



Warehouse Safety Manual

Operation, use, inspection and maintenance
of conventional adjustable pallet racking



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MANUAL FOR USING AND MAINTAINING CONVENTIONAL ADJUSTABLE PALLET RACKING (APR)

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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 EN15635 (Steel Static Storage Systems - Application and maintenance of storage equipment), plus the company's over 50 years' experience in the warehouse sector.

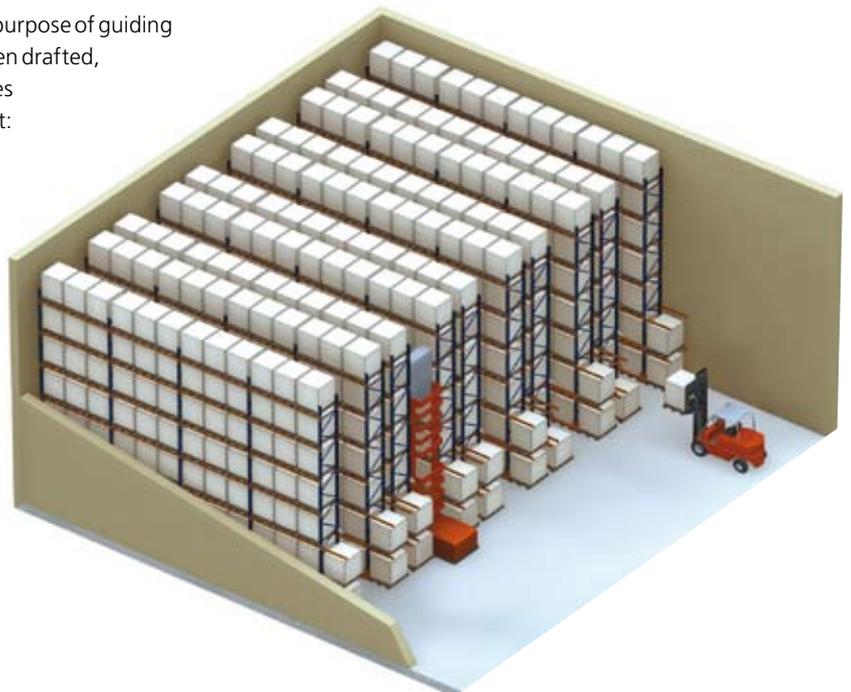
Consequently, this manual should be read carefully and its recommendations strictly applied. The Mecalux Group is available for any consultation on the material that the user may find worthwhile for their facility.

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 made according to the Standard EN-15635.

The Customer must also comply with the specific regulations for this type of installation that are in force in each country.



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.

Special considerations have to be taken into account when it comes to providing storage for plastic or metal based loads and containers. These considerations must be clearly identified and firmly established prior to the design. Additional measures may well be necessary which in turn can result in increased maintenance for the system.

Wooden pallet



Metal or plastic pallet

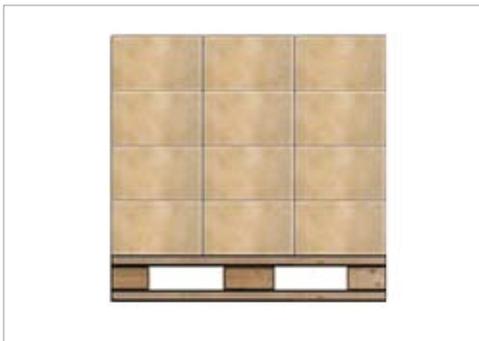


Container



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.



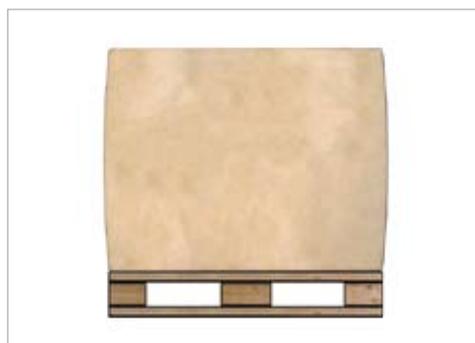
Larger than the pallet, but centred over it.



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/mm².
- 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.
- **Extra-tall forklifts.** Divided into turret trucks, side loaders and order-pickers.
- **Multi-directional forklifts** or four-wheel steered trucks.
- **Stacker cranes.** For automatic facilities.



Stacker



Counterbalance forklift



Stacker crane



Reach truck



Turret truck



Side loader

Choosing these tools is the key to properly handling a palletized warehouse. 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 procedures used to refer to the parts that form the 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 stacker cranes.
- **Class 200:** pallet loaded with a narrow aisle operated by automatically controlled stacker cranes 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.

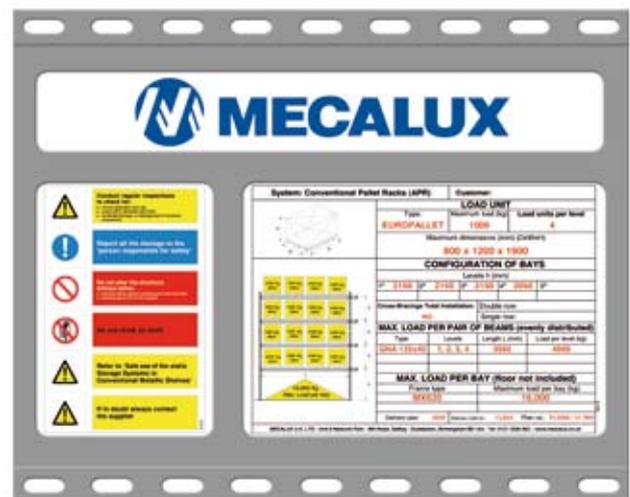
With narrow aisles: pallet loaded with a narrow aisle that can be used by specialized forklifts.

This safety manual only deals with conventional pallet racking system (APR).

Its design was determined from data or specifications provided by the user or representative. To be specific, the characteristics to be considered for conventional pallet systems are comprised in EN standard 15629 (Steel static storage systems - Specifications 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 to the storage system.



Important Note!

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

Conventional pallet racking system

Description and components

Metal racks requiring lifting equipment (forklifts) that permits the storage of various products and provides direct access to them. These racks are basically designed for pallet load units, on occasions manual loading may be used on certain levels.

Description

The basic components of a conventional facility are:

- **Frames:** vertical metal components to support the different load levels.
- **Beams:** horizontal metal components where the loads are deposited and which define the load level (gaps or cavities) together with the frames.
- **Anchor bolts:** metal parts used to fasten the structure to the floor, as determined by the forces the racking units must bear and the characteristics of the floor itself.

The use of the following components is recommended in order to reduce the risk of accidents:

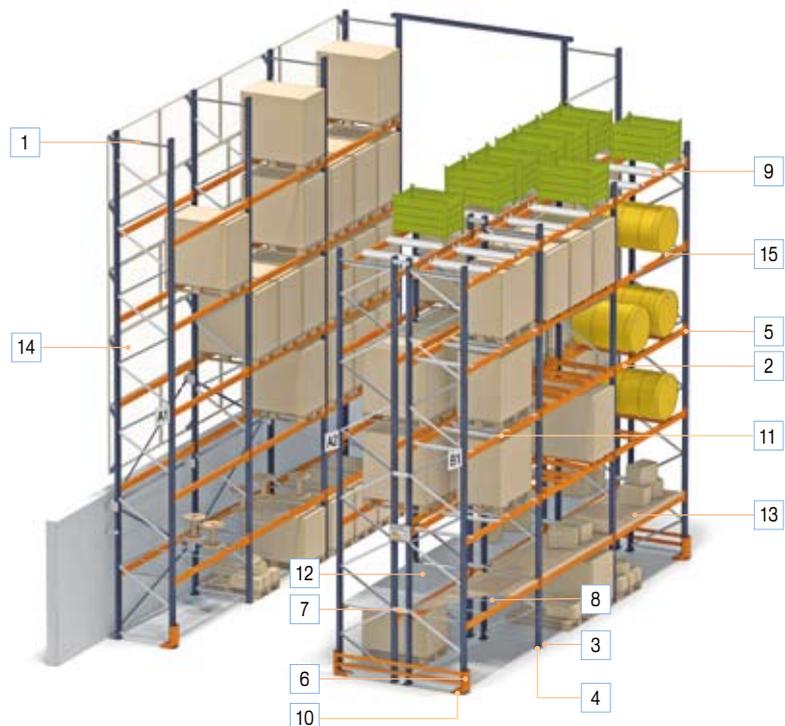
Protectors

These are metal parts designed to absorb impacts during handling or manoeuvring load units.

As specified in EN standard 15512:

- These protectors must prevent impacts on the rack uprights, thanks to the proper training of the operator and adopting the appropriate safety measures, among which includes the use of protectors.
- As a minimum, protectors must be placed on the corner uprights in circulation aisles or at aisle junctions where forklifts change direction.

- 1) Frame
- 2) Beam
- 3) Heavy duty footplates (base plate)
- 4) Levelling shims
- 5) Safety pins
- 6) Upright protector and end frame protection
- 7) Row spacer (frame spacer)
- 8) Support crossbeam
- 9) Container support bar
- 10) Anchor bolts
- 11) Pallet crossbeam
- 12) Picking level
- 13) Standard/Melamine chipboard
- 14) Anti collapse mesh (safety mesh)
- 15) Drum support



Your installation may include only part of the above mentioned components.

The drawings and the technical quote provided indicate the constructive system installed at your warehouse.

Upright protector

Used mainly to protect uprights in operating aisles.

Side protector

Specially used to protect corner uprights in circulation aisles and/or junctions.

Frame protector

Specially used to protect frames located in the main circulation aisle and/or junctions.
All protectors installed must have a minimum height of 400 mm and be capable of absorbing forces of at least 400 mm in any direction and at any height between 100 and 400 mm, according to EN 15512 stipulations, section 6.4.1. c.



Upright protector

Frame protector

Side protector

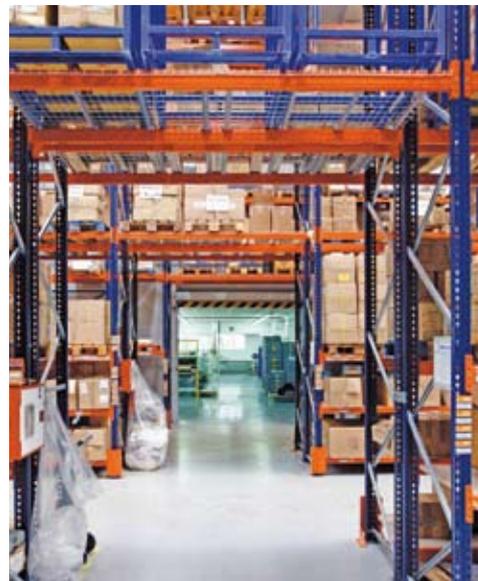
Safety mesh

When the load unit is not shrink-wrapped or its safety features are insufficient to prevent the merchandise from falling, a safety mesh must be installed. A single racking unit that borders a work or foot traffic area must be protected by the safety mesh to prevent the accidental toppling of materials, possible crushing, etc.



Racks and mesh horizontal protections

The standard EN 15629 indicates that the passageways for pedestrians or forklifts that pass under or through racking or shelving shall be provided with overhead guarding, generally on the first load level, to prevent any stored goods from falling through the racking.



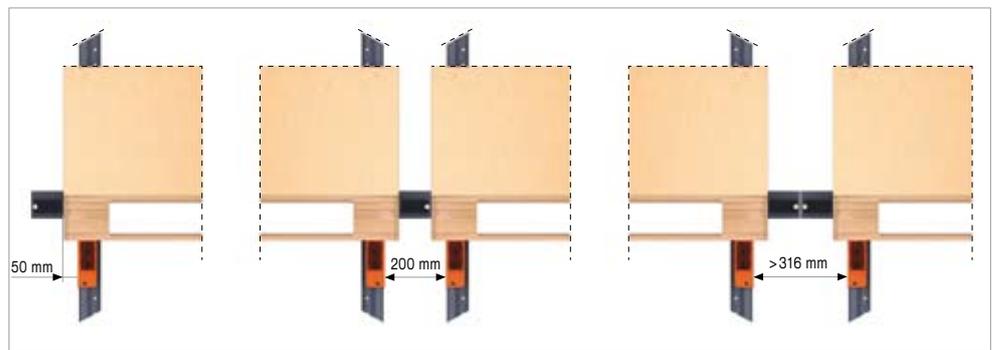
Conventional pallet racking system (APR)

The following components must be available when the initial specification is requested:

Positioning bar

This consists of a bar placed in such a way so the pallet (not the load) is kept in constant contact.

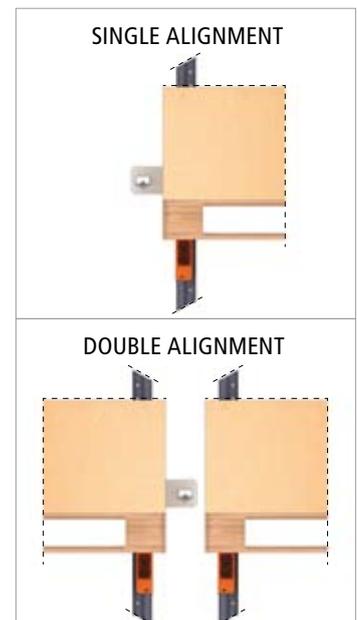
This component can be placed only when the racking has been designed to sustain the impact and the thrust indicated in EN 15512.



Safety bar

This constitutes a system that prevents the load unit from toppling, but its purpose is not to resist forces applied during positioning. It cannot be used as a way of intentionally braking while manoeuvring, as it is the load (not the pallet) that presses against the safety bar.

The accessory is designed as a safety feature to prevent any possible toppling or collisions of the load units for a manoeuvring error in the lifting devices. It can be placed as long as the design provides the required space.



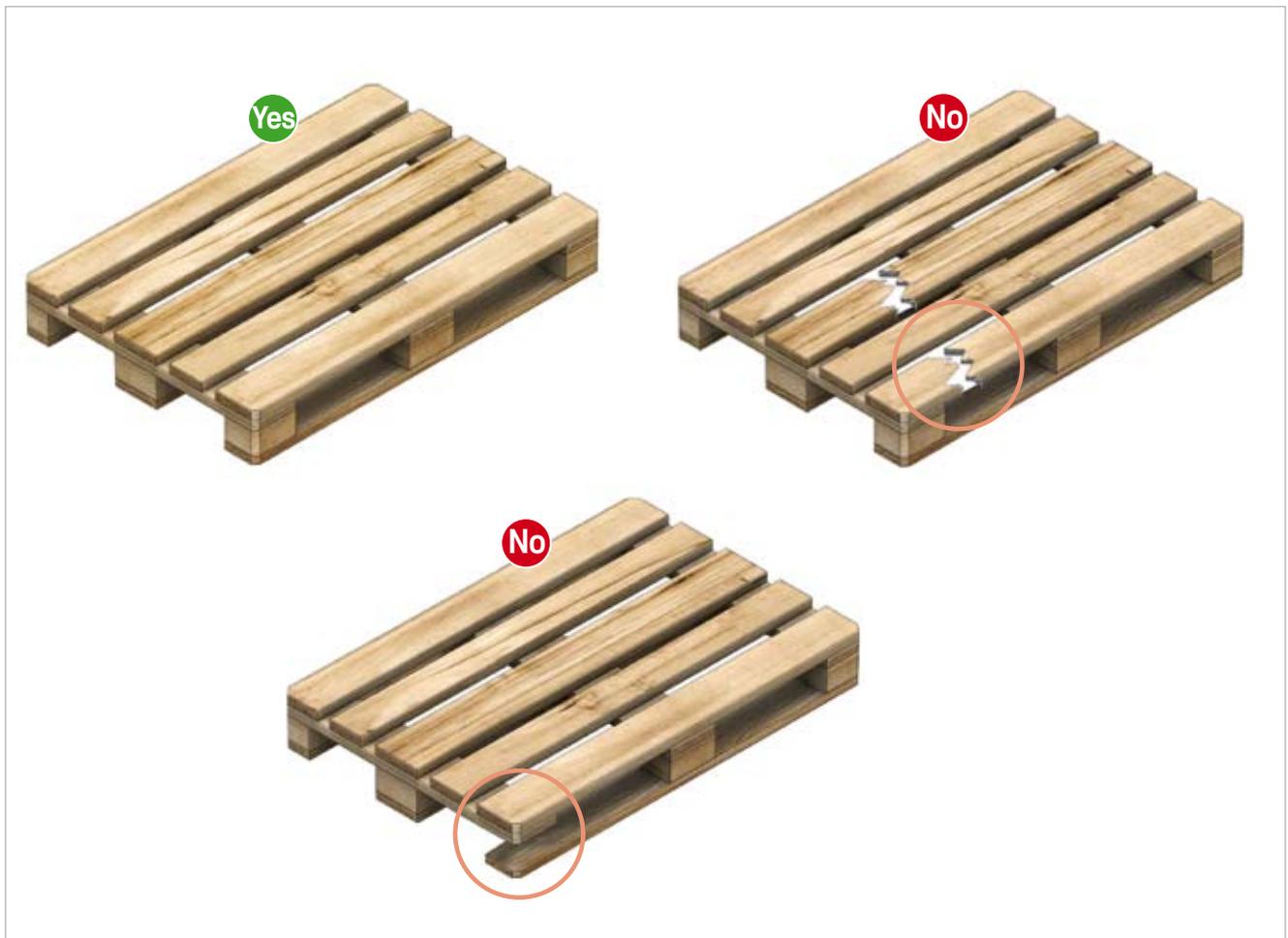
Using the equipment and racking system

Load units

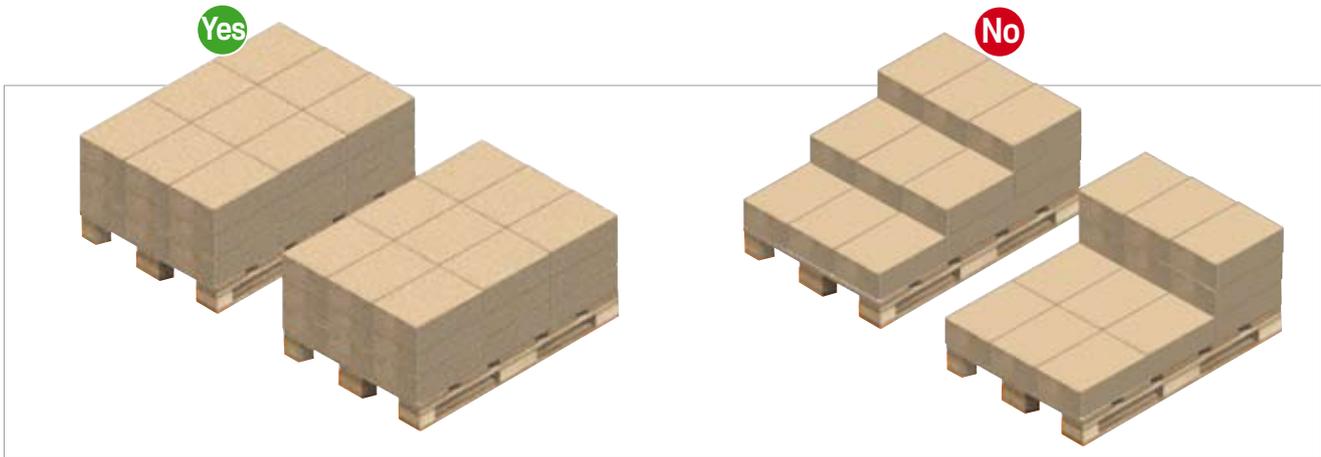
The load units, formed by the pallet or container plus the merchandise, must adhere to the following requirements:

- 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 with 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 the recirculation of damaged pallets in the warehouse.



- 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 800x1200 mm flat wooden pallets.
- **EN 13698-2**
Specifications for producing pallets. Part 2: specifications for building 1000x1200 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.

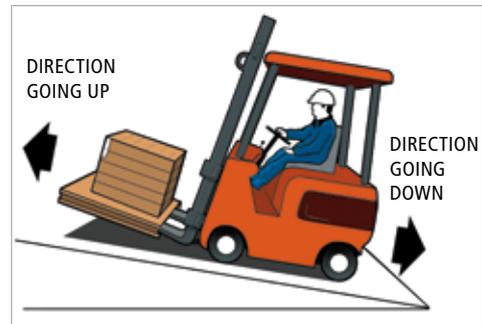


Figure 3
Driving on slopes.

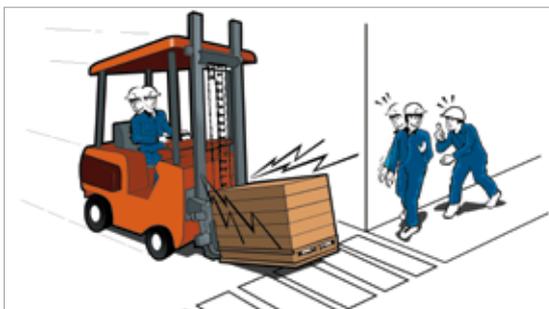


Figure 4
Slow down at intersections.

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 lanes forklifts and pedestrians may be travelling however pedestrians 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.

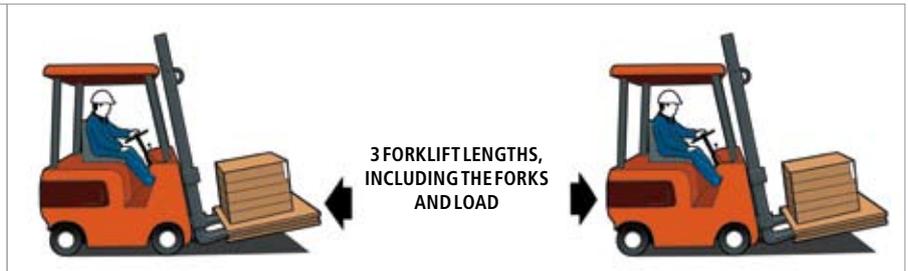


Figure 6
The proper distance between two forklifts.



Figure 7
Work centre speed limit.

Respect all rules and traffic signs. The maximum speed established at work centres is 10 km/h (6mph) 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.

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.

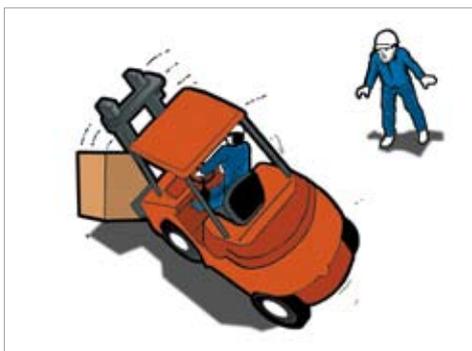
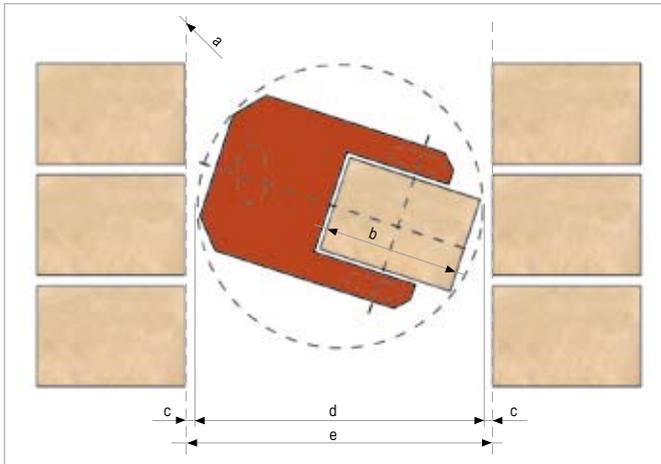


Figure 8
Losing control of the forklift.



- 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 conventional 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 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 while moving, approaching and removing the load from the rack must be appropriate and adjusted to the nature of the load unit.
- The forklift must move vertically toward the gap and be positioned frontally with the load slightly raised from the floor.

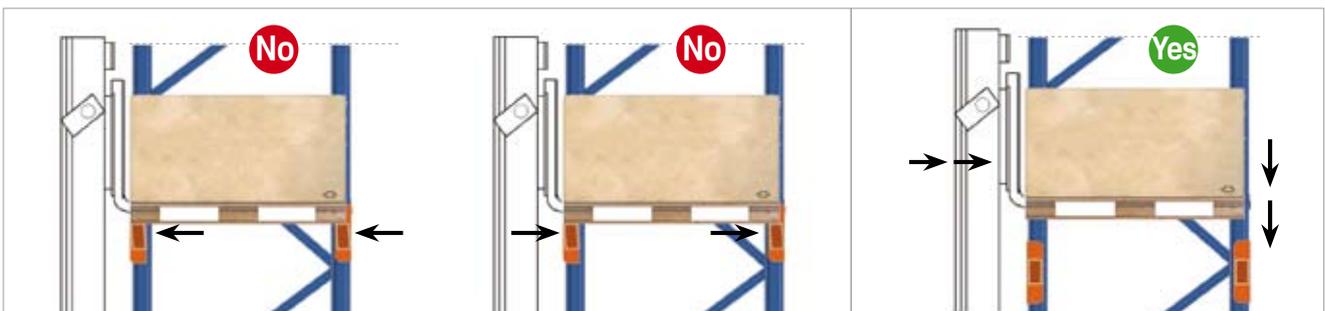
Figure 9
Overloading the crossbeam due to not lowering pallets horizontally.



- 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 crossbeams and frames bordering the cavity where the manoeuvre is taking place, as well as of any load units adjacent to the unit being handled.

Figure 10. The beam rolls by dragging or pushing.

Placing the pallet on the crossbeam.



In addition to overloading, there are other reasons accidents happen to racking units, such as:

- 1) Loading methods (in the cavity, on beams, on modules).
- 2) Poor floor conditions
- 3) Poor racking unit conditions

The factors to bear in mind when using conventional pallet storage systems include:

Important Note!
The facility characteristics are reflected on the technical notes from the Mecalux proposal and the load sign placed at the entrance to the storage system.

Factor 1. Established design

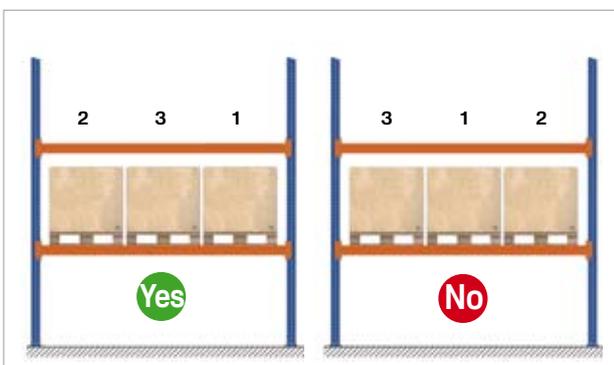
The established design must not be varied in any shape or form (load units, geometry...) without consulting Mecalux technical departments.

It is expressly prohibited to:

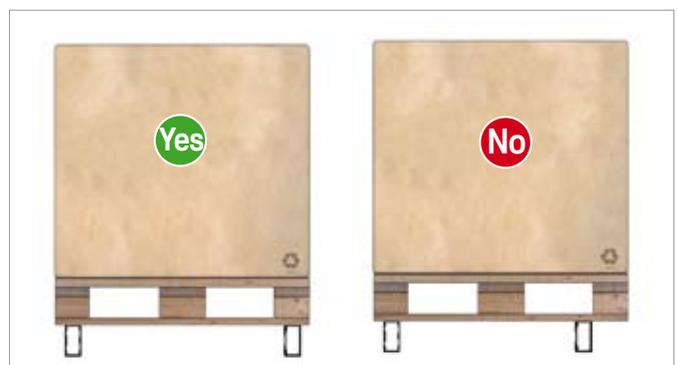
- Modify the height of the levels.
- Modify the number of levels (even when maintaining the load per frame).
- Modify the beams .
- Remove or add levels.
- Use the facility in such a way that damages its principal components (frames, beams, safety pins or catches, braces...).
- Use the facility without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

Factor 2. Placing the load units

When there are more than two load units per cavity, it is recommended to place the ones on the ends first to maintain a certain placement reference, as shown in the drawing.



Placement order.

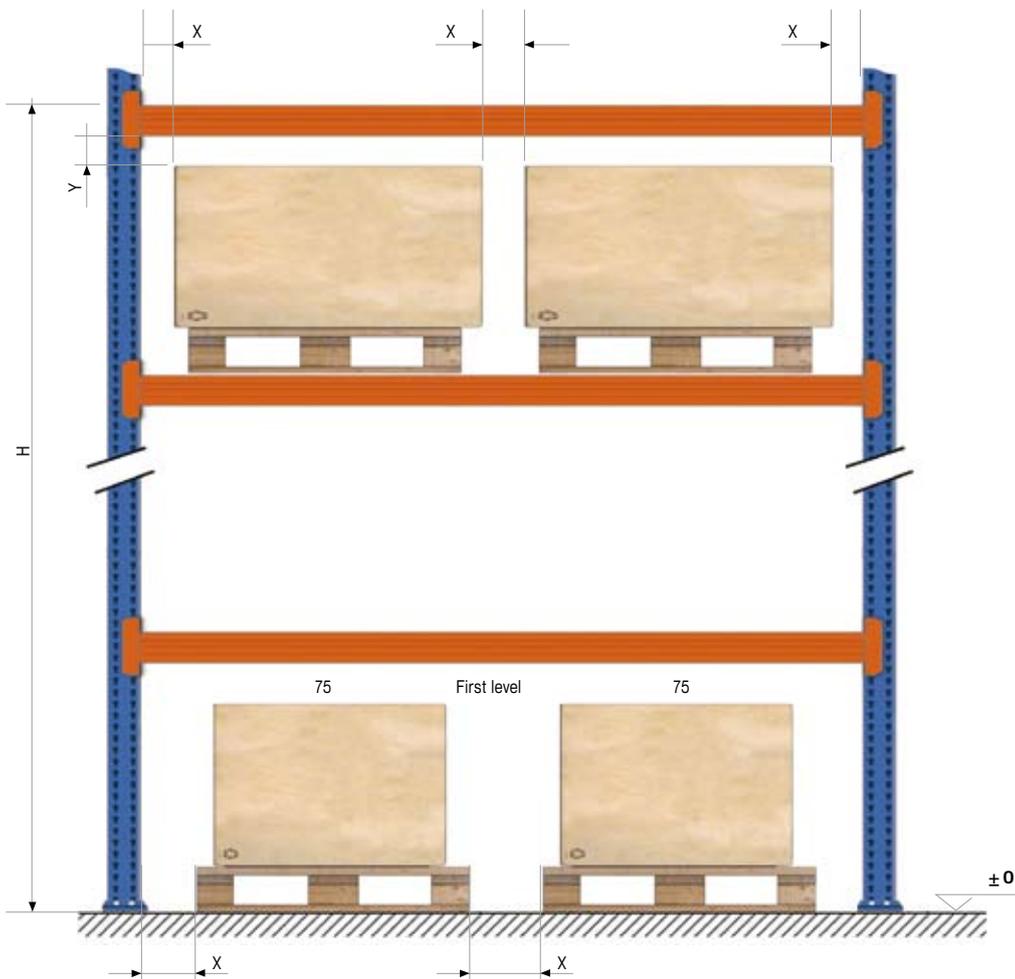


Side centred

The pallet must always be centred over the support beams.

Factor 3. Abide by clearance margins

When placing pallets into position, the clearance indicated in the following figure must be respected:



Clearance in the cavity

Y = height between pallet and the bottom of the beam for levels other than height +0

X = minimum clearance between pallets or loads

Heights in mm

For levels between:	Class 400		Class 300A		Class 300B	
	X	Y	X	Y	X	Y
$0 \leq H \leq 3,000$	75	75	75	75	75	75
$3,000 < H \leq 6,000$	75	100	75	75	75	100
$6,000 < H \leq 9,000$	75	125	75	75	75	125
$9,000 < H \leq 12,000$	100	150	75	75	100	150
$12,000 < H \leq 13,000$	100	150	75	75	100	175
$13,000 < H \leq 15,000$	--	--	75	75	100	175

Cavity/space clearance table, according to EN 15620 applied from January 2009, where:

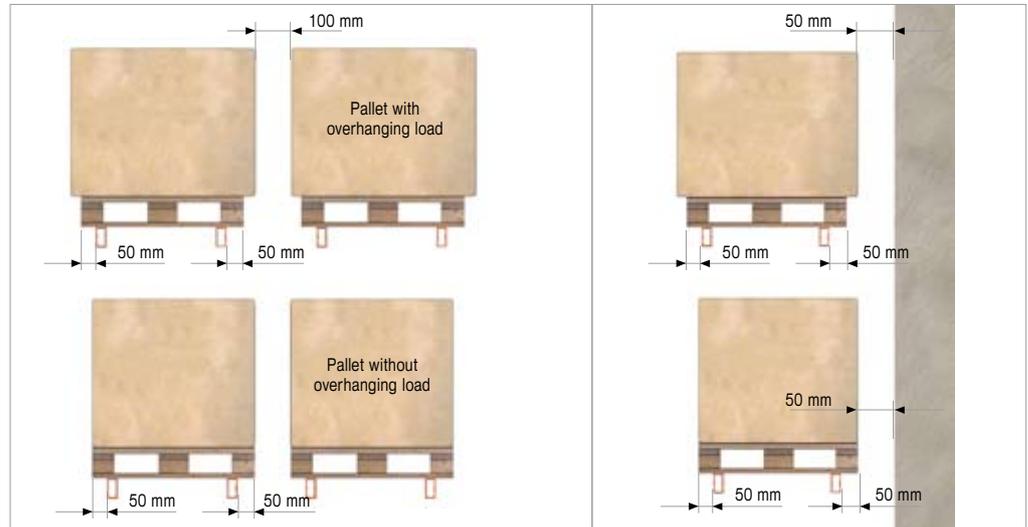
Class 400: counterbalanced forklift or reach truck.

Class 300 A: VNA truck man-up (very narrow aisle).

Class 300 B: VNA truck with man operating at ground level only (very narrow aisle).

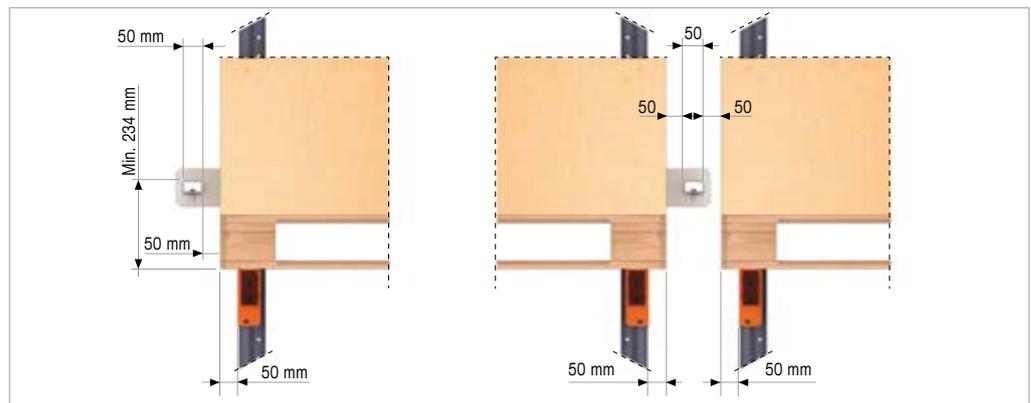
Horizontal clearance in depths without load or pallet bars

Except when the specifications require other clearances, the following guidelines must be respected:

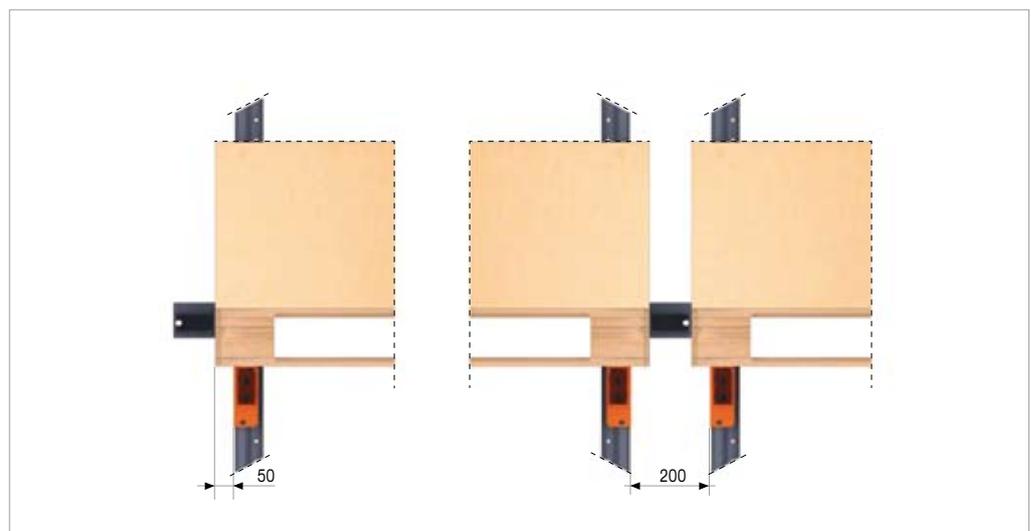


Double alignment

Single alignment



Single and double alignment with safety bar.



Single and double alignment with positioning bar.

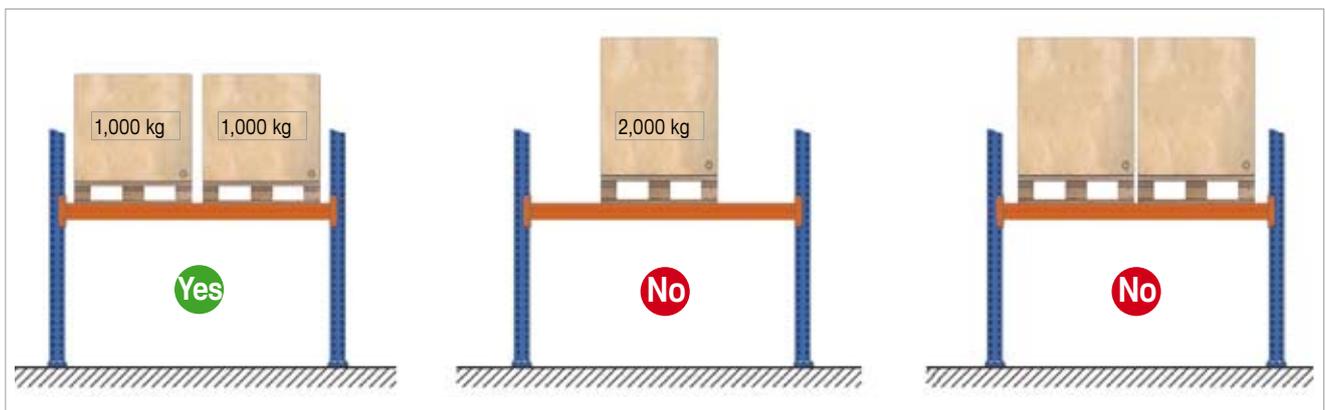
Factor 4. Loading methods

Pallets must be placed with their lower braces perpendicular to the crossbeams, as:

- The support surfaces on the beam must be sufficient.
- The pallet or container corresponds to the model planned for in the original facility design.
- They must be able to bear the deposited load.



Avoid concentrating loads in the centre of the beams, either by putting the pallets too close together or by changing the load unit.



Concentrating load units.

- The beams of the top levels are a good point of reference to facilitate the placing of the pallets.
- A good solution when placing the pallets on the floor is to paint lines indicating where the pallets should be placed ensuring that they do not encroach the working aisle.

Inspection and Maintenance

Inspecting the storage system

According to EN 15635:

There must be a person responsible for storage equipment safety (PRSES).

Racking units 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 units. 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 or catches, 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 beams and/or frames, cracks in the floor, absence of levelling shims, broken fasteners, missing safety pins or catches, 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 person responsible for storage equipment safety (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, person responsible for storage equipment safety (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 expert who is competent and experienced in this activity, properly notifying, qualifying and reporting any 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. 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.

It is necessary to investigate the potential causes of any damage in order to reduce or eliminate the possibility of recurrence. 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 damages caused to the storage system, diminish the resistance and the safety coefficients considered in the calculations there of all damages observed must be reported immediately to the member of staff responsible for the storage equipment safety (PRSES).

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 about the customer/ user responsibility according EN 15635:

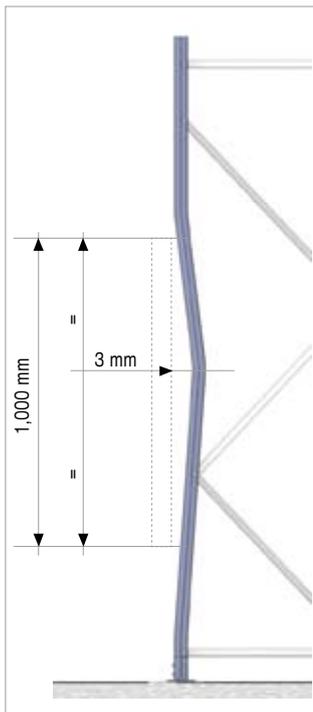
The customer/user has responsibility for the safety of persons and for the safe working condition of the equipment in use (shelving racking, forklift).

Therefore, the customer/user shall be responsible for the fulfillment of all the above mentioned inspections and the requirements of the European Standard, among them, appointing a person with responsibility for maintaining the safe operation of the warehouse storage system and carrying out risk assessments plan.

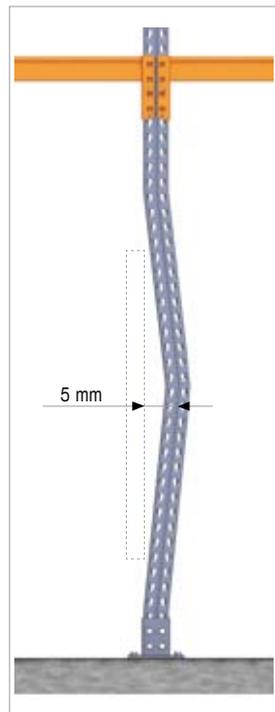
Inspecting the frames

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

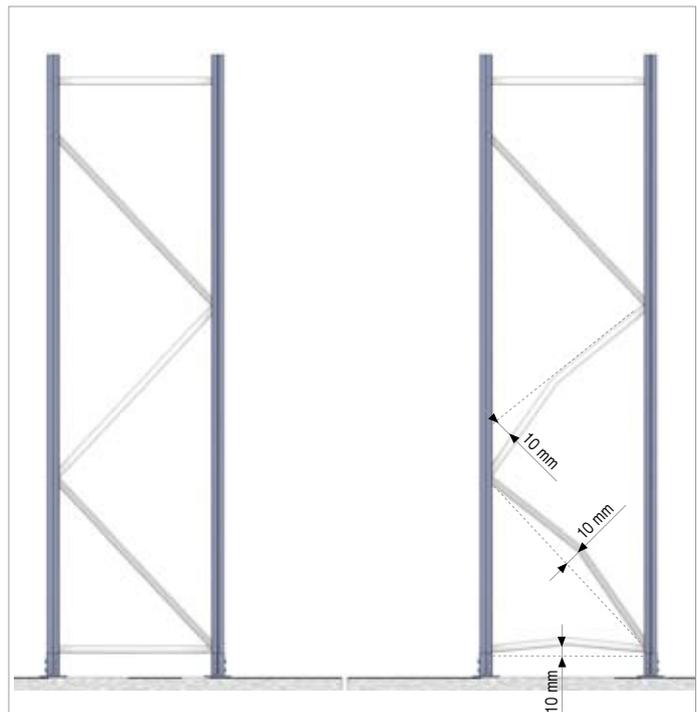
In order to properly check for structural deformations, a 1-metre rule is placed against the upright, situating its halfway point in the area of greatest deformation, as shown in drawings A and B.



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 of 1 meter long.



B) Uprights bent in the direction of the beam's plane having a permanent deformation equal or greater than 5 mm, as measured from the centre of an interval of 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 m, 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 vigilance 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.



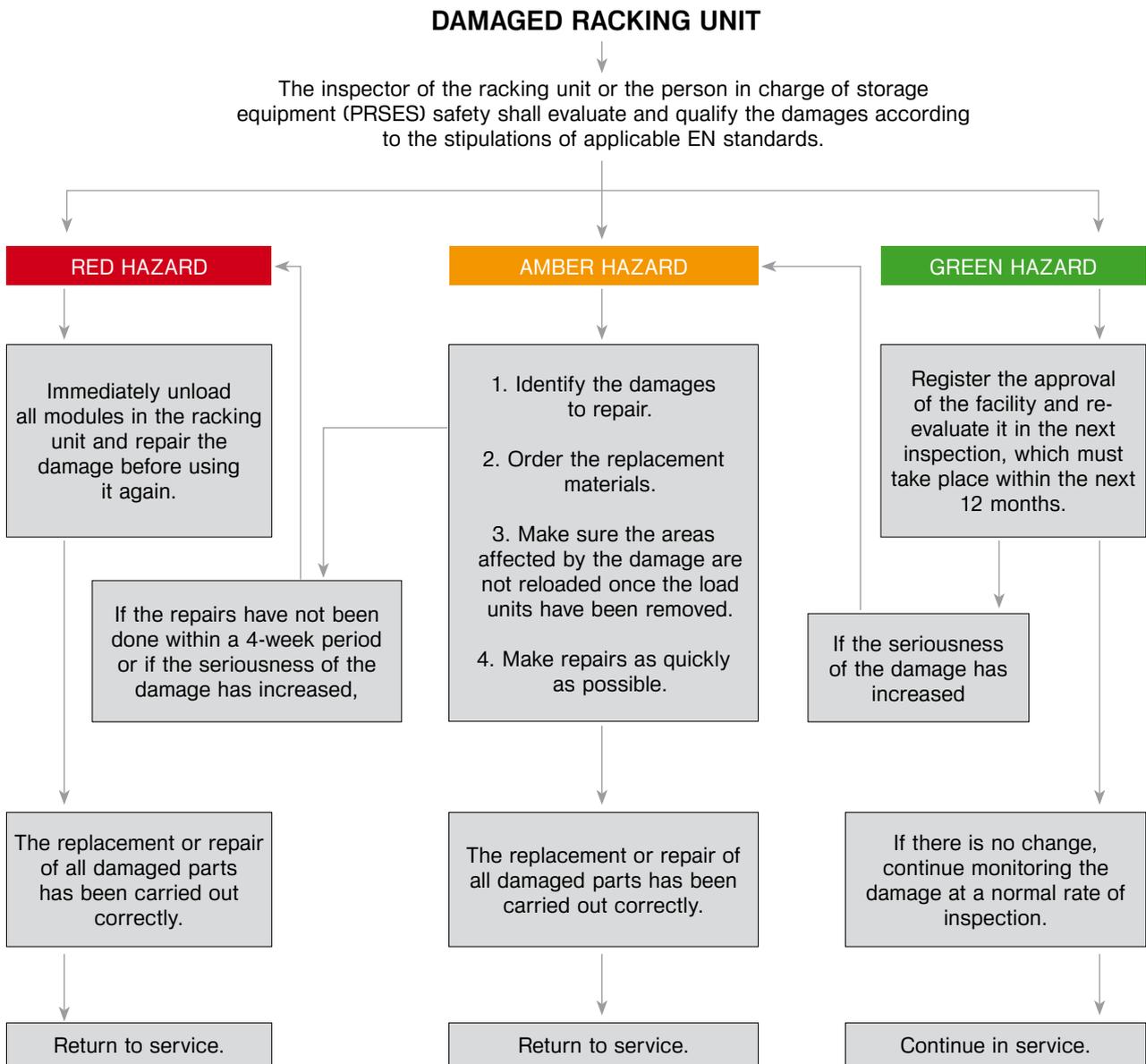
Gouged upright



Dented upright

Inspecting the racking units

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

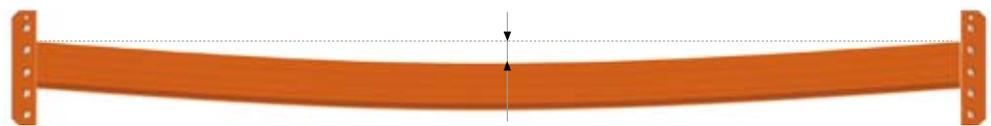


Inspection procedure for classifying damages

Inspecting the beams

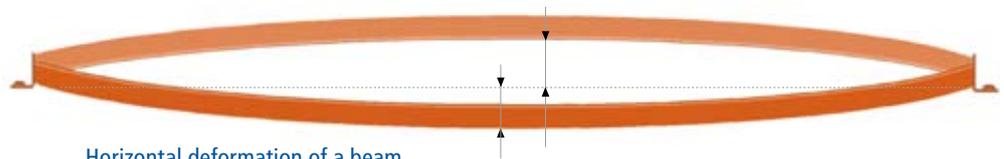
In the following cases, the beam affected must be unloaded and replaced.

- Residual deformation (that which remains after unloading the beam) that is permanent and vertical is greater than 20% of the deformation or nominal distance ($L/200$) with a load.



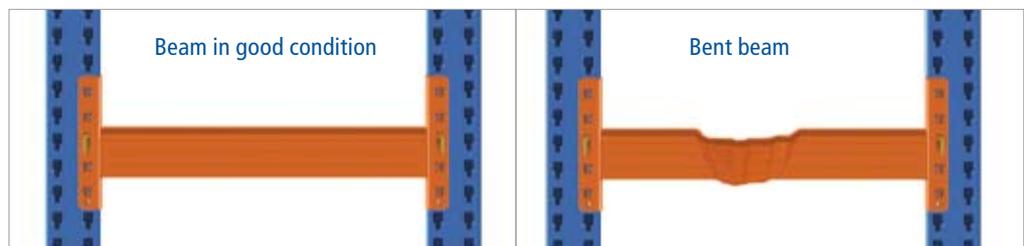
Vertical deformation of a beam

- Residual lateral deformation greater than 50% of the deformation or nominal vertical distance ($L/200$) with a load.



Horizontal deformation of a beam

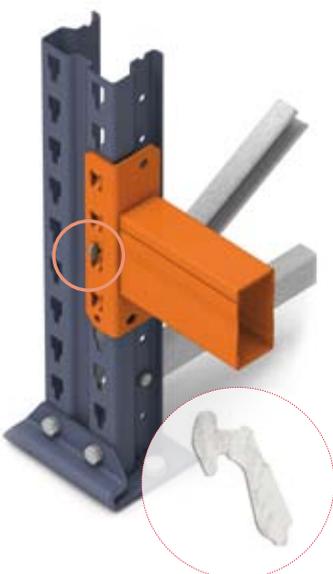
- One or more connector tabs are torn off, open or visibly cracked.



Localised 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 beam changed.

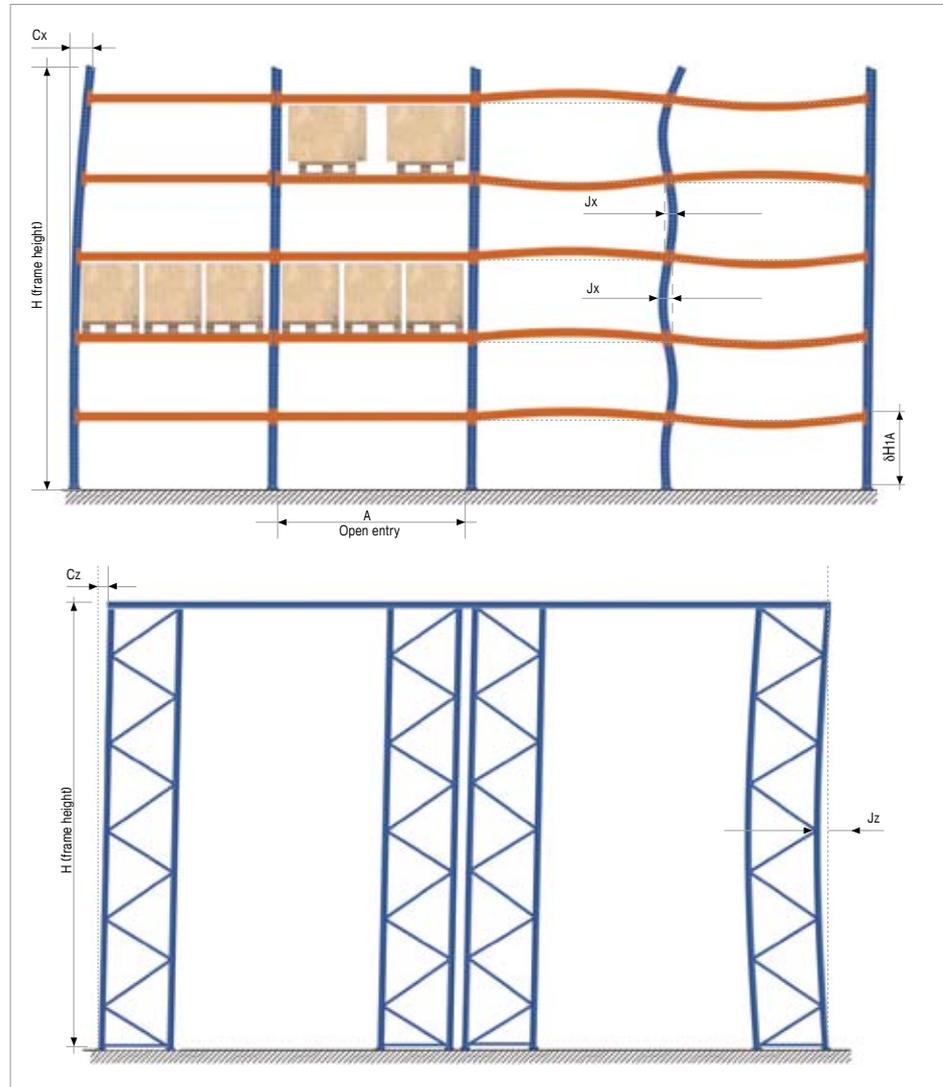
Safety pins and catches

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



Assembly tolerances

The facility must always be within the assembly tolerances in terms of verticality. This ensures that structural elements function properly.



The maximum measurements admissible after assembly must not surpass the following values:

CLASSES 300 A and B

Cx: $\pm H/500$
 Cz: $\pm H/500$ (with placement)
 $\pm H/750$ (without placement)
 Jx: ± 3 mm or $\pm HB/750$
 Jz: $\pm H/500$

δH_{1A} : The variation in the upper section of the crossbeam on the lowest level from the floor must be ± 7 mm in each post.

CLASE 400

Cx: $\pm H/350$
 Cz: $\pm H/350$
 Jx: ± 3 mm or $HB/400$ (the highest of both values)
 Jz: $\pm H/500$

The variation from the second level of beams and above has to be $H_y \pm 10$ mm (is valid in both classes cases).

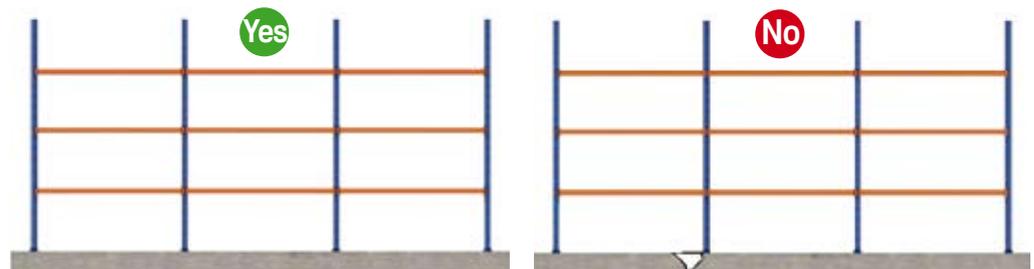
In addition to the tolerances previously mentioned for classes 300 and 400, the stipulations mentioned in EN standard 15620 must be complied with.

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 frame 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 there 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 plumb.

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 condition, replacing any which are damaged as stipulated in EN standard 15635, annex C.

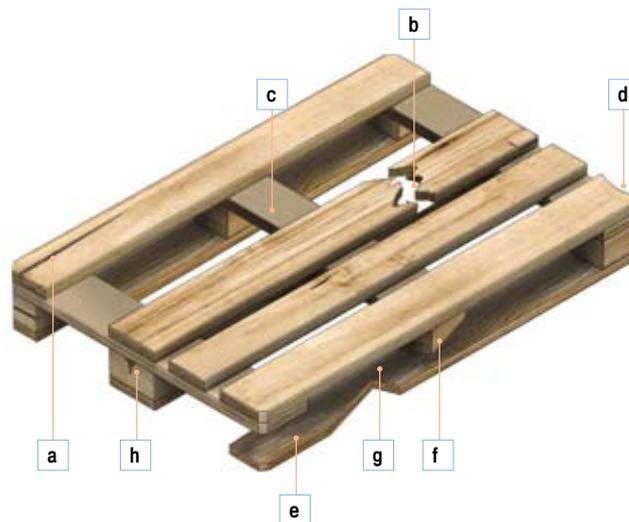
What's more, a pallet may no longer be used if:

- 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 dirtying 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.



- 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.

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, stabilised and strapped down and/or shrink-wrapped.

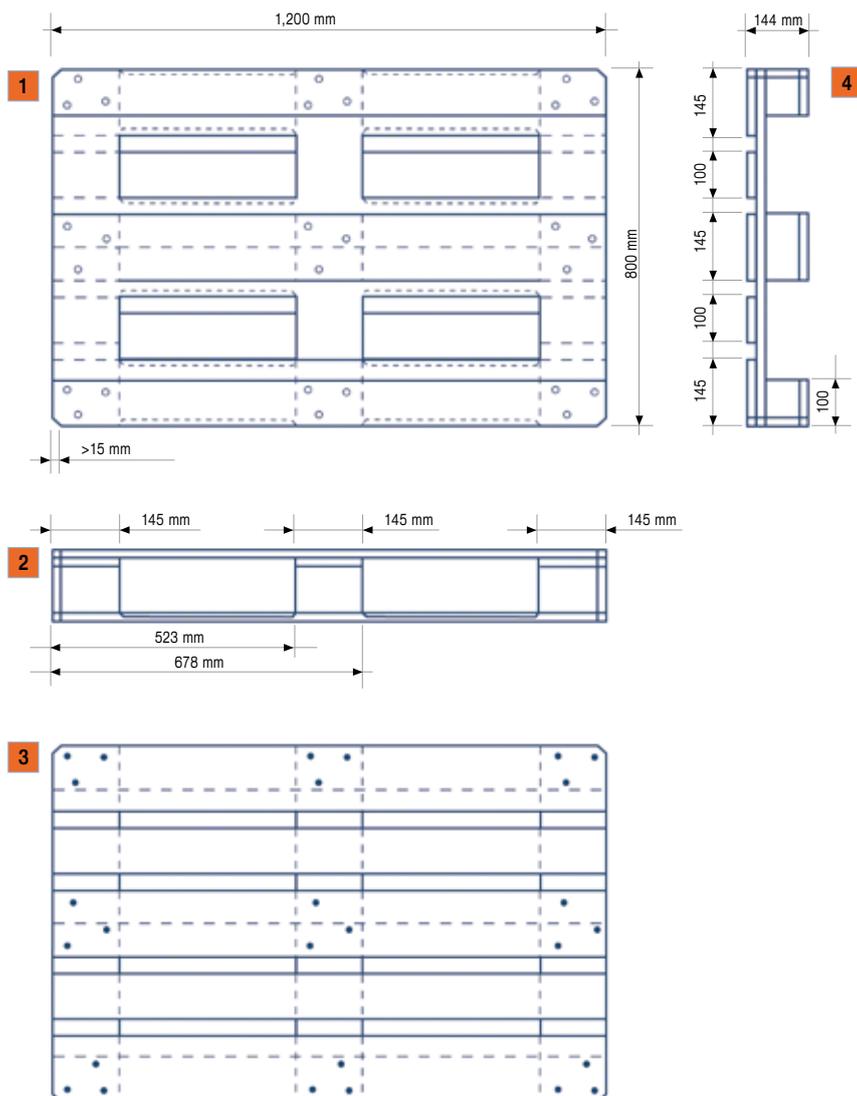
Make sure that load units do not surpass:

- 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 the most common pallet, 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.

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 authorised driver, who shall remove it when leaving the vehicle.

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 storage system 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 adjustable pallet racking.

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

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

RACK	BAY	LEVEL	FRONT	REAR	BEAMS				OTHER ELEMENTS IN POOR CONDITION				
					Type:		Length..... mm		Cross-bracing		Protection		
					Green	Amber	Red	Missing safety pins	Vertical	Horizontal	Upright	Frame	

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.

