Safety and Maintenance Manual

PALLET RACKING

Doc: 14MSRPEN00

www.esnova.es

INDEX

1. Introduction.

To optimise the maintenance status of a Pallet Racking warehouse will ease the works undertaken in it. However, a wrong use of the equipment or the deterioration of some of the existing elements may cause an accident.

In order to avoid interruptions in the warehouse functioning, damages in the racks or some of the elements, and especially, to avoid possible injuries on the personnel, the following measures should be taken into account:

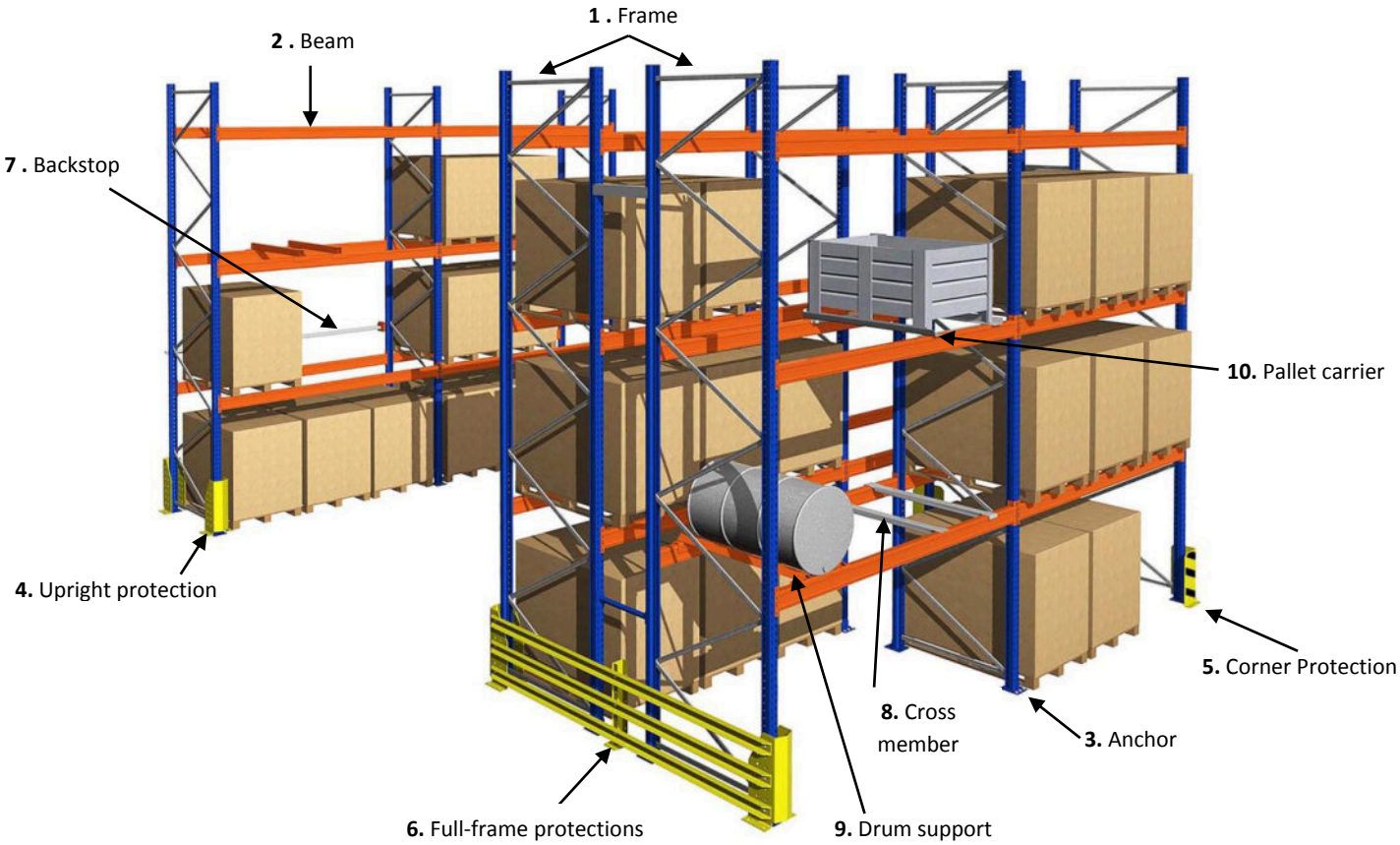
- **Prevention:** training and education of the personnel so as they can make a correct use of the equipment and facilities.
- **Inspection:** a continuous control should be made so as to check that the correct use indications are fulfilled.
- **Maintenance:** Damage correction.

ESNOVA RACKS S.A. has made the following manual so as clients know how to make a proper use of the Pallet racking installation. Esnova has taken into account to develop this manual many indications gathered by different European authorities (FEM, INRS), Technical Prevention Notes NTP.298-1993 established by the Safety and Hygiene National Institute at work, as well as their extensive experience in the warehousing sector.

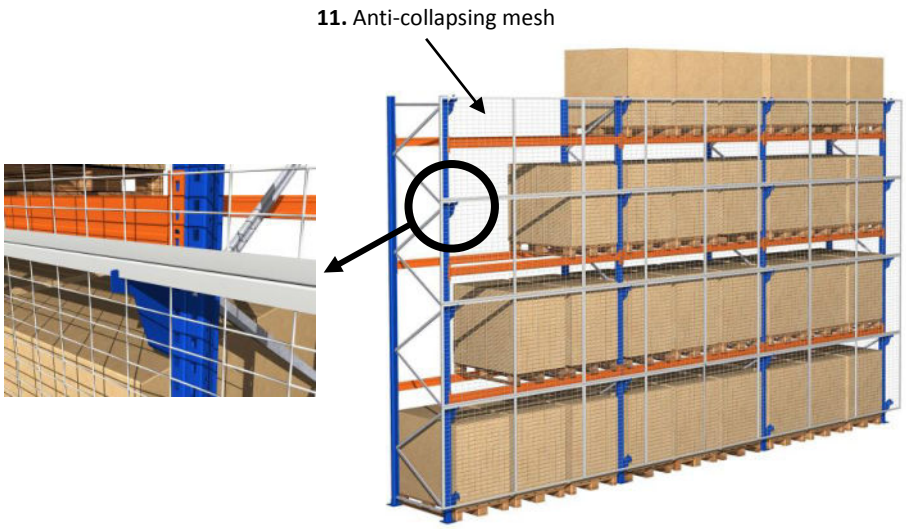
This document can be used as a reference within the standard pallet racking market for designers, assembly operators, supervisors and users in general, in order to make visible the contractual requirements and their interpretations.

2. Warehouse configuration.

The Pallet Racking system consists of placing different types and forms of pallets in the different loading levels, and which can be adjustable in height. This process will be carried out by different kinds of forklifts. In some occasions, picking levels can also be created.



1. Frame.
2. Beam.
3. Anchor.
4. Upright protection.
5. Corner protection.
6. Full-frame protection.
7. Backstop.
8. Cross member.
9. Drum support.
10. Pallet carrier.
11. Anti-collapsing mesh.



3. Pallet Racking components.

3.1. Frames.

Vertical metallic structure that will sustain the loading levels and their accessories.

3.2. Beams.

The horizontal elements where the load units will be sustained. They will have a significant stiffening role when it comes to the longitudinal rigidity of the installation.

3.3. Anchors.

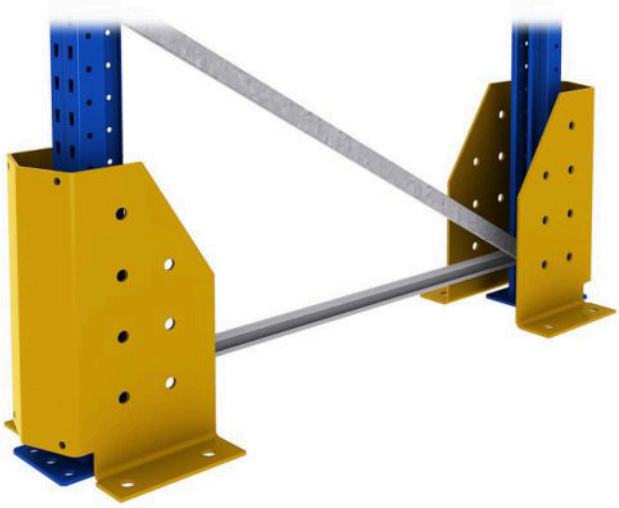
Metallic element that fixes the structure to the floor.

3.4. Protections.

Metallic elements that can absorb possible impacts caused by the use of different handling equipment when loading and unloading the goods.

3.4.1 Upright protection.

They are placed in working aisles so as they can protect any damage to the upright.



3.4.2 Corner protection.

They will be used to protect end uprights, in working aisles or intersections.

3.4.3 Full-frame protection.

They will be used to protect frames or groups of frames (uprights, and horizontals and diagonals close to the floor). Those protections should have a minimum height of 400mm and they need to be capable of absorbing, at least, 400Nm, according to what the standard EN 15512 shows in section 6.4.1.c.

3.5. Anti-collapsing mesh.

When the back part of a rack will be used as a working area or as a transit area, this will be protected with the use of anti-collapsing mesh, which may prevent the goods from falling down.

3.6. Safety profile (Backstop LTC).

Metallic item designed as a safety element so as to avoid the goods from falling down at the back part of the rack. It is important to know the available space in order to design the backstop.
This element cannot be used as a breaking device, since this is not designed to resist efforts.

4. Pallet Racking functioning.

4.1. Pallet Racking system.

There are some important points to take into account for the correct functioning of this system:

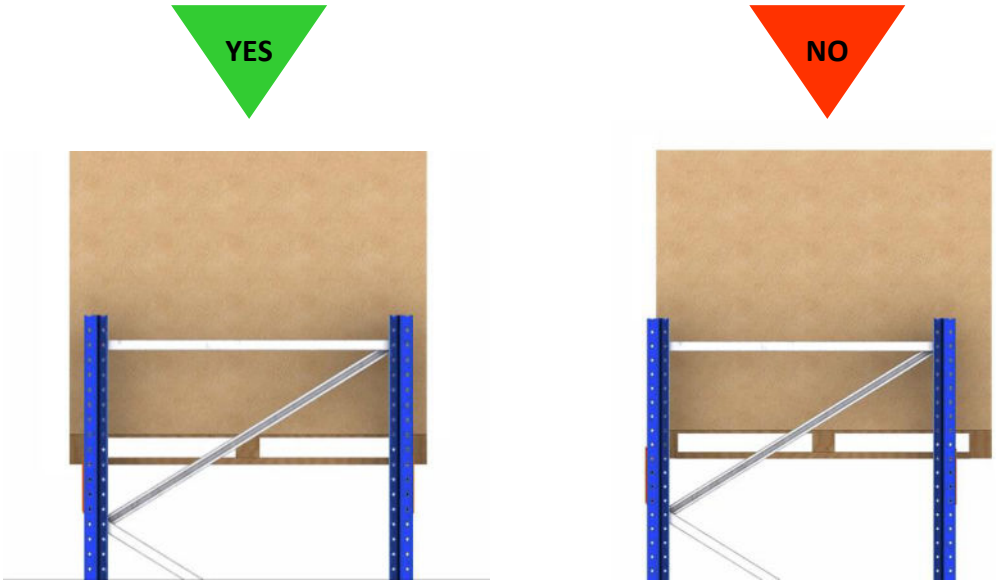
- The designed arrangement cannot be changed without consulting Esnova's technical department.

- No modification can be made in any of the following points:

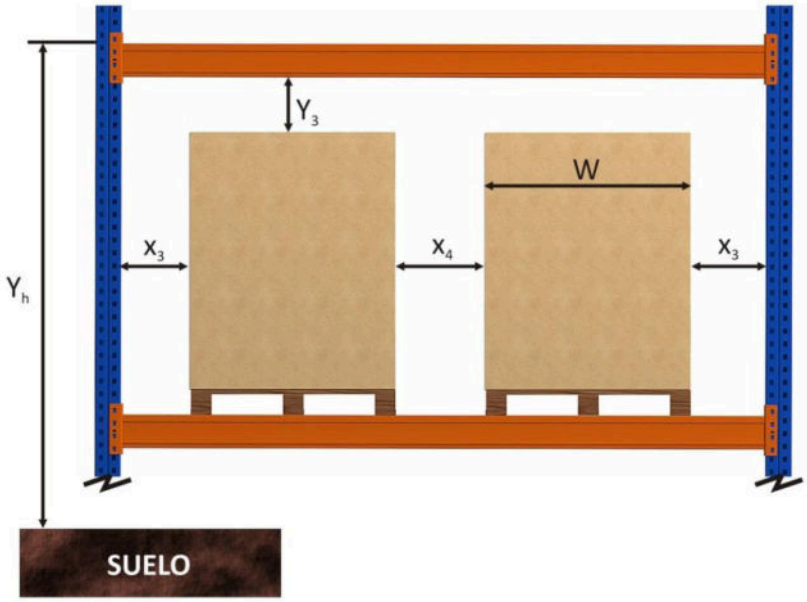
    - The distance between levels
    - The number of levels
    - Type of profile already quoted
    - Increase or decrease the number of levels
    - To use the installation if it has suffered some damages in its main structure
    - To use the installation if there is some element missing
    - To use the installation when some collapse is figured out

- The location of the loading units:
  When there are more than 2 pallets per storage cell, the best way to load them is by placing the ones at the edges first, something that will help operators to maintain the distances:

The pallet should always be centred on the beams.



- The following clearances must be respected.

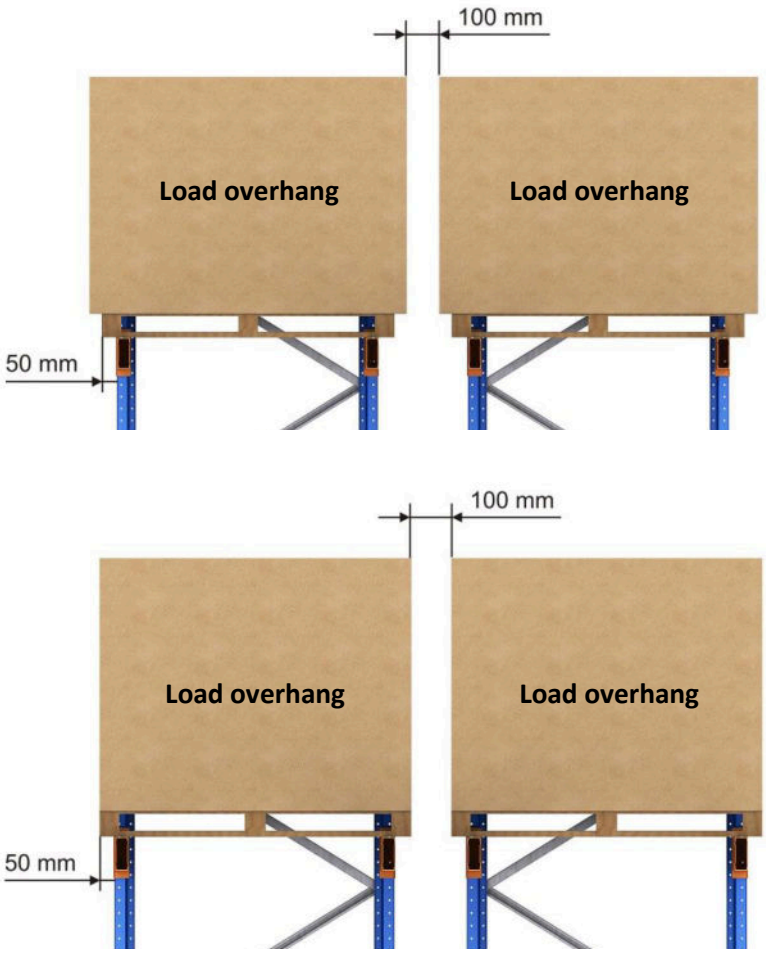


BEAM HEIGHT Y_h UNTIL (mm.)	RACK CLASS 300A		RACK CLASS 300B	
	X_3 X_4	Y_3	X_3 X_4	Y_3
3000	75	75	75	75
6000	75	75	75	100
9000	75	75	75	125
12000	75	75	100	150
15000	75	75	100	175

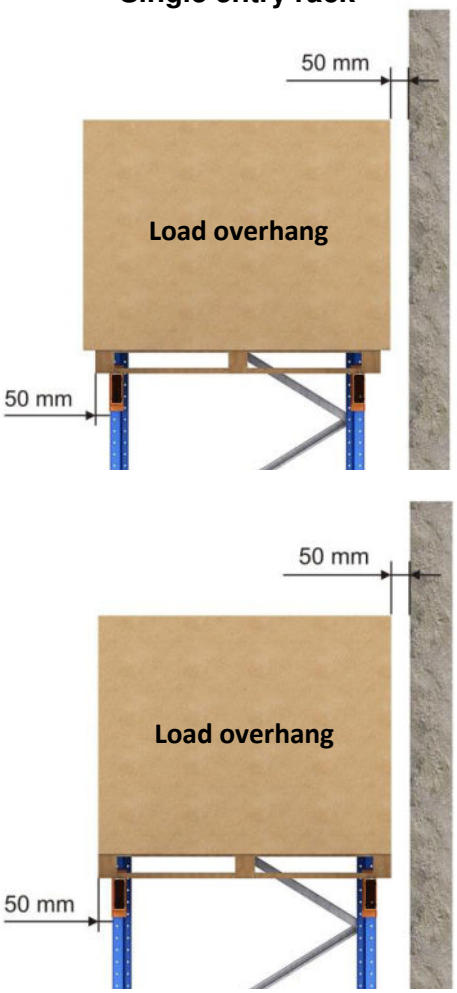
BEAM HEIGHT Y_h UNTIL (mm.)	RACK CLASS 400A	
	X_3 X_4	Y_3
3000	75	75
6000	75	100
9000	75	125
13000	100	150

- Horizontal clearances in depth without any stop element:

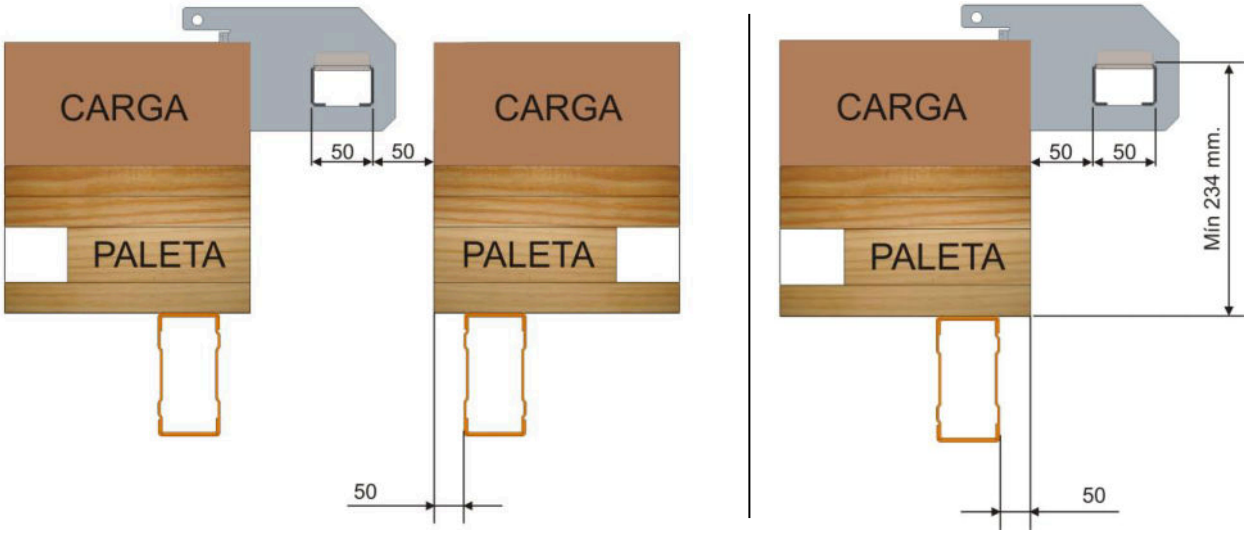
Double entry rack



Single entry rack

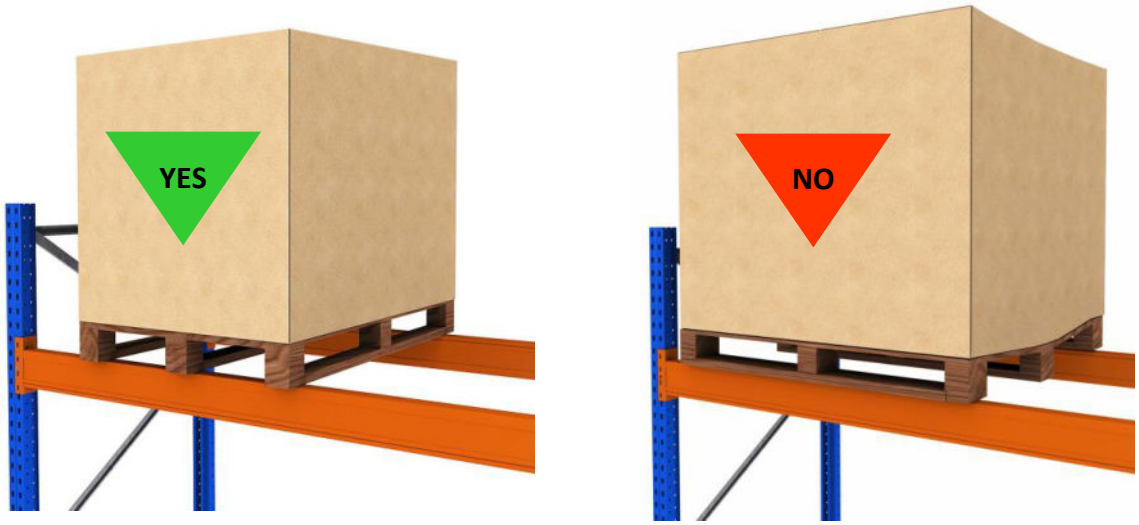


Double and simple entry runs with safety profile LTC



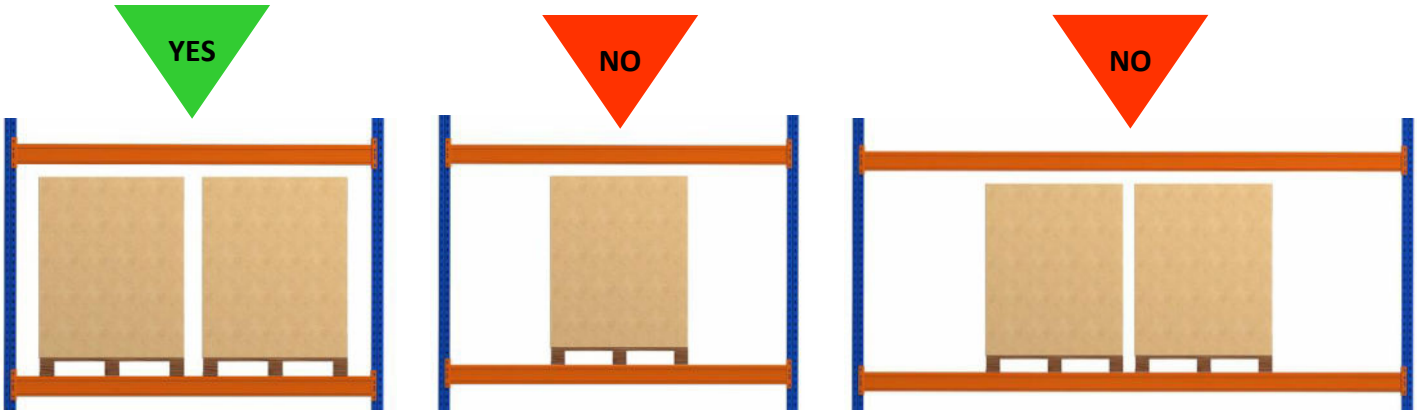
- How to load

The pallets should be placed with the bottom wooden pieces perpendicular to the beams.

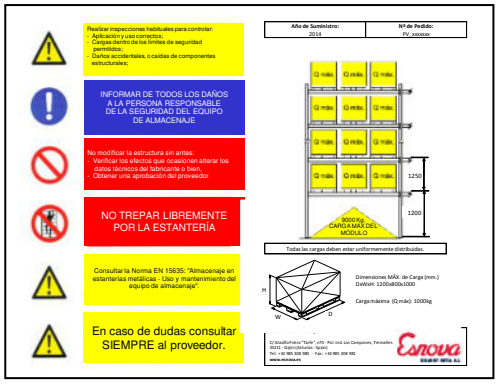


- Positioning of the loading units.

It is important to avoid the loading units from being located on the centre of the beams.



- It is important to always consider what is included in the load notice plates in order to use the installation correctly. Those notice plates should always be visible, in the own rack, or in an adjacent area in the warehouse.



4.2. Elements that take part in the storage process.

4.2.1. Pallet features.

The pallet or container which will be used must coincide with what has been developed in the design of this installation. For security reasons, the pallets used in a pallet racking storage system must be in perfect conditions due to the efforts they will be subjected to.

4.2.2. Goods features.

4.2.2.1. Load unit conditions.

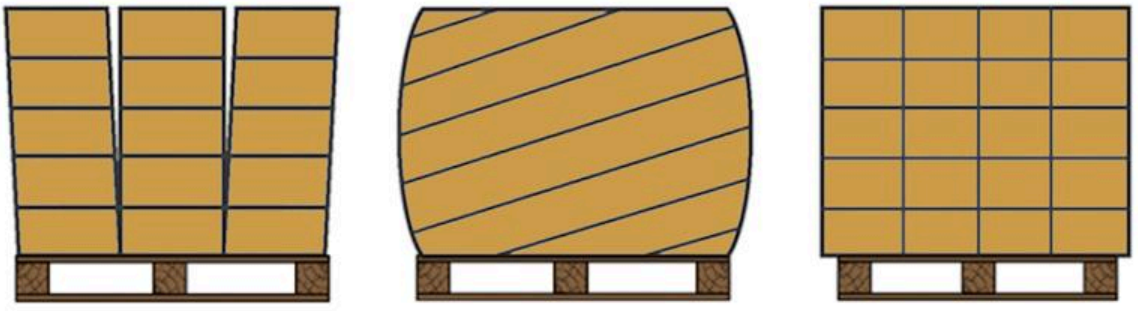
It is important to control the load units introduced in this pallet racking, since they should not exceed what is indicated in the load notice plate.

4.2.2.2. Load unit stability.

The goods should be stacked or palletised so as those units will be stable and compact.

4.2.2.3. Dimensions.

The real dimensions of the loading units, and, in particular, stored goods, could not affect unfavourably to the clearances considered when designing the installation in order to have a correct functioning thereof.



(a) Load out of plumb (b) Bulging load (c) Overhanging load

Dimensions of the load: they cannot affect to the clearances of what has been designed.

4.3. Handling equipment.

4.3.1. Operating conditions when transporting the load unit.

- The maximum load that the handling equipment (according to forklift supplier) could sustain must not be exceeded, since this may imply the turnaround of the forklift.

The forklift should not be overloaded.

- The load should be placed as nearest as possible to the forklift centre of gravity in order to avoid any possible risk of tipping.

Load placed as nearest as possible to the forklift centre of gravity.

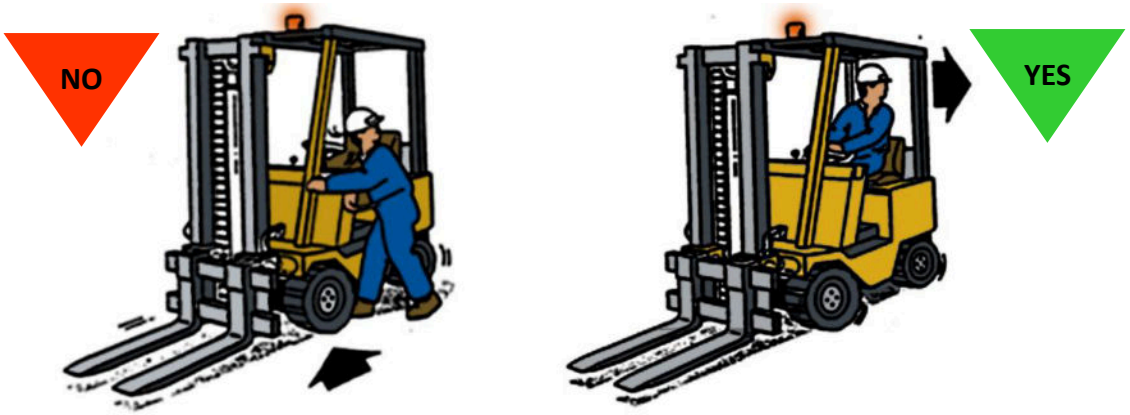
- The load should be centred perpendicular to the forklift direction so as to avoid overturnings or possible accidents.

4.3.2. Driving safety tips.

The following tips should be taken into account when using a forklift:

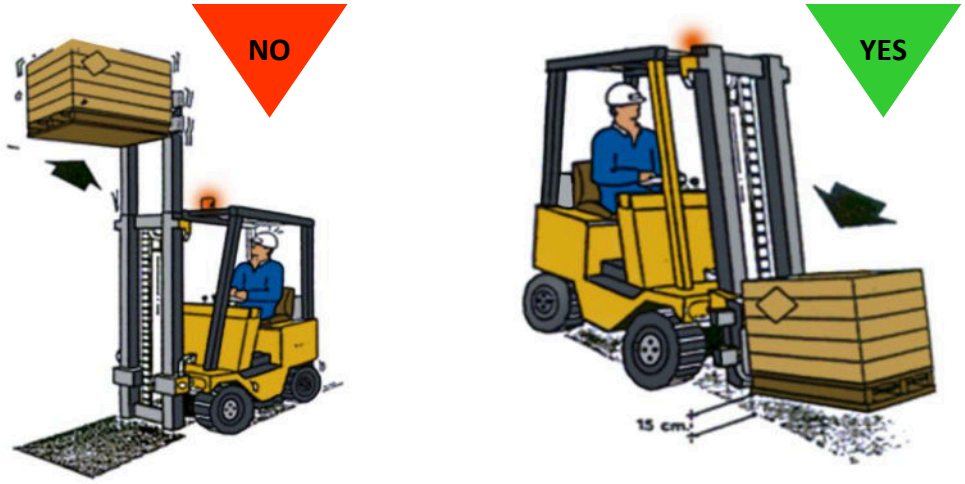
- To drive at moderate speed.
- To avoid sudden movements.
- The loads should be placed correctly.
- To keep an eye on the work.

- It is compulsory that the operator will always be on the forklift position intended for it. The body of the operator should always be inside the vehicle, and he/she always needs to be in running direction.



Only use the forklift on the driver seat and always in running direction

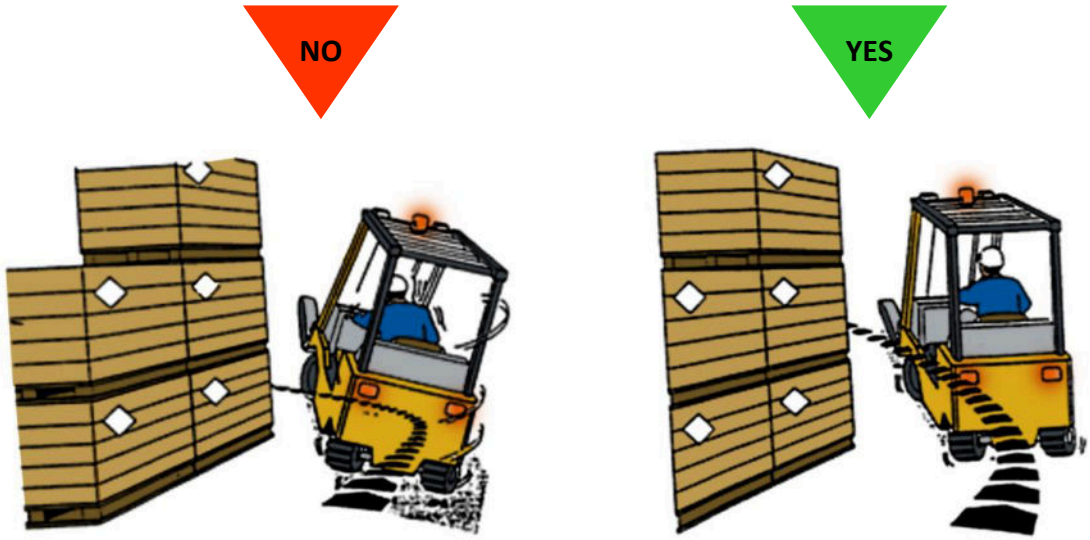
- The load should be transported from one place to another with the forks in a low position, 15-20mm aprox. from the floor.



The load cannot never be UP.

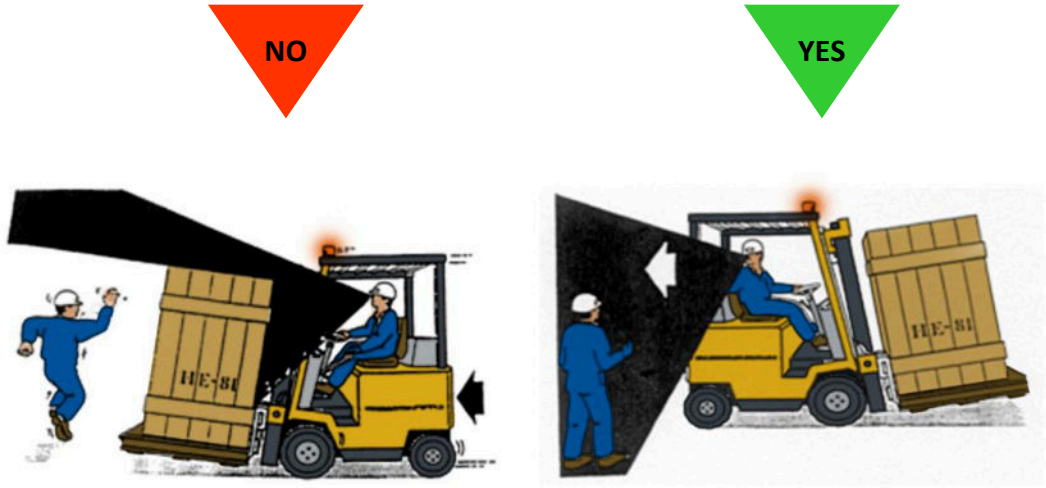
- When the operator should turn the corner without too much visibility, it is advisable to slow the pace and to honk in order to advise the existence of someone coming. It is

very important to reduce the pace when a load is being transported, since this increases the possible risk of tipping.



Be careful when turning a corner without too much visibility.

- In case bulky loads were considered, which may difficult their transporting, it is advisable to do it reverse.



In some cases, the transportation of bulky loads could make drivers hard to see, so it is advisable to do it reverse.

NO

YES

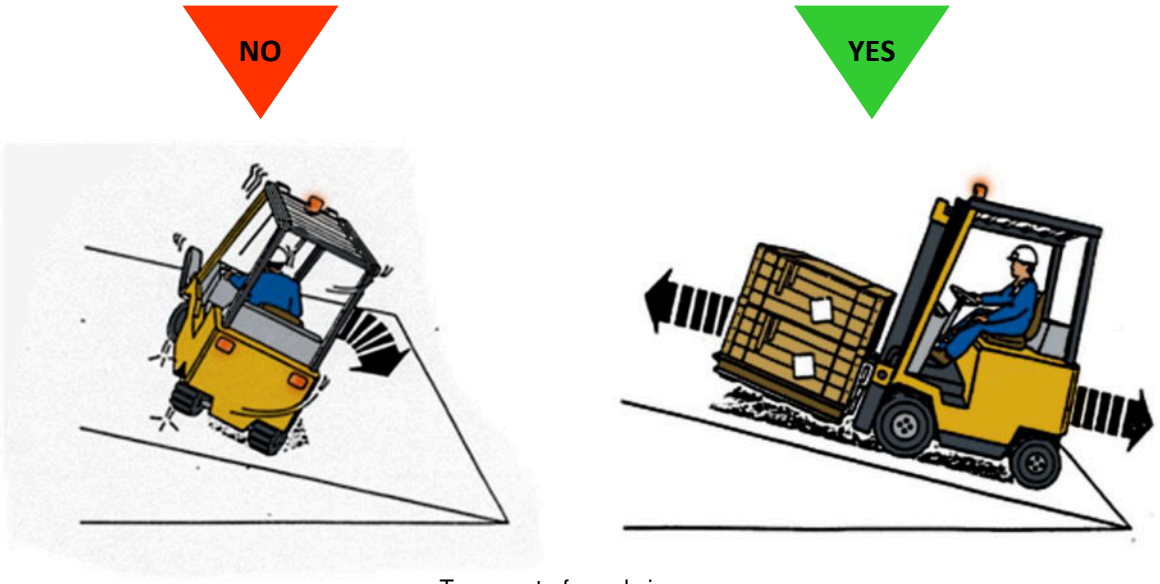
Always look at running direction

NO

YES

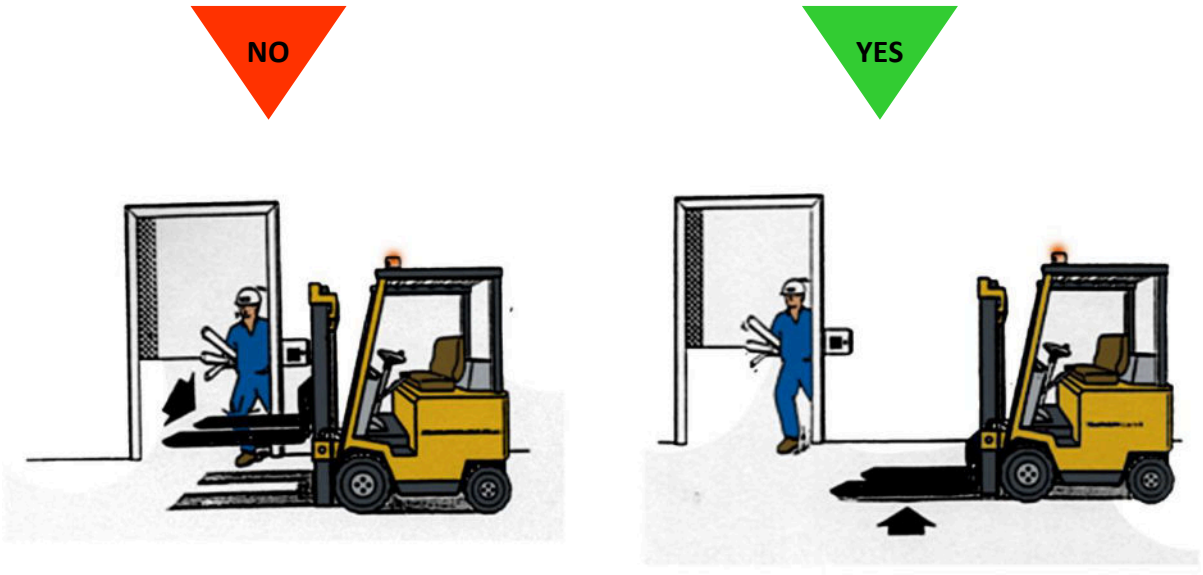
Do not allow anyone to be near or below the load.

- In sloping areas, it is advisable to avoid turns, since this can provoke the overturning of the forklift. When the forklift is ascending a ramp, the load must always be first.



Transport of goods in ramps

- The forks could never stay raised when the truck is stationed.



Ensure the forks will never be raised when stationed.

- As a general rule, the speed of 10Km/h cannot be exceeded, since this is the maximum speed established in work centres.

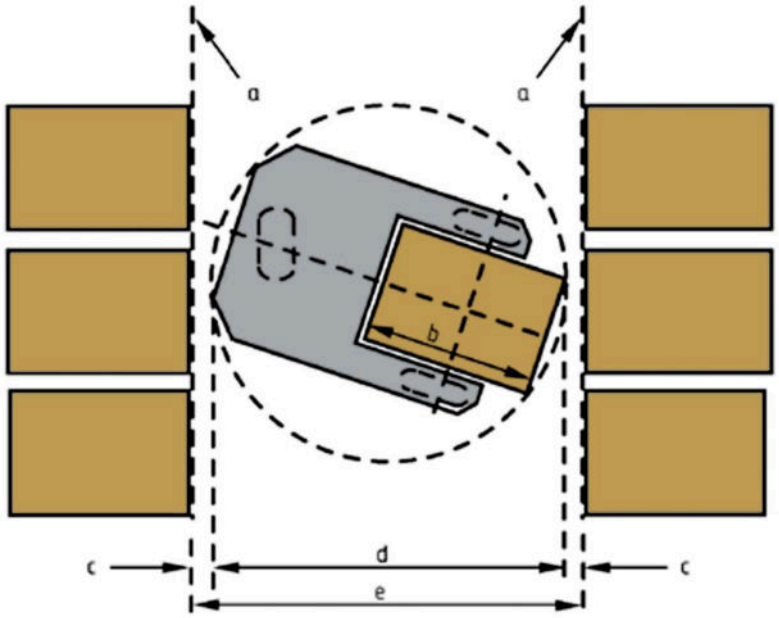
- In case there will be more than one forklift operating in the same installation, it is compulsory to leave, at least, three times the length of the trucks in each manoeuvre.

- When loading and unloading, the following considerations need to be taken into account:

    - Manoeuvre speed should be made as slow as possible so as to ensure a proper and safe positioning of the load.

    - The upward and downward movement of the load should be made with the forks in horizontal position and it is important to maintain the load totally centred when entering the installation.

    - The aisle between frames must allow the necessary turns to manipulate the loading units.



The aisle must allow the necessary turns of the forklift.

- a: Positioning line of the goods marked in the floor.
- b: Maximum dimension in the top view of the pallet or the load if it overhangs.
- c: Clearance.
- d: Diameter of the forklift and load turning circle.
- e: Width of the working aisle.

5. Pallet Racking Maintenance and defect detention.

This section will include the information indicated in the Standard UNE-EN 15635.

5.1. Installation inspections.

Some inspections should be made on a regular basis.

An inspection planning should be elaborated in order to know their frequency and scope.

A report should be elaborated so as to fill every possible incidence and observation derived from the inspection.

Inspections should be made weekly, or at different intervals depending on the risk assessment for this installation.

A 12-month inspection should be made by a qualified person. Consequently, there must be a report with all the information derived from this inspection.

Any safety problem or damage detected by someone must be notified to the supervisor of this warehouse.

5.2. Damage assessment.

Whichever damage that should happen must go accompanied by a corresponding investigation.

The potential causes of the problems need to be investigated so as to be able to reduce or eliminate the possibility of this occurring again.

Hereby, some causes that may provoke those damages or problems will be highlighted (this enumeration is not fixed):

- Wrong functioning of the forklift.
- A non-expertise operator.
- Changes in the handling equipment.
- Changes in the type or quality of the pallet used.
- Defective loading units.
- Overhangings in the goods which were not contemplated initially.
- Insufficient clearances.
- Insufficient aisle width.

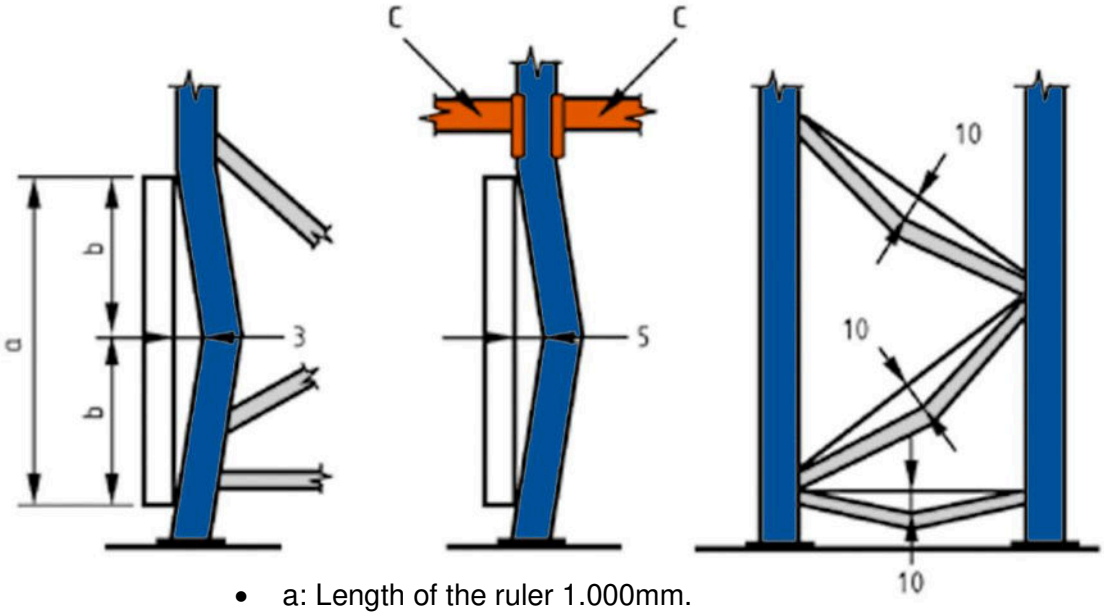
- Poor cleanliness and tidiness.
- Poor lighting.
- Floor deficiencies.

5.3. Damage control.

A damage control plan should be made so as to check every component of the storage system.

5.3.1. Frame inspection.

In case that any blending can be found in any of the elements that form the frames, it is compulsory to analyse the damages. Hereby, the most usual deflections are shown:



- a: Length of the ruler 1.000mm.
- b: Half the length of the last pattern.
- c: Horizontal element.

The method used to measure the deflection of the upright is to place a ruler 1m long in the side view of the deflected profile on its dished area and centred.

The deflection limits on the uprights will be:

- 3 mm. if this deflection will be located in the plan that contains the two uprights of the same frame.
- 5 mm. if this deflection will be located in the perpendicular plan to the plan that contains the two uprights of the same frame.
- In case that there is deflection in both directions, the limits aforementioned must be respected.

For any deflected element of the lattice in both plans, the distance between the ruler and the maximum deflected area must not exceed 10mm for a stretch of 1 m. For different dimensions of the lattice, this can be prorated.

In case that there will be any crack or material tearing in any of the elements of the installation, this should be replaced immediately.

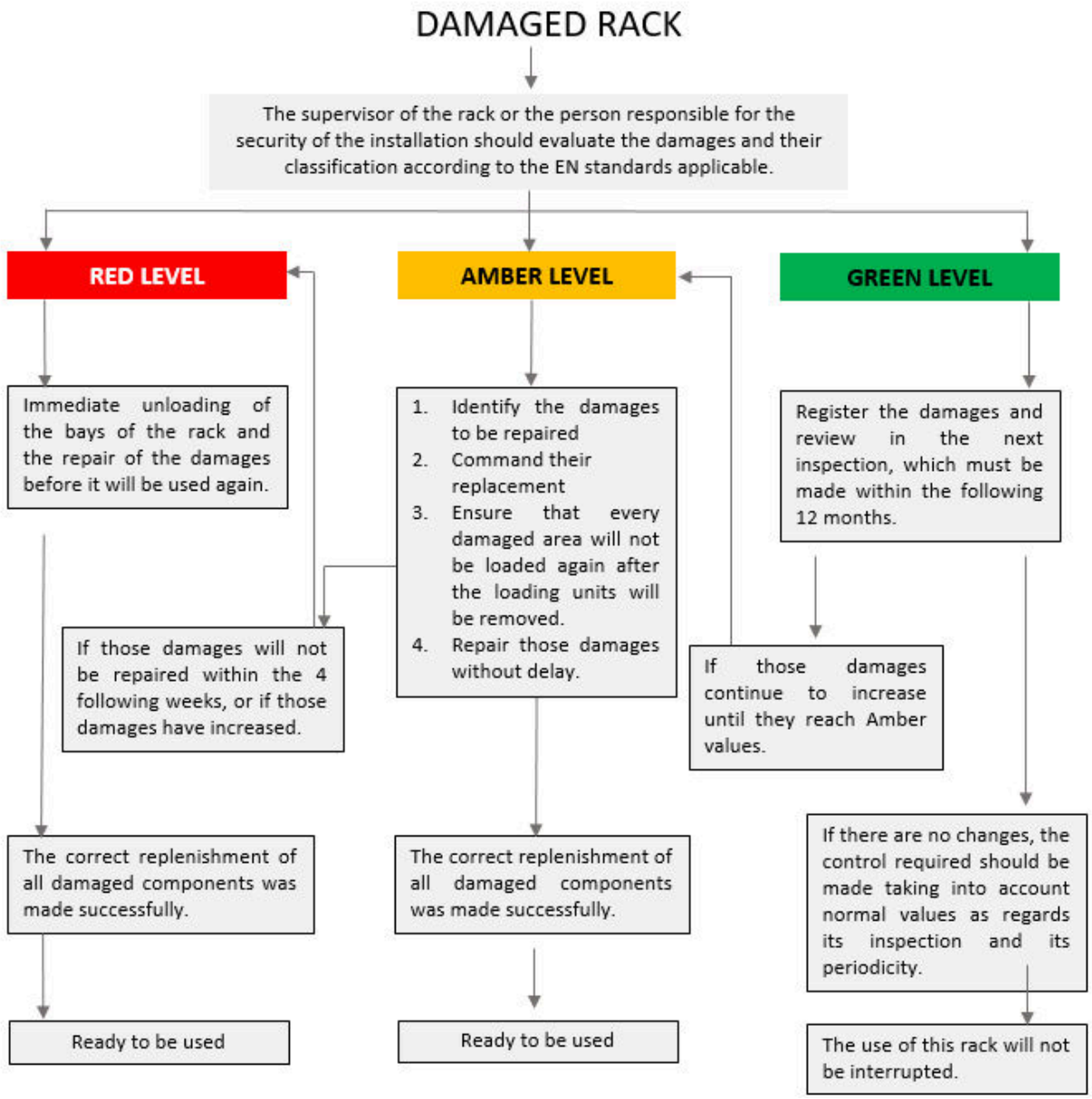
According to the fault found, a classification in level of significance can be made:

- **Green level**: if the deflection limits are not exceeded. There is no need to reduce the load capacity neither the reparation of this element. It is only needed to have all these deflections identified for subsequent inspections.

- **Amber level**: if the deflection limits indicated before are exceeded, but with a factor inferior to 2. These damaged components must be replaced. If those items will not be repaired within 4 weeks, this damage will be then classified as red.

- **Red level**: if the deflection limits indicated before are exceeded with a factor superior to 2. This will imply the immediate unloading of the rack and its isolation. This component must be replaced.

5.3.1.1. Course of action.



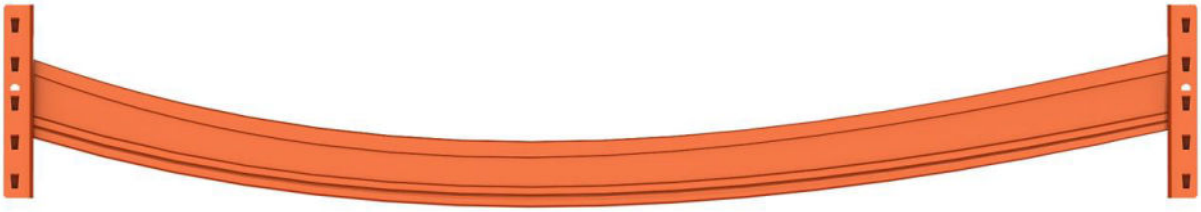
Flow chart: course of action in case any damage is spotted.

5.3.2. Beam inspection.

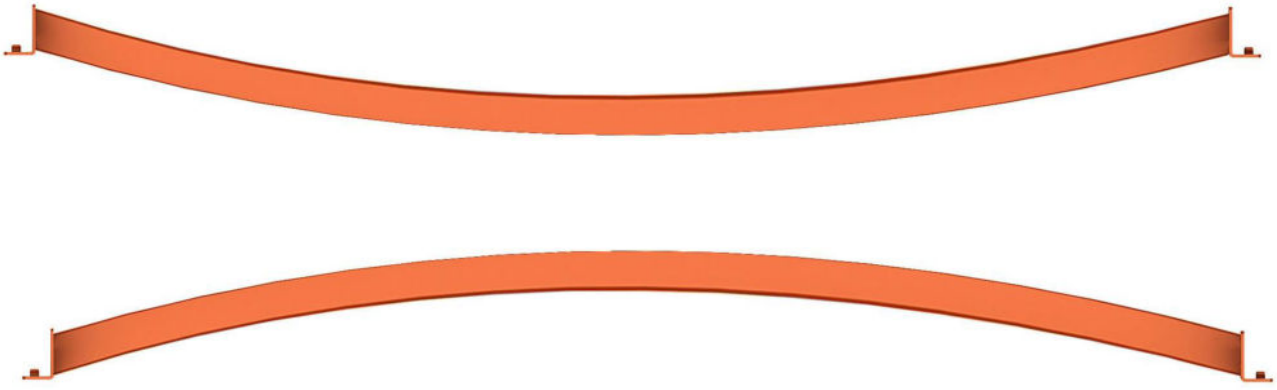
In this type of elements, if one of the following faults or deflection limits will be detected, this piece must be unloaded and it must be replaced.

- Profile buckling.

- Permanent vertical plastic deflection superior to the 20% of the nominal deflection L/200.

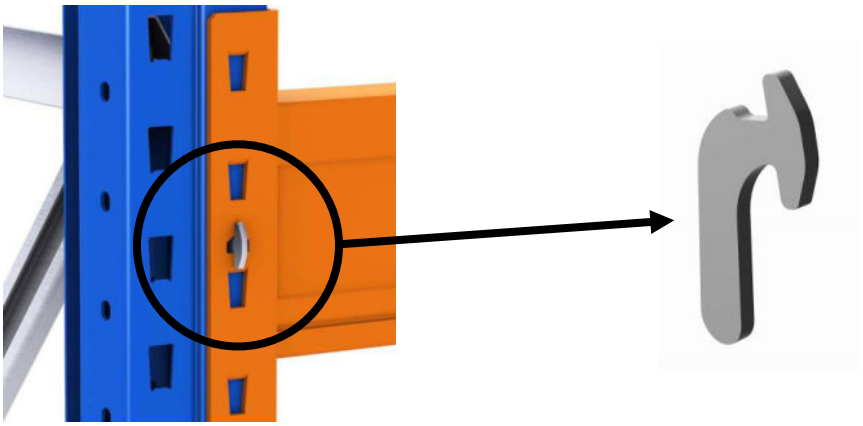


- Permanent horizontal plastic deflection superior to the 50% of the nominal deflection.



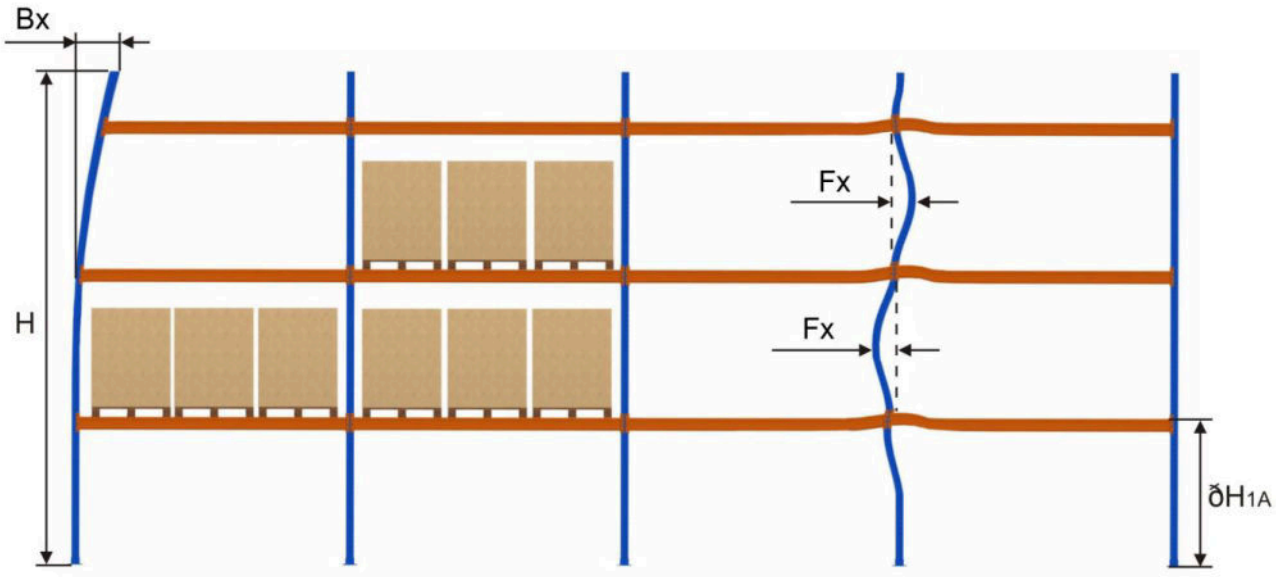
5.3.3. Safety clip inspection.

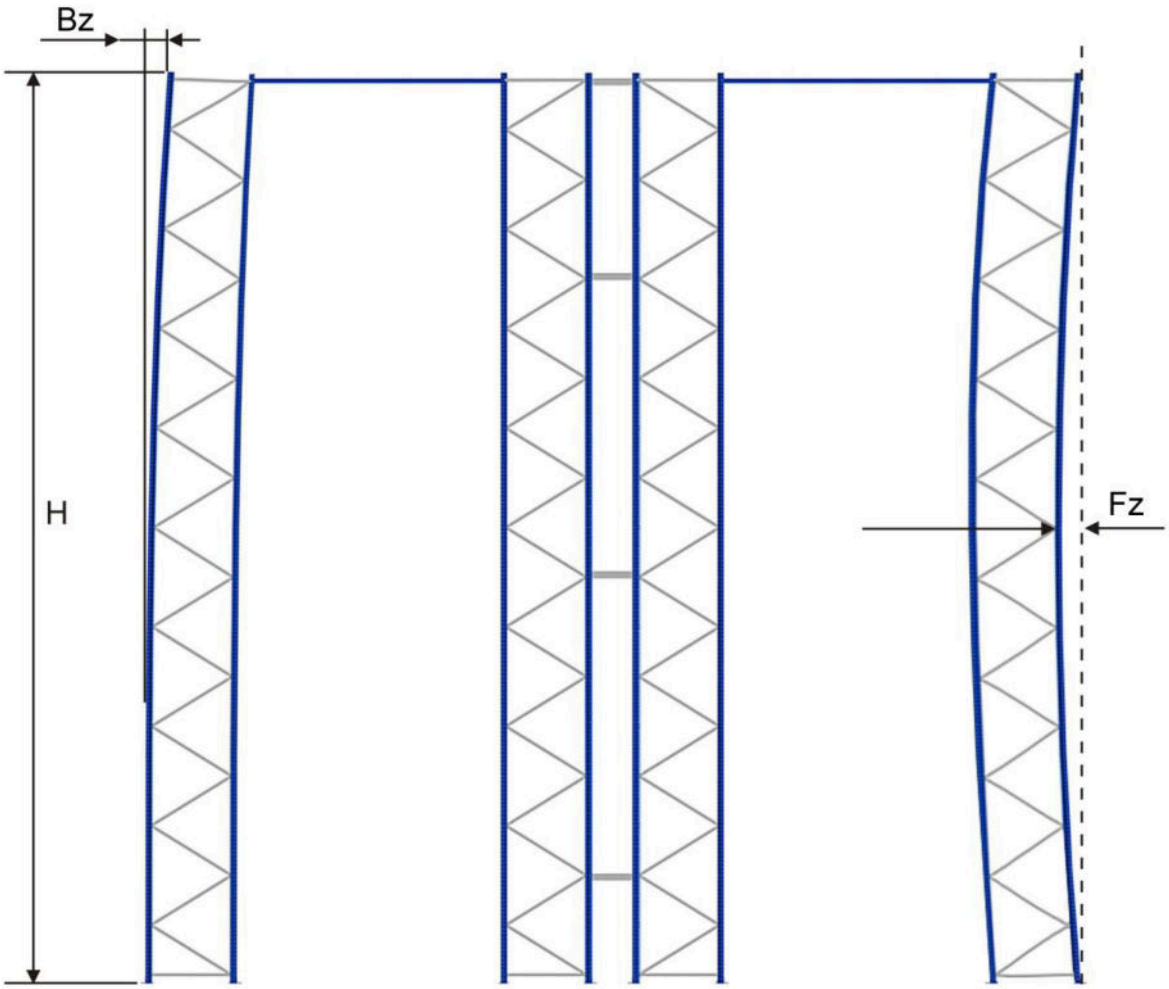
Every beam should have two safety clips. This will prevent the beam from falling down when placing the loading units.



5.3.4. Assembly tolerances inspection.

The installation should always comply with the assembly tolerances in terms of its verticality.





Hereby, the maximum admissible measures after the assembly process and with the racks unloaded:

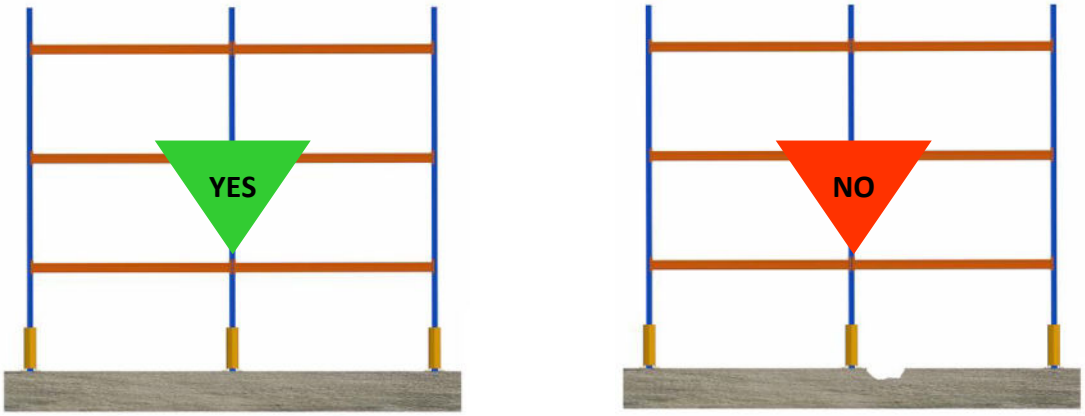
CLASS 300 A and B
B_x: ±H/500
B_z: ±H/500 (class 300B)
± H/750 (class 300A)
F_x: ±3mm o ±HB/750
F_z: ±H/500
ðH$_{1A}$: the variation from the upper part of the bottom beam from ground level in each upright should be ±7m

CLASS 400
B_x: ±H/350
B_z: ±H/350
F_x: ±3mm o HB/400 (the highest value)
F_z: ±H/500

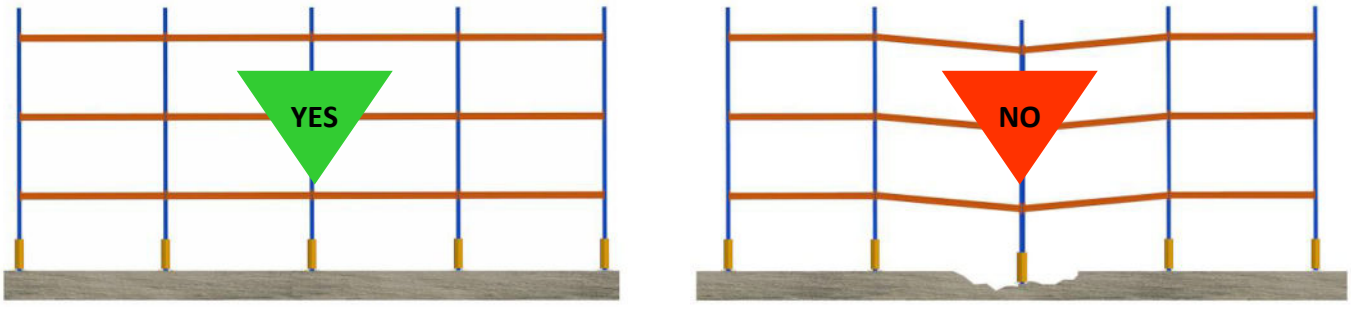
The difference in level between the upper parts of the frontal and the back beams of the same storage cell H_y: ± 10 mm. (valid for class 300 as well as 400).
Apart from the tolerances aforementioned for classes 300 and 400, the tolerances included in the Standard EN 15620 must also be respected.

5.3.5. Floor, base plate and aisle inspection.

A floor inspection must be made in order to verify that the conditions considered for this installation were not modified, just to avoid any potential collapse. The floor cannot have any irregularity, because this may provoke the falling of the installation.



It must be verified that the positioning of the shim plates and their fixation will be made correctly.

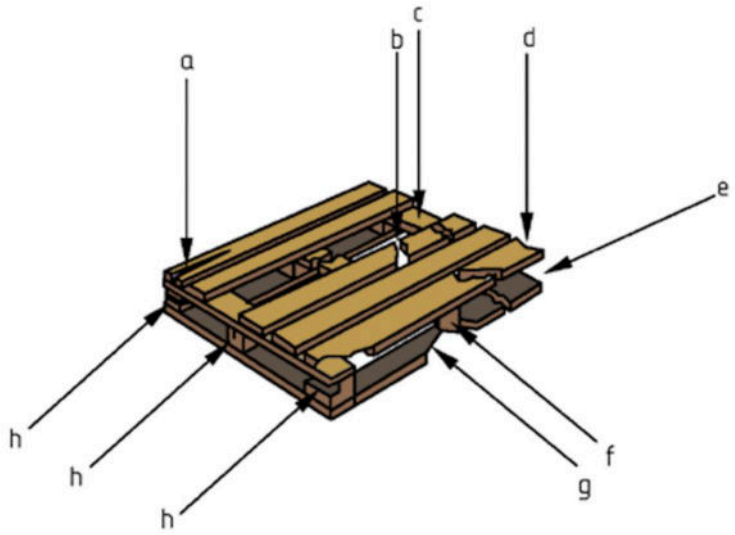


The ground must be completely clean, especially the pedestrian walkways, where there cannot be any obstacle. Similarly, there could not be any substance that could make structure or load to be slippery and which can cause any fall to the people working there.

5.3.6. Pallet and handling equipment inspection.

5.3.6.1. Pallets.

Pallet conditions must be periodically checked so as to avoid the use of damaged pallets. The list below includes the main defects that a pallet could suffer:



- a: The existence of cracks bigger than half the width or length of the wooden board.
- b: Broken board.
- c: The loss of one board.
- d: One board without wood in more than the third part of its width.
- e: Lack of one peg.
- f: One peg rotated more than 30º.
- g: One board without wood within 2 pegs bigger than a quarter of the width of it or if the nails are visible.
- h: One peg without wood or with some cracks in more than half the width or height of the peg.

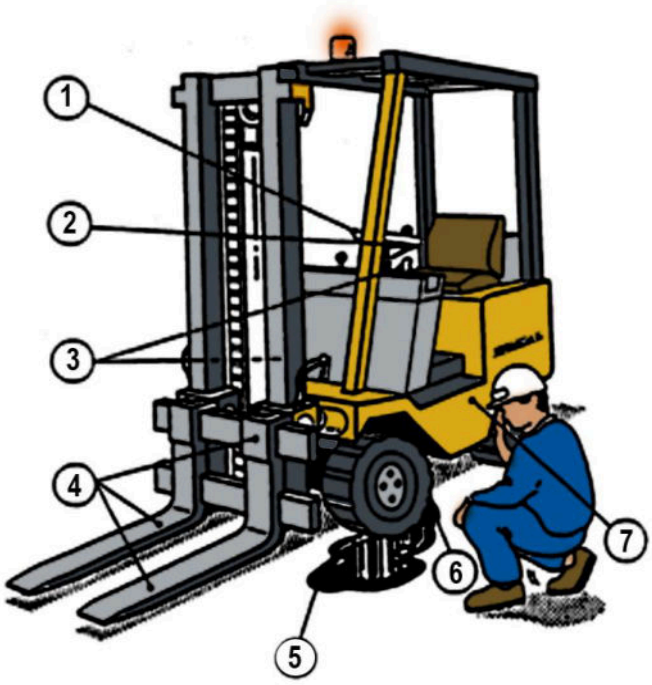
The pallets used will be the ones included in the standards described in the norm:

- UNE-EN 13382: Pallets for materials handling. Principal dimensions.
- UNE-EN 13698-1: Pallet production specification. 1st Part: Construction specification for 800x1.200 mm flat wooden pallets.
- UNE-EN 13698-2: Construction specification for 1.000x1.200 mm. flat wooden pallets.

5.3.6.2. Handling elements

This section includes a series of general recommendations about the proper use of the handling equipment. Notwithstanding, the recommendations included in the manufacturer user manual must be considered as the main ones.

Daily Verifications.

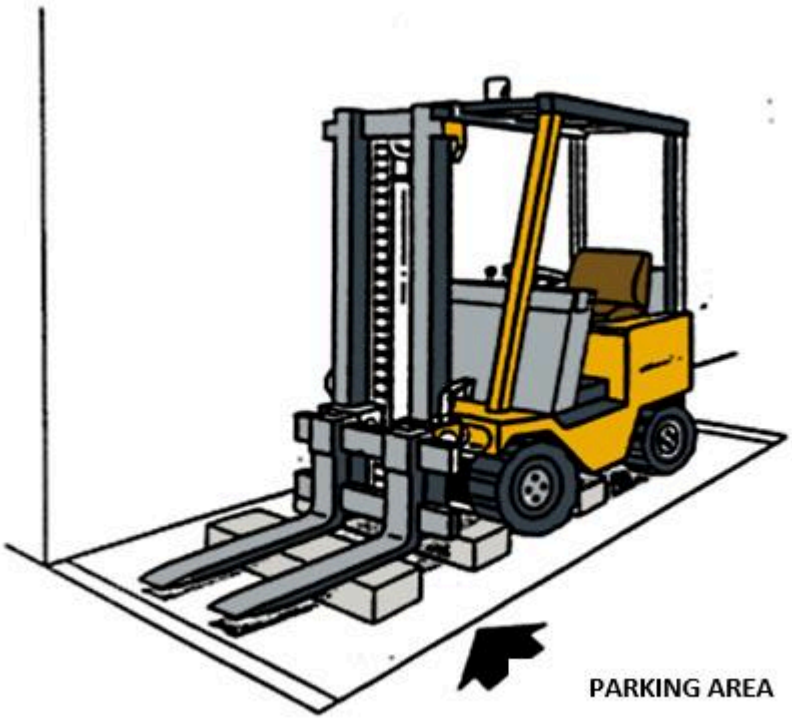


Daily verifications.

- 1: Steering wheel.
- 2: Horn.
- 3: Detention braking.
- 4: Fork elevation system.
- 5: Check the absence of leaks.
- 6: Tyre status and pressure.
- 7: In combustion engines, it is compulsory to check water, oil and fuel levels.

If any of the failures above described is found, please contact the person in charge of its maintenance. This handling equipment cannot be used until this malfunction is not fixed.

Parking verifications.



- The forklift should be in the correct place for its parking, protected against inclemency.
- The forklift must always be parked in a flat Surface. If this cannot be made, it is compulsory to put some wedges on the wheels.
- The fork should be in its bottom position, sustained on the floor or on some wedges.
- Stop the engine and remove the ignition key.
- Put the detention braking and wedge the forklift.
- Put the forklift in neutral.