMENTS IN POOR CONDITION**

Vertical bracing .....	Horizontal bracing .....	Protectors .....
.....	.....	.....

**COMMENTS**

If after the evaluation, the condition of any component has not approved any of the points indicated, contact the Mecalux technical inspection service.



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Mecalux offers to all its customers a special technical inspection service carried out on completion of installation, as well as for advice in case of changes, damages to the racking or alterations.

In the event of any accident at the installation, please notify our technical inspection department immediately for a quick and proper inspection and/or repair to be made.

In this way we hope to continue making strides towards our ongoing quality control goals which we have been building on for years to offer our customer better and better service.

