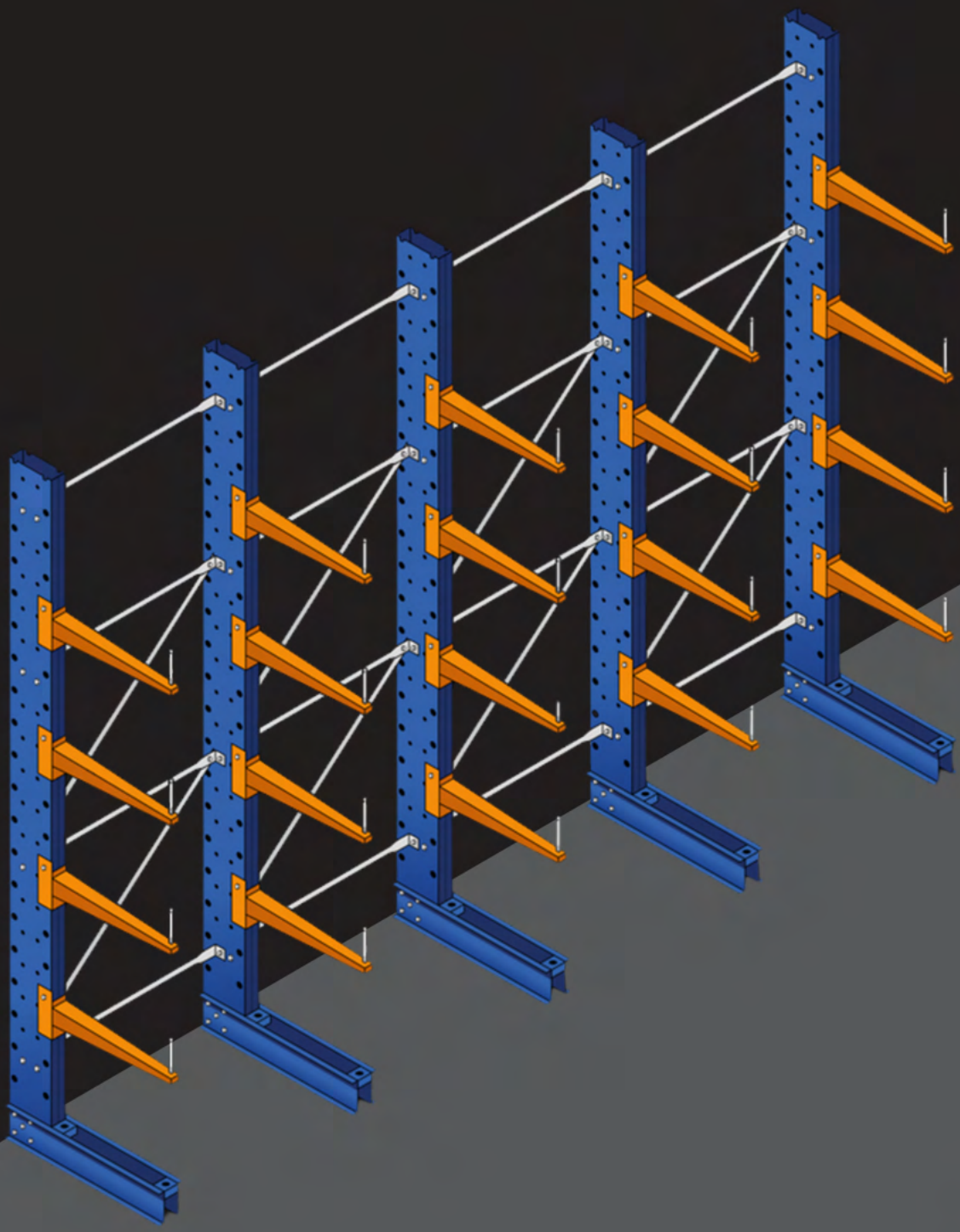
APEX RACKING

CANTILEVER RACKING USER MANUAL



V.1

CONTENTS

NOTE

This document only covers APEX cantilever racking.

This document does not cover other racking including, but not limited to:

- Drive-in racking
- Push-back racking
- Selective pallet racking
- Mobile racking
- Racking made of materials other than steel

SECTION 1

ASSEMBLY SPECIFICATION

The below instructions are to assemble APEX cantilever racking within the following specifications:

- Column heights of no higher than 6096mm.
- Arm lengths of no longer than 1500mm.
- No less than two columns braced with appropriate horizontal and diagonal bracing.
- Height to the top arm level and arm spacing as discussed with local APEX representative.
- Load to be uniformly distributed both between the sets of arms on a level as well as along each level.

Contact your APEX representative for assembly of custom C350, C410-A or C410-B systems.

PRODUCT OVERVIEW

Cantilever racking systems store large, long and non-palletised materials off the ground.
APEX offers C200 and C305 options in both powder-coated and HDG (hot-dipped galvanised).
Heavy Duty applications can be imported, including C350, C410-A and C410-B.

All APEX cantilever racking is designed and manufactured to FEM 10.2.09 standards.

SITE REQUIREMENTS

FLOOR

Cantilever racking is designed to be installed on a suitable concrete surface. This implies that the concrete has been reinforced and will be able to accept the load that will be applied at each of the footplates of the system.
Although most warehouse floors are designed with cantilever racking loading in mind, you should always check with a structural engineer if unsure.

DRY CONDITIONS

All engineering calculations relevant to the specification of this document have been based on dry internal application. Should you have an external racking requirement, cool room or humid environment (such as an industrial laundry or abattoir), please refer to your local APEX representative for further information.

TEMPERATURE RANGE

All engineering calculations relevant to the specification of this document have been based on greater than +4°C and in the freezing range of -24°C to -16°C.

Should you wish to install APEX in a chilled environment in the range of -16°C to +4°C or any other humid or outdoor environment, it is recommended that you have the additional corrosion protection of galvanised racking. Temperatures below -24°C must be discussed with your APEX representative.

COMPONENTS REQUIRED (AS SPECIFIED BY YOUR APEX REPRESTATIVE TO SUIT YOUR SPECIFIC LOADING REQUIREMENTS)

- Minimum of 2 columns;
- Minimum of 2 bases;
- Minimum of 2 arms;
- Minimum of 1 bracing set, dependent on height;
- Minimum of 1 SWL sign, if requested.

ENSURE A SAFE WORK ENVIRONMENT PRIOR TO ASSEMBLY

RISK ASSESSMENT

Prior to assembly, a risk assessment should be undertaken which considers all tasks necessary to complete the assembly of your APEX cantilever racking. This includes the equipment being used as well as any hazardous substances being handled. This will highlight associated risks and ensure necessary steps taken to reduce the risk to acceptable levels. From this risk assessment, a Safe Working Method Statement (SWMS) should be produced.

SAFE WORK METHOD STATEMENT (SWMS)

A SWMS is developed for activities undertaken by workers, which identify the hazards associated with a work activity. A SWMS will assess the risk of these hazards occurring and outline the preventative controls to be put in place. It is a requirement of Work Health and Safety legislation that a SWMS be prepared for high risk work, prior to work commencing.

For further information regarding SWMS, refer to the WorkSafe fact sheet: Safe Work Method Statements (SWMS) guidance.

https://www.worksafe.vic.gov.au/resources/safe-work-method-statements-guidance

SITE SURVEY

A site survey should be undertaken prior to the supply of material to site and an assembly layout prepared.

This layout should include but not be limited to:

- Location of doorways.
- Location of building columns.
- Floor type, flatness and any drainage or joint locations.
- Headroom clearance and any obstructions.

EQUIPMENT

The following is a guide only on the equipment required to facilitate the safe assembly of the structure.

Equipment may include, but not be limited to:

- Hand pallet trucks.
- Surveying equipment.
- Access towers.
- Forklift trucks.
- Hand tools.
- Trolleys.
- Power tools.
- Scissor lifts.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protective Equipment should be worn to ensure personal safety during assembly.

Personal protective equipment may include but not be limited to:

- Hard hat.
- Safety boots or shoes.
- Rigger gloves.
- High-Visibility vest.
- Ear defenders.
- Work wear.
- Safety harness.
- Safety goggles.

ASSEMBLY GUIDE

Note: THIS IS A GUIDE ONLY. It is always recommended that you use a cantilever racking install contractor whom may use different methods, however the below will assist in self-installation. Please independently refer to FEM 10.2.09, other relevant standards and the building codes of Australia for further necessary information prior to installation to ensure compliance.

WARNING: Check your states legislation as you may require a building license to install cantilever racking, such as a QBCC license in Queensland. It is upon the installer/self-installer to ensure compliance with state and local authority regulations.

1. Measure and mark out the location of the cantilever racking, prior to the assembly of the rack, making sure that the columns of the racking will end up square and running in a straight line; this can be achieved by marking out a simple 3,4,5 right-angled triangle on the ground.
Each column and base location should be clearly marked on the floor, and its level taken to find the highest point under the rack.
The remainder of the assembly will have their bases packed with shim plates to level up to this highest point.
Ensure aisles or access to emergency escape routes or fire equipment is not blocked by the assembly of the rack.
2. Lay two (2) posts on the ground and attach to their bases using the base bolts provided.
3. Attach the cleats/brackets for the bracing to the posts using the bolts provided while laid down.
4. Stand the two posts up for the starter bay and attach the lowest horizontal brace using the bolts provided.
5. Attach the rest of the horizontals and diagonals for the bracing to the cleats up through the system until you reach the top level. You may require a scissor lift for this part of the installation.
6. Repeat steps one, two and three using just one post and one base.
7. To level the rack, fit the appropriate number of shim plates under each footplate which is attached to the bottom of each frame.
As a check to make sure the racks are true & plumb to the vertical, a spirit level should be used to measure the "out of plumb", on the front top of the base uprights, adding or subtracting shim plates as required.
8. All bases attached to columns must be anchored to the floor to resist any lateral movement or uplift of the racking system. Secure each footplate to the floor using the anchors provided.
9. When the system is in place attach your arms to the posts using the bolts provided.
10. For safe operation of your racking system please ensure all bolts are securely tightened, that it is plumb and level and that you have a Safe Working Load sign fitted to a highly visible location in the racking area at approximately 2000mm above the floor level. It is recommended that the Safe Working Load sign is fixed to the end of the rack (if appropriately visible).

11. A Safe Working Load sign details the maximum height of the arm level as well as the maximum capacity of the side if a column and the maximum capacity of each arm. Although each arm has been engineered to take a certain maximum UDL load it should be noted that depending on the configuration the load capacity detailed on the load sign may be less than this to ensure that the maximum capacity of the column is not exceeded. This calculation is done taking into account a number of factors including but not limited to the thickness of the steel used, the rolled section of the arm, the size of the post, and the moment produced by certain length arm as well as the moment produced by a certain maximum arm height. If installing your cantilever racking yourself, please contact your local APEX representative for information on load signage.

LOAD SIGN

Standalone bays must NOT be used to imitate runs of joined bays. See page 18.

This is the post height

This is how many arms will be on each post.

This is how much weight each arm can hold across the arm (universally distributed load).

This is how much weight each side of the post can hold (universally distributed load). This is often the sum of the weight that each arm level can hold.

This details information regarding the design, manufacture and install of the racking system.

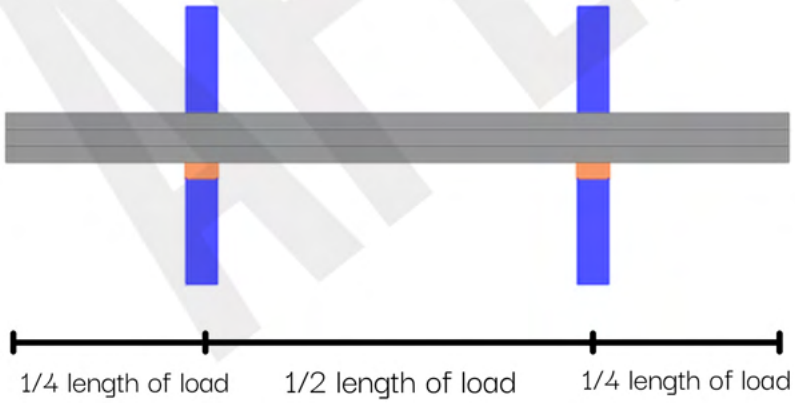
SECTION 2

CORRECT USE OF CANTILEVER RACKING

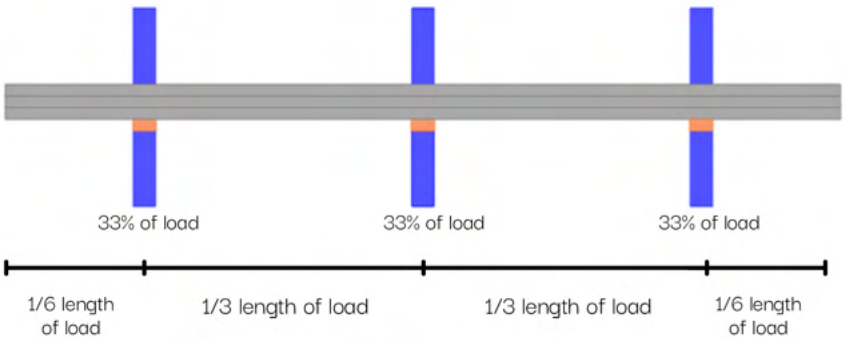
DETERMINE THE NUMBER, CAPACITY & SPACING OF ARMS

There must be enough arms under the load to prevent deflection,
Deflection causes undesirable side pressure on the arms, see below.

If two arms are used, the required arm capacity is half of the load's weight.
The distance between the uprights is half of the load's length, see below.



If three arms are used, the required arm capacity is one-third of the load's weight, and the distance between upright centerlines will be one-third of the load's length, see below.



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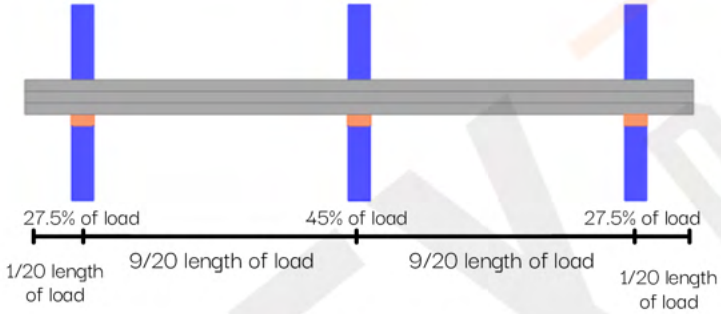


If the stored items aren't very rigid and the load is not evenly distributed, the middle arm (shown above) may be overloaded unless it is carefully checked during the design phase.

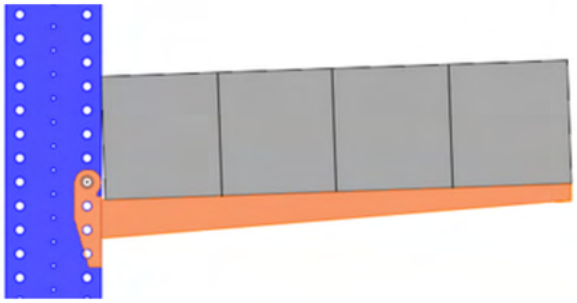
✗ AVOID THIS

Note: Loads should extend beyond the end of the rack by roughly half the distance between the centers of each two posts. Loading without this overhang is not recommended, as it results in uneven weight distribution.

DETERMINE THE ARM LENGTH

The arm length should equal the load depth. For example, 1500mm wide plasterboard requires an arm length of 1500mm or longer. The load depth should never exceed the length of the arm.

It is also important to note that the rated arm capacities may be seriously diminished if proper loading techniques are not followed, see below.



Uniformly Distributed Load

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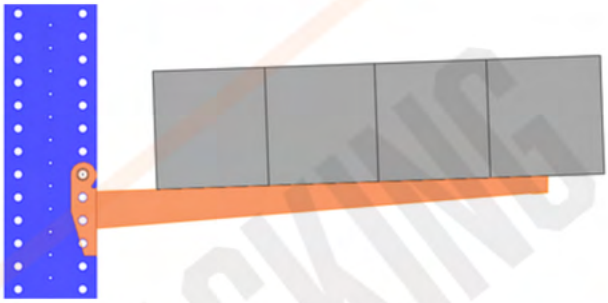

Non-Uniformly Distributed Load

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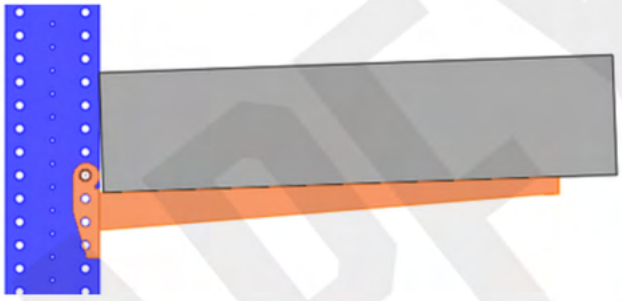


Non-Uniformly Distributed Load

✗ DON'T DO THIS

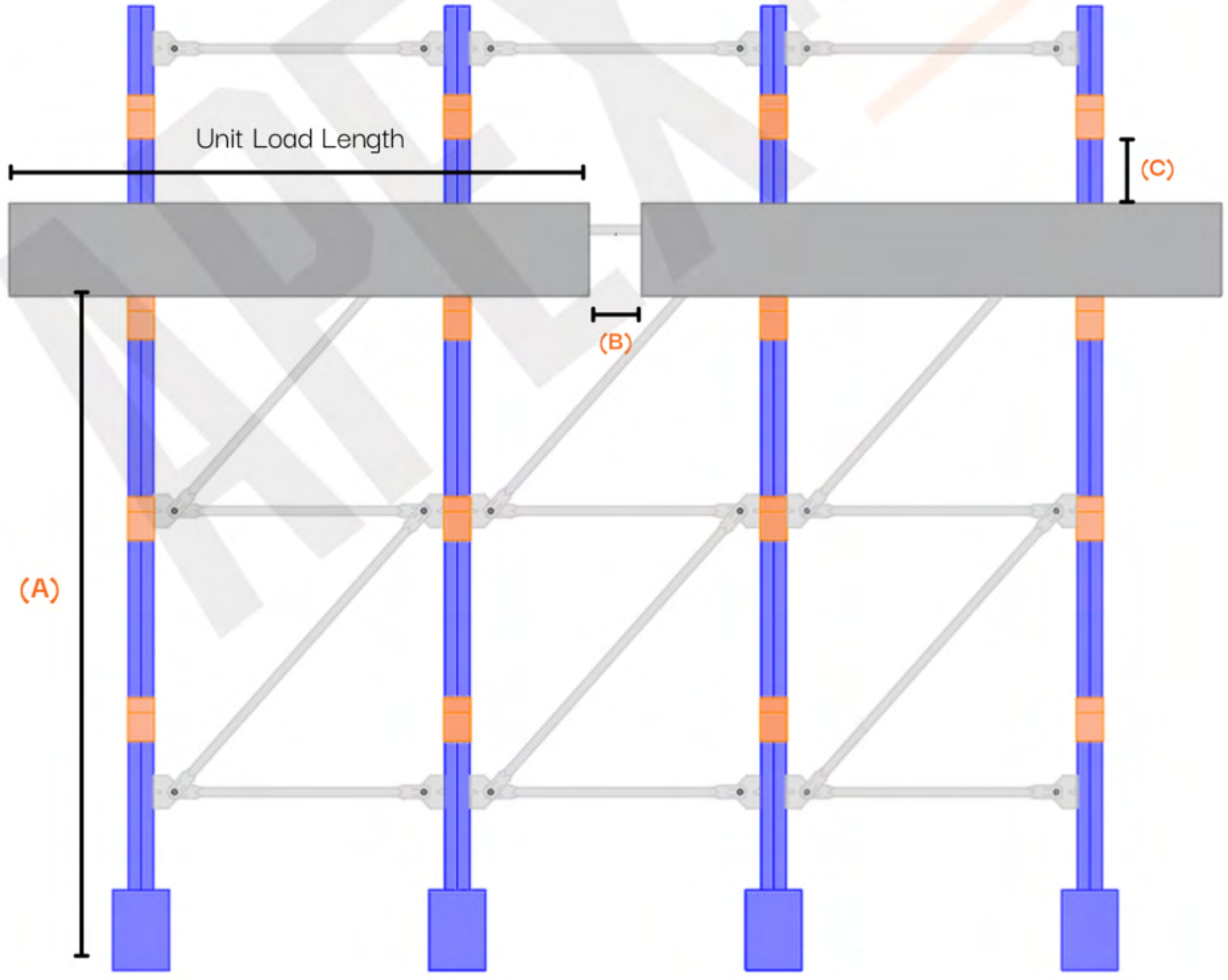
Non-Uniformly Distributed Load

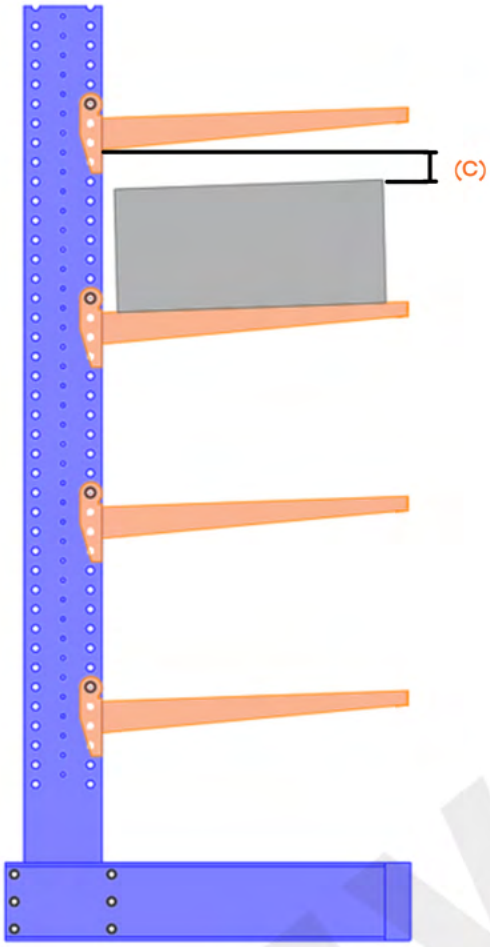
✗ DON'T DO THIS

HORIZONTAL & VERTICAL CLEARANCES

The following table outlines the minimum recommended horizontal and vertical clearances for safe and efficient use of cantilever racking systems. These clearances are essential to ensure ease of loading and unloading, prevent accidental contact with structural components, and maintain compliance with standards and safe work practices. Proper clearances also help to protect both the racking structure and the materials being stored, reducing the risk of damage and improving overall operational safety.

Arm height (from ground up to arm level) (A)	**Minimum pack spacing for unit load length (up to 3m)** (B)	**Minimum pack spacing for unit load length (3m to 6m)** (B)	**Minimum pack spacing for unit load length (over 6m)** (B)	**Minimum vertical clearance above stored items** (C)
3000mm	200mm	250mm	300mm	75mm
6000mm	250mm	300mm	350mm	100mm
9000mm	300mm	350mm	400mm	150mm
13000mm	400mm	450mm	500mm	200mm





CLEARANCES ON SLOPING FLOORS

GENERAL

Please note that any floor slope or unevenness may require additional clearance beyond what is listed in this document. This is especially important for outdoor areas where floors are often sloped with a ~2% gradient or more to allow for rainwater drainage. These slopes can affect how the rack aligns with the load, potentially increasing stress on individual arms during loading and unloading. This may impact both safety and rack design.

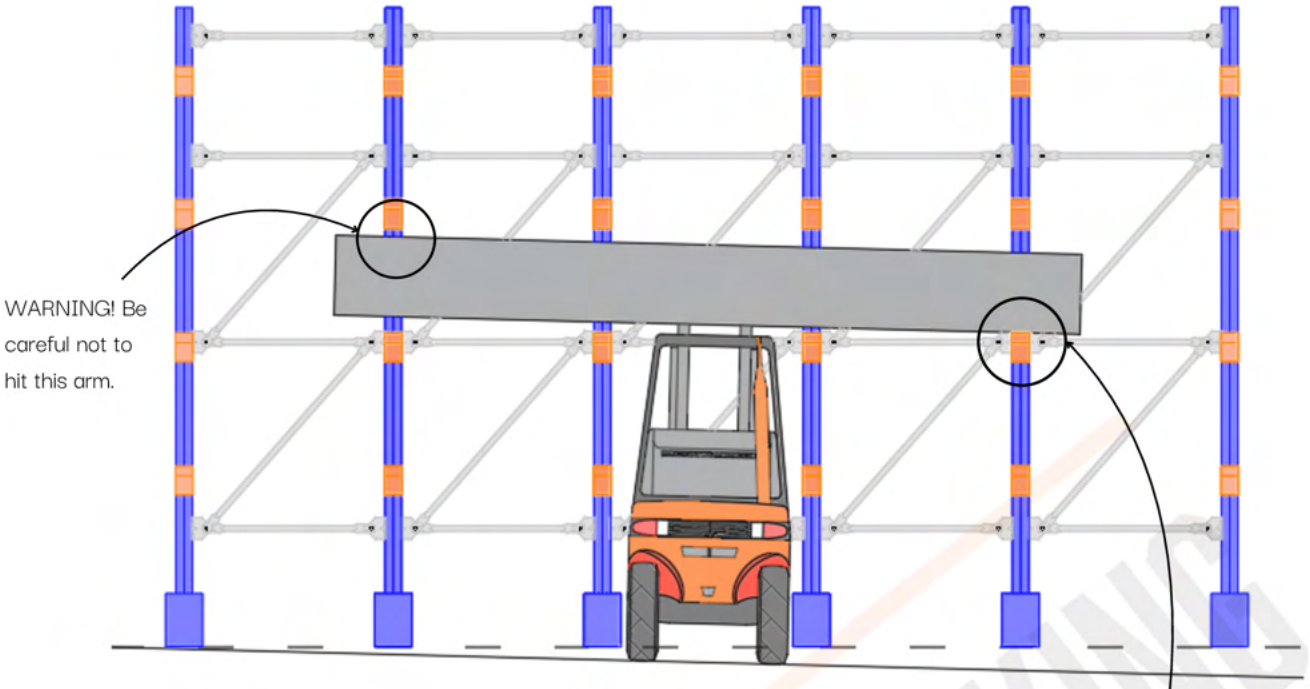
CROSS AISLE

The racking must be shimmed so that they are installed vertically. Forklifts can then use their tilt function to safely and evenly place or retrieve goods. In most situations, no further adjustments are needed.

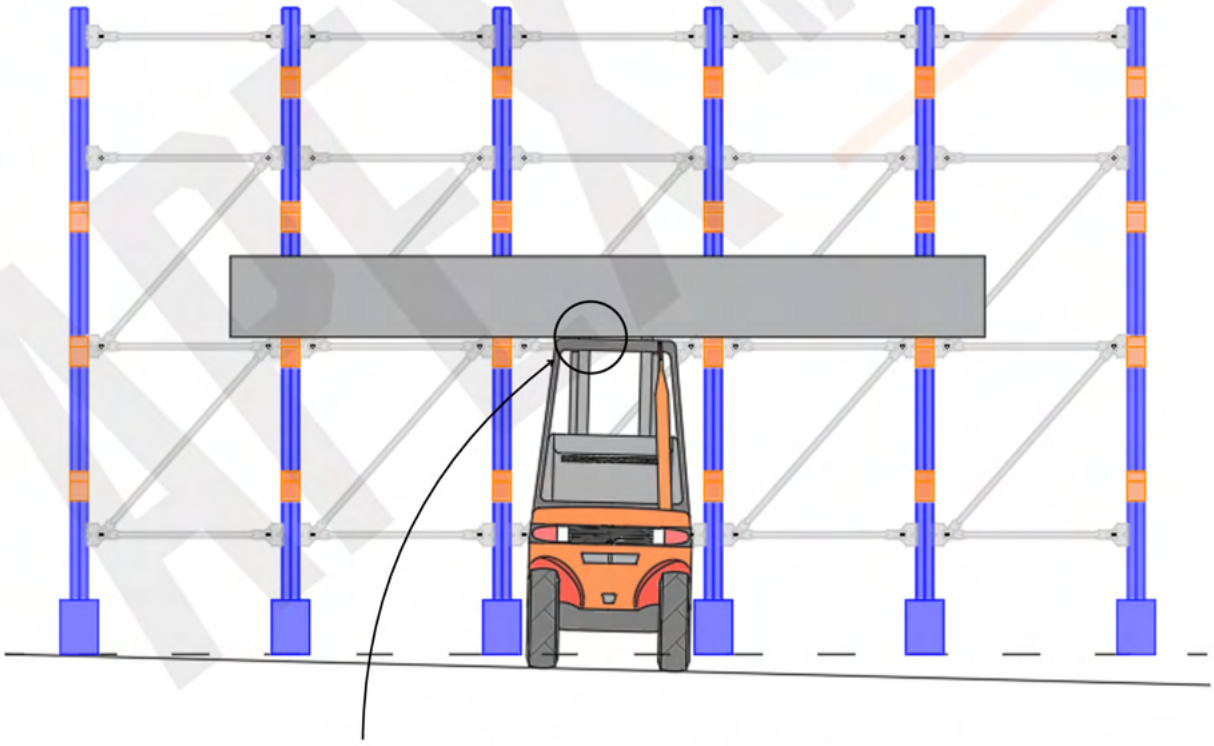
DOWN AISLE

If the floor slope changes less than 3mm over a 1-meter length along the aisle, then the standard clearance values shown in the "Horizontal & Vertical Clearances" table can be used–they already account for this level of variation.

However, if the slope exceeds 3mm per meter, the clearance value ("C") should be increased by the full height of the rack post to ensure safe operation.



In the above scenario, the goods will place weight on the downward-sloping arm first, which could lead to overloading if not the load is not handled carefully during operation.



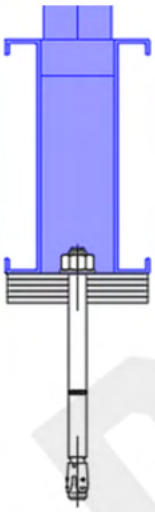
In the above scenario, when unloading, the uphill forklift tine takes on the load first, which can strain the equipment or damage the goods if not handled with care.

SHIMMING FOR STANDARD FLOORS

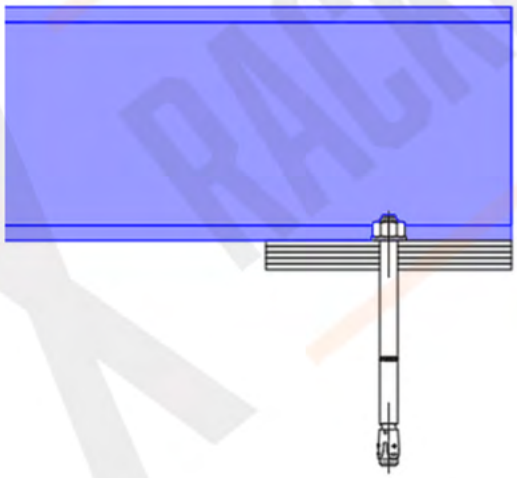
Shimming is a standard practice with racking to ensure the rack is level as all floors have a small amount of variation. APEX uses 1.5mm and 10mm thick shims purpose cut to size & shape.
The shims are stacked on top of each other at the anchor points and must be arranged so that they can not move, including if hit by a forklift tyne. This may require additional anchors or welding in particularly large slope circumstances. Your authorised APEX representative will be able to advise you in this matter.
As per engineering requirements, these shims extend under the base laterally as viewed from the front of the rack. The base must be level at the "toe", the "heel" and under the column.

LIGHT DUTY

Front view



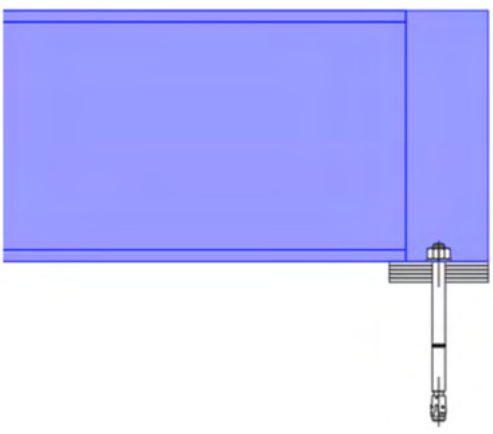
Side view



MEDIUM DUTY

Front view

Side view

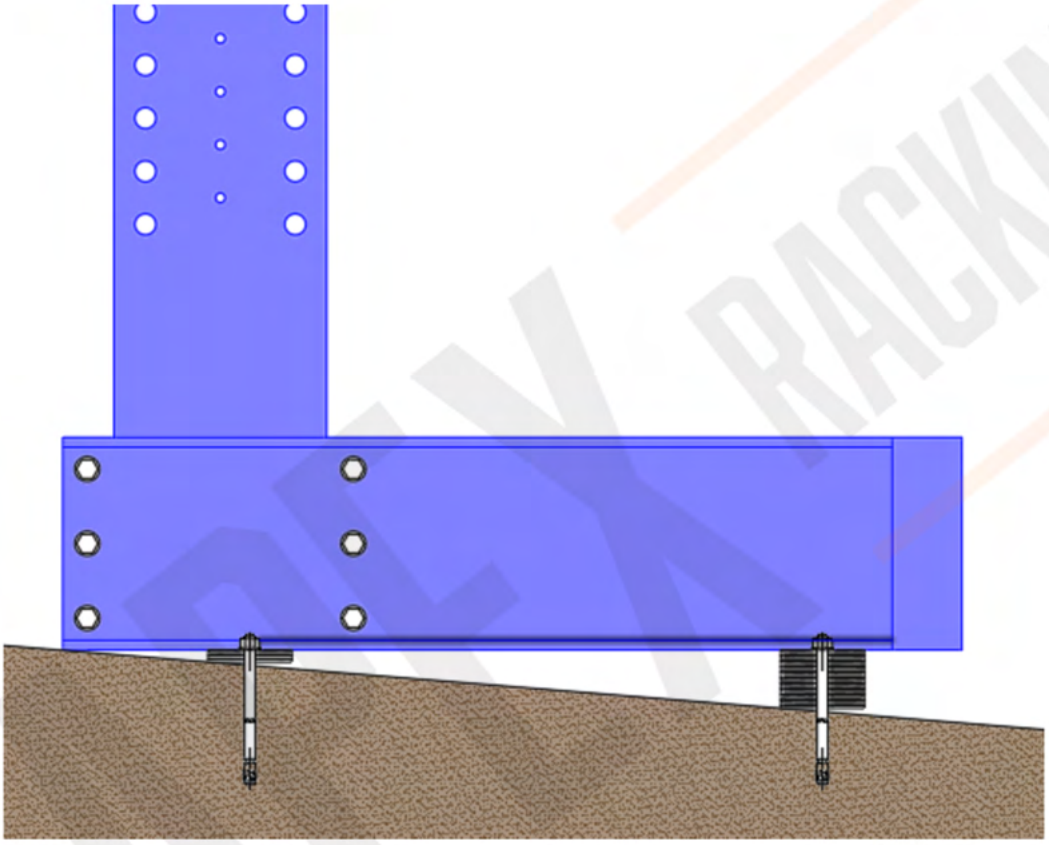


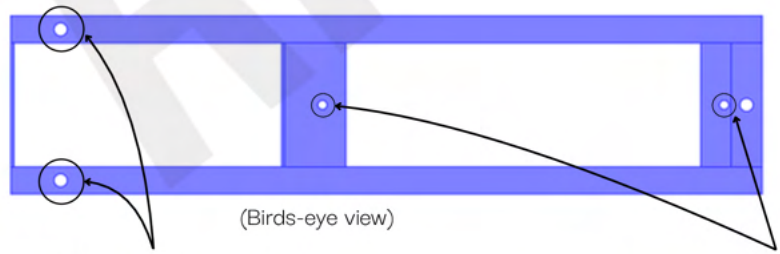
SHIMMING FOR UNEVEN SLOPES

Sometimes cantilever will need to be installed on uneven slopes. When this occurs, we will need to shim the racking in order for it to be level. The slope may run in a number of different directions. The below scenarios show slopes running front to back, back to front and side to side. In real world scenarios it is likely that all 3 are happening at once.

Outdoor racking often is installed on drainage gradients which means that the scenario of high shims at the toe of the cantilever rack and minimal shims at the heel is generally the most common situation.

Scenario 1: Slope falling from heel to toe of cantilever rack.





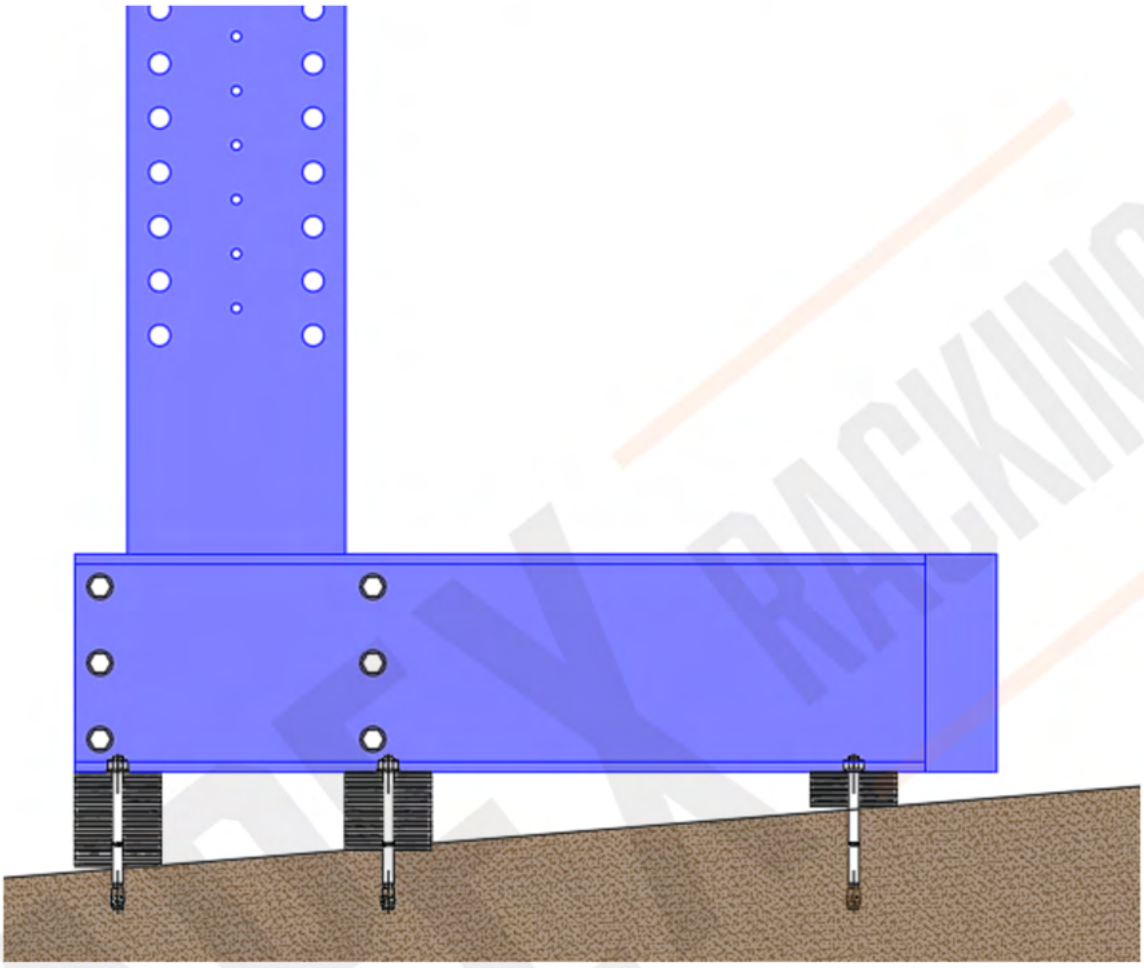
(Birds-eye view)

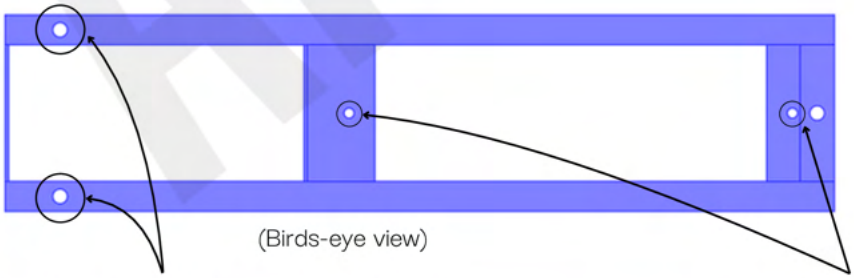
M12 stud anchors at 70mm embedment (only if required).

M16 stud or chem anchors.

This second scenario is fairly uncommon unless there is a drainage channel. However, it is critical to understand that the post must be supported by shims as per below.

Scenario 2: Slope falling from toe to heel of cantilever rack.





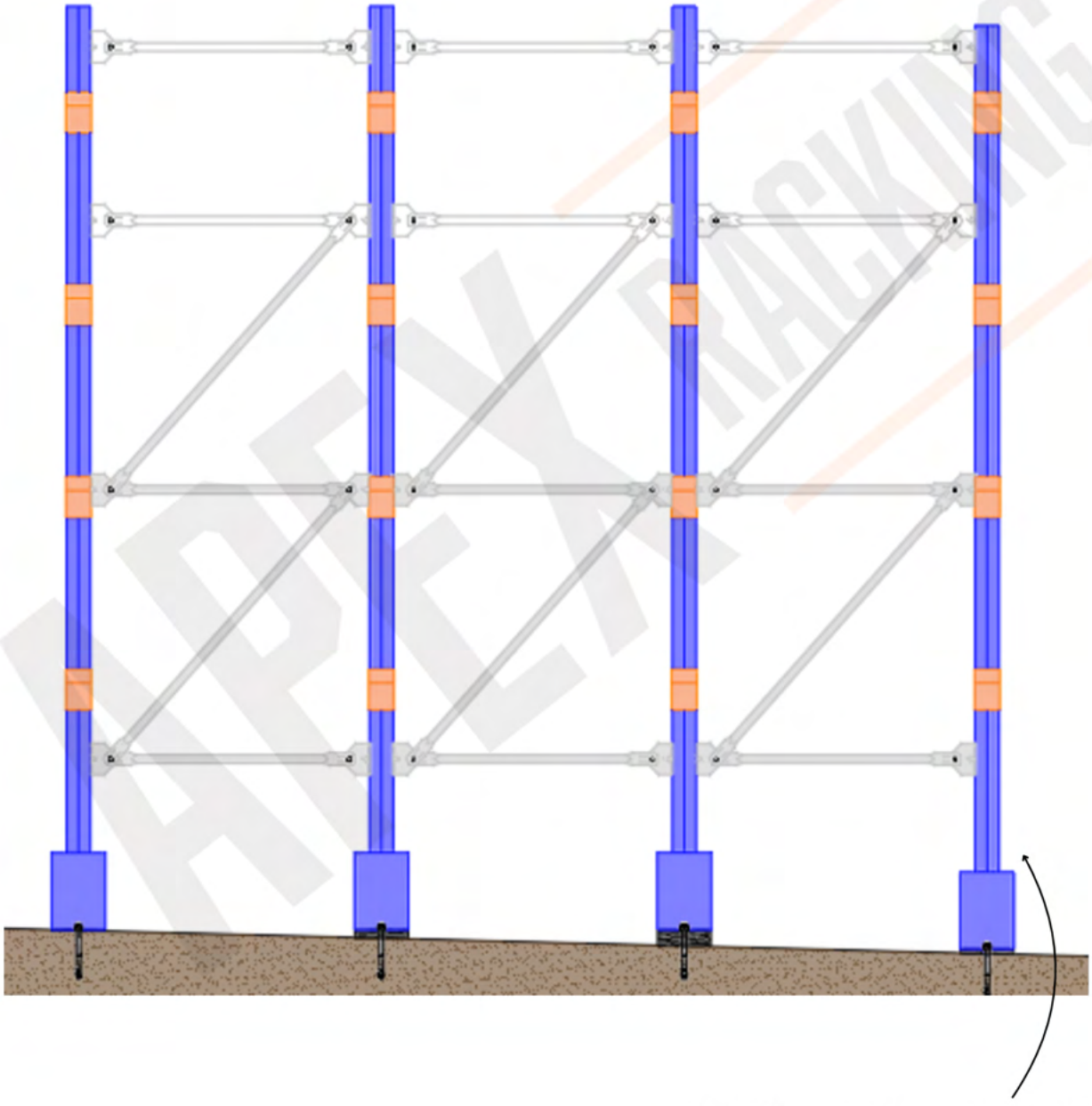
(Birds-eye view)

M12 stud anchors at 70mm embedment may be required to secure shims from slipping out from under the column.

M16 stud or chem anchors.

This third scenario shows a fairly common situation where the racking is built along a slope. There are a number of solutions that may be used to ensure the racking is level.
The bases can be shimmed underneath, however as the run gets longer the number of shims will increase making it hard to achieve the requirement anchor embedment. Therefore it may be required to either do shorter runs or "step" the columns down to keep the arms at the same level as depicted by the right hand column in the below drawing.

Scenario 3: Slope falling from left to right of cantilever rack.



DETERMINE THE UPRIGHT HEIGHT

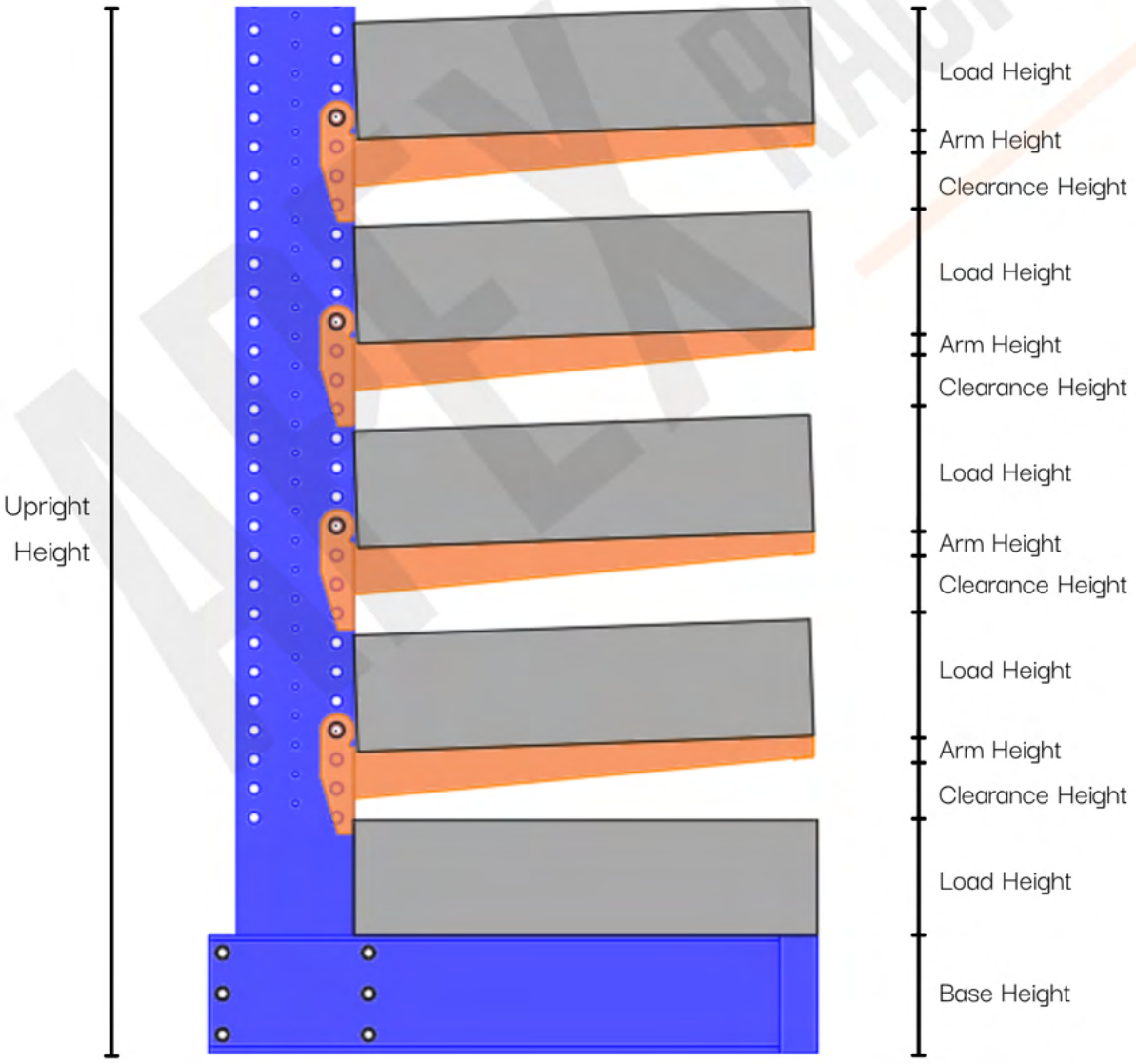
When determining the upright height, it is important to check the limitations of your site or plant, such as ceiling height, forklift reach, sprinkler system and other factors that might affect the overall height.

Note: The load placed on the base does not reduce the rated capacity of the upright. Thus, the heaviest loads should be placed on the base.

The height of the uprights can be determined by adding:

- Base height;
- Load height multiplied by number of loads;
- Arm thickness multiplied by number of arms; or
- Clearance (between the load and next arm) multiplied by number of levels.

See below:



LOADING AND UNLOADING THE RACK

PICKING UP THE LOAD

Check that forklift tynes or crane slings are spaced to support the load with minimum deflection when lifted and will clear the cantilever arms when loading the system. Where a forklift or a side loader is used, the load must be picked up square to forks. Misaligned loads cannot be corrected during the placement sequence and results in uneven loading on arms.

APPROACHING THE RACK

Slow down and stop the forklift or crane in front of the desired location. Reduce any tilt on the forklift mast and raise the load to the required storage level ensuring the load is still aligned centrally.
The pack or bundle must be presented to the rack squarely and not at an angle.

LOADING THE RACK

1. Correctly position the load above the cantilever arms within the depth of the rack in accordance with the following instructions. Ensure no contact is made with the arms or rack structure whilst maneuvering load into position.
2. Carefully lower the goods onto the support arms and release the load. Once the load is in contact with the support arms, it must not be slid or dragged along or across the structure.
3. Carefully remove the forks or slings from the load and exit the system.

Note: It is not acceptable practice to:

- **Nudge one bundle or pack with another in an attempt to move or re-align loads.**
- **Drag or slide loads on the arms.**

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

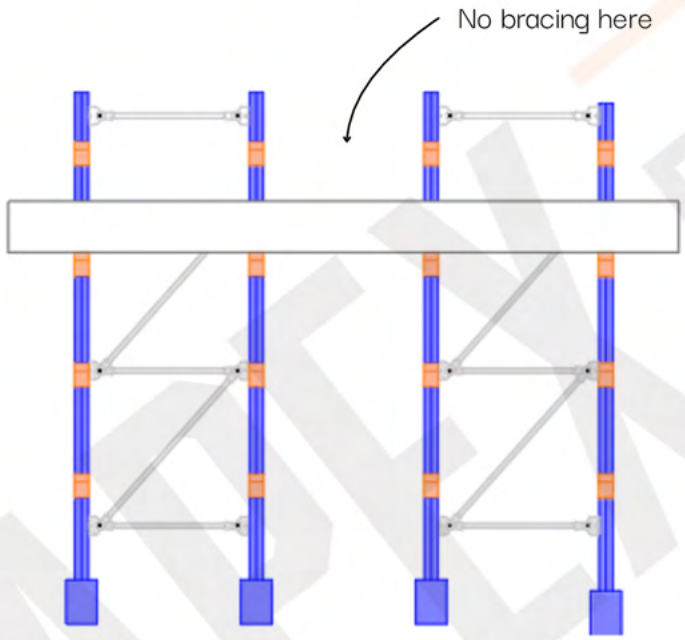
UNLOADING THE RACK

1. Approach the rack squarely and align the forklift or crane centrally in front of the required goods.
2. Insert the forks under load or slings around the load.
3. Carefully lift the load just clear of the cantilever arms. Ensure the load is not raised too high so you don't hit the arm of the level above.
4. Remove the goods well clear of the rack before lowering the load to the floor or correct travelling position.

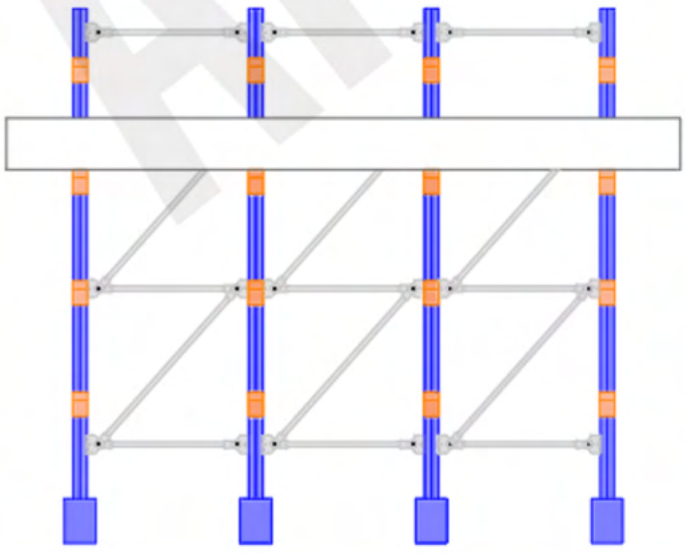
USING STANDALONE BAYS TO IMITATE RUNS OF JOINED BAYS

When placing loads across four or more arms, it's essential to brace all posts together to ensure the entire structure functions as a unified system. Using individual, unconnected bays to mimic a continuous run of three or more bays is not permitted, as such configurations lack the necessary structural integrity, increasing the risk of misalignment and potential load shifts.

Consider the analogy of two trucks driving side by side: if one veers slightly, the other doesn't automatically adjust its path. Similarly, without proper bracing, if one rack experiences an unexpected force—such as a forklift impact, seismic activity, or routine operational stress—it may move independently, leading to instability and potential hazards.



✗ DON'T DO THIS



✓ DO THIS

SECTION 3

DAMAGED RACK & RISK ASSESSMENT

Almost all damage to racking systems occur as a result of a collision impact on the structure by a forklift or the load that the forklift or crane is transporting. Any damage will reduce the ultimate load carrying capacity of the rack to some degree. The greater the damage, the greater the reduction in safety factor, until ultimately a collapse could occur at normal working load.

It is important that the user is aware of this situation and understands the need to monitor the racking carefully to ensure any damage is identified and dealt with.

REPORT ALL DAMAGE

If the racking is damaged, it should be reported immediately to ensure the necessary precautionary actions are taken.

REPLACE, DON'T REPAIR

- It is not recommended to repair damaged rack components.
- Any component that is no longer fit for use should be replaced on a like-for-like basis.
- If the bottom portion of an upright is damaged, replace the whole upright
- Never apply heat in an attempt to straighten bent components.

TYPICAL CAUSES OF DAMAGE

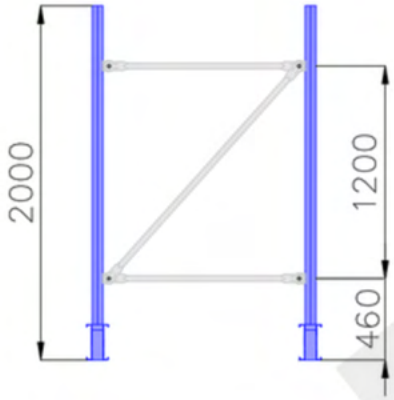
The following are some typical contributing factors to why damage can occur.

- Handling equipment: Poor or ill maintained equipment, or a change in the type and size of handling equipment.
- Goods stored: Change in the type or size of goods stored, overloading or incorrect loading of arms and rack.
- Forklift drivers: Contract or agency drivers, inexperienced or ill-trained or not familiar with the correct operating procedures.
- Poor housekeeping: Damaged packs, unstable loads or obstructions within the aisle.

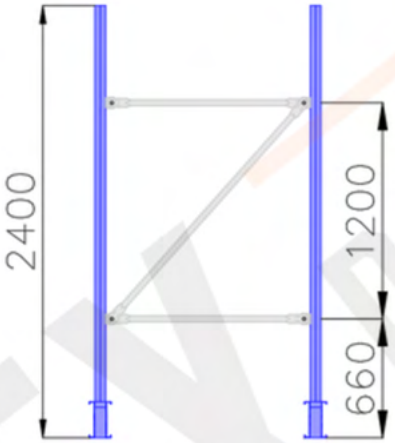
SECTION 4

STANDARD BRACING CONFIGURATIONS

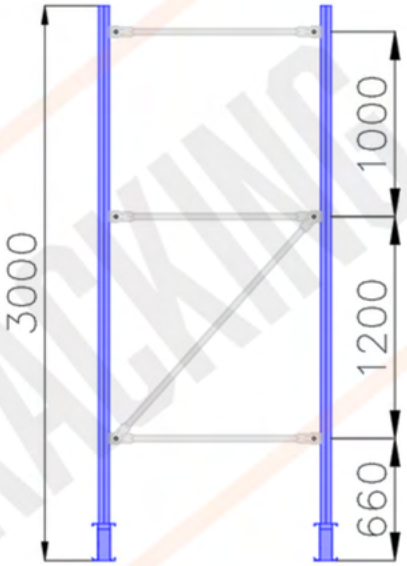
C200



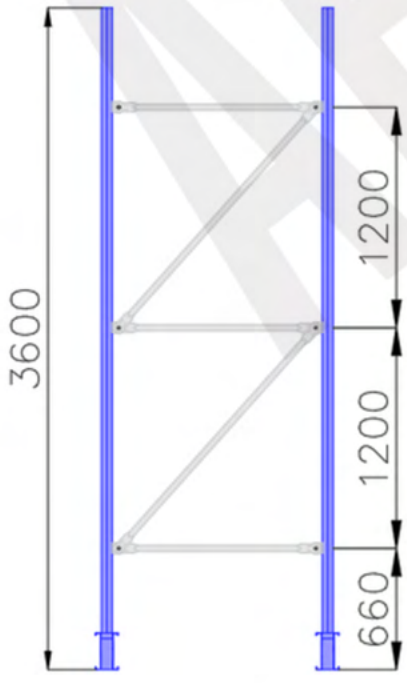
2000H



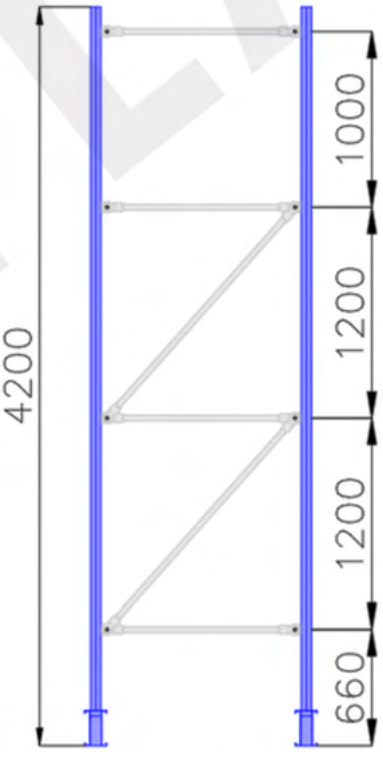
2400H



3000H

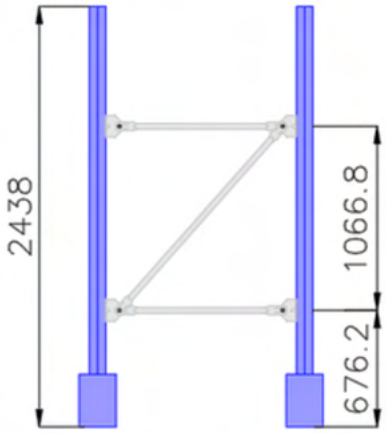


3600H

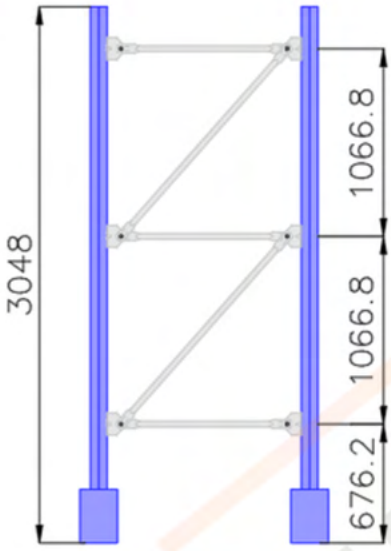


4200H

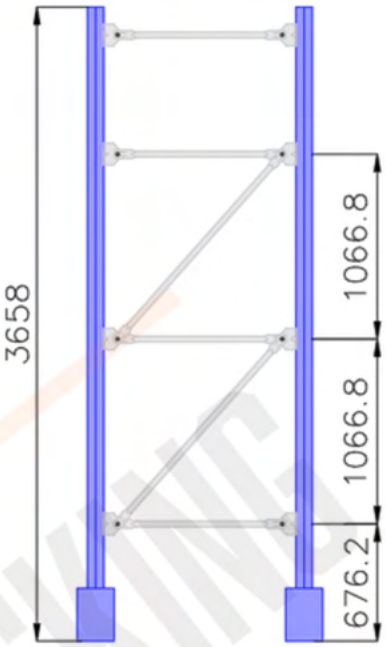
C305 / C350 / C410



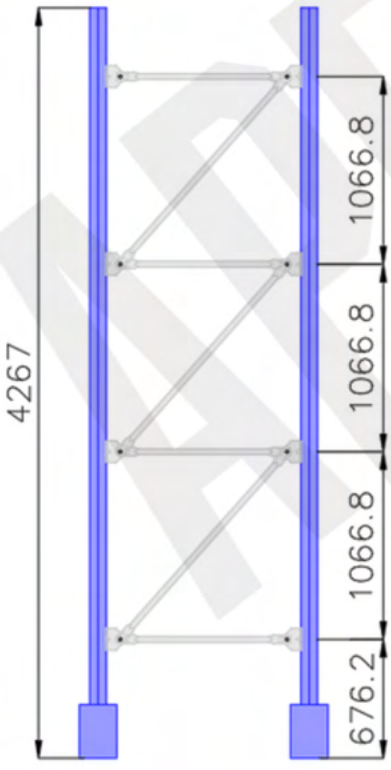
2438H



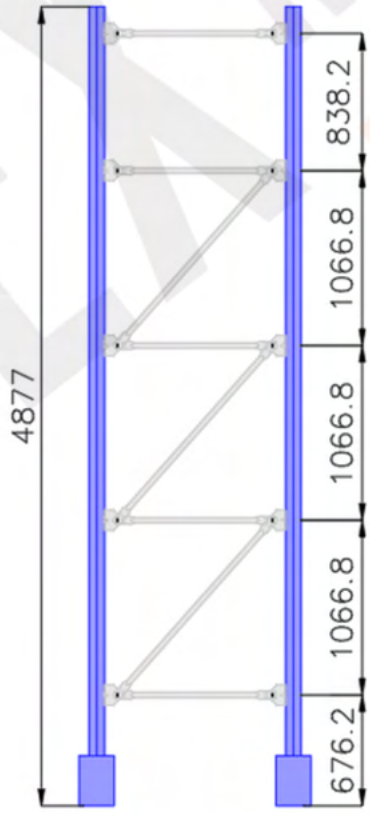
3048H



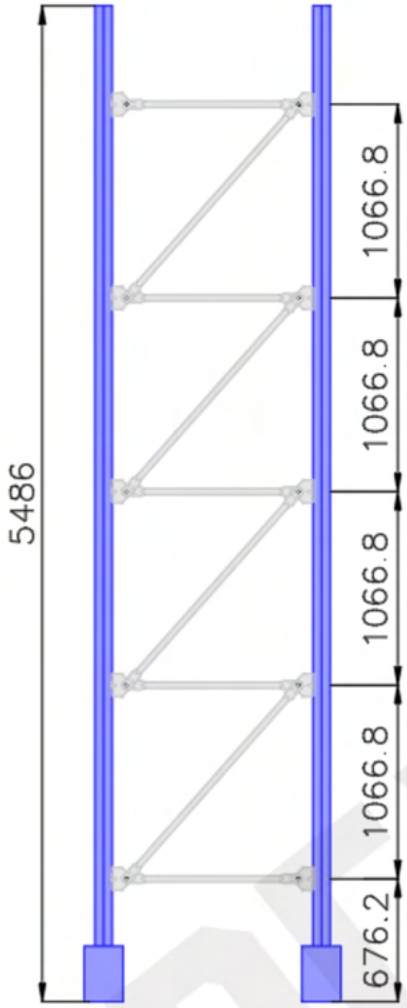
3658H



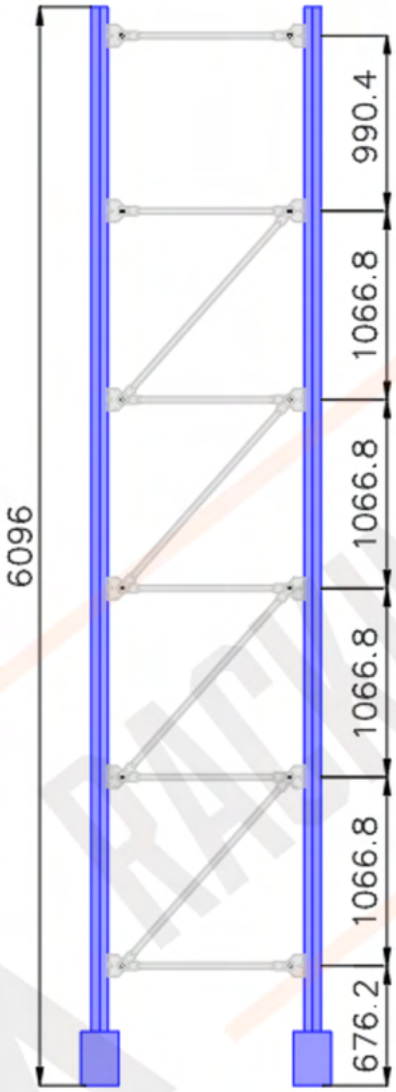
4267H



4877H


5486
1066.8
1066.8
1066.8
1066.8
676.2

5486H


6096
990.4
1066.8
1066.8
1066.8
1066.8
676.2

6096H

APEX RACKING