Drive-In Pallet Racking
User Manual



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1. Introduction

This manual provides advice and instructions to users of Drive-In Racking systems manufactured and installed by APC Storage Technology.

With the combination of moving materials handling equipment (forklifts and stock pickers), heavy loads and high storage levels, a warehouse can be a dangerous work environment. It is essential that all personnel within the warehouse understand the risks involved and the safe operating procedures to ensure those risks are minimized.

2. Purpose

This manual provides advice and instructions to users, maintenance personnel and WHS officers to ensure the safe and efficient use of the equipment.

Racking systems are made up of steel components which, if incorrectly installed, damaged or overloaded, can lead to significant hazards for users and the surrounding environment. It is essential that the points in this guide are understood and acted upon if serious accidents are to be avoided. Even minor damage can add to the overall weakening of a rack structure that could lead to a collapse.

This manual should be understood by all personnel involved with racking systems and is designed to be used for training purposes.

3. Applicable standards

All equipment has been designed and tested in accordance with the following standards:

AS 4084-2023	Steel Storage Racking
AS 4100-2020	Steel Structures
AS/NZS 4600-2018	Cold-Form Steel Structures
AS/NZS 1170.0-2002	Structural Design Actions – Part 0: General Principles
EN 15629	Guidelines for the safe provision of static steel racking and shelving. Previously known as FEM 10.2.03
SEMA	Code of Practice for the Design of Adjustable Pallet Racking.
ANSI MH16.1-2012	Specification for the Design, Testing and Utilisation of Industrial Steel Storage Racks
FEM 10.2.07	Design of Drive-In and Drive-Through Racking Design Code 2012

4. Drive-In Pallet Racking Components

Drive-In Racking consists of various components that work together to deliver a safe storage structure for palletized goods. All components can be seen in **Fig 1.**

Support Beams and Portal Beams.

The Support and Portal Beams are the load bearing horizontal members that are attached to the posts via oval connectors. APC's Beams are designed to ensure strength and rigidity.

Posts.
Posts are the vertical, perforated sections of a frame and are connected by braces at regular intervals. APC posts are roll formed at a single length for maximum strength and durability.

Frame Bracing.
Frame Bracing consists of diagonal and horizontal braces that connect two posts together forming a frame. Bracing increases stability and helps transfer the loads down to the ground.

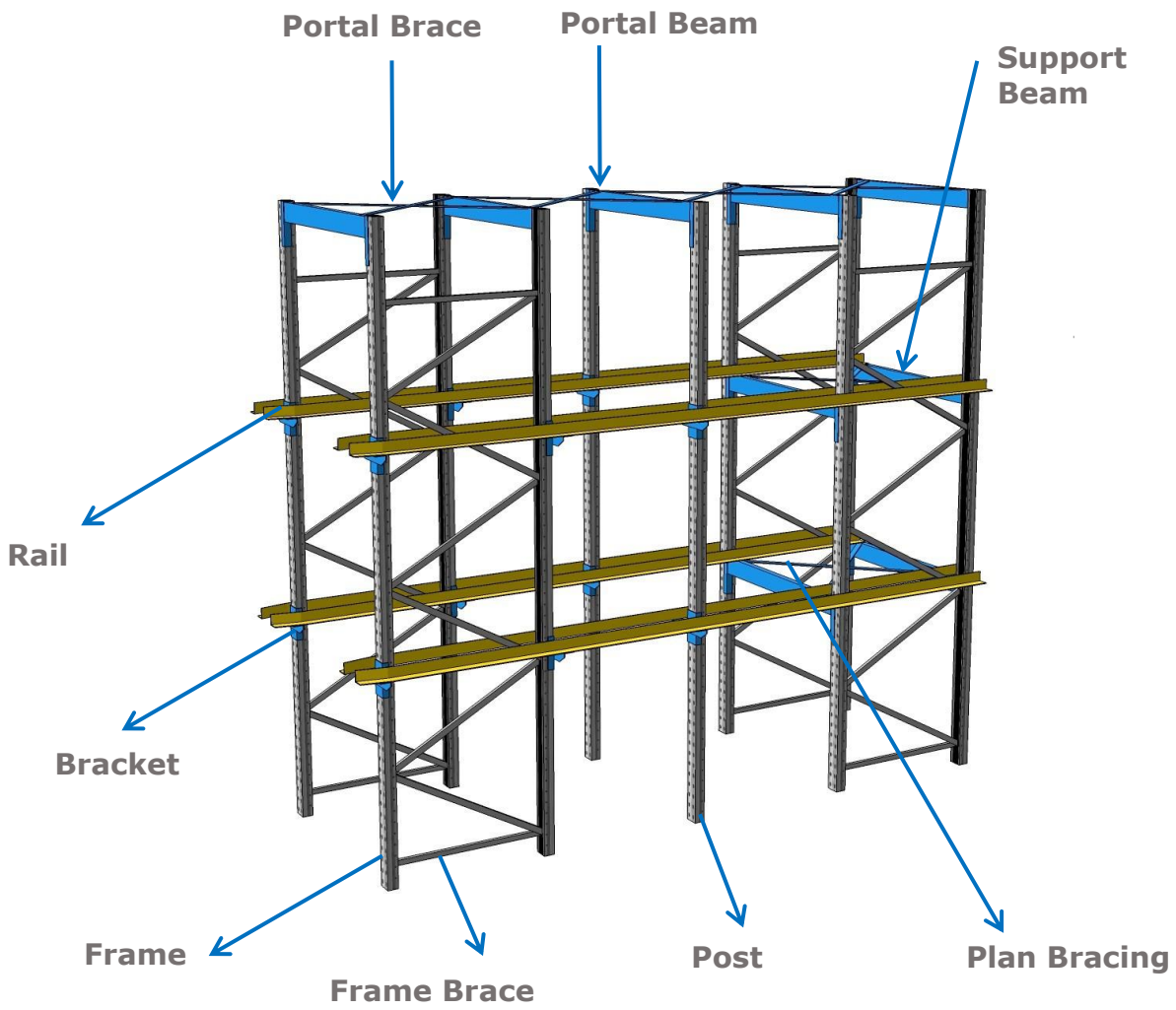
Rails.
The guide rail is a 5-6mm thick steel angle, used by goods handling equipment to guide pallets into the correct position during the loading process.

Brackets.
The bracket supports the rail, allowing the force of a load on the rail to be distributed down the post. It is attached to the upright posts via oval connectors.

Portal and Plan Bracing.
Portal and Plan Bracing consists of horizontal cross bracing that ensures the racking system remains square.

Frames.
Frames consist of posts, bracing and footplates. APC frames are punched with APC's unique hole configuration and are supplied galvanised for maximum visibility and corrosion resistance.

Fig. 1 – Drive-In Pallet Racking Components



5. Drive-In Pallet Racking Basics

It is important that the user understands as much as possible about the equipment. This not only concerns the racking system, but also the quality and type of product and mechanical equipment used to load and off-load the racking.

5.1. Unit Load

The total weight (including weight of pallet), overall dimensions (including any overhang), security and stability of all units loaded to the pallet racking must be considered prior to loading, ensuring that the designed load is not exceeded.

5.2. Pallet Handling Equipment

Make sure you use the correct material handling equipment, considering the type, capacity, maximum lift height and minimum practical operating aisle.

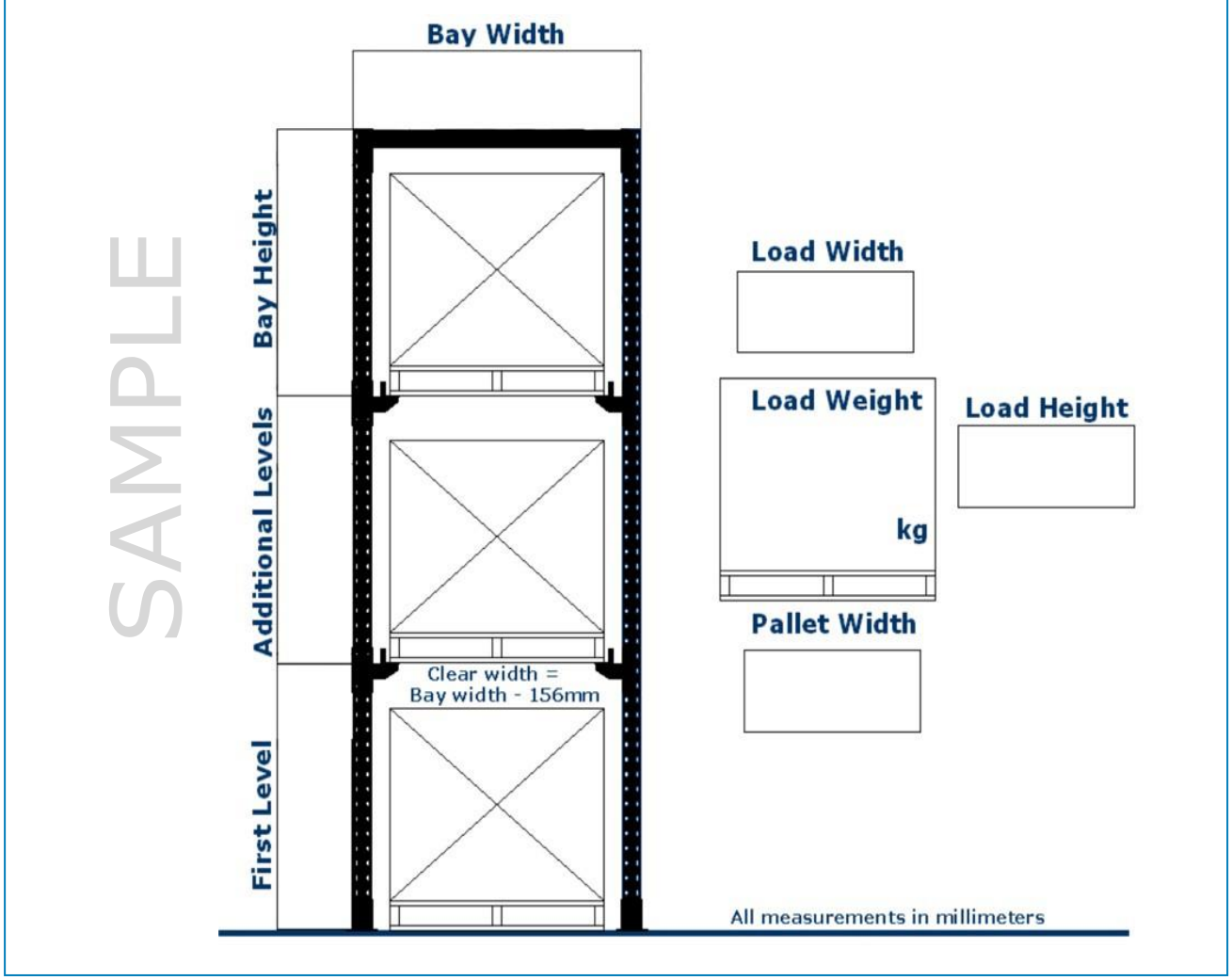
5.3. Modifications to the Racking Configuration

Each rack design is based on the beam (and rail) loading and the distance between beam (and rail) levels. If either of these factors need to be changed, it is essential that the racking supplier is contacted so the structural integrity of the design can be checked.

5.4. Load Signs

Load signs **(Fig. 2)** must be placed in an area visible to operators 2m above floor level.

Fig. 2 – Load Sign Sample



6. Pallets

The quality, design and material of a pallet is a critical factor in the design of pallet racking systems. Some pallets, in particular the plastic variety, may not have sufficient strength in the base structure to be used in pallet racking, without the use of additional steel supports. Please check with your pallet supplier to ensure that the pallets in use are capable of being used on Drive-In Racking.

Use of the wrong type of pallet, or damaged pallets can lead to an unsafe load. Drive-In pallet racking is designed for specific pallet types and cater for Australian Standard Pallets. Refer to your installation drawing for pallet dimensions.

It is important to advise your racking supplier which pallets are being used and only those specified should be used in the racking.

- Australian Standard Pallet: 1170 x 1170mm
- European Pallet: 800 x 1200mm
- Industrial Pallet: 1000 x 1200mm
- NZ Pallet: 1200 x 1000mm

For more information on pallets refer to AS4068 - [Flat Pallets for Material Handling].

7. Loading & Unloading

Impact from Material handling Equipment (forklifts) or the unit loads they carry are the leading cause of rack damage. To minimize the chance of impact damage it is important that operators follow these guidelines.

7.1. Use the correct forklift

The forklift must have the adequate capacity and be capable of lifting loads to the required height. Also ensure the aisle clearance is suitable for the forklift to operate correctly and clear of any obstructions.

7.2. Use the correct tine length

The correct forklift tine length **(Fig. 3.1)** is critical to ensure load stability and minimize rack damage. Forklift tines must be of sufficient length to support all loads **(Fig. 3.2).** Forklift tines must not extend beyond the load **(Fig. 3.3).**

Fig. 3.1 – Correct Forklift Tine Length

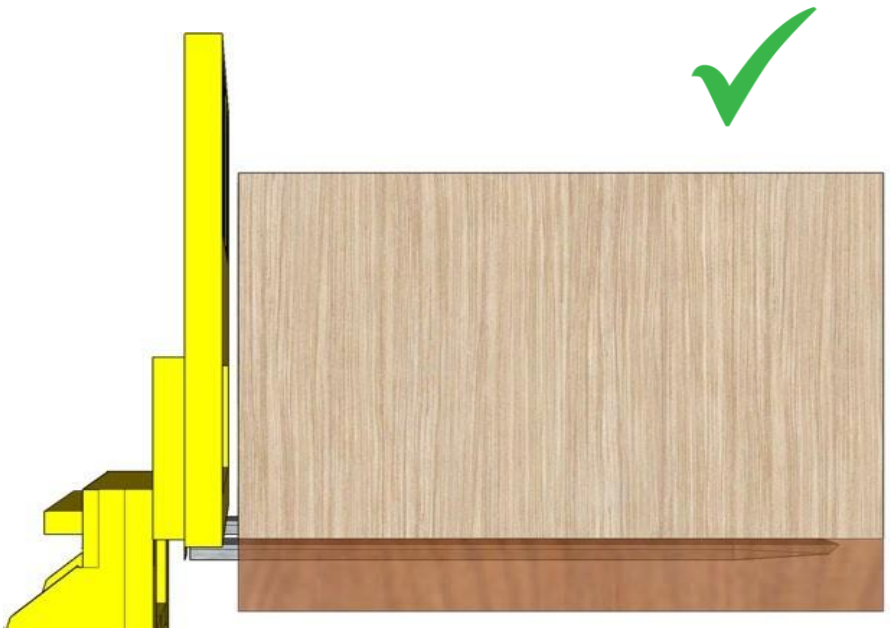


Fig. 3.2 – Forklift Tine Length Too Short

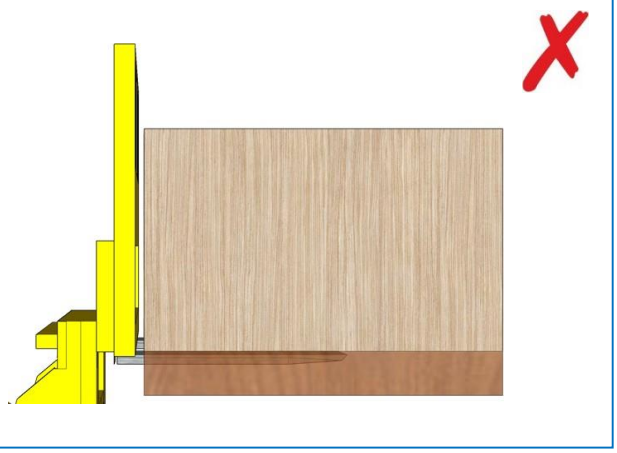
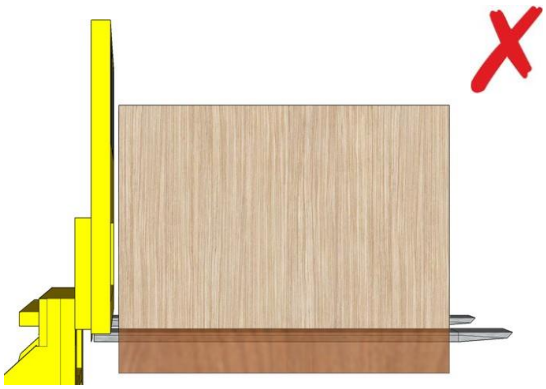


Fig. 3.3 – Forklift Tine Length Too Long



7.3. Picking up loads

When lifting a load into place on the racking system, it is important that all goods are positioned square to the materials handling equipment **(Fig. 3.4).** If the palletised goods are not positioned square on **(Fig. 3.5)** then the effective size of the load is increased, resulting in reduced control of the load and damage to the racking system or product when positioned within the rack.

Fig. 3.4 - Pallet is Correctly Aligned

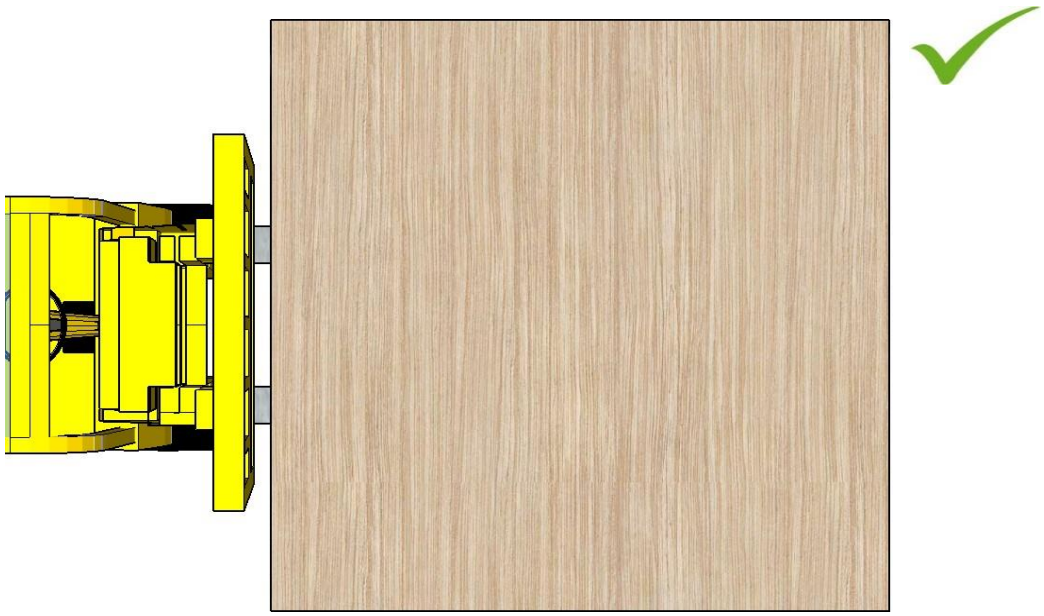
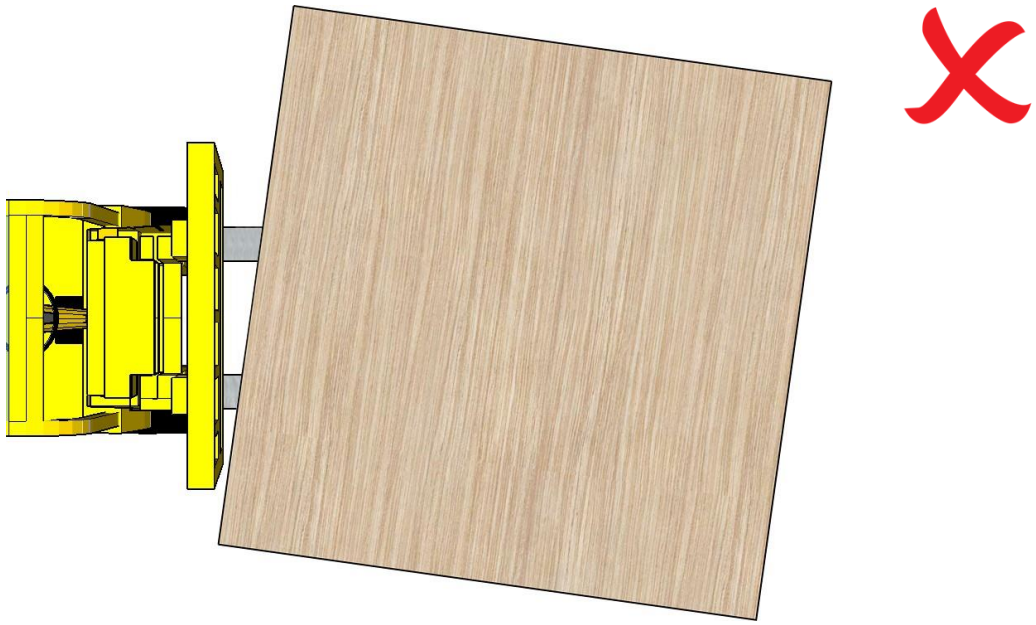


Fig. 3.5 - Pallet is Incorrectly Aligned



7.4. Entering the rack

To safely deposit or retrieve a load, the forklift **MUST** approach the racking square on, not at an angle **(Fig. 3.6).**

- DO **NOT** attempt to deposit or retrieve a load if the forklift is not aligned **(Fig. 3.7)**
- DO **NOT** 'nudge' a load to position it correctly on the rack.
- DO **NOT** slide pallets on the rail.

Fig. 3.6 – Correctly Aligned

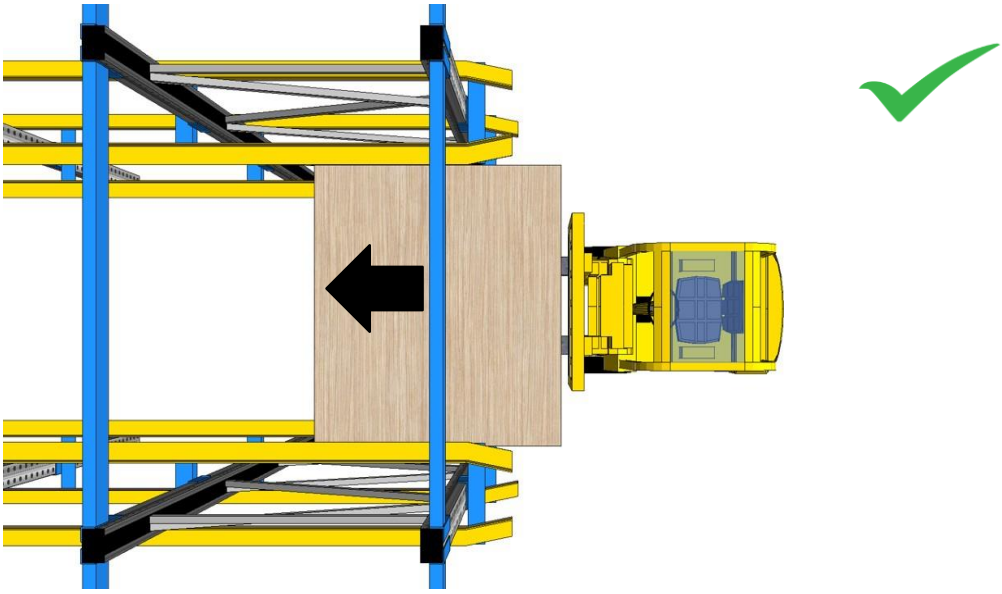
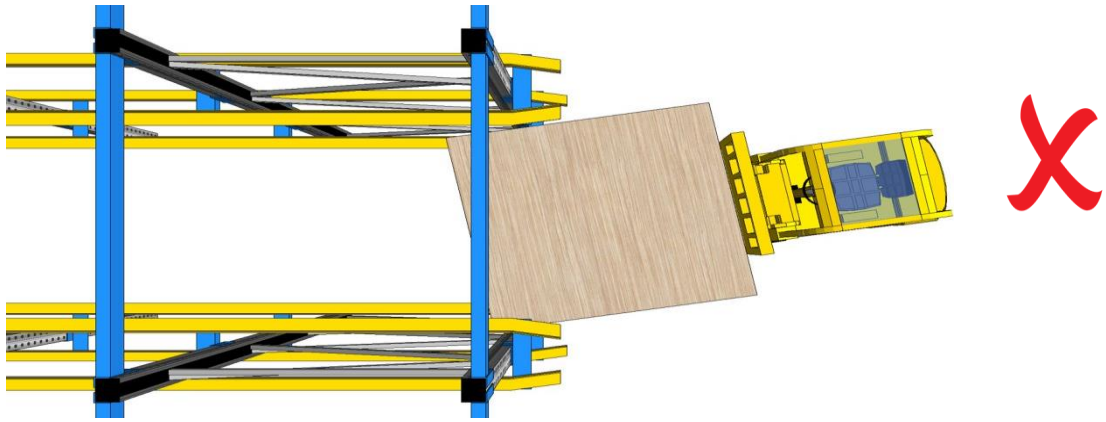
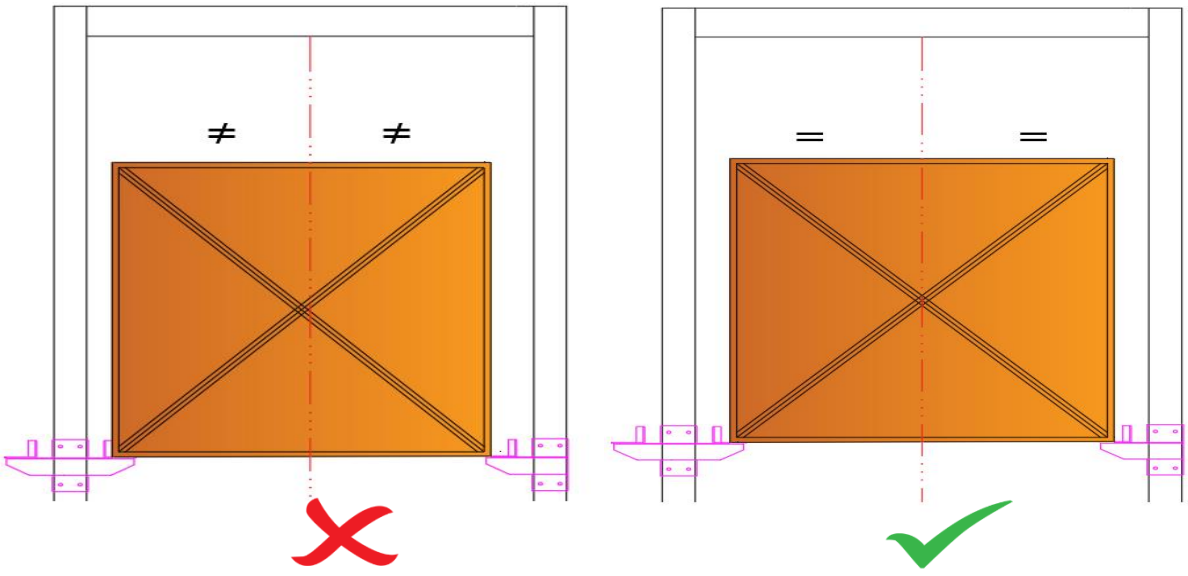


Fig. 3.7 – Incorrectly Aligned



7.5. Pallet Alignment

Fig. 3.8 – Pallet Alignment



7.6. Positioning the pallets

Incorrect pallet load placement can be dangerous to workers and can damage racking or goods.

Below are key points to note when positioning pallets into the racking:

- Loads should be evenly distributed across the rails and bay length
- Load weight should not exceed the designed load capacity
- Loads should be positioned evenly across the pallet to ensure even weight distribution, unless the rack structure has been specifically designed for uneven load distribution.
- When loading a bay, start at the ground level, continue to load the pallets above until the bay is full. Repeat for all further bays **(Fig. 3.9).**

NOTE: Under no circumstances should the operator use the mechanical handling equipment (MHE) to push a pallet into position once it is on the rails. This practice can exceed design loads for horizontal forces and can permanently damage the racking structure.

Fig. 3.9 – Load Placement

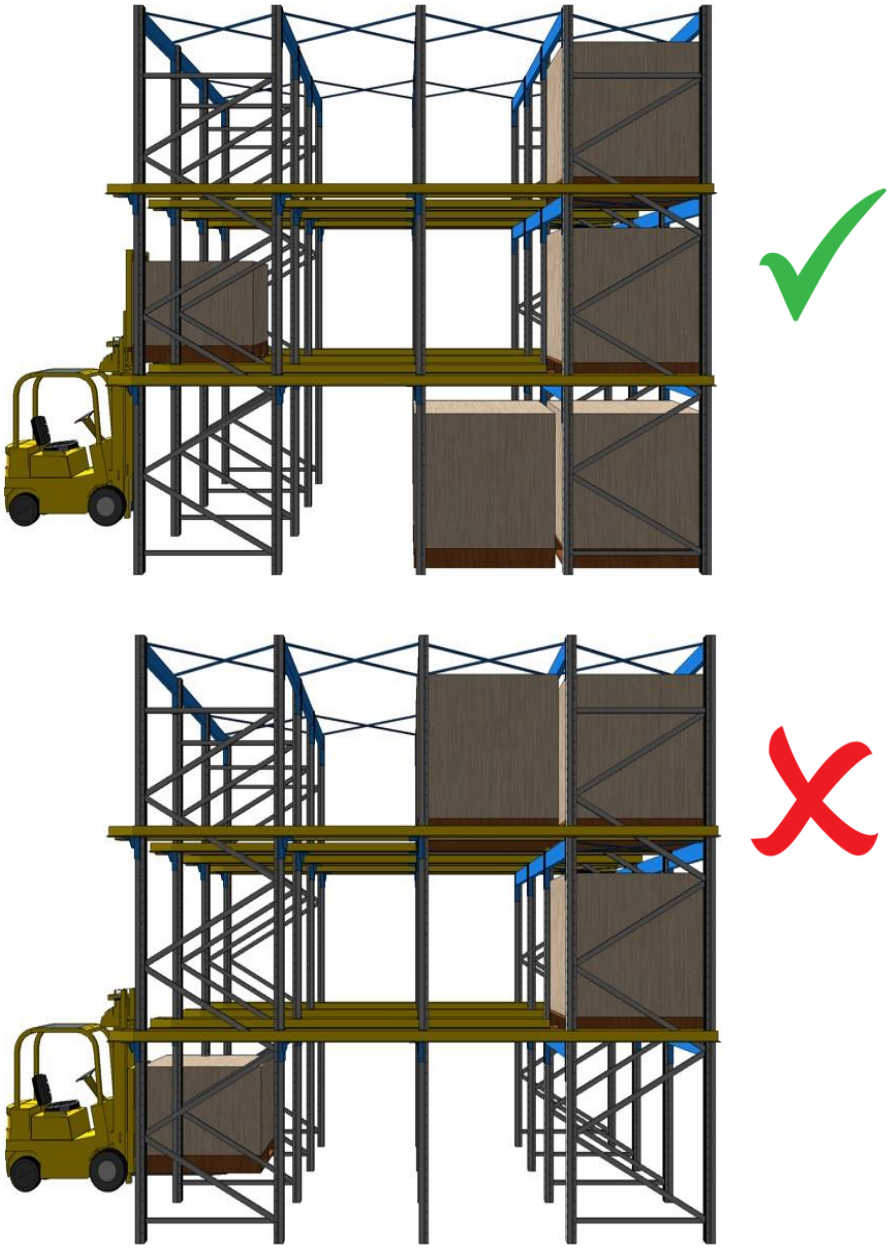


Fig. 3.10 – Loading & Unload Pattern

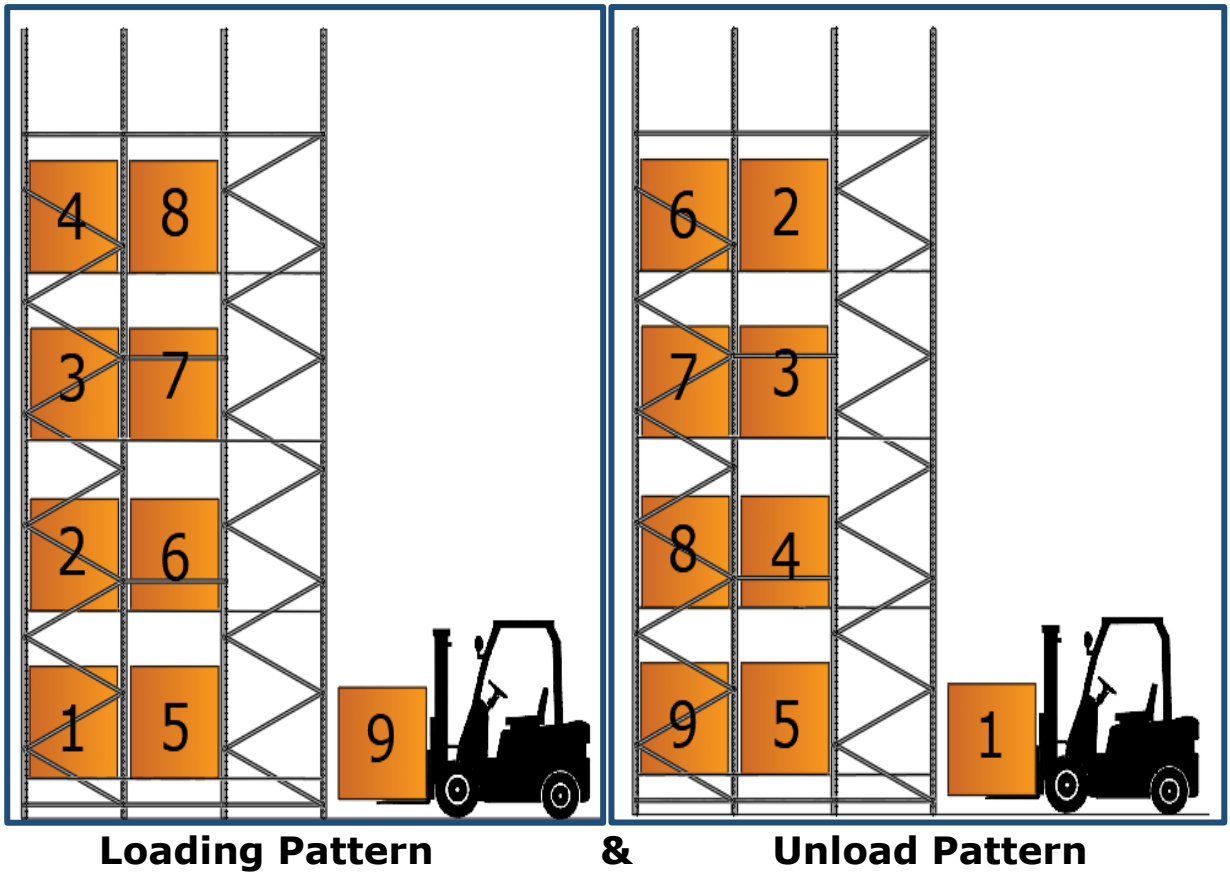
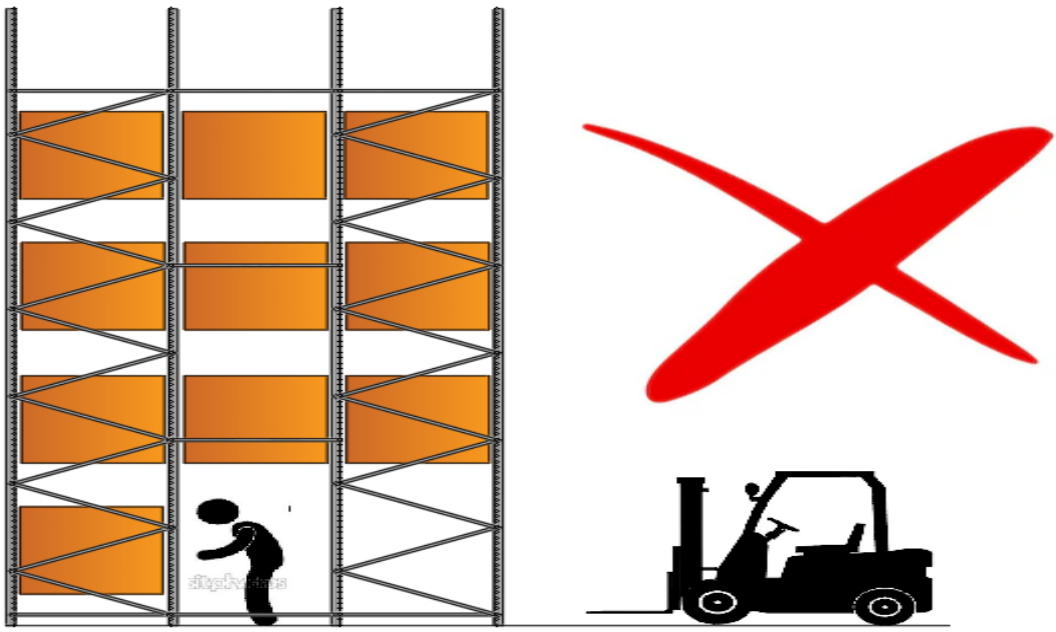


Fig. 3.11 – Safety warning



8. Unit Load Clearances

AS 4084.2:2023, clearly outlined the guidelines for minimum vertical clearances between the top of the unit load and the beam level above. **(Fig. 4).**

If the equipment operator is at ground level:

- For unit loads below 6 meters in height, the minimum vertical clearance should be **100 mm.**
- For unit loads equal to or above 6 meters in height, the minimum vertical clearance should be **125 mm.**

If the equipment operator is elevated to the storage level, the minimum vertical clearance should be 100 mm.

There shall be a minimum horizontal clearance of 75 mm between the unit load and upright frame; and 100 mm between adjacent unit loads on a common beam pair.

Fig. 4 – Unit Load Operating Clearances Sample (Dimensions in mm)

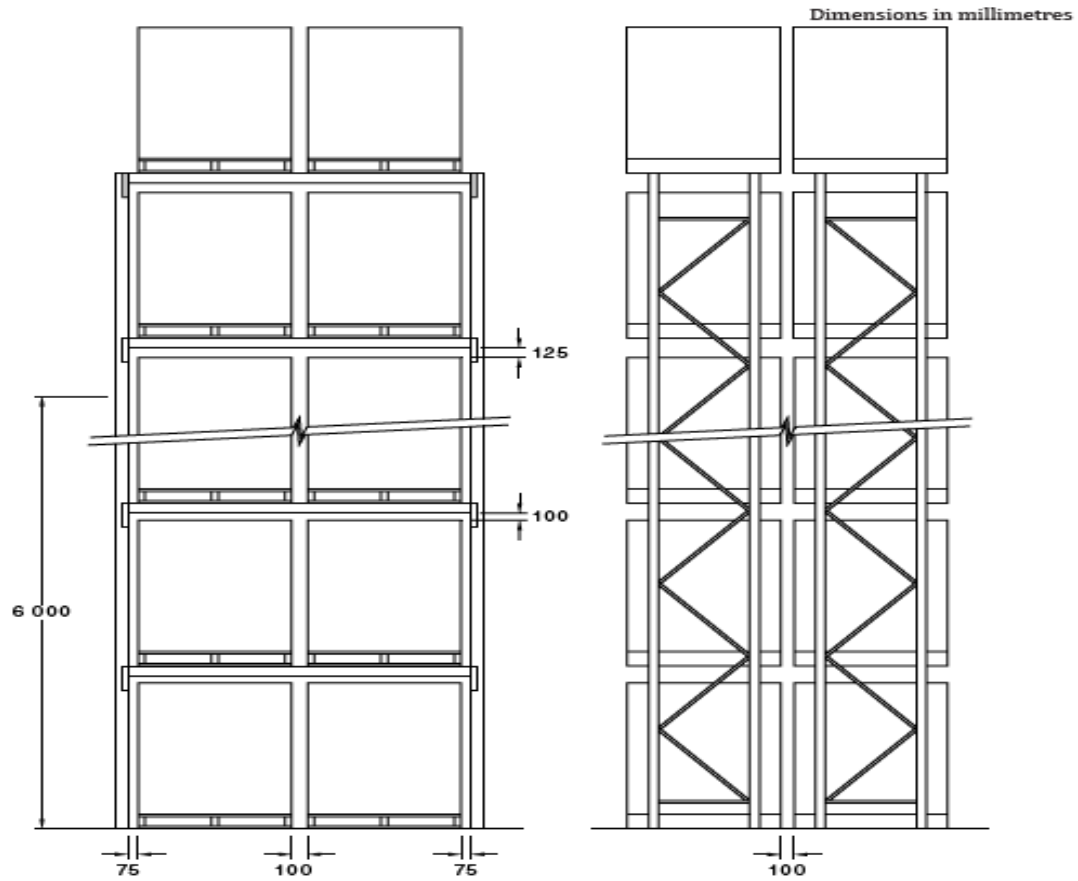


Figure 2.3(A) — Unit load operating clearances

Image sourced from: AS 4084.2-2023, Figure 2.3(A) (pg14)

9. Load packing

Ensure the load is packed correctly on the pallet **(Fig. 5).**

Do Not load a pallet with an overhanging load unless the rack has been designed for this **(Fig. 6).**

Fig. 5- Correctly Packed Pallet



Fig. 6 - Over Hanging Load



10. Rack Protection

It is recommended that Rack Protection is used on all entries. APC supplies a range of racking protection that reduces impact damage. It is important to note that although these products are used to protect racking, they can also be damaged and may require replacement/repair to properly function.

Below is a list of rack protection that can be used on Drive-In Pallet Racking.



APC Bodyguard®

The Bodyguard is formed from a rubber composite (EPDM). Its patented design deflects impact away from the upright whilst also absorbing any direct impact force, diffusing it through the guard.



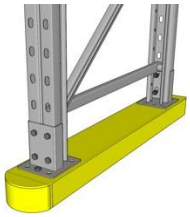
Angle Guard

Easily attachable directly to the post, this unit is designed to deflect any frontal impact without causing any loading obstructions to users.



Column Guard

A 'U' shaped guard designed to be secured to the floor at the base of the post via heavy duty concrete anchors. This unit protects the front and sides of the racking, absorbing any impact directly into the ground.



Floor Channel
The Floor Channel is designed to protect Drive-In Racking uprights from accidental damage from materials handling equipment.
Uprights are raised from the warehouse floor to guard against drive by traffic.

11. Damage Reporting

If any signs of damage are noticed, report them to your supervisor immediately. A damaged rack should not be used or accessed until it is inspected and cleared for use.

The below is responsibility of the user:

- The ongoing safety of the storage equipment.
- Inspections, reports and repairs relating to racking shall be documented and retained by the end user until the racking is removed from service.
- Carry out informal inspections at a frequency based on:
  - **a)** The result of a risk assessment (e.g. daily or weekly)
  - **b)** At intervals recommended by a competent person.

11.1. Impacts

Report ANY and ALL impacts and assess any signs of damage.

11.2. Damage to Racking

Any damage to a racking post will reduce its load carrying capacity. When damaged, the post may fail under its normal working load.

12. Safety Notes

- Recognize that racking components are produced from light gauge thin-walled sections which can only tolerate limited impact.
- A single failure in a pallet racking structure can lead to a catastrophic failure or collapse which may result in injury or even a fatality.
- Racking, MHE and load interactions are critical to operating a safe workplace.
- Keep aisles clear at all times.
- A small dent / deflection in a post could render the racking unsafe and may require replacement.
- Even though racking beams are adjustable, the beam level position is critical in the design of the total structure's load-bearing capacity. Levels must not be removed and/or repositioned without consulting the manufacturer or competent person.
- Beam safety clips are to be fixed at all times.
- Damage inspections should be carried out in accordance with AS4084-2023.
- Racks shall be inspected every 12 months as a minimum.
- AS4084-2023 introduces a process to inspect racking for corrosion and provides guidelines and schematic examples for evaluating the degree and classification of corrosion damage. If there is any doubt about the level of corrosion during an informal inspection carried out by an end user, advice should be sought from a competent person.

- Users should be encouraged to report any damage.
- Employers have a duty of care under the WHS Act to provide and maintain plant and systems that are safe and without risk to health. Having regular inspections will assist employers to comply with their obligations under the WHS Act.

13. Rack Inspections

It is recommended to conduct systematic evaluations of pallet racking systems at regular intervals, informally during daily or weekly site safety checks and formally at least once every 12 months, as a minimum.

APC offers a full inspection service to assess your racking. Contact our office on 1300 138 303 or visit our website (apcgroup.com.au) to find out what we can offer.

14. Disclaimer

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