

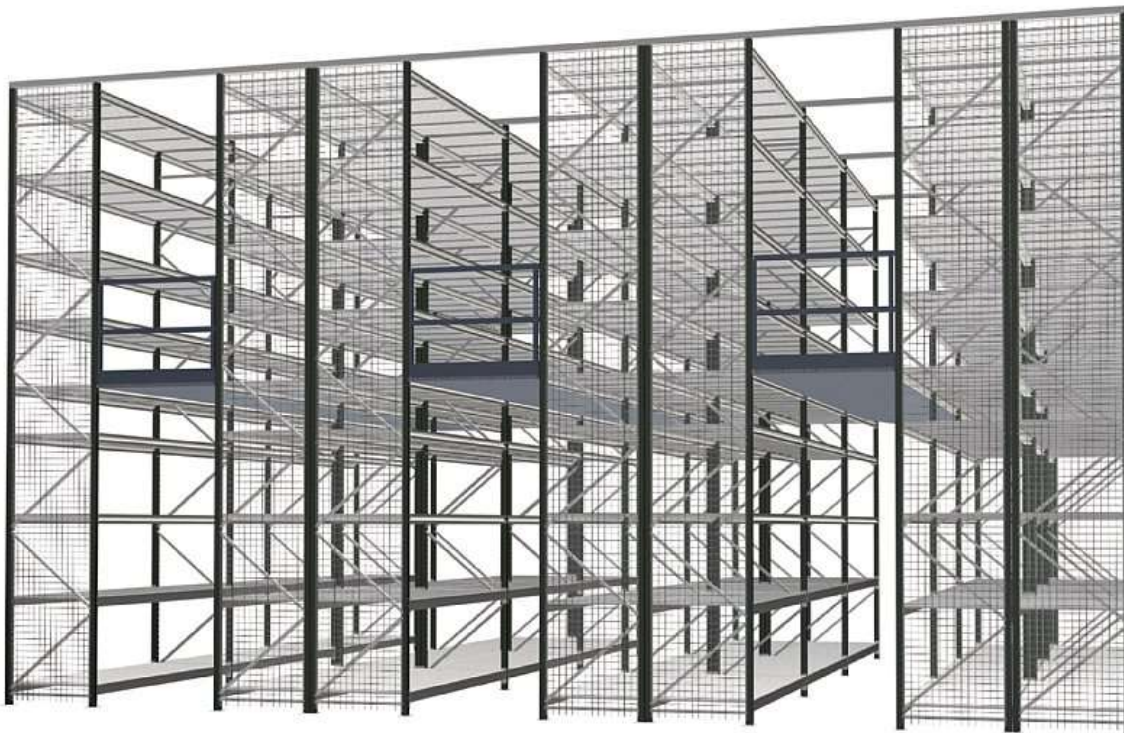
SPEEDLOCK P90 PALLET RACKING SYSTEM

Construction Guidelines

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English

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Preface:

These guidelines describe the components and the suggested method of construction for the **Speedlock P90** pallet racking system.

Speedlock P90 is a versatile product that can be built to meet individual requirements whether these are in the length, width or height of the equipment being supplied, or in the style of the premises in which the product is being installed. It is therefore impracticable to detail specifics for all conceivable installation styles. This document therefore makes suggestions recognising that where appropriate they be adapted by those with sufficient experience to meet individual requirements.

‘SAFETY FIRST’

If there is any doubt to any of the suggestions made within these guidelines it is important to consult the supplier of the equipment.

It is recommended that time be taken to read these guidelines and to familiarise yourself with the product prior to attempting to install the racking.

The information contained within these guidelines relates solely to the **Speedlock P90** product, it should not be used as the basis for installing any other product, from an alternative source.

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Whilst the utmost care is taken to ensure the accuracy of the data and design details shown within, the company can in no circumstances be held liable for any injuries, expenses or loss incurred which could in any degree be attributed to the adoption of such data and design details.

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1. General Introduction

Speedlock P90 is a versatile pallet racking system which is manufactured according to EN ISO 9001 quality management system. This ensures the careful adherence to the defined quality parameters, starting with the structural calculations, the selection of material, through all stages of production, right through to installation and maintenance. By systematic checks quality standards are constantly monitored.

1.1. Safety instructions and obligations of the operator

The Speedlock P90 system ensures maximum safety. This safety can only be achieved in practice if the necessary actions are implemented in the planning and implementation phase as well as during use. The user of the racking system has the responsibility to plan these actions and to monitor their implementation.

The local companies of the Constructor Group can support you at any time. Don't hesitate to contact us.

For simplification we will hereafter indicate the essential rules, regulations and tasks of an operator of a racking system during planning, installation (if it is self-executed) and after commissioning.

1.2. Rules and Regulations

- FEM (Fédération Européenne de la Manutention)
- Guidelines of national industrial professional associations for
 - Traffic routes
 - Aisles
 - Stability
 - Protections against and falling down of components, loading units and storage items
 - Rack protections
 - Rack installation
 - Marking and securing of danger zones
 - Fire protection installations
 - Electrical equipment of storage facilities
- Accident prevention regulations of national industrial professional associations

Guidelines and rules for installation may be different from country to country.

1.3. Tasks before and during the installation

Determination of weights and dimensions of the units to be stored and possible special storage.
Verification of the design and load capacity of the floor on which the racks are installed.
Determination of loads that can be transferred from handling trucks such as stacker cranes or forklifts directly or indirectly to the rack structure.
Compliance with minimum gaps, so that the probability of a collision of loads, or loads and equipment is minimized.
Compliance with the assembly instructions in this construction guidelines and the directive of the national industrial professional associations.
Correct assembly of the racks when these are installed by the user.
Fitting the load signs.
Installing rack protections in exposed areas.

1.4. Tasks after Startup

Compliance with the user guidelines and the directive of the national industrial professional associations.
Intended use of the racking system and the appropriate use of each rack parts.
Operation of the racking system only in perfect functional condition.
Providing trained personnel for the operation of the racking system.
Briefing and regular training of employees according to the accident prevention regulation on the basis of these construction guidelines and operating characteristics at the site.
Regular review of the rack construction and safety equipment for damage. It has to be ensured that any damage will be repaired by qualified and authorized personnel or damaged parts are replaced with new parts from the same manufacturer.

In failure to comply with one or more points, the proper function of the racking system may be at risk. For improper installation or usage the Constructor Group cannot accept any liability.

By rebuilding or a realignment of the racks at a different location, the conditions for the usage and the load values of the racks can change. Please contact in such cases your local company of the Constructor Group!

1.5. Application area

The Speedlock P90 system is mainly designed for use in dry, warehouses, with a sufficient carrying capacity. It is designed to carry static loads.

Possible designs are: wide aisle pallet racking, narrow aisle high-rise racking, push-back racking, pallet flow racking, mobile pallet racking, drive-in racking, silos, etc. The limits of applications are broad.

Together with the range of accessories a solution for every application can be found.

⚠ **The information provided in this manual does not apply to racks that are installed outdoors.**

Racks with outdoor use often require building permissions from national authorities. Please don't hesitate to contact your local company of the Constructor Group for support.

1.6. Method of construction

Each line of racks is built by truss frames and beams.

Two rack lines can be combined to a double rack Bolted spacers ensure a uniform distance.

The beams are hooked with hook beam end connectors in the slots of the frames and can be adjusted in height in steps of 50 mm.

The hook connection fits right when the beam end connector rests against the wide side of the upright and the safety locking pin can be plugged in.

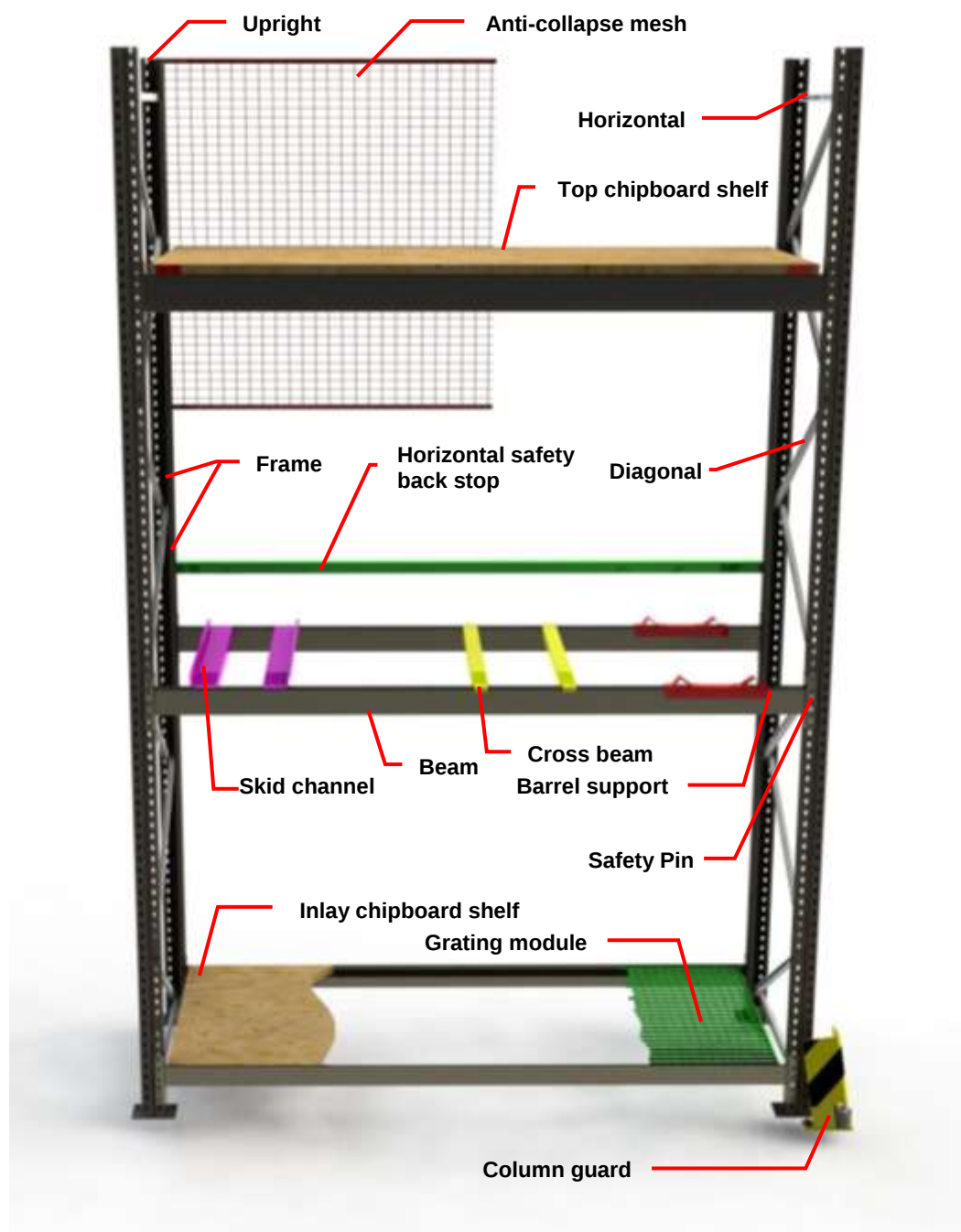
The rack frames are fixed to the floor with anchors through base plates.

If rack lines end at a transport route, the last frame must extend the highest beam level for at least 500 mm in order to prevent the load units from falling down.

When stacker cranes are used in the aisles of a P90 racking system, some peculiarities have to be observed and clarified between the customer and the contractor.

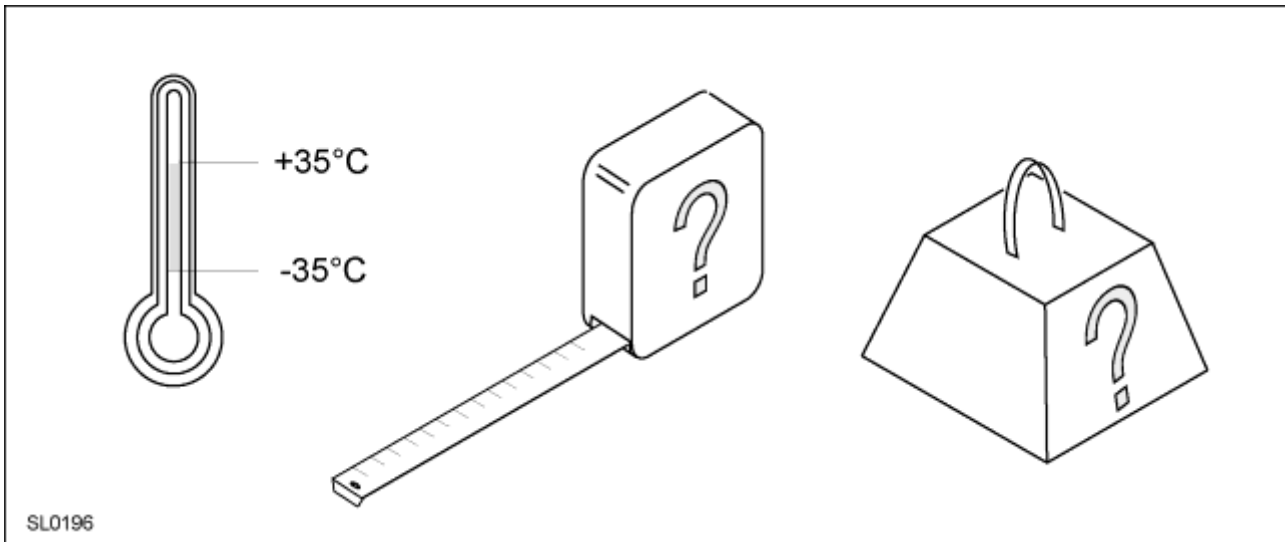
2. Product Introduction

Speedlock P90 is a versatile adjustable, heavy duty, construction system which can be used to create many styles of storage installation, individually designed and constructed to suit client requirements, i.e. site conditions and mode of operation.



Speedlock P90 is the name given to the product. The term P90 is also used to describe a type of upright, namely the 90 mm wide upright. There are three other, larger, upright types whose names also reflect the width of the upright, namely uprights P100, P120 and P140. As well there is one smaller upright type, namely upright P75.

Parameters of the system



The **Speedlock P90** product has been designed to operate within the following standard parameters. Consultation should be sort if considering applications outside of this range.

Type of pallet: wood, steel, and plastic pallets are acceptable, but must be in good condition without broken bearers, blocks etc.

Loads: loads should be stable and self-supporting, with the weight uniformly distributed about the centre, i.e. not eccentric. Eccentric loads where the weight distribution is not 50%/50% between front and back should be designed to the higher ratio throughout.

Warehouse Floor: should generally be of a solid CONCRETE construction designed to accept the point loads imposed by the rack legs. Installations on floors such as bitumen and tarmac, which by nature are flexible, need to be specifically designed to suit the individual floor.

Dry Conditions: components and load data are based on dry internal warehouse applications.

Temperature Range: -25°C to +35°C. Although temperatures within 5°C either side of zero, and those where moisture is likely to be present should be given a protective finish, i.e. galvanising.

3. Component Identification

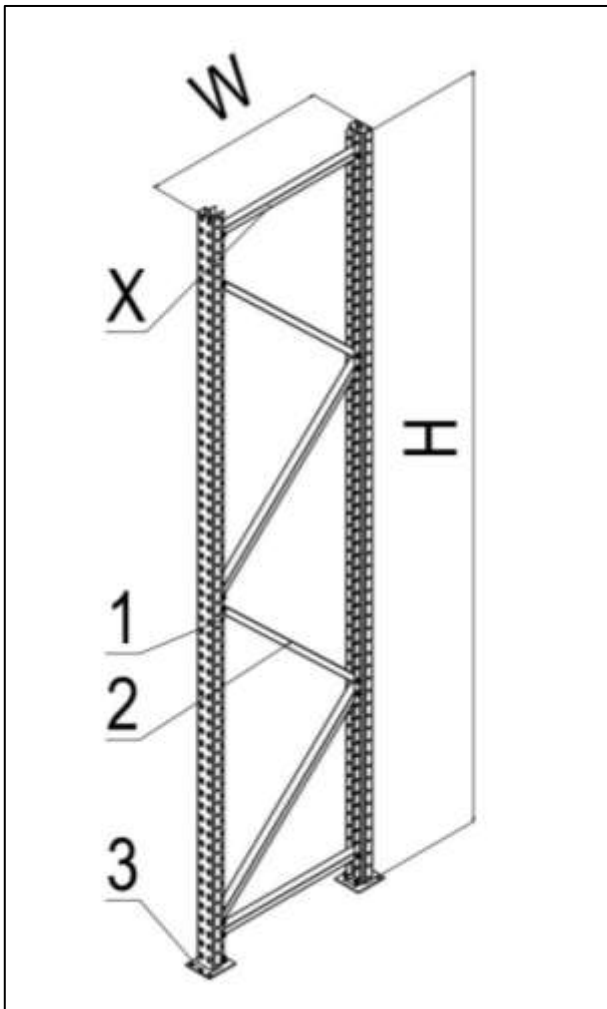
This section of the guidelines identifies the different components used in the construction of Speedlock P90 pallet racking.

Subsequent sections then detail where and how these components are used. Not all components are necessary for all installations.

Frames, beams and uprights can be supplied in varying sizes and duties to meet the individual load carrying requirements of each application. The exact specification of these components will be supplied with the rack material and it is important that the correct components are used in constructing each rack.

3.1. Frame Components

Two uprights joined together with bolted bracing complete with baseplates.



Frame

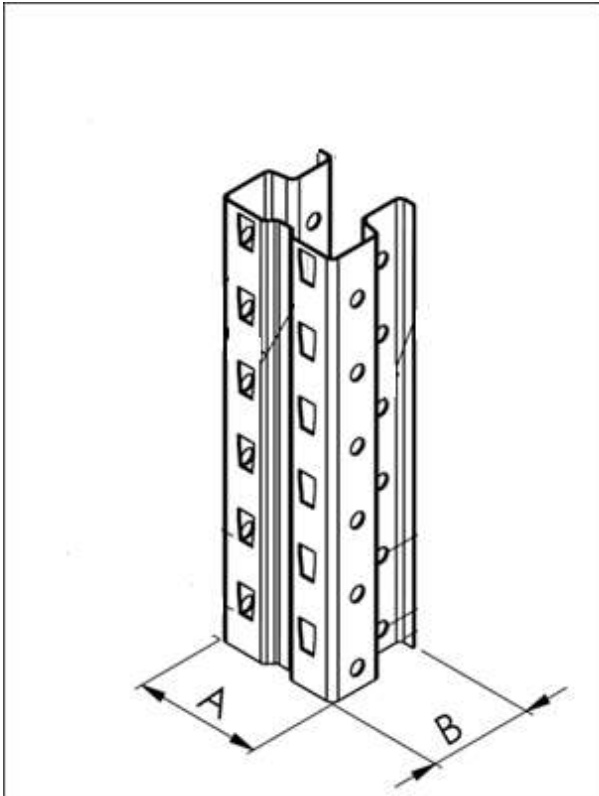
(H) Height
(W) Depth
(X) Horizontal bracing (the upper one is optional)

Dimensions to suit individual applications.

Comprising the following components:

#1 = two uprights
#2 = diagonal bracing
#3 = two baseplates

The size of a frame is defined by the depth measured from outer edge to outer edge of the uprights and their height. Standard frame depths are 800mm, 900mm, 1050 and 1100 mm.



Upright

(A) Width

(B) Depth

Grade to suit application

Choice of upright width either 75mm, 90mm, 100mm, 120mm or 140mm.

Choice of upright grade (material thickness)
The grade is stamped on the upright section.

The uprights are provided with a conical punching in a grid of 50 mm. In this grid, the compartment heights can be varied.

Bolts and nuts with a zinc passivated surface quality of 8.8 are generally used for the frame fixing.

The following upright types are available for different load carrying requirements:

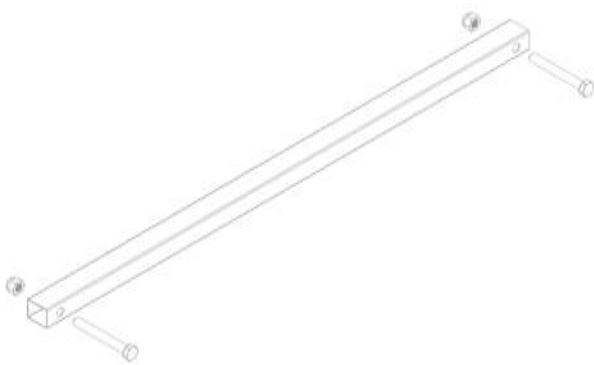
A	X				
75	15	18			
90	15	18	20		
100	18	20	23	25	28
120	25	28	30	33	
140	30	33	35		

A defines the upright width. **X** defines the material thickness (e.g.: 15 = 1.5 mm).

The product description of the upright is abbreviated as follows: PB/X (e.g.: P90/18, P120/28 etc.)

P always stands for the system description 'Speedlock **P**90'.

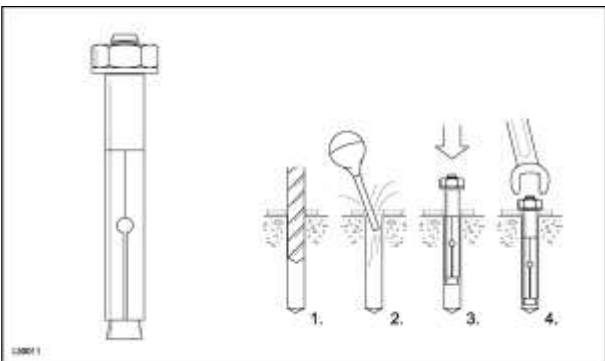
Bracing



Channel section with fixing holes at ends.
Length dimension = hole centres.

Bracing lengths and location are detailed in the
"Frame bracing schedule"

Baseplates fixed to the floor with floor fixings.

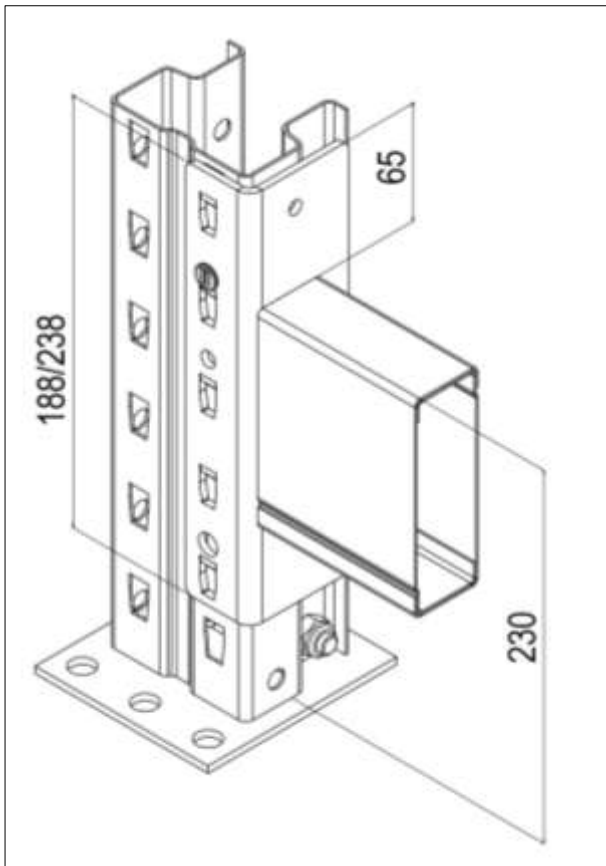


RackStar calculations consider always one anchor as standard.

Location detailed within the “Frame bracing schedule”

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3.2. Beam Components



Beams

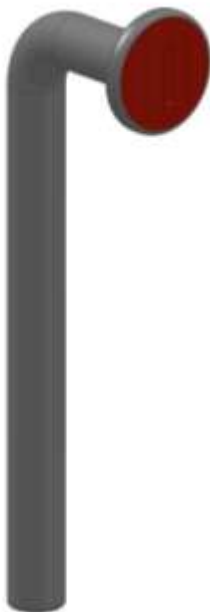
Beams are used to bear the load. They consist of the beam profile and the beam end connectors which are welded to both ends of the profile. The end connectors have 4 or 5 hooks.

Beams hook into the rack uprights.

The beam length (clear entry) is the dimension between uprights once installed.

Fitted with safety locking pins. Two pins per beam (left and right).

Safety locking pin



Fitted to the beam prior to beam location

Used to help prevent accidental dislodgement of the beam when in use.

Available beam cross sections:



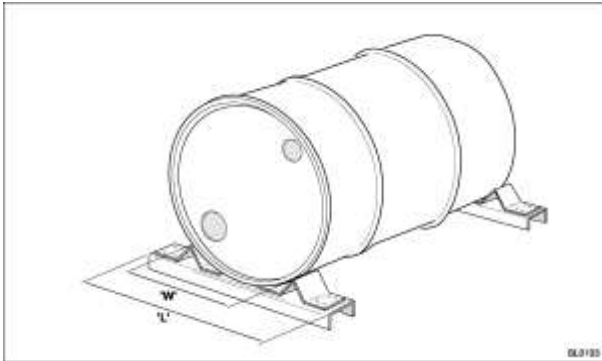
Beam profile						
	Material thickness	Width (B)	Height (H)	Description	Status	Hooks per BEC *
	1.25	40	60	60/40/13	standard	4
			70	70/40/13	standard	4
			80	80/40/13	standard	4
			90	90/40/13	standard	4
			100	100/40/13	standard	4
			110	110/40/13	standard	5
			120	120/40/13	standard	5
			130	130/40/13	standard	5
			140	140/40/13	project-specific	5
		50	80	80/50/13	standard	4
			90	90/50/13	standard	4
			100	100/50/13	standard	4
			110	110/50/13	project-specific	5
			120	120/50/13	standard	5
			130	130/50/13	project-specific	5
	1.5	40	100	100/40/15	project-specific	4
			110	110/40/15	project-specific	5
			120	120/40/15	project-specific	5
			130	130/40/15	standard	5
			140	140/40/15	standard	5
		50	100	100/50/15	standard	4
			110	110/50/15	standard	5
			120	120/50/15	standard	5
			130	130/50/15	standard	5
			140	140/50/15	standard	5
	1.75	50	140	140/50/18	standard	5
			150	150/50/18	standard	5
			160	160/50/18	standard	5
	2	50	140	140/50/20	project-specific	5
			150	150/50/20	project-specific	5
			160	160/50/20	project-specific	5

BEC = Beam end connector

3.3. Rack Accessories

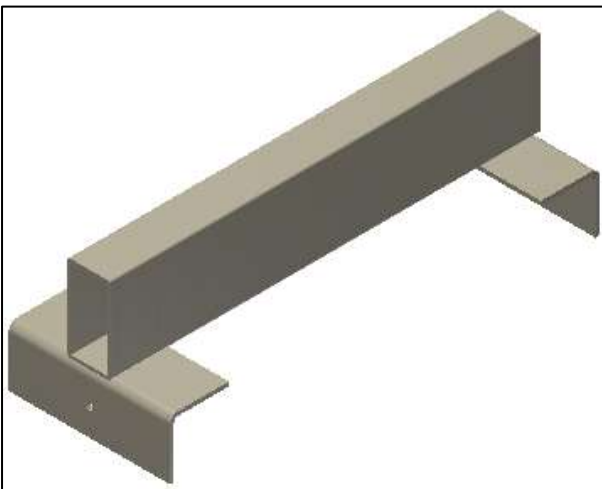
Various accessories are available enabling storage of non-palletized goods. A selection of these is shown below.

Accessories should be positioned in the quantity and location as directed with the supply of material.



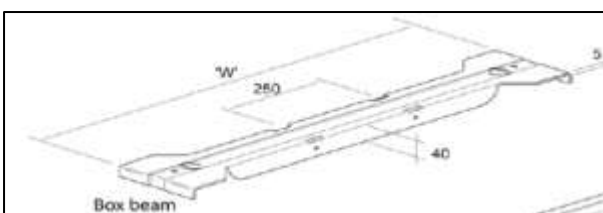
Barrel support / chock

Used to locate and prevent drums from rolling along the beams.



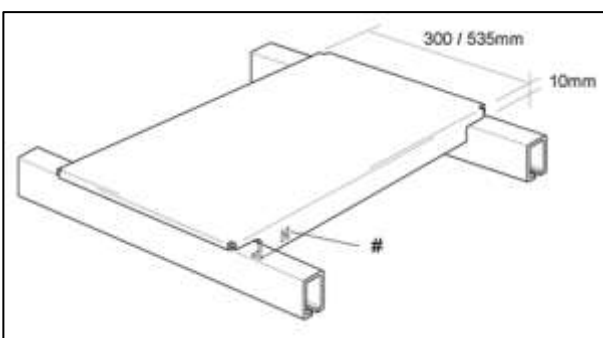
Fork entry beam

Used to support and raise non palletised loads to create access for the lift truck forks.



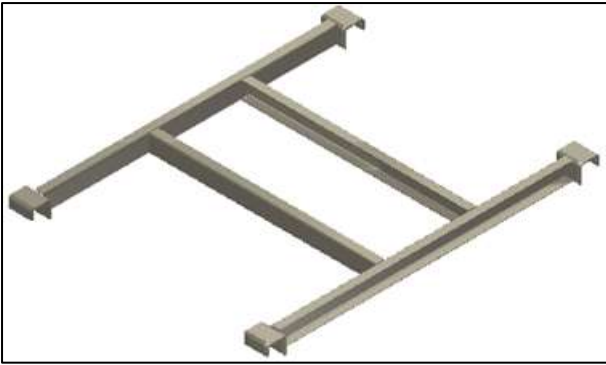
Cross beam / Pallet support bar

Used to provide secondary support for pallets without front to back bearers.



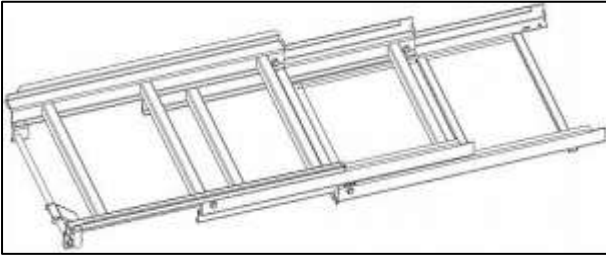
Steel shelf panel

Used to deck out a pair of beams to create shelf space for smaller handed loaded items.



Half Pallet Inserts

Used to support pallets 600 x 800 mm (= half EURO pallet) on box beams.



Pull-Out Units

Used to improve ergonomics and productivity in picking applications of warehouses or production areas.

See separate installation guidelines for Pull-Out Units.

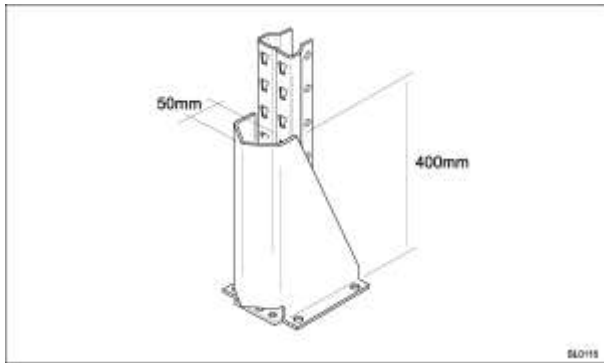
The racking where Pull-Out Units are installed must be according with the specific requirements.

Other accessories are also available.

3.4. Rack protection components

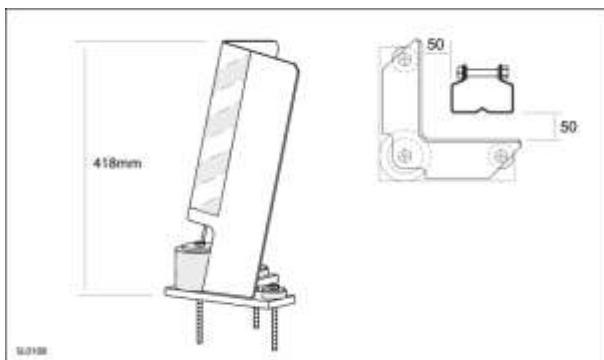
Various styles of protector are available to help safeguard the racking.

Position these as indicated using the correct rack protection fixings (these are not necessarily the same as the rack fixings).



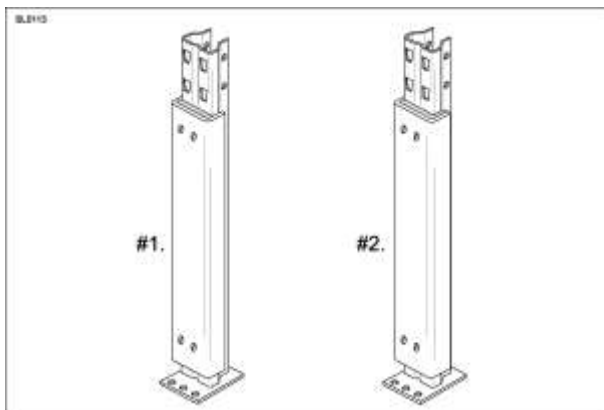
Column guard

Floor mounted wrap around guard.



Shock absorbing column guard

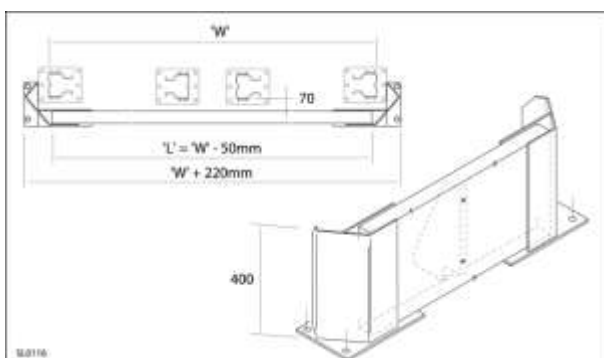
Floor mounted corner guard with shock absorbing fixing mounts.



Upright guard

Upright mounted guards with cellular polyethylene inserts.

#1 = intermediate upright.
#2 = corner upright.



Frame protector

Protects end frames adjacent to transfer aisles etc.

4. Construction Guidelines

This is a guide to the considerations that must be taken into account when installing Speedlock P90 Pallet Racking.

Whilst it is important to install the racking professionally, accurately and in an efficient manner, it is of greater importance to achieve this in a safe environment. It is strongly recommended that the assembly is executed by assembly teams of the Constructor Group.

If the assembly is done by the user of the rack, it must be executed according to the construction guidelines which are provided by the Constructor Group.

Speedlock P90 is a versatile product that can be built to meet individual requirements whether these are in the length, width or height of the equipment being supplied, or in the style of the premises in which the product is being installed.

If there is any doubt to any of the suggestions made within these guidelines it is important to consult the supplier of the equipment.

4.1 Safety instructions

- During assembly especially the national accident prevention regulations and the instructions of these construction guidelines have to be observed.
- We assume that it was clarified before the placement of order that the execution meets the construction requirements of the
 - local building supervision
 - office for employment protection and safety technology (public trade supervision)
 - environment office (if applicable)
 - fire authority

These requirements vary from country to country. However, they are mandatory and can influence the structural design.

- Wide enough transport routes and aisles must be provided for loading the racks. The width depends on the stored material and the dimensions of the stacker crane. It usually doesn't correspond to the distance between the rows of racks, as the stored goods extend into the aisle on the front side of the rack.
- All important dimensions for the stacker crane are shown in the documents of the manufacturer.
- If working personnel and stacker cranes are together in an aisle, the relevant safety guidelines need to be followed.
- Transport routes for pedestrians between storage facilities must be at least 1.250 mm wide.
- Transport routes resp. passages for forklift trucks to load the racks have to be marked with warning colour.

During the assembly the following work should be done with special care:

- All P90 frames are anchored to the floor. We assume that the floor is of sufficient strength in this area and suitable for anchoring.

- Care is necessary during the work to avoid damage to components.
- Tolerances according to **Chapter 6 Rack installation tolerances** must be complied!
- The use of narrow-aisle trucks or stacker cranes may require smaller tolerances (follow manufacturer's instructions).
- The loading of the racks may be done after inspection and hand over.
- In case of modifications of the rack system or discrepancies during the assembly experts from the Constructor Group must be consulted.
- With corrosion promoting industrial floors (e.g. magnesite floors) isolation between all components and the floor (especially the anchors) must be effected. Directions for use of the flooring manufacturer are strictly to be observed.

4.2 Site Requirements

National regulations and standards for floor tolerances must always be considered.

- Floor tolerances need to be compensated with levelling material from the Constructor Group
- Information about lines, heating pipes, channels, maintenance shafts or something similar, which are located in the hall floor need to be communicated to the Constructor Group before the contract.
- The operator of the racking system must notify the manufacturer of the system about specifics without being asked.
- Forces are transmitted into the floor via the baseplates. The suitability and capacity of the hall floor must be ensured by the operator.

4.3 Tools & Clothing

- Screw-wrench
- Impact wrench
- Impact drill
- Tape measure
- Levelling device (for determining the height differences of the floor)
- Chalk line (for marking the frame position before installation)
- Safety gloves
- Safety helmet
- Safety footwear
- If necessary, locally related safety clothing and protective equipment for the protection against falling

4.4 Preparing the building site

Chalk line



- Lay out the levelling plan and rack assembly plan, if available
- Note that the proposed rack clearance is not equal to the working aisle width because the pallets protrude approx. 75 mm in to the aisle at a pallet depth of 1200 mm. This overhang must also be considered with walls and pillars of the hall.
- Measure the position of the rack lines and draw the front edge of the upright on the floor.
- Use tape measure and chalk line for it.
- You get a perfect straight line by aligning the chalk line exactly, stretch it tight, pull it about 20 cm upwards and release. The chalk line then hits the floor and thereby loses the previously added marking powder.

Levelling



- Mark out the upright bases.
- Uneven floors must be determined by laser level or tube level at the points where the uprights will be installed.
- The measured results are entered into an upright plan.
- It is useful to get the necessary levelling material ready (The Constructor Group delivers adapted levelling plates for each base plate type).

4.5 Frame assembly

Frame components

Each frame consists of:

- 2 Uprights
- 2 Baseplates
- 1 or 2 Horizontal bracings
- Diagonal bracings (Amount see [Frame bracing schedule](#))
- 1 or 2 distance tubes for horizontal bracings
- Screws & nuts

Not included are:

- Levelling plates
- Anchors

This applies for pre-assembled frames and frames which are delivered unassembled.

Unassembled frames must be assembled prior to the actual rack assembly.

Top horizontals are optional because they are not required for static reasons.

Standard frame kits are available with one and two horizontals.

If the assembly isn't done by an installation team of the Constructor Group please check the number of horizontals per frame in the order documents (order acknowledgement, delivery note) before you start with the frame assembly.

Pre-sorting

Pre-sorting is useful. Possibly present drawings are to be considered.



Pre-sort the frame components and pay attention to:

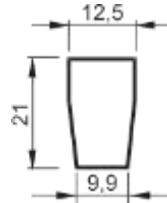


- Upright type and destination
- Upright height
- Baseplate type
- Length of horizontal bracings
- Length and arrangement of diagonal bracings

Baseplate assembly

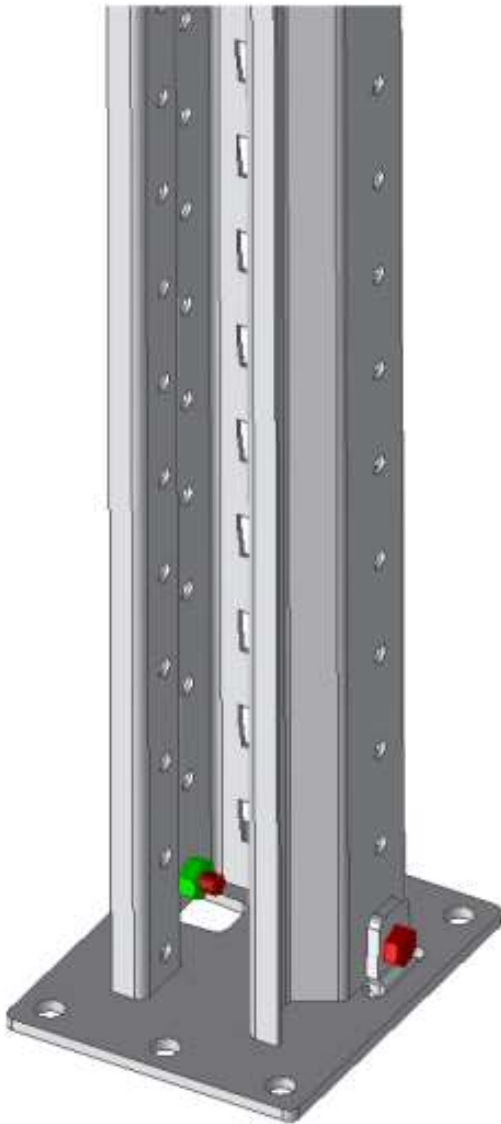


- Put two uprights at a comfortable working height side by side on a flat surface, preferably on an assembly support.
- Be sure that the holes for the beam end connectors point towards the baseplate with the 9.9 mm wide side



- If the uprights include bolted baseplates, these are bolted now.
- If the uprights include welded baseplate, skip this point.

 **All screws must be tightened. Tightening torque: 22 Nm**



For the different upright widths there are different types of baseplates. The assembly of the baseplates depends on the type of baseplate.

Pay attention to the correct combination of uprights and baseplates in the following steps.

Baseplates P75/P90/P100/P120 – Standard

P75	P90
P100	P120

Baseplate P90/P100/P120/P140 - Narrow-aisle

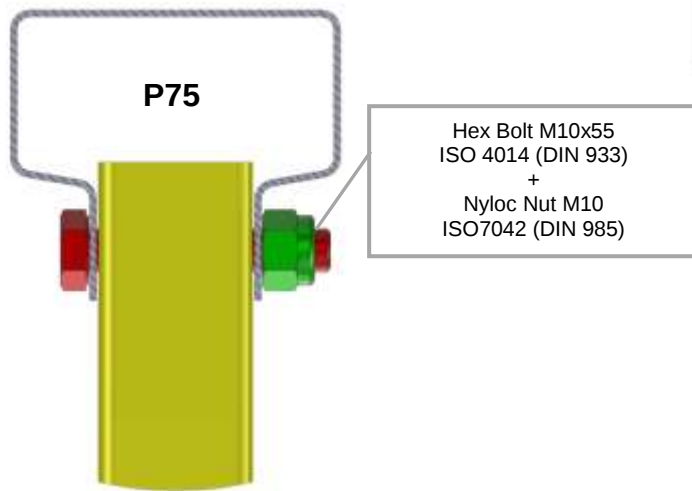
P90	P100
P120	P140

Baseplate P90/P100/P120/P140 – Heavy Duty

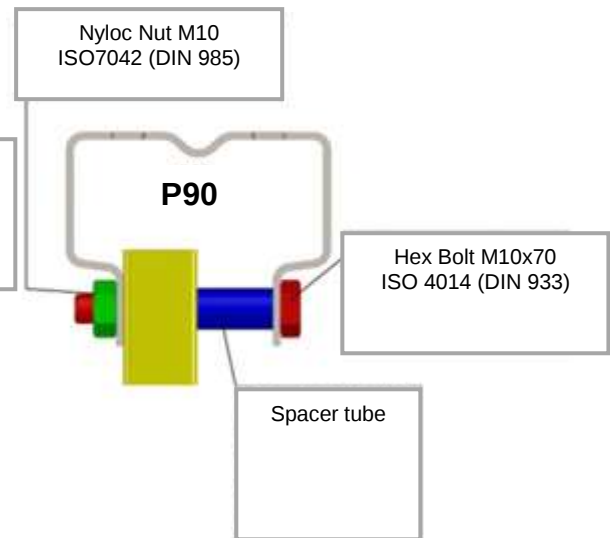
P90	P100
P120	P140

Assembly of horizontal and diagonal bracing

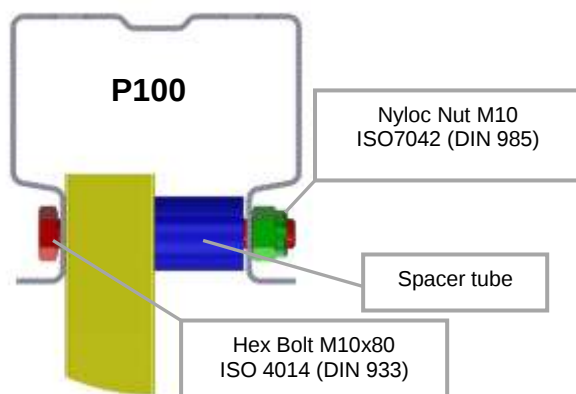
P75 (75 mm wide upright), C-Profile



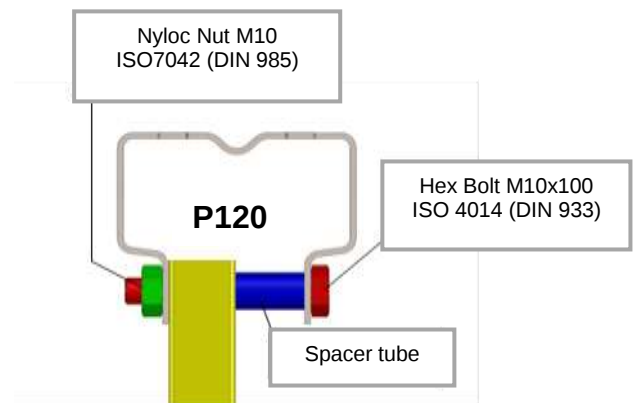
P90 (90 mm wide upright), Square tube



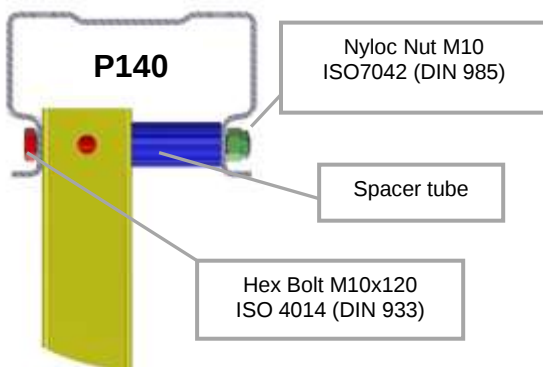
P100 (100 mm wide upright), Square tube



P120 (120 mm wide upright), Square tube



P140 (140 mm wide upright), C-Profile



Horizontals and diagonals are assembled differently, depending on the width of the upright.

Pay attention to the corresponding alignment according to the sketch:

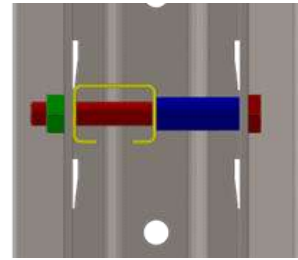
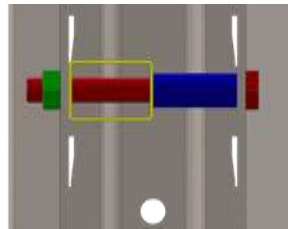
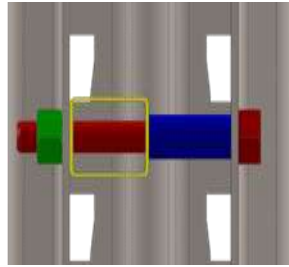
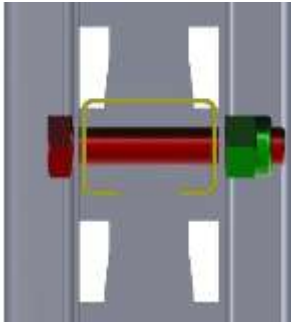
Connection of horizontal:

P75

P90/P100

P120

P140



Bolting of horizontals:

- Insert the lower horizontal in the upright profile
- Insert the distance tube
- Insert the long hex bolt through the third hole from the bottom
- Fix the bolt with the nut from the other side

P75

P90/P100

P120

P140



Connection of horizontal/diagonal:

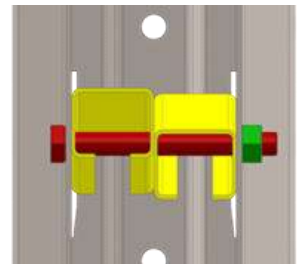
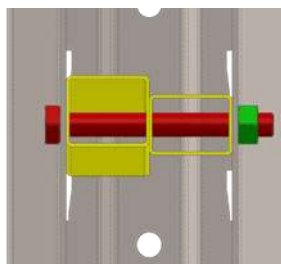
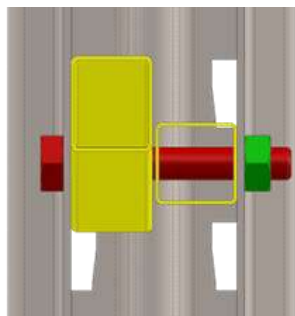
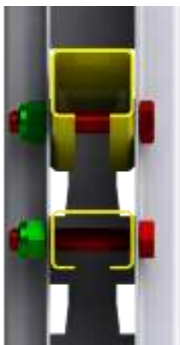
- Place the first diagonal onto the lower horizontal in the upright profile
- Arrangement of the diagonals according to [Frame bracing schedule](#)
- Insert the hex bolt (M10x65) through the third hole from the bottom
- Fix the bolt with the nut from the other side
- The arrangement of the diagonal and the horizontal must always be performed according to the following scheme:

P75

P90/P100

P120

P140



☞ Note: If the frame has no upper horizontal, the upper diagonal must be inserted with the mouth in the same direction as the diagonal underneath, so that the distance tube can be assembled on the open side.

Bolting of diagonal/diagonal:

- Insert the further diagonals in zigzag pattern into the upright profile (note the direction of the diagonal as shown in the sketch)
- Arrangement of the diagonals according to Frame bracing schedule
- Insert the long hex bolt through the upright and the two diagonals
- Fix the bolt with the nut from the other side
- The arrangement of the diagonals must always be performed according to the following scheme:

P75**P90/P100****P120****P140**

☞ All screws must be tightened with a torque of 22 Nm.

☞ C-Profile diagonals must always be assembled with the open side facing outwards.

Sort the finished frames according:

- Type (P75, P90, P100, P120, P140)
- Frame depth (if different)
- Frame height (end frames that are placed at a transport route, are 500mm higher than the centre frames)
- Colour (if different)

4.6 Frame set-up

Assembled frames will be raised into position, with beams being fitted at appropriate levels.

The exact sequence adopted will vary according to the style of each installation, e.g. height, access equipment available, and the phasing, either across or along the rack runs.

Generally smaller low rise installations can be raised manually, whilst larger and taller installations will need the assistance of specialist lifting equipment such as fork trucks and scissor lifts.

Low frames can be raised manually by two assemblers:



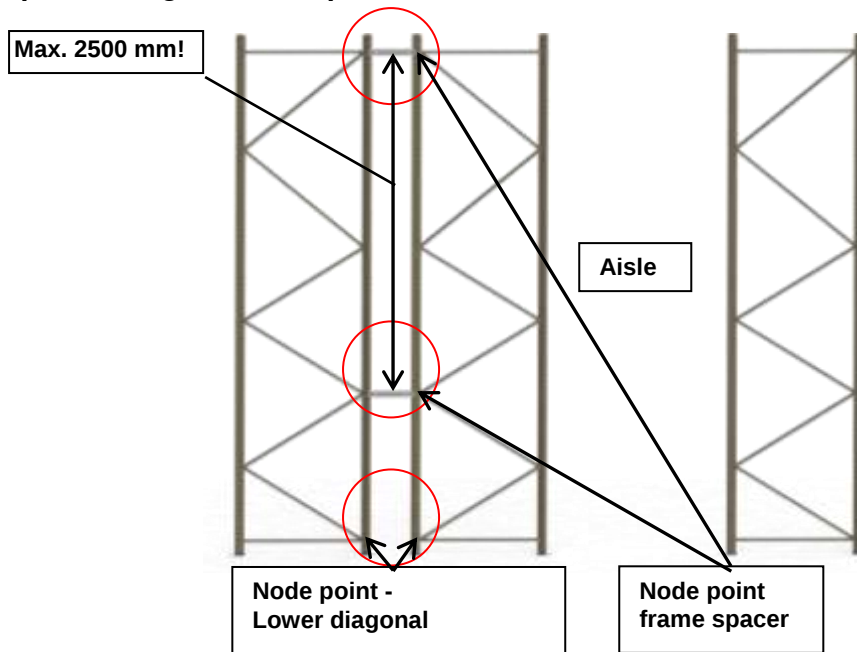
One assembler secures the frame against sliding, while the other sets up the frame.

In order to raise high frames two assemblers and a forklift are required:



One assembler secures the frame against sliding, while the other sets up the frame with the forklift.

Use and positioning of frame spacers



Double entry rows of racking will have a space between the two frames on either side of the rack. This space is necessary to allow an overhang of the pallets and front to back clearance.

Each frame pair is connected via frame spacers. These are positioned at the node points of the frame.

- One spacer at the bottom diagonal node point
- One spacer at the upper diagonal node point
- The lower spacer at the lowest diagonal always points away from the aisle!
- The first spacer is always mounted at the lowest node point where the first diagonals are connected to each other!
- The last spacer is always mounted at the last node point, the connection point of the last diagonal (optional with horizontal) is connected!
- A minimum of 2 spacers must be used for every frame.
- The maximum distance of 2500 mm must not be exceeded!
- If larger distances are required, additional spacers must be added.

Spacers are not positioned accurately at the node points, but at the nearest position above or below the node points.

When specifying spacer levels, beam position must be considered.

4.7 Beam assembly

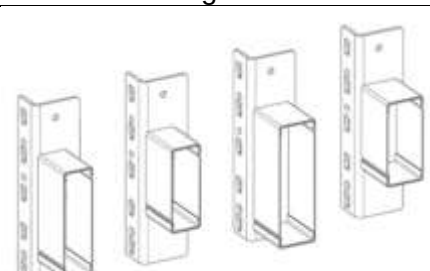


- To mount the first pair of beams, settle the beams, set up the frames and then hang on the first beam in twos.
- In extension bays only one frame must be secured before the first beam of the extension bay is mounted.
- With higher frames each frame must be secured by at least one assembler or a forklift.
- Pay attention to the right combination of beams and frames (see embossment).

 Due to the very large range of applications within the Speedlock P90 system, two different types of beam end connectors are used.

To ensure a secure fit of the beam end connector, they absolutely must be mounted with the correct upright type. The mark of the beam end connector type is embossed on the beam end connector.

The type of beam end connector depends on the material thickness of the upright.

Beam end connector	Upright material strength
C3	< 2.5 mm
C4	>=2.5 mm
4 hooks	5 hooks
Beam height ≤ 100 mm	Beam height > 100 mm
	



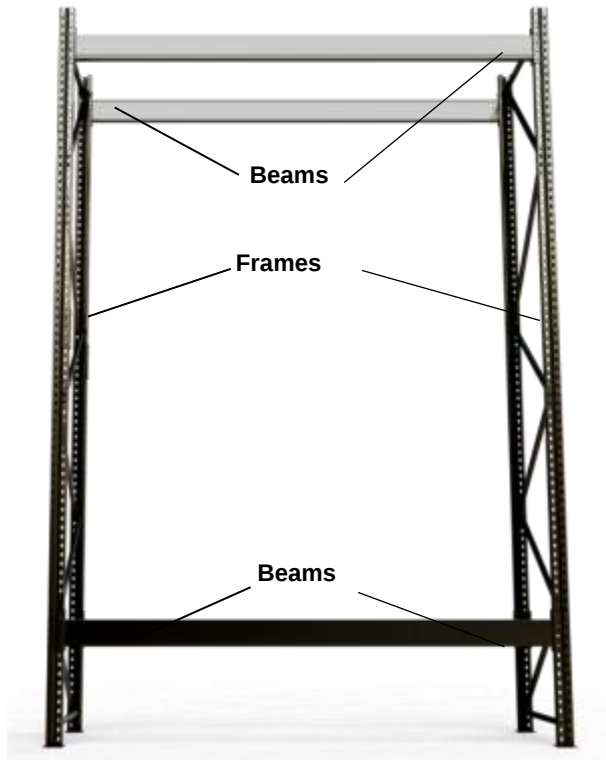
- Check the correct installation height of the beams.
- Beams can be mounted from the bottom to the picking height of the assembler.



- The use of a forklift is required with a higher rack.
- Put the beams on the forks.
- Two assemblers rise up on the frames and mount the beams in the correct distance.
- **The assemblers have to secure themselves against falling according to the national accident prevention regulations.**



- A safety pin must be plugged through **EACH** beam end connector after a beam is mounted.



Rack bay

👉 When installing racks with ≤ 2 bays or ≤ 2 beam levels, additional anchorage and screw connections for the baseplates and beam end connectors must be considered.

Each baseplate must be fixed diagonally with 2 concrete screws into the floor.

The first beam level of a bay must be fixed on each side with a bolt M8x25 DIN 933 and a nut M8 DIN 934 in the holes which are intended for the beam end connectors.

4.8 Floor fixing

Only after the racks are aligned and levelled, you can start with the anchoring.

It is most important that the racks are fixed to the floor in accordance with the instructions specified by the rack designer.

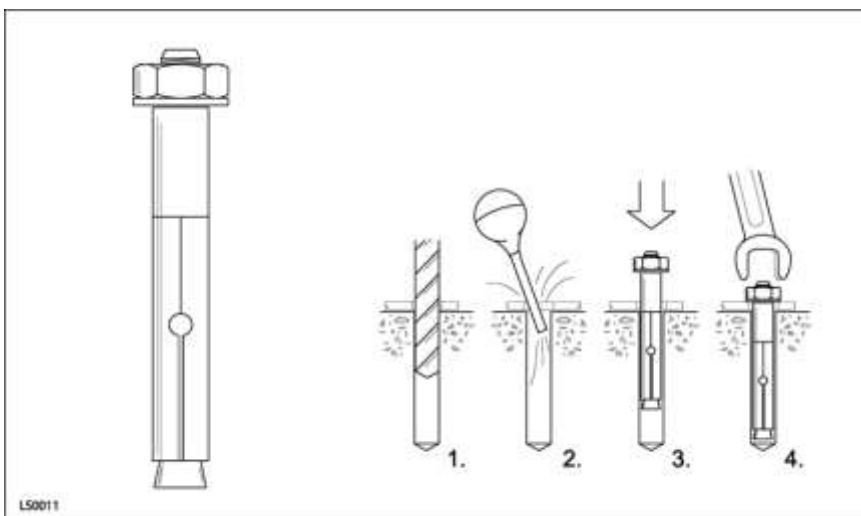
These instructions will be specific to the installation and will take into account:

- the rack application and use
- the rack's height to width ratio
- the style of baseplate in use
- the number of fixings required for each baseplate

The type of fixing is also important and will be specified, always use Dexion approved fixings and do not substitute these with non-approved alternatives.



- Drill the anchor holes through the base plates.
- The holes have to be drilled in accordance with manufacturer's instructions of the anchor manufacturer and to be cleaned thoroughly.
- Different anchors are available for the respective loads.
- Always follow the manufacturer's installation instructions.



The above is an illustration of a typical floor fixing.

4.9 Accessories

Horizontal Safety Back Stop



- Mount the angle bracket approximately 120 mm above the upper edge of the beam (valid for standard downweld position of beam section on the beam end connector at 65mm)
- To do this, use two hexagonal screws M10x25 with nut and washers Ø 10.5.
- Fix a screw very loose into the backstop clamp.
- Slide the screw and the backstop clamp into the slot of the angle bracket.
- Slide the rectangular tube profile (the safety back stop) over the backstop clamp.
- Repeat the process on the opposite side of the rectangular tube profile.
- Tighten the screws.

Inlay Chipboard Shelves

Inlay chipboard shelves are mounted with support angles for inlay chipboard shelves between a pair of beams. One support angle sits on each beam. The combination of support angles and inlay shelf ensure a flush surface at beam level.

2 support angles are required for every compartment.

In compartments above picking height inlay chipboard shelves can be inserted only with the help of a forklift.



Top Chipboard Shelves

Top chipboard shelves are fixed with 4 retaining brackets. For this purpose the brackets are pushed from below over the beams.

Fix each retaining bracket with a pan head-chipboard screw 5x45 on the chipboard shelf.

In compartments above picking height top chipboard shelves can be placed only with the help of a forklift.



Skid Channels

Skid channels are placed in the distance of the pallet width on the beams (storage tolerances must be observed).

The skid channels can be fixed with tapping screws against slipping.



Pallet Support Bars / Cross Beams

Pallet support bars resp. cross beams are placed in the distance of the pallet width (under the runners of the pallet) on the beams.



The pallet support bars resp. cross beams can be fixed with tapping screws against slipping.

Load Signs

All pallet racking installations must be supplied with load signs stating the capacity of the equipment installed. In addition to this, the notice must include the suppliers name and date of installation.

There are various ways of specifying load, and an appropriate method must be adopted for each installation, i.e. maximum pallet load, maximum load per pair of beams, or maximum bay load

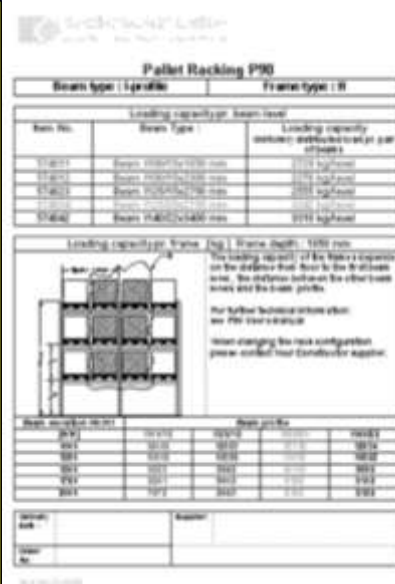
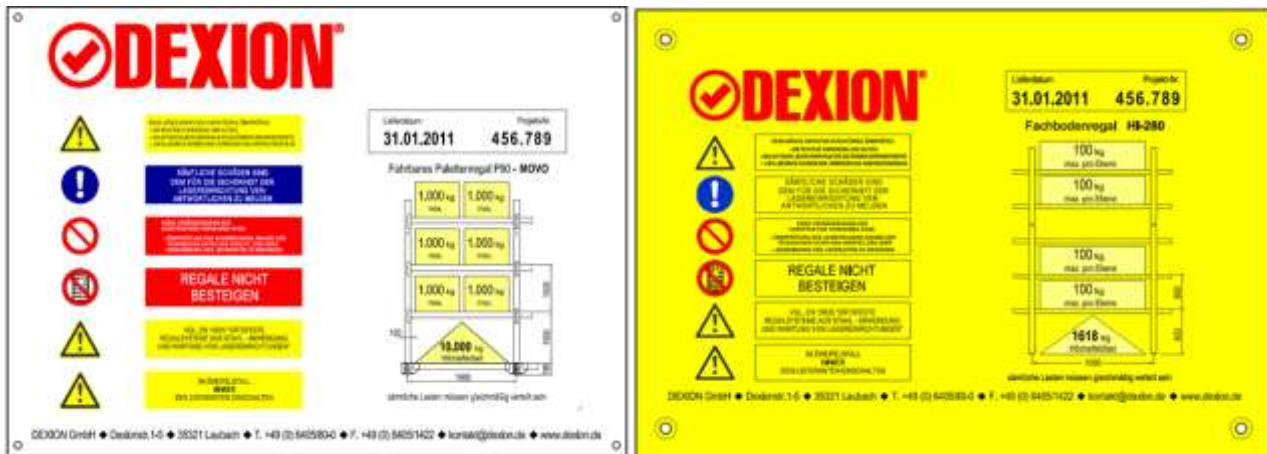
All racking types or configurations must be provided with an own sign.

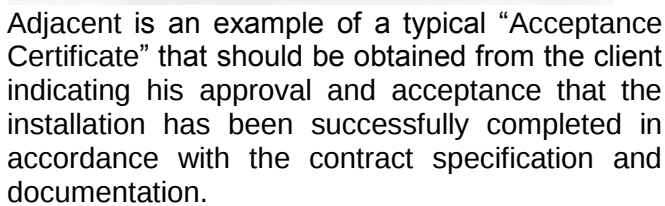
All load signs must be fitted at regular intervals and in positions clearly visible both for fork truck drivers and for people present in the respective area.

If you design and build your racking system by yourself or you modify it, you need to ensure the attachment of the load signs with the correct information.

You should ask us to carry out this work.

The following are examples of different signs that are being used in the Constructor Group.





An inspection should be carried out prior to obtaining the clients authorised signature and 'Acceptance Certificate'.

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6. Rack installation tolerances

DIN EN 15620 and FEM 10.3.01, a comprehensive document published by FEM, deal with the subject of “Tolerance, Deformations and Clearances” for adjustable beam pallet racking.

This Appendix summarises those sections that relate to acceptable erection tolerances.

The respective standard required will depend on the type of installation and its intended use.

The document details four groups of tolerance, each based on a type or classification of handling equipment. These four groups are the following:

Class 400

Wide aisle installations using counter balanced fork lift trucks or reach trucks.

Class 300 A

Narrow aisle installations where the operator is raised and lowered with the unit load

Class 300 B

Narrow aisle installations where the operator remains at ground level and is not raised or lowered with the unit load and he does not have the use of a CCTV monitoring system to guide him. For safety reasons, this class of racking must be provided with a P+D station for accurately locating the pallet on the input cycle

Class 200

Crane operated installations where the SR machines are automatically controlled and have a fine positioning system at the load storage positions, and installations where the SR machine is manually controlled.

Class 100

Crane operated installations where the SR machines are automatically controlled and do not have a fine positioning system at the load storage positions.

Classes 200 and 100 refer to FEM 9.831 and have progressively tighter tolerances than classes 400 and 300.

FEM 9.831 is a document prepared by the crane manufacturers in association with rack manufacturers and specifies the accuracy the racks should be built to. Many tolerances also have sub-clauses and definitions.

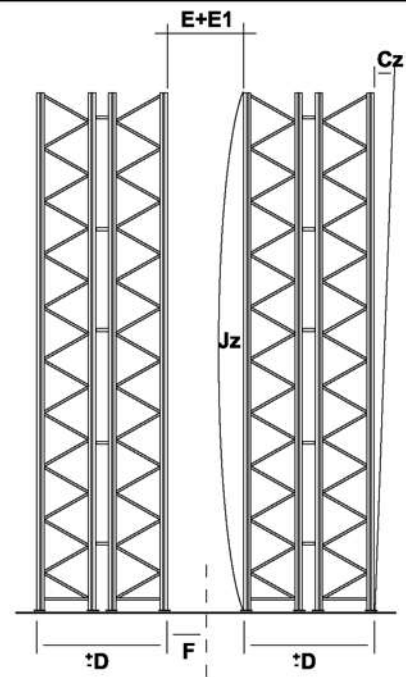
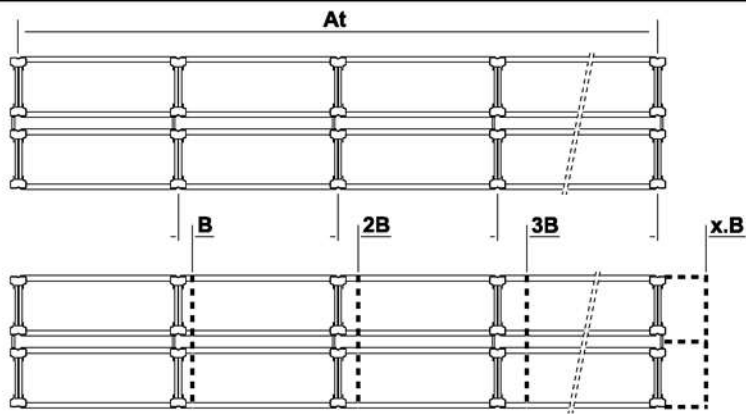
When considering these tighter tolerances it is important not to evaluate them independently but in connection to other factors having an influence on the installation.

Example: the construction team on site is asked to work to a theoretical norm using material which is manufactured with +/- tolerances.

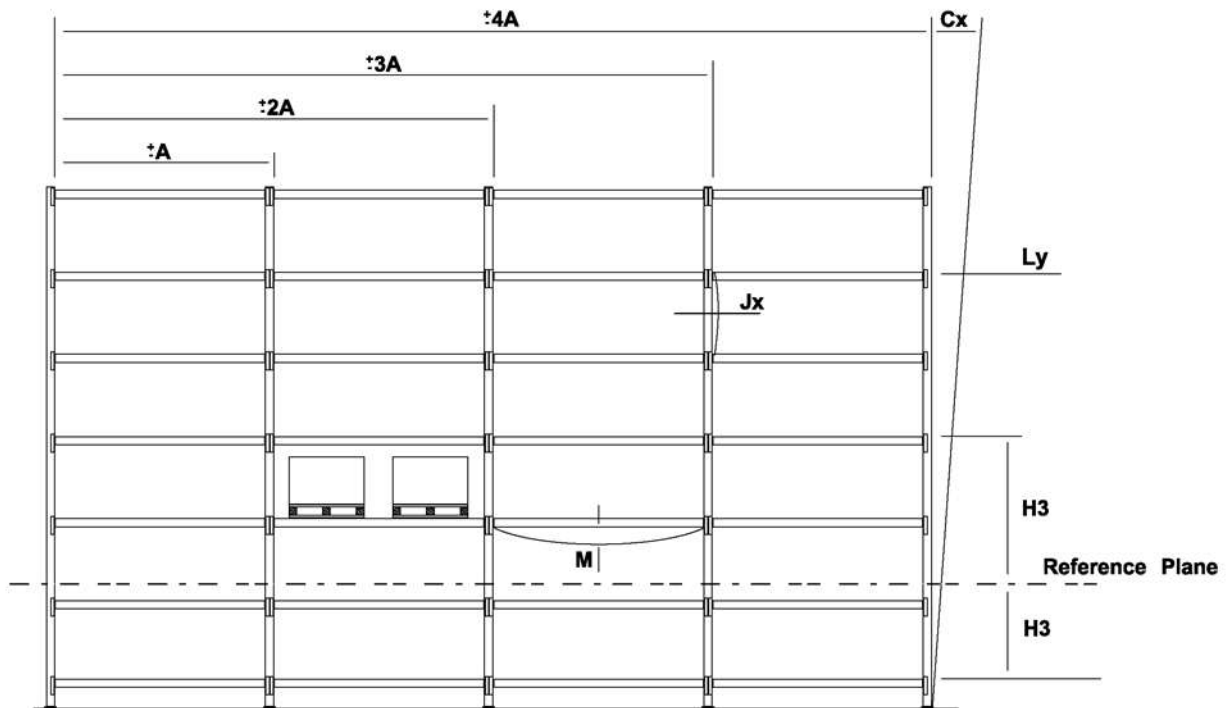
Therefore, Class 200 and 100 applications are to be assessed individually after consultation with the engineering, manufacturing and installation departments.

These tolerances are measured prior to loading..

The following is a summary of the terms given to the individual tolerances and how they relate to Classes 400 and 300.



FEM 10.3.01 Rack Erection Tolerances



SL0159

DIN EN 15620/FEM 10.3.01 Rack erection tolerances

Description (n = number of bays)		Tolerance class		
		400	300A	300B
Horizontal tolerances				
A	Maximum deviation in individual bays	±3 mm	±3 mm	±3 mm
At	Total deviation in rack length cumulative per bay	±3,0 n	±3,0 n	±3,0 n
B	Length difference between 2 rows of bays at each side of an aisle; cumulative, (the larger value applies)	±10 mm or 1.0 n	±10 mm or 1.0 n	±10 mm or 0.5 n
Cx	Maximum misalignment of upright perpendicular to frame reference level (larger value applies)	±10 mm or 1/1350	±10 mm or 1/500	±10 mm or 1/500
Cz	Maximum misalignment of upright in the frame reference level (larger value applies)	±10 mm or 1/350	±10 mm or 1/500	±10 mm or 1/750
D	Rack depth (single or multiple frames)	±3 mm	±3 mm	±3 mm
E	Deviation in aisle width	±20 mm	±5 mm	± 5 mm
E1	Deviation in aisle width between guide rails		+5/ -0 mm	+5/ -0 mm
F	Straightness of aisle measured against aisle reference line	± 15 mm	±10 mm	±10 mm
Description		Tolerance class		
		400	300A	300B
Vertical tolerances				
H3	Variation in beam level at H3 above or below the reference level (larger value applies)	±10 mm ±H3/400	±10 mm ±H3/400	± 5 mm
Jx	Upright straightness between beams spaced 'h' apart (larger value applies)	±3 mm ±h/400	±3 mm ±h/750	±3 mm ±h/750
Jz	Curve of upright Unspliced frame Spliced frame	H/750 H/500	H/750 H/500	H/750 H/500
Ly	Maximum variation of pallet support levels between front and rear pallet (larger value applies)	± 5 mm ±H3/ 1000	± 5 mm ±H3/ 2000	± 5 mm H3/ 3000
M	Maximum beam deflection with regard to beam span. Beam stiffness may be increased to achieve lower deflections to suit individual conditions.	1/200	1/200	±10 mm

These tolerances are measured prior to loading.

7. Frame bracing schedule

This appendix details the bracing requirements for Speedlock P90 frames. These should not be confused with Deepstor P90 frames as they are not always identical.

Table 1:	Length of bracing profile for standard frame depths with upright P75
Table 2:	Length of bracing profile for standard frame depths with upright P90
Table 3:	Length of bracing profile for standard frame depths with upright P100
Table 4:	Length of bracing profile for standard frame depths with upright P120 / P140

Note

The NORMAL frame bracing schedule must always be used unless otherwise instructed by the PC design program to use either the LIGHT or HEAVY-DUTY schedules

Table 5:	NORMAL frame bracing schedule for unspliced frames Uprights 75, frame heights 2000 to 12000 in 500 mm increments
Table 6:	NORMAL frame bracing schedule for unspliced frames Uprights 90/100/120/140, frame heights 2000 to 12000 in 500 mm increments
Table 7:	Frame bracing schedule LIGHT for unspliced frames Uprights 90/100/120/140, frame heights 2000 to 14000 in 500 mm increments
Table 8:	Frame bracing schedule HEAVY for unspliced frames Uprights 90/100/120/140, frame heights 2000 to 14000 in 500 mm increments

Fixings

Fixings must be tightened to a torque setting of 22 Nm.

Upright length

Standard galvanised uprights are available in 500 mm increments.

Splice positions

When using external type splices, it is not possible to position the beams at the same level as the splices. The smallest possible distance between beam and splice is detailed in the respective splice description.

A bracing node point cannot be connected within the upright splice area.

Bracing holes

The first bracing hole in uprights is set at a distance of 15 mm away from the upright end.

Bracings

Minimum section sizes apply for each type of upright, these are:

Upright	75:	minimum type C-profile 25x35, material strength 1.25 mm
Upright	90:	minimum type square tube 25x25, material strength 1.0 mm
Upright	100:	minimum type square tube 25x30, material strength 1.0 mm
Upright	120:	minimum type square tube 25x40, material strength 1.3 mm
Upright	140:	minimum type C-profile 50x40, material strength 1.5 mm

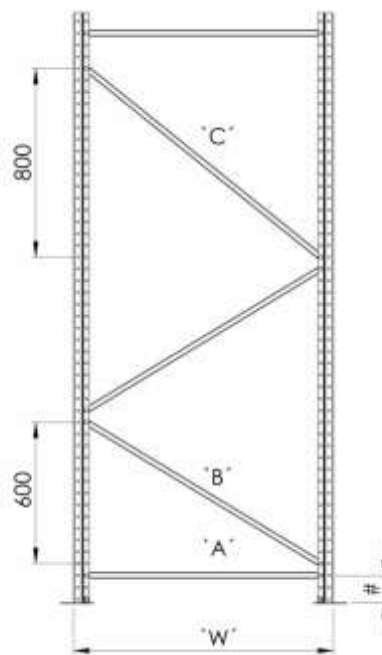
Top horizontal

Top horizontal bracing profiles are not required for structural reasons. Frame kits are available with and without a top horizontal.

Table 1: Length of bracing profile for standard frame depths with upright P75

Frame depth	Horizontal 'A'	Diagonal 'B'	Diagonal 'C'
		Gate 600 mm	Gate 800 mm
	Hole distance	Hole distance	Hole distance
800 mm	690.8 mm	915.0 mm	1057.0 mm
900 mm	790.8 mm	992.7 mm	1124.9 mm
1000 mm	890.8 mm	1074.0 mm	1197.3 mm
1050 mm	940.8 mm	1115.8 mm	1235.0 mm
1100 mm	990.8 mm	1158.3 mm	1273.5 mm

Total length of profile = hole distance + 40 mm

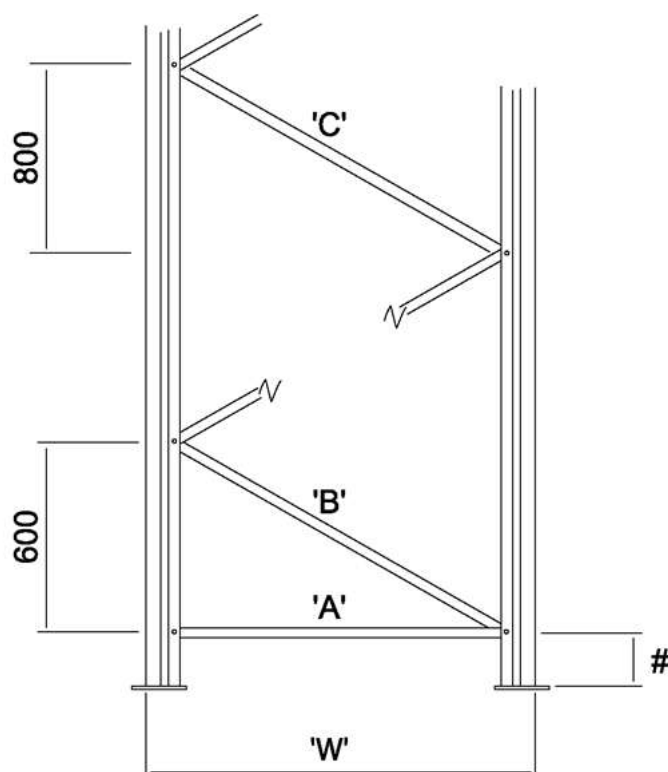


= Height to first horizontal – 115 mm

Table 2: Length of bracing profile for standard frame depths with upright P90

Frame depth	Horizontal 'A'	Diagonal 'B'	Diagonal 'C'
		Gate 600 mm	Gate 800 mm
	Hole distance	Hole distance	Hole distance
500 mm	390 mm	715.6 mm	890.0 mm
600 mm	490 mm	774.7 mm	938.1 mm
700 mm	590 mm	841.5 mm	994.0 mm
750 mm	640 mm	877.3 mm	1024.5 mm
800 mm	690 mm	914.4 mm	1056.5 mm
850 mm	740 mm	952.7 mm	1089.8 mm
900 mm	790 mm	992.0 mm	1124.3 mm
990 mm	880 mm	1065.1 mm	1189.3 mm
1000 mm	890 mm	1073.4 mm	1196.7 mm
1050 mm	940 mm	1115.2 mm	1234.3 mm
1100 mm	990 mm	1157.6 mm	1272.8 mm
1150 mm	1040 mm	1200.7 mm	1312.1 mm
1200 mm	1090 mm	1244.2 mm	1352.1 mm
1250 mm	1140 mm	1288.3 mm	1392.7 mm
1300 mm	1190 mm	1332.7 mm	1433.9 mm
1400 mm	1290 mm	1422.7 mm	1517.9 mm
1450 mm	1340 mm	1468.2 mm	1560.6 mm
1500 mm	1390 mm	1514.0 mm	1603.8 mm

Total length of the profile = hole distance + 40 mm



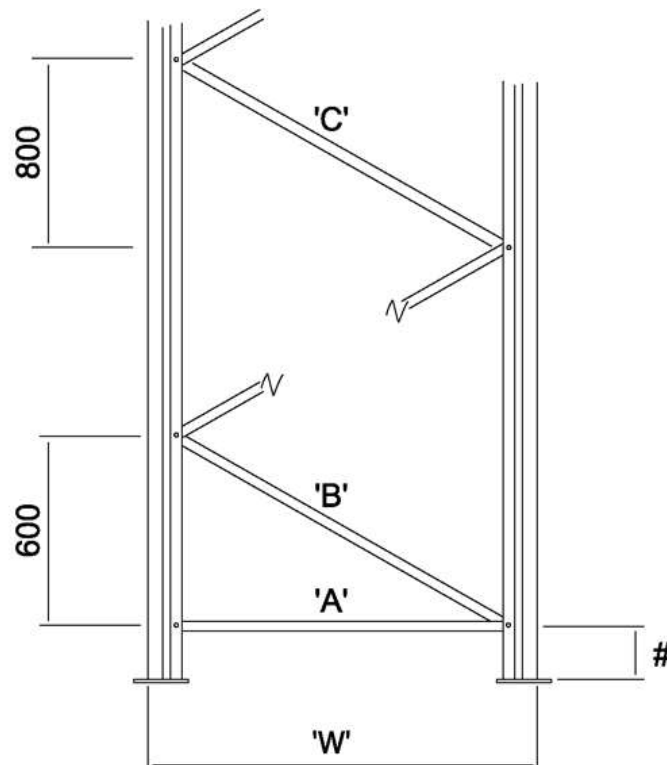
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= Height to first horizontal – 115 mm

Table 3: Length of bracing profile for standard frame depths with upright P100

Frame depth	Horizontal 'A'	Diagonal 'B'	Diagonal 'C'
		Gate 600 mm	Gate 800 mm
	Hole distance	Hole distance	Hole distance
500 mm	352 mm	695.6 mm	874.0 mm
600 mm	452 mm	751.2 mm	918.9 mm
700 mm	552 mm	815.3 mm	972.0 mm
750 mm	602 mm	849.9 mm	1001.2 mm
800 mm	652 mm	886.1 mm	1032.0 mm
850 mm	702 mm	923.5 mm	1064.3 mm
900 mm	752 mm	962.0 mm	1098.0 mm
990 mm	842 mm	1033.9 mm	1161.4 mm
1000 mm	852 mm	1042.1 mm	1168.7 mm
1050 mm	902 mm	1083.3 mm	1205.7 mm
1100 mm	952 mm	1125.3 mm	1243.5 mm
1150 mm	1002 mm	1167.9 mm	1282.2 mm
1200 mm	1052 mm	1211.1 mm	1321.6 mm
1250 mm	1102 mm	1254.8 mm	1361.8 mm
1300 mm	1152 mm	1298.9 mm	1402.5 mm
1400 mm	1252 mm	1388.3 mm	1485.8 mm
1450 mm	1302 mm	1433.6 mm	1528.1 mm
1500 mm	1352 mm	1479.2 mm	1571.0 mm

Total length of the profile = hole distance + 40 mm



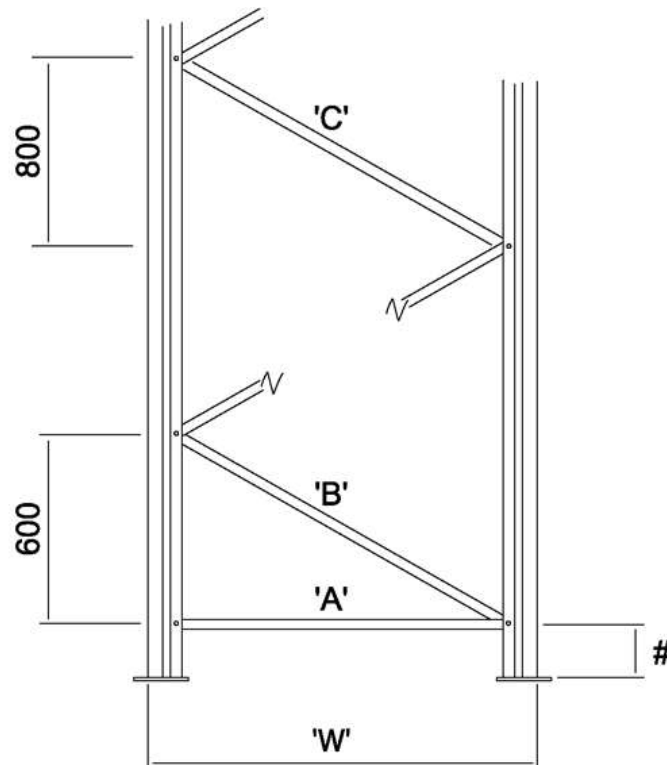
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= Height to first horizontal – 115 mm

Table 4: Length of bracing profile for standard frame depths with upright P120 / P140

Frame depth	Horizontal 'A'	Diagonal 'B'	Diagonal 'C'
		Gate 600 mm	Gate 800 mm
	Hole distance	Hole distance	Hole distance
800 mm	652 mm	886.1 mm	1032.0 mm
900 mm	752 mm	962.0 mm	1098.0 mm
1000 mm	852 mm	1042.1 mm	1168.7 mm
1050 mm	902 mm	1083.3 mm	1205.7 mm
1100 mm	952 mm	1125.3 mm	1243.5 mm

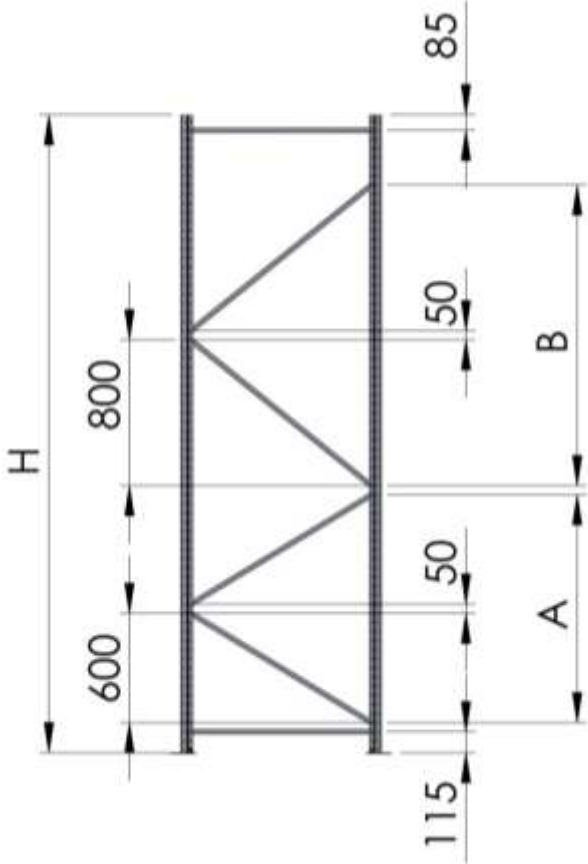
Total length of the profile = hole distance + 40 mm



SL0180

= Height to first horizontal – 115 mm

**Table 5: NORMAL frame bracing schedule for unspliced frames
P75**

 The diagram illustrates a frame bracing system with two vertical columns and two horizontal beams. The total height is labeled 'H'. The height of the upper section is 800, and the height of the lower section is 600. The width of the upper section is labeled 'B', and the width of the lower section is labeled 'A'. The distance between the centerlines of the columns is 115. The thickness of the columns is 85. The distance from the centerline of the column to the centerline of the beam is 50. The bracing system consists of diagonal members connecting the columns and beams.		
H	A	B
2000	-	1650 (2x800+50)
2500	1250 (2x600+50)	800
3000	2550 (4x600+3x50)	-
3500	3200 (5x600+4x50)	-
4000	1950 (3x600+2x50)	1650 (2x800+50)
4500	3200 (5x600+4x50)	800
5000	3850 (6x600+5x50)	800
5500	2000 (4x600+3x50)	2500 (3x800+2x50)
6000	3850 (6x600+5x50)	1650 (2x800+50)

**Table 6: NORMAL frame bracing schedule for unspliced frames
P90/P100/P120/P140**

H	A (x 600)	B (x 600)	C
2000	3	-	85
2500	1	2	185
3000	2	2	85
3500	4	1	185
4000	5	1	85
4500	7	0	185
5000	8	0	85
5500	6	2	185
6000	7	2	85
6500	5	4	185
7000	6	4	85
7500	8	3	185
8000	5	6	85
8500	7	5	185
9000	8	5	85
9500	6	7	185
10000	7	7	85
10500	9	6	185
11000	10	6	85
11500	8	8	185
12000	9	8	85

Table 7: Frame bracing schedule LIGHT for unspliced frames P90/P100/P120/P140

Upright types P90/P100/P120/P140. frame heights 2000 mm to 12000 mm in 500 mm increments

Note

Use this table ONLY if the PC-based design program instructions instruct you to use frame bracing schedule LIGHT.

A	B	C	D	E	F	G	H
2000	115 mm	1/2	3	0	85 mm	685 mm	2000 mm
2500	115 mm	1/2	1	2	185 mm	985 mm	2500 mm
3000	115 mm	1/2	2	2	85 mm	885 mm	3000 mm
3500	115 mm	1/2	0	4	185 mm	985 mm	3500 mm
4000	115 mm	1/2	1	4	85 mm	885 mm	4000 mm
4500	115 mm	1/2	3	3	185 mm	985 mm	4500 mm
5000	115 mm	1/2	0	6	85 mm	885 mm	5000 mm
5500	115 mm	1/2	2	5	185 mm	985 mm	5500 mm
6000	115 mm	1/2	3	5	85 mm	885 mm	6000 mm
6500	115 mm	1/2	1	7	185 mm	985 mm	6500 mm
7000	115 mm	1/2	2	7	85 mm	885 mm	7000 mm
7500	115 mm	1/2	0	9	185 mm	985 mm	7500 mm
8000	115 mm	1/2	1	9	85 mm	885 mm	8000 mm
8500	115 mm	1/2	3	8	185 mm	985 mm	8500 mm
9000	115 mm	1/2	0	11	85 mm	885 mm	9000 mm
9500	115 mm	1/2	2	10	185 mm	985 mm	9500 mm
10000	115 mm	1/2	3	10	85 mm	885 mm	10000 mm
10500	115 mm	1/2	1	12	185 mm	985 mm	10500 mm
11000	115 mm	1/2	2	12	85 mm	885 mm	11000 mm
11500	115 mm	1/2	0	14	185 mm	985 mm	11500 mm
12000	115 mm	1/2	1	14	85 mm	885 mm	12000 mm
12500	115 mm	1/2	3	13	185 mm	985 mm	12500 mm
13000	115 mm	1/2	0	16	85 mm	885 mm	13000 mm
13500	115 mm	1/2	2	15	185 mm	985 mm	13500 mm
14000	115 mm	1/2	3	15	85 mm	885 mm	14000 mm

A = Frame height

B = Height of first horizontal #

C = Number of horizontals

D = Number of bracing gates 600 mm

E = Number of bracing gates 800 mm

F = Upper bracing height

G = Upright section, not spliced (upper end of upright above the top bracing node point)

H = Upright length

= Height to first horizontal – 115 mm

⚠ In rack designs that differ from the standard design, the frame bracing schedule must be installed according to the static design!

Table 8: Frame bracing schedule HEAVY for unspliced frames P90/P100/P120/P140**Note**

Use this table ONLY if the PC-based design program instructions instruct you to use frame bracing schedule HEAVY.

A	B	C	D	E	F	G	H	I
2000	115 mm	1/2	0	0	3	85 mm	685 mm	2000 mm
2500	115 mm	1/2	0	2	1	185 mm	985 mm	2500 mm
3000	115 mm	1/2	0	2	2	85 mm	885 mm	3000 mm
3500	115 mm	1/2	1	1	3	185 mm	985 mm	3500 mm
4000	115 mm	1/2	2	1	3	85 mm	885 mm	4000 mm
4500	115 mm	1/2	4	0	3	185 mm	985 mm	4500 mm
5000	115 mm	1/2	5	0	3	85 mm	885 mm	5000 mm
5500	115 mm	1/2	3	2	3	185 mm	985 mm	5500 mm
6000	115 mm	1/2	4	2	3	85 mm	885 mm	6000 mm
6500	115 mm	1/2	2	4	3	185 mm	985 mm	6500 mm
7000	115 mm	1/2	3	4	3	85 mm	885 mm	7000 mm
7500	115 mm	1/2	5	3	3	185 mm	985 mm	7500 mm
8000	115 mm	1/2	2	6	3	85 mm	885 mm	8000 mm
8500	115 mm	1/2	4	5	3	185 mm	985 mm	8500 mm
9000	115 mm	1/2	4	5	4	85 mm	885 mm	9000 mm
9500	115 mm	1/2	2	7	4	185 mm	985 mm	9500 mm
10000	115 mm	1/2	3	7	4	85 mm	885 mm	10000 mm
10500	115 mm	1/2	5	6	4	185 mm	985 mm	10500 mm
11000	115 mm	1/2	6	6	5	85 mm	885 mm	11000 mm
11500	115 mm	1/2	3	8	5	185 mm	985 mm	11500 mm
12000	115 mm	1/2	4	8	5	85 mm	885 mm	12000 mm
12500	115 mm	1/2	6	7	5	185 mm	985 mm	12500 mm
13000	115 mm	1/2	7	7	5	85 mm	885 mm	13000 mm
13500	115 mm	1/2	5	9	5	185 mm	985 mm	13500 mm
14000	115 mm	1/2	5	9	6	85 mm	885 mm	14000 mm

A = Frame height

B = Height of first horizontal #

C = Number of horizontals

D = Number of bracing gates 600 mm

E = Number of bracing gates 800 mm

F = Number of cross bracings

G = Upper bracing height

H = Upright section, not spliced (upper end of upright above the top bracing node point)

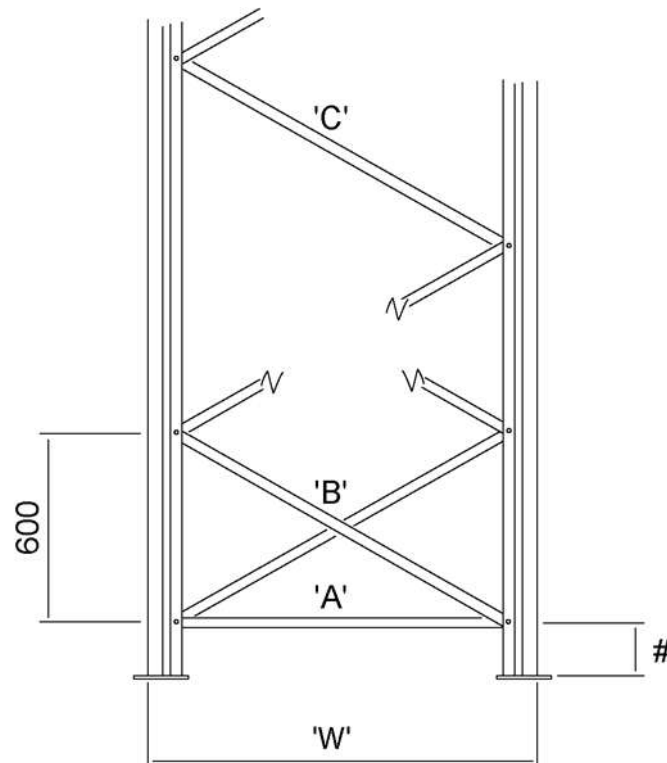
I = Upright length

Frame bracing schedule HEAVY involves doubling the diagonal braces at the bottom of the frame to create cross braced panels (see illustration below). Frame bracing schedule NORMAL is used as the basis for the number of panels, with the number of crosses dictated by the following rules.

The cross braced panels must extend in height beyond the first beam level.

If the height of the first beam level is lower than 1000 mm, the crosses must extend to the height of the second beam.

The height to the top of the crosses must exceed 20% of the overall frame height.



SL0197

= Height to first horizontal – 115 mm

⚠ In rack designs that differ from the standard design, the frame bracing schedule must be installed according to the static design!

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