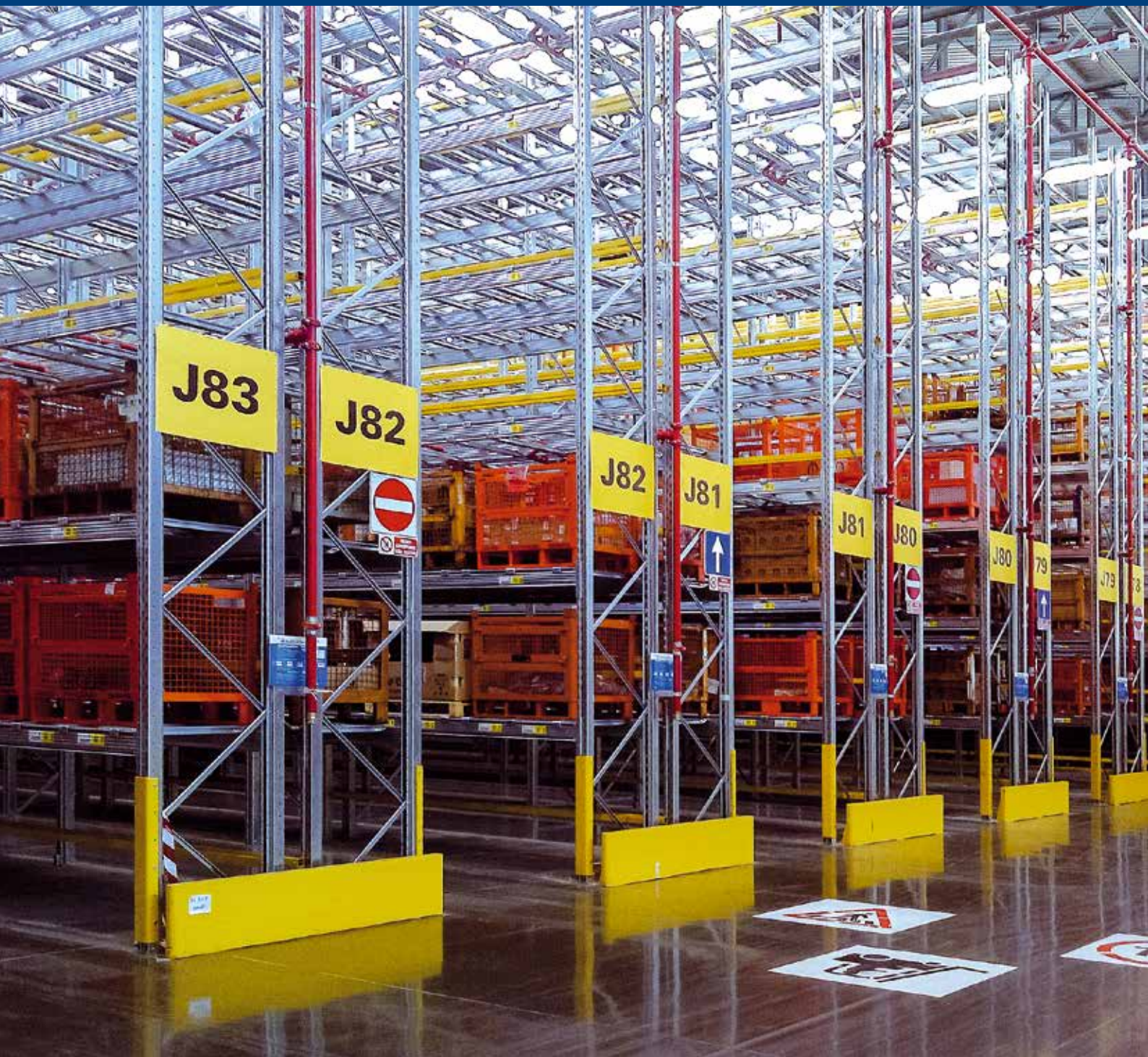
Installation, use and maintenance, risk assessment manual

Pallet racks **Bi-Bloc**

DALMINE LOGISTIC SOLUTIONS



Contents

General information

GENERAL RULES FOR THE USE OF BI-BLOC STORAGE SYSTEM

Use

Bi-Bloc racks are made of vertical elements called uprights and by horizontal elements called beams. Both elements have been carefully designed to store load units. A load unit is made of a pallet and stored goods. Once racks are fitted with additional accessories they can take other kinds of load units, including boxes, cartons etc.
Maximum load and size limitations for each load unit cannot be exceeded. Pallets must be suitable for rack usage and must be free of defects or damages that may result detrimental to load performances. (see appendix B - FEM 10.2.03). Disposable pallets are not recommended.
Goods must be placed on pallets or containers in a way that ensures good balance and stability.
Goods must be kept within the frame space of pallets or containers so to ensure room of maneuver between racks and load units. Racks are not designed for stackable load units.

Overloads

It is strictly forbidden to load racks beyond the maximum load allowed. Load limits can be found on signalization panels or technical specifications, such as blueprints or brochures. It is also required to verify maximum permissible loads upon contract forms.
As a general rule, the maximum weight allowed for horizontal parts of the structures (beams, platforms and side-guards) refer to the "evenly spread load" standard.
Indeed, a very localized load or an unbalanced load yet within the limit, may jeopardize the overall stability of a structure.

Dynamic loads

Loads must be softly placed on racks, avoiding rough handling or unusual horizontal shifts.
Structures that will be subject to special dynamic conditions, such us free-fall supply storage areas or in case of rugged environmental conditions causing exposure to winds, snow loads or even earthquake must be specially designed.

Variations in layout

Wherever some modifications to the basic design are required, this must involve a study of feasibility so to ensure that load parameters on each section of a rack and the rack itself as a whole are fit to withstand new load conditions.
Whenever beam platforms are removed or in case of a greater headroom clearance that may become necessary in order to store bulkier load units, upright loads might be effected, resulting in a hindered loading capacity. Please contact the technical office at DalmineLS for customized design.

Pallet storage

Pallets are available in a wide choice of different configurations, including 2 or 3 beam versions, either reversible or not. Size and performances are varied as well.
As far as 1200x800 Europallets are concerned, the standard loading procedure involved forklift handling from the 800 mm side, thus between-uprights depth of 1000 mm.
Upright frames can be set to take 800 mm deep containers or pallets in case forklifts must operate from the 1200 mm side. Drop guards will be installed on beams so to ensure pallets are laid safely, in a such way to allow loading pallets upon two separate drop guards, 1,000 millimeters apart (to be measured across the outward faces).

Collisions

In no way, manipulation vehicles shall bump into the racks. In case of accidental damages, their extent must be carefully assessed and all components being effected must be replaced.
In case of frequent similar accidents or bumps, it is highly recommended to install crash barriers by the racks.

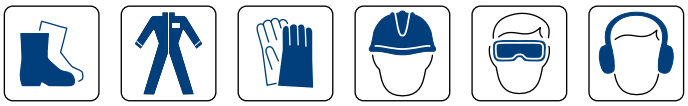
Staff training

The warehouse foreman must receive detailed technical information about the storage capacity and features.
Each rack or component maximum load is detailed on both lay-out blueprints and the load capacity panels that come with the rack itself.
There is some basic information that must be spread and made available to all personnel, including:

- Maximum load for each couple of beams
- Maximum load for each upright frame
- Distance between two loading levels

Staff must be trained to:

- use the handling equipment correctly
- inform those in charge immediately in the event of collisions with structures
- inform those in charge of any malfunctions noted
- use the personal protection equipment during installation, maintenance and handling operations



Forbidden procedures

The following are forbidden on warehouse storage systems supplied by DalmineLS:

- welding
- fitting of ties for use for installing systems of any kind

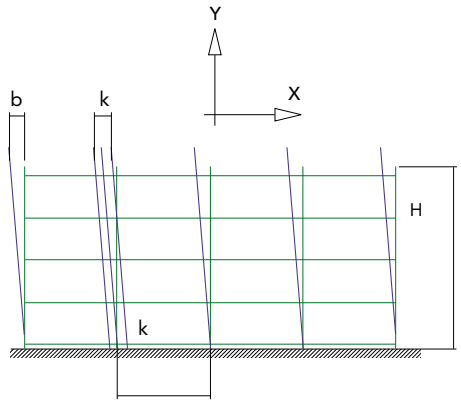
All such operations must be included in the installation design and approved in writing by DalmineLS.

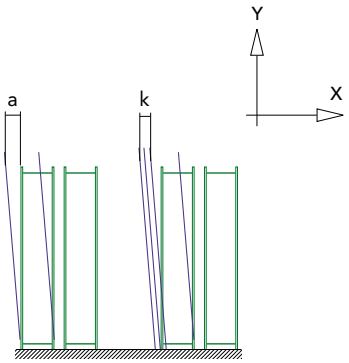
CONSTRUCTION AND ASSEMBLY TOLERANCES

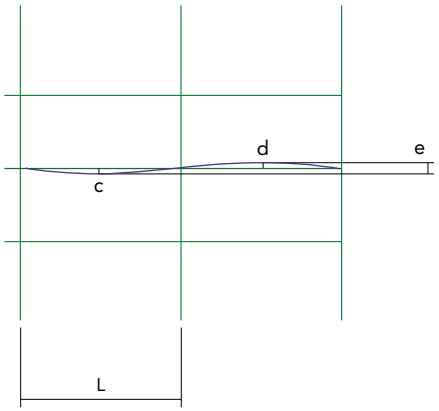
Mounting tolerances concerning shelves verticality and beams' deflexion

K = ± 10 mm
e = ± 10 mm

H = Rack height
L = Beam length
a = Net shift along Z-axis
b = Net shift along X-axis
c = Beams positive deflexion
d = Beams negative deflexion
e = Vertical tolerances along Y-axis
K = Single upright tolerances, resultant of deformation, inclination and shifting of the upright basis







	a [mm]	b [mm]	c [mm]	d [mm]
H	$\frac{H}{500}$	$\frac{H}{1000}$	–	–
L	–	–	$\frac{L}{200}$	$\frac{L * 0.7}{200}$

LIMITS OF SUPPLY AND USE

Bi-Bloc has been designed for indoor applications, within industrial buildings.
Specially designed racks can be supplied for outdoor use, whenever racks are exposed to winds, snow or placed in seismic areas.
Racks will be placed on a reinforced concrete floor, laid down by the buyer. Said floor must be adequately flat, with a tolerance of +/- 1 cm and must be suitable to withstand the rack driven loads.

Whenever floors are laid upon a lower store's ceiling, its load and deformation must be carefully verified and compared with the rack weight. Attention must be focused on concentrated spot loads.

Materials other than concrete are not recommended for the floors.
A load limit panel must be placed in a position making it easy to detect for all operators. Load limits cannot be trespassed.

MANUFACTURING STANDARDS

UNI EN 15512:2009 dated 14/05/09
Steel static storage systems - Adjustable pallet racking systems - Principles for structural design.

UNI EN 15620:2009 dated 11/06/09
Steel static storage systems - Adjustable pallet racking - Tolerances, deformations and clearances.

UNI EN 15629:2009 dated 19/03/09
Steel static storage systems - Specification of storage equipment.

UNI EN 15635:2009 dated 19/03/09
Steel static storage systems - Application and maintenance of storage equipment.

USER'S RESPONSIBILITIES

Bi-Bloc users have a number of specific responsibilities with regard to the assurance of conditions of compliance.
They are responsible for:
• compliance with the regulations in the country of installation;
• compliance with the supplier's detailed assembly and installation instructions, which must be followed correctly when installation is carried out by the user or its contractor;
• compliance with specifications concerning the maximum weight and overall dimensions of the goods or load units for storage;
• compliance with limits concerning anchoring to the ground, evenness of floor, floor load-bearing capacity, etc.;
• clearly showing the load limitations of handling equipment including lifts and forklifts;
• care not to drag or push goods when in contact with the warehouse's structural elements;
• the provision of the essential recommended turning spaces, to minimise the risk of collision between loads, or between loads and the warehouse storage fittings;
• the use of equipment compliant with the contract specifications;
• the fitting of guards on the uprights where necessary;
• regular inspections of the pallet rack throughout its working life to ensure that any damage is repaired and damaged components are replaced with new parts supplied by the same producer;
• the use of staff skilled in the use of the handling equipment and the proper storage of load units upon the pallet racks, to ensure safe operation of the system.

MAXIMUM PERMISSIBLE UPRIGHT FRAME LOADS

MAXIMUM PERMISSIBLE UPRIGHT FRAME LOADS

H (mm)	S 80 L (kg)	S 80 ML (kg)	S 80 M (kg)	S 80 MH (kg)	S 100 M (kg)	S 100 MH (kg)	S 100 H (kg)
1200	5000	8000	11100	13800	14700	19300	26700
1500	4500	7500	10300	12800	14100	18300	25200
1800	4000	6600	9500	11700	13400	17400	23300
2100	3500	5000	8200	10100	12200	15600	20800
2400	3000	4100	6600	8400	11400	13800	18100

Regarding S 120 M, S 120 MH, S 120 H, S 121 MH, S 121 H profiles, please refer to actual job specifications.

• By maximum permissible load we mean an evenly distributed weight between two framed uprights. Unbalanced situations such as weights leaning depth-wise must be carefully evaluated.
• "H" is the height where the first beam is placed, starting from the floor, or the beam base along the height, wherever it is larger. In case of a larger base between beams height-wise, such portion of the rack must be verified keeping such base as "H" value.
• Each span must feature 2 pairs of beams along the height in order to maintain longitudinal stability. In case of jointers (extended upright frames) 3 pairs of beams are required.
• When assessing profiles, all weights leaning on the ground locked pair of beams (172 mm high) will not be considered.
• Loads are figured out to be valid in case of a H/B ratio up to 10 (H = upright height and B = upright depth).

MAXIMUM PERMISSIBLE BEAM LOADS

As calculated on each pair of beams with an evenly distributed weight.

R 60 L		
Length (cm)	Load (kg)	Camb (cm)
1300	1880	0,65
1800	1070	0,90
2200	740	1,10
2700	500	1,37

R 60 M		
Length (cm)	Load (kg)	Camb (cm)
1300	2380	0,65
1800	1370	0,90
2200	950	1,10
2700	640	1,35

R 90 H		
Length (cm)	Load (kg)	Camb (cm)
1300	4500	0,40
1800	3520	0,80
2200	2740	1,10
2700	1860	1,35

R 100 L		
Length (cm)	Load (kg)	Camb (cm)
1300	3660	0,40
1800	2710	0,75
2200	2250	1,10
2700	1600	1,35
3600	920	1,80

R 60 H		
Length (cm)	Load (kg)	Camb (cm)
1300	2870	0,65
1800	1660	0,90
2200	1150	1,10
2700	780	1,35

R 80 L		
Length (cm)	Load (kg)	Camb (cm)
1300	2700	0,50
1800	2000	0,90
2200	1390	1,10
2700	940	1,35

R 100 M		
Length (cm)	Load (kg)	Camb (cm)
1300	4500	0,39
1800	3370	0,75
2200	2800	1,10
2700	2000	1,35
3600	1140	1,80

R 100 H		
Length (cm)	Load (kg)	Camb (cm)
1300	4500	0,39
1800	4050	0,75
2200	3360	1,10
2700	2370	1,35
3600	1360	1,80

R 80 M		
Length (cm)	Load (kg)	Camb (cm)
1300	3390	0,50
1800	2510	0,90
2200	1750	1,10
2700	1180	1,35

R 80 H		
Length (cm)	Load (kg)	Camb (cm)
1300	4070	0,50
1800	3020	0,90
2200	2110	1,10
2700	1430	1,35

R 110 L		
Length (cm)	Load (kg)	Camb (cm)
1300	4170	0,35
1800	3090	0,65
2200	2570	1,00
2700	2000	1,35
3600	1150	1,80

R 110 M		
Length (cm)	Portata (kg)	Camb (cm)
1300	4500	0,25
1800	3830	0,65
2200	3170	1,00
2700	2450	1,35
3600	1410	1,80

R 90 L		
Length (cm)	Load (kg)	Camb (cm)
1300	3180	0,45
1800	2350	0,80
2200	1840	1,10
2700	1250	1,35

R 90 M		
Length (cm)	Load (kg)	Camb (cm)
1300	3970	0,45
1800	2940	0,80
2200	2300	1,10
2700	1560	1,35

R 110 H		
Length (cm)	Load (kg)	Camb (cm)
1300	4500	0,25
1800	4500	0,65
2200	3780	1,00
2700	2910	1,35
3600	1670	1,80

R 120 L		
Length (cm)	Load (kg)	Camb (cm)
1300	4500	0,30
1800	3550	0,60
2200	2950	0,90
2700	2440	1,35
3600	1430	1,80

R 120 M		
Length (cm)	Load (kg)	Camb (cm)
1300	4500	0,25
1800	4410	0,60
2200	3660	0,90
2700	3020	1,35
3600	1770	1,80

R 120 H		
Length (cm)	Load (kg)	Camb (cm)
1300	4500	0,30
1800	4500	0,50
2200	4360	0,90
2700	3590	1,35
3600	2090	1,80

R 140 L		
Length (cm)	Load (kg)	Camb (cm)
1300	5900	0,30
1800	4360	0,55
2200	3610	0,80
2700	3000	1,10
3600	2030	1,80

R 140 L		
Length (cm)	Load (kg)	Camb (cm)
1300	6000	0,20
1800	5410	0,55
2200	4480	0,80
2700	3690	1,20
3600	2500	1,80

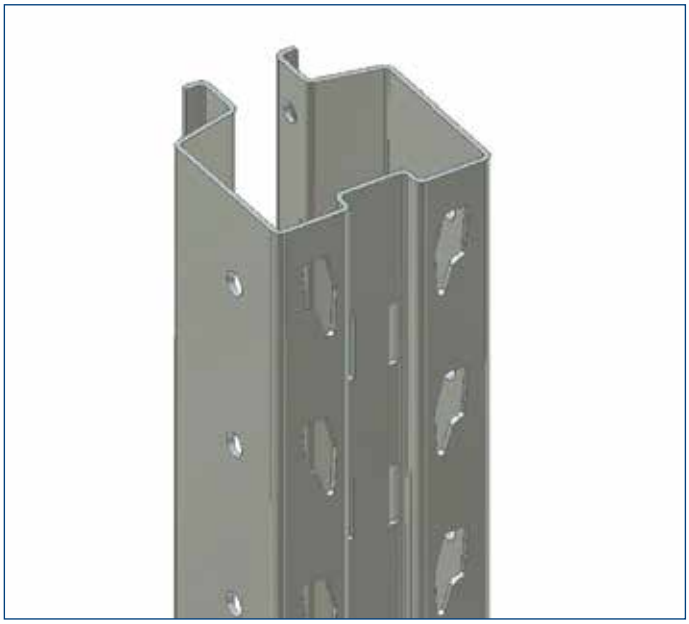
R 140 H		
Length (cm)	Load (kg)	Camb (cm)
1300	6000	0,20
1800	6000	0,50
2200	5350	0,80
2700	4400	1,20
3600	2970	1,80

R 160 M		
Length (cm)	Load (kg)	Camb (cm)
1300	6000	0,20
1800	6000	0,45
2200	5360	0,70
2700	4410	1,00
3600	3360	1,80

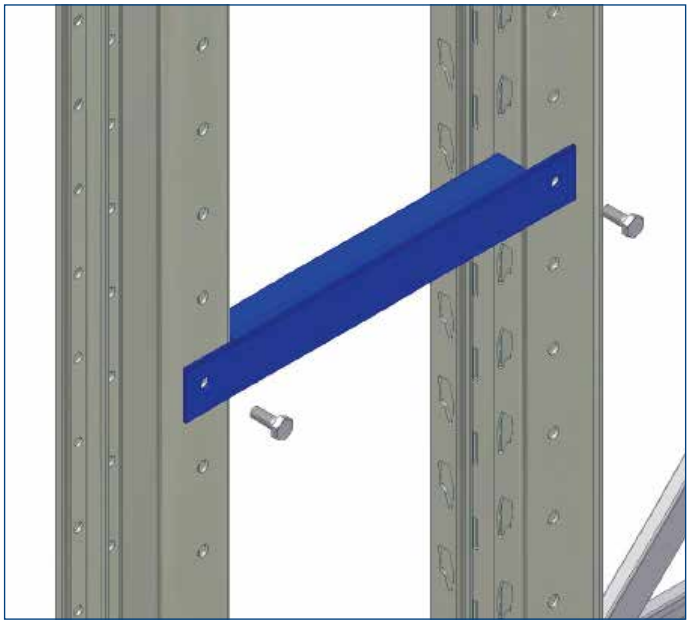
R 160 H		
Length (cm)	Load (kg)	Camb (cm)
1300	6000	0,15
1800	6000	0,40
2200	6000	0,65
2700	5290	1,05
3600	4020	1,80

List of components

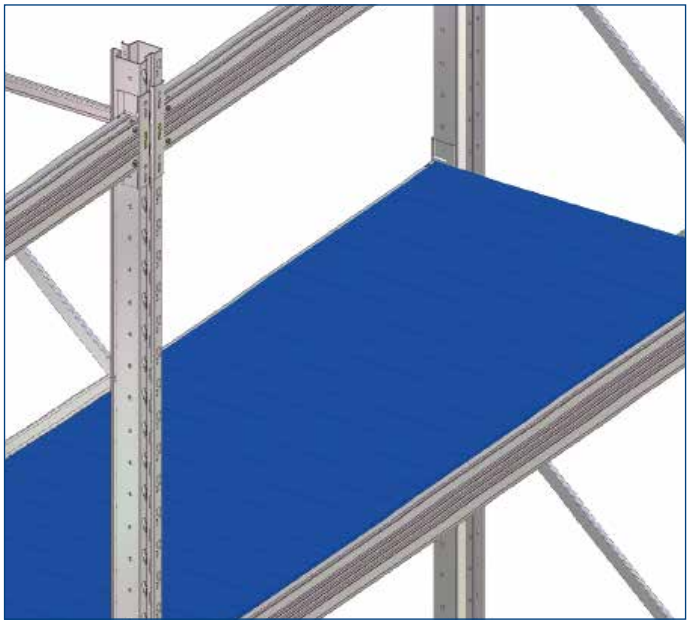
Base plate



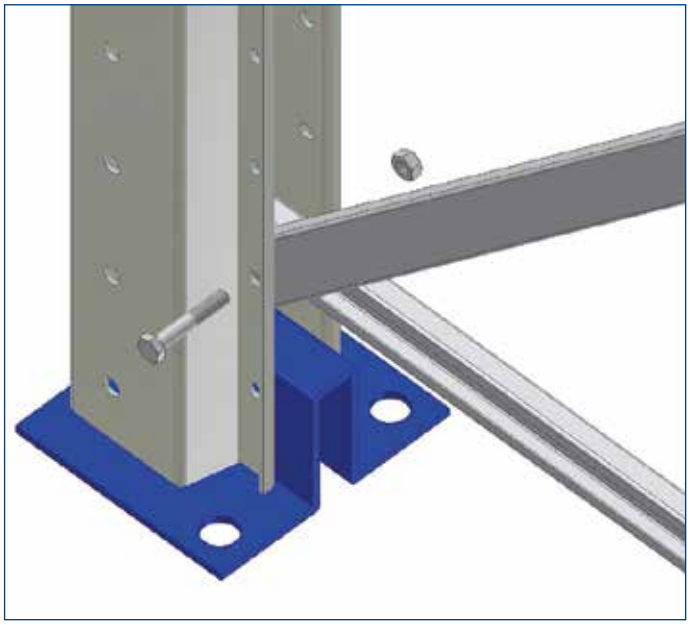
Upright



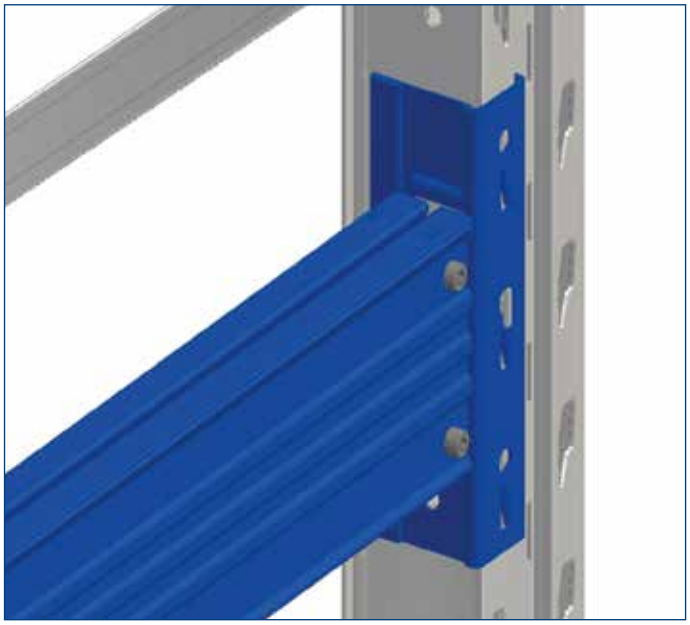
Frame connection



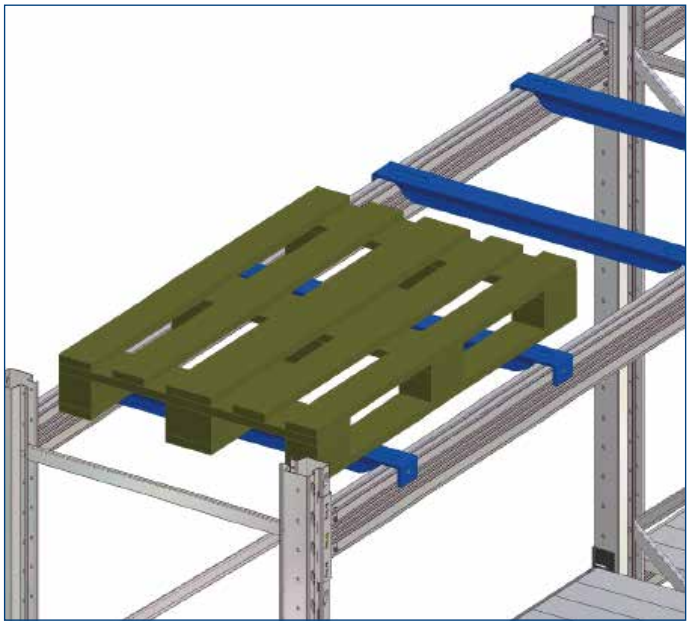
Tiles



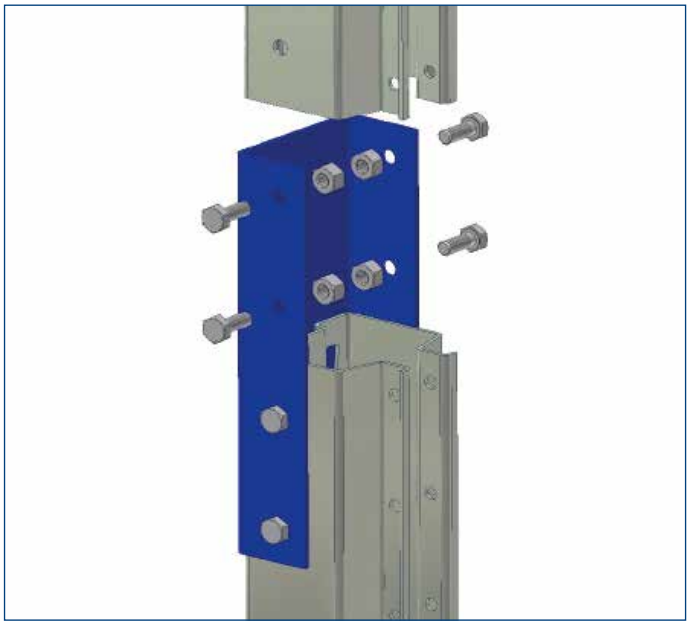
Cross beams and diagonals



Beams



Guard beams



Upright assembly joint

Installation

INSTALLATION PHASES

Axis draw

When starting assembly axis must be drawn, by actually drawing on the floor some boxes representing the required lay out of one-sided and double-sided racks.

Upright frames assembly

1) Install the base plate by means of the upright screw hole.

2) Install diagonals, and place the gasket on the first hole (where diagonals do not overlap).

3) Insert locking screws in every hole on uprights and diagonals.

4) Go ahead and install all diagonals that are needed in order to complete an upright frame.

5) Fit the gasket on the top whole in the last upper diagonal.

6) Tighten all screws by means of an electric screwdriver after having fitted a locking screw nut on each. Minimum tightening torque 20 Nm.

7) Upright frame assembly is completed.

8) Install every upright frame in the project, by following the procedures explained insofar.

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Upright frames positioning

9) Move the first pair of upright frames in the erection area and bring the first in vertical position. This operation requires a minimum of three persons.

10) Fit a beam in the beam slots and insert a beam stoppers.

11) Repeat the operation with the second upright frame and fit a beam as already done on the first. Fix beam stoppers.

12-12a) Insert all other beams as per the project and fix beam stoppers.

13) M 10x25 screw bolts, to be inserted in upright frames, can be used to replace beam stoppers.

14) Tighten all screws.

Place all remaining upright frames sequentially, using pallet-bearing beams as connections.

As soon as double-sided upright frames are installed, proceed with connections. Wherever the original project requires so, make the overall structure stiffer by use of vertical bracing.

11

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12

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12a

13

14

15) Verify verticality and horizontality by following the table.

16) Accessories include filler shoes that can be used only in case of assembled upright frames that do not conform with the specified verticality.

17) Lock tiles with the expanders we supply along with the rack.

Check that all screws and bolts are adequately tightened. Refer to the tightening torque tables included in this manual and prepare all load panels that must be attached at the rack's end.

VERTICALITY: v<H/1000
v = Longitudinal and side out-of perpendicularity
H = Structure height
ALIGNMENT: a = ± 5 mm
a = Maximum structure drift lengthwise and sidewise.
HORIZONTALITY: o = ± 5 mm
o = Maximum drift of flat parts, when compared with the original blueprint.

Remarks:
Equipment tolerances are given case by case.

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Tile positioning

18) A sufficient quantity of tiles must be carried to the assembly area, a loading platform will be prepared by using different sized tiles and by placing them on the tile holders.

19) Lay all tiles until you obtain an even and full platform.

18

19

Safety beams positioning

20) Insert safety beams. The required number of beams depends on the span.

21) Proceed to install all of them.

20

21

Pallet end stoppers assembly

22) Assemble the pallet end stopping system using the upright slots. The stopper must be placed right over the beams level, so that the containment action will be performed on pallets and not on stored goods.
Fix the two support brackets to the uprights using screws.

22

23

23) Fit the pallet stopper tube into the bracket holes and fix it with the dedicated pin.

Upright protection assembly

24) Place protection elements over base plates.

25) Fix the elements using expansion plugs.

24

25

TIGHTENING TORQUE TABLES

• In case of mechanic expanders being used, strictly refer to the manufacturer's data.
• Hexagonal head screws as per UNI 5737 or similar, round head screws with die-cast hexagon as per UNI 5931.
• Below-head and upon-thread friction factors u=0.14 (Phosphated black screw, use lubricant before assembly).
• Torque to be applied with dynamometric wrenches. Dead-end screwdrivers are not considered.
• If such equipment is used, M torque must be reduced by 10%.
• In case cadmium screws are used, reduce M torque by 20%.
• In case large hexagonal head screws are used, increase M torque by 5%.

MINIMUM TIGHTENING TORQUES FOR SHEAR JOINTS, WITH CLASS 8.8 SCREWS

d (mm)	Area (mm^2)	Ts (N x m) = 8,8
5	**14**	3
6	**20**	5
8	**36**	12
10	**58**	20
12	**84**	45
14	**115**	72
16	**157**	112
18	**192**	154
20	**245**	218
22	**303**	298
24	**353**	350

Instructions for proper maintenance

Constant, systematic checks are required to ensure that the structures remain in good condition over time.

Scheduled maintenance table

DESCRIPTION OF OPERATION	FREQUENCY	PROCEDURE
Beam stopper check	Every 6 months	Check that beam stoppers are effectively in place and that beams are properly inserted in their slots. In case an illegal positioning of beams is found, the loading section must be carefully offloaded and the beam will be fixed back in place.
Inspection for collision damage	From 6 months to one year	Check regularly for permanent dents of varying extent caused by collisions. On systems with a high turnover rate, a thorough visual inspection should be performed every 6 months. For other systems, the inspection can be performed annually. The damaged parts must be replaced with genuine components.
Check that structure is vertical	Every 2 years	Checks that the structures are vertical must be performed by inspecting the structures of both ends of the system in both directions (lengthways and crossways). Consider the assembly tolerances stated in the manual. Restore structures to the vertical position using shims. *Tools required: Plumbline.*
Inspection of anchoring to the foundations	Every 2 years	Check the tightening torque of the expansion plugs. *Tools required: torque wrench calibrated at an authorised laboratory.*
Tightness of bolts	Every 3 years	Check 10% of bays, evenly distributed over the various zones of the drive-in system. In the event that more than 5% of the bolts checked are not properly tightened, proceed to check 50% of bays. In the event that more than 10% of the bolts checked are not properly tightened, proceed to check 100% of bays. At the next inspection, check the bays not checked the time before. *Tools required: torque wrench calibrated at an authorised laboratory.*
Inspection of galvanised and painted finishes	From one to 5 years	Check the condition of the galvanised or painted finishes at a frequency decided depending on the installation location: in corrosive environments, inspect every year; in normal indoor environments, the inspection interval may be as long as 5 years.

Risk identification, analysis and assessment

The method adopted for the identification of risks is based on the identification of processes involved in the construction of the system.
The risks were identified for each process, and then evaluated on the basis of the legal requirements and the rules of good practice, the environmental context, and the simultaneous and/or consecutive presence of different contractors and/or different processes.

Semi-qualitative scales

Risks were assessed with the aid of the two semi-qualitative scales:

- **D index scale: indicates the potential damage related to the risk**
- **P index scale: indicates the probability and frequency with which an event may occur**

For allocation of the values 0,1, 2 and 3, the occurrence of even just one of the conditions stated in the "criteria" column is sufficient. Naturally, the allocation of one of the values does not imply a prediction that all the conditions corresponding to the value chosen, listed in the "criteria" column, will apply.

D INDEX (POTENTIAL DAMAGE) SCALE

VALUE	CRITERIA
3	Damage causing irreversible injuries (death, anatomical and/or functional loss). Injuries producing temporary disability with initial prognosis of recovery in > 40 days may occur. There is a correlation between the procedure and the possibility of death or permanent disability.
2	Injuries producing temporary disability with initial prognosis of recovery in > 21 days may occur. There is a correlation between an accident during a stage of the process and the risk of injury with partial or total stoppage of operations lasting > 30 days and/or the production of limited environmental contamination.
1	Injuries producing temporary disability with initial prognosis of recovery in ≤ 21 days may occur. There is a correlation between an accident during a stage of the process and the risk of injury with partial or total stoppage of operations lasting > 1 and ≤ 30 days.
0	Injuries producing temporary disability with initial prognosis of recovery in ≤ 3 days may occur. There is a correlation between an accident during a stage of the process and the risk of injury with partial or total stoppage of operations lasting ≤ 1 day.

P INDEX (PROBABILITY - FREQUENCY OF EVENTS) SCALE

VALUE	CRITERIA
3	There is a direct correlation between the risk factor and the cause related to a form of damage. Damage has already occurred due to the problem identified (accidents, injuries, occupational illnesses). There is a correlation between the procedure and/or the risk factor and the deterioration of the accident rate and/or the rate of occupational illness over a significant period (three to five years). The likelihood of an accident is ≥ 2*10-2
2	The risk factor may cause damage, although not automatically or directly. Occasions on which the problem noted has led to the damage are recorded. There is a correlation between the procedure and/or the risk factor and a random trend in the accident rate and/or the rate of occupational illness over a significant period (three to five years). The likelihood of an accident is < 2*10-2 e ≥ 3*10-3
1	The factor may only cause damage in occasional circumstances or due to an unlucky combination of events. No occurrences are known, or they have been rare. There is a correlation between the procedure and a positive trend in the accident rate and/or the rate of occupational illness over a significant period (three to five years). The likelihood of an accident is < 3*10-3 e ≥ 3*10-5

Assignment of risk categories

To assign a risk category, the two indicators, D and P, must be correlated by placing them on Cartesian axes and taking the value assigned on a sectorial basis as reference:

D INDEX (POTENTIAL DAMAGE)				
	3	C	D	D
	2	B	C	D
	1	A	B	C
	0	A	A	B
		1	2	3

P INDEX (PROBABILITY OR FREQUENCY OF EVENTS)

Risk categories are assigned as follows:
A-SLIGHT: Risk conditions for which the monitoring of the potential hazards has to be maintained or implemented.
B-MINOR: Risk conditions for which monitoring of the potential hazards has to be established to identify any increase.
C-MODERATE, D-HIGH: Risk conditions for which preventive and protective measures have to be adopted to reduce the risks in relation to the degree of risk identified.

MARKING OF UPRIGHT FRAME OUTLINES ON THE FLOOR

Operation
Marking of the outlines of the upright frames on the floor (laying of "marker lines").

Work place
Place where the shelving system is installed.

! Type of risk
Possible interference, to be assessed on a case-by-case basis, with activities carried out at the same time (e.g. installation of electrical or air-conditioning systems, masonry finishing operations).

Preparations and equipment required to guarantee compliance with the regulations
The requirements to be met for compliance with the regulations must be assessed on a case-by-case basis depending on the characteristics of the place of installation.

Performance procedures
To be decided on a case-by-case basis depending on the characteristics of the place of installation.

TRANSPORTATION OF BI-BLOC COMPONENTS TO THE WORK SITE

Operation
Unloading of shelving system components from the truck.

Work place
As specified in plan.

! Type of risk
Small metal parts (metal fasteners, etc.) striking workers.

Preparations and equipment required to guarantee compliance with the regulations
Such loads must only be lifted using metal buckets or bins;
the use of open platforms or slings is not permitted (art. 58 of Italian Presidential Decree 164/56).

Performance procedures
Informing of workers with regard to the procedures to be adopted when lifting (raising and lowering) loads.
If the material for unloading is not in small pieces, bundles of sections or other materials may be lifted with two slings of the same length with the aiding of lifting machinery (e.g. a truck-mounted crane).

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Bruises to the head.

Preparations and equipment required to guarantee compliance with the regulations
Use of hard helmet.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Bruises to the feet.

Preparations and equipment required to guarantee compliance with the regulations
Use of puncture resistant safety footwear.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Cuts or grazes to the hands.

Preparations and equipment required to guarantee compliance with the regulations
Use of protective gloves.

Damage index: 1

Probability index: 2

Risk index: B

! Type of risk
Back injury.

Preparations and equipment required to guarantee compliance with the regulations
Assess loads during this stage. In general, if the average weight lifted by a person is more than 25 kg, there is a risk of back injury.
Depending on the company, this general statement must be backed up by a risk assessment (pursuant to Italian Decree Law 81/2008) bearing in mind all parameters (actual weight of the load, handling conditions, frequency, etc.) required to provide a complete risk assessment.
If risks of this kind are actually identified, the employer (contractor performing the installation) must fulfil all the obligations required by Decree Law n. 81/2008, (health monitoring, information and training of workers).

Damage index: 2

Probability index: 2

Risk index: C

STORAGE OF BI-BLOC COMPONENTS

Operation
Creation of a storage area for the materials.

Work place
To be specified in the plan.

! Type of risk
Material falling onto people.

Preparations and equipment required to guarantee compliance with the regulations
The materials must be placed or stacked in such a way as to prevent collapse or overturning (Decree Law 81/2008). Use helmets and puncture resistant safety footwear.

Performance procedures
Provide the workers concerned with instructions on the way in which the materials are to be stacked and where to stack them.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Fire caused by flammable materials (paints, solvents, etc.).

Preparations and equipment required to guarantee compliance with the regulations
Even small amounts of flammable materials (paints, solvents) must be stored away from sources of heat, equipment which causes sparks, and electrostatic discharges, and must be in sealed containers.
No smoking signs must be provided in the places where these materials are stored.
A class 13A - 89BC powder fire extinguisher must be provided in the store containing this material. If more than small amounts of flammable materials are present, the number of extinguishers must be increased, and units with extinguishing capacity of at least 21A 89BC must be installed.
If, for example, the quantity of paint exceeds 500 kg, fire prevention certification must be applied for (point 20 of Ministerial Decree of 16/2/1982). The access door to the store must have a raised threshold to prevent leaks.
A ventilation opening should be provided (as a guideline, at least 1/100 of the floor area of the room).

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Cuts or grazes to the hands.

Preparations and equipment required to guarantee compliance with the regulations
Use of protective gloves.

Damage index: 1

Probability index: 2

Risk index: B

ASSEMBLING THE UPRIGHT FRAMES

Operation
Assembly of the various elements which make up the upright frames using bolts, and transfer of the assembled upright frame from the work-surface (trestles) to the storage position (which may be temporary deposit in the installation site).

Work place
As specified in plan.

! Type of risk
Noise exposure

Preparations and equipment required to guarantee compliance with the regulations
Noise assessment (Decree Law 277/91).

Performance procedures
The use of ear plugs or ear defenders is recommended when using an electric screwdriver (as a precautionary measure).

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Cuts or grazes to the hands.

Preparations and equipment required to guarantee compliance with the regulations

Use of protective gloves.

Performance procedures

Draw up a procedure for the manual handling of the upright frames on the basis of the results of the health monitoring operations and the characteristics of the loads (NIOSH regulations).

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk

Bruises to the feet.

Preparations and equipment required to guarantee compliance with the regulations

Use of puncture resistant safety footwear.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk

Back injury due to the manual handling of loads.

Preparations and equipment required to guarantee compliance with the regulations

Assess loads during this stage. In general, if the average weight lifted by a person is more than 25 kg, there is a risk of back injury.
Depending on the company, this general statement must be backed up by a risk assessment bearing in mind all parameters (actual weight of the load, handling conditions, frequency, etc.) required to provide a complete risk assessment.
If risks of this kind are actually identified, the employer (contractor performing the installation) must fulfil all the obligations required by Decree Law n. 81/2008, (health monitoring, information and training of workers).

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk

Injury due to the exposure of the upper limbs to vibration during the use of electric or pneumatic screwdrivers.

Preparations and equipment required to guarantee compliance with the regulations

In general, the vector sum of the accelerations measured on the three axes in normal conditions of use exceeds 5 m/s2. In the scientific literature, this value is accepted as the "trigger threshold" above which preventive and protective measures must be taken. In this case, the use of vibration-damping gloves and health monitoring must be enforced.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk

Knocks to the head.

Preparations and equipment required to guarantee compliance with the regulations

Use of protective helmet.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk

Electrocution due to the use of electric screwdrivers.

Preparations and equipment required to guarantee compliance with the regulations

Portable devices (electric screwdrivers) must have double insulation (class II) identified by the symbol of two concentric squares.
Power supply sockets must be fitted with a device which prevents accidental removal of the plug. Unsecured plug sockets may be used provided they comply with the CEI 23-12 "Industrial plug sockets" standard.
Unsecured plug sockets and their power supply cables must be protected against mechanical damage.
Cables laid temporarily must be flexible (H07 RN --F) with rubber insulation with polychloroprene (PCP) or equivalent sheathing. Whether unsecured or permanently mounted, plug sockets must have at least IP44 protection. In particularly hazardous work site environments (presence of water, etc.) use of a higher degree of protection (IP55 or IP67) should be considered.
Portable devices must be connected to an electricity supply system fitted with a high-sensitivity differential safety breaker having tripping threshold Id of 30 mA or below; a single differential safety breaker may protect up to 6 sockets on the same panel.
For overload protection, a magnetothermic switch must be installed for each socket, unless the power supply to the panel is protected by a single magnetothermic switch having rated current the same as the lowest of the rated currents of the plug sockets.
The power supply panel must have protection appropriate to the environment where it is used (at least IP43).

Damage index: 3

Probability index: 1

Risk index: C

TRANSPORTATION OF UPRIGHT FRAMES AND SHELVING TO THE INSTALLATION SITE

Operation
Transfer of assembled upright frames, beams and bolts by fork-lift truck from store to installation position.

Work place
Route from store to installation site.

! Type of risk
Hitting of workers with parts of the upright frames which project from the fork-lift truck during transport.

Preparations and equipment required to guarantee compliance with the regulations
Provide traffic lanes of suitable width for the dimensions of the load and the characteristics of the work site.
Safety helmets must be worn both by the fork-lift truck driver and the workers on the work site.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Hitting of workers with parts of the upright frames which project from the fork-lift truck during transport.

Preparations and equipment required to guarantee compliance with the regulations
Place the load on the fork-lift truck in accordance with the instructions provided by the truck's manufacturer, to ensure that it does not fall off in transit. Improve the driver's front view by placing the transported load, in accordance with the instructions provided by the manufacturer of the fork-lift truck, in such a way that it does not obstruct the lines of vision needed for safe driving (note that an incorrectly positioned load distracts the driver's attention, meaning that he pays less attention to any people present in the vicinity). Anyone assigned to follow the transported load from close at hand should wear a high-visibility vest.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Overturning of the fork-lift truck.

Preparations and equipment required to guarantee compliance with the regulations
Ensure that the fork-lift truck driver receives suitable training;
The driving position must have appropriate protection against crushing in the event that the truck overturns (in general, this protection is provided by fitting the truck with an enclosed cab).
When reversing, fork-lift truck drivers must be assisted by a person on the ground.Passengers must not be carried unless permitted by the truck's manufacturer in the driver's cab.

Damage index: 3

Probability index: 1

Risk index: C

! Type of risk
Improper use of the fork-lift truck.

Preparations and equipment required to guarantee compliance with the regulations
No workers who have not received the information, training and instruction required by the relevant regulations must be allowed to use fork-lift trucks.

Damage index: 1

Probability index: 2

Risk index: B

! Type of risk
Accidental operation of load handling controls.

Preparations and equipment required to guarantee compliance with the regulations
For fork-lift trucks placed on the market, and/or put into service before Presidential Decree no. 459/96 came into force, and which do not have the CE marking pursuant to the "Machinery Directive".
• All load control devices must have automatic return to the idle position;
• Load control devices must be of the "hold-to-run" type and operated by electrical, mechanical or other systems;
• Load control devices must be placed and arranged in such a way that they cannot be accidentally operated, especially with regard to the specified route for access to the vehicle's driving and control position (see Ministry of Labour and Social Security Circular no. 50/98).
For fork-lift trucks with CE marking, the measures specified above do not apply, since this marking confirms that the manufacturer has complied with the essential safety requirements for the machine (Presidential Decree no. 459/1996).

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Shearing or crushing of parts of the operator's body by parts of the fork-lift truck moving in relation to each other.

Preparations and equipment required to guarantee compliance with the regulations
Chains, sprockets or other moving parts in any way accessible to the drivers or others must be fully protected by means of guards.
As an alternative to these guards, "safety distances" between moving parts are equally acceptable (see Ministry of Labour and Social Security Circular no. 50/98).

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Noise exposure.

Preparations and equipment required to guarantee compliance with the regulations
The use of ear plugs or ear defenders is recommended (as a precautionary measure).

Damage index: 2

Probability index: 1

Risk index: B

UPRIGHT FRAME ASSEMBLY WITH THE LOWER LEVEL OF BEAMS

Operation
Lifting upright frames and locking them with the first beam row.

Work place
As per layout.

! Type of risk
Hands cuts or bruises.

Preparations and equipment required to guarantee compliance with the regulations
Use protection glove.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Foot bruises.

Preparations and equipment required to guarantee compliance with the regulations
Use steel sole toe shoes.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Back and lumbar damages because of manual manipulation of loads.

Preparations and equipment required to guarantee compliance with the regulations
Assess loads during this stage. In general, given the average weight of the upright frames (90 - 150 kg) it can be stated that there is a risk of back injury. In this case the employer (contractor performing the installation) must fulfil all the obligations required by Decree Law no. 81/2008, (health monitoring, information and training of workers).

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Risk of being hit by falling or dropped materials.

Preparations and equipment required to guarantee compliance with the regulations
Use hard hats.

Damage index: 3

Probability index: 1

Risk index: C

! Type of risk
Risk of being hit by collapsing unbalanced uprights due to mishandling.

Performance procedures
Draw up a appropriate assembly procedure, complete with any hand signals for communications (see Decree Law 493/96).

Damage index: 3

Probability index: 1

Risk index: C

! Type of risk
Hitting of workers with parts of the upright frames which project from Damages cause by upper limbs exposures to vibrations cause by an electric or air-powered screw-driver

Preparations and equipment required to guarantee compliance with the regulations
In general, the vector sum of the accelerations measured on the three axes in normal conditions of use exceeds 5 m/s^2. In the scientific literature, this value is accepted as the "trigger threshold" above which preventive and protective measures must be taken. In this case, the use of vibration-damping gloves and health monitoring must be enforced.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Electrocution caused by an electric screwdriver.

Preparations and equipment required to guarantee compliance with the regulations
See operation n.4, paragraph 7.

ASSEMBLING BEAMS AND ACCESSORIES AT HIGHER LEVELS

Operation
Assembly of the shelving and accessories at a height exceeding 2 m.

Work place
As envisaged by the design.

! Type of risk
Cuts or grazes to the hands.

Preparations and equipment required to guarantee compliance with the regulations
Use of protective gloves.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Bruises to the feet.

Preparations and equipment required to guarantee compliance with the regulations
Use of puncture resistant safety footwear.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Back injury due to the manual handling of loads.

Preparations and equipment required to guarantee compliance with the regulations
Assess loads during this stage. In general, since the average weight of the elements handled is 20 kg (to be subdivided by the two workers who assemble the parts), the risk of back injury can be considered to be under control and therefore acceptable.
If a risk of this kind is actually identified, the employer (contractor performing the installation) must fulfil all the obligations required by Decree Law no. 81/2008, (health monitoring, information and training of workers).

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Injuries due to falling objects.

Preparations and equipment required to guarantee compliance with the regulations
Use of safety helmet for both the assigned workers and for other workers present during the operation (also those from other companies).

Damage index: 3

Probability index: 1

Risk index: C

! Type of risk
Fall from height.

Preparations and equipment required to guarantee compliance with the regulations
Use of motorised and other equipment allowing work to be carried out using platforms fitted with parapets. Working cages lifted by lifting equipment may also be used within the limits set by art. 184 of Presidential Decree no. 547/55 and further to the installation of effective cage (or basket) safety devices as envisaged by Ministry of Labour and Social Security Circular no. 103/98.
A properly anchored safety harness can be used only where the use of equipment of this kind is not possible (e.g. during installation with aisles less than 1.70 – 1.50 metres wide).

Damage index: 3

Probability index: 2

Risk index: D

! Type of risk
Injury due to the exposure of the upper limbs to vibration during the use of electric or pneumatic screwdrivers.

Preparations and equipment required to guarantee compliance with the regulations
In general, the vector sum of the accelerations measured on the three axes in normal conditions of use exceeds 5 m/s^2.
In the scientific literature, this value is accepted as the "trigger threshold" above which preventive and protective measures must be taken.
In this case, the use of vibration-damping gloves and health monitoring must be enforced.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Electrocution due to the use of electric screwdrivers.

Preparations and equipment required to guarantee compliance with the regulations
See operation n. 4, paragraph 7.

PAINTING OF SMALL AREAS OF METAL COMPONENTS

Operation
Painting with paints or enamels.

Work place
Shelving system.

! Type of risk
Inhalation of harmful chemicals (solvents).

Preparations and equipment required to guarantee compliance with the regulations
Follow the instructions provided in the product safety information; in all cases, a facial half-mask with A2 filter is recommended.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Contact between skin and harmful chemicals (solvents, paints).

Preparations and equipment required to guarantee compliance with the regulations
Follow the instructions provided in the product safety information; in all cases, chemical-resistant gloves should be worn.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Knocks to the head from collisions with shelving system elements.

Preparations and equipment required to guarantee compliance with the regulations
Use of protective helmet.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Foot crushing or puncturing.

Preparations and equipment required to guarantee compliance with the regulations
Use of puncture resistant safety footwear.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Fire or explosion.

Preparations and equipment required to guarantee compliance with the regulations
Do not carry out painting jobs while open flames are used, or sparks or electrostatic charges are generated, in the vicinity.
Do not leave paint containers open.

Damage index: 2

Probability index: 1

Risk index: B

ASSEMBLING GROUND LEVEL COMPONENTS

Operation
Anchoring of metal elements to the floor.

Work place
Place where the shelving system is installed.

! Type of risk
Inhalation of dust generated by use of drills.

Preparations and equipment required to guarantee compliance with the regulations
Use of protective masks.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Exposure to the noise produced by drills.

Preparations and equipment required to guarantee compliance with the regulations
Earplugs or noise-proof headset as recommended (pre-emptive measures).

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Knocks to the head from collisions with shelving system elements.

Preparations and equipment required to guarantee compliance with the regulations
Use of protective helmet.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Foot crushing or puncturing.

Preparations and equipment required to guarantee compliance with the regulations
Use of puncture resistant safety footwear.

Damage index: 2

Probability index: 1

Risk index: B

! Type of risk
Electrocution due to the use of electric screwdrivers.

Preparations and equipment required to guarantee compliance with the regulations
See operation n.4, paragraph 7.

VERTICALITY CHECKS AND INSPECTIONS FOR CORRECT INSTALLATION

Operation
Inspection of Bi-Bloc sections, including high locations.

Work place
Rack.

! Type of risk
Precipitation.

Preparations and equipment required to guarantee compliance with the regulations
Use of motorised and other equipment allowing work to be carried out using platforms fitted with parapets.
Working cages lifted by lifting equipment may also be used within the limits set by art. 184 of Presidential Decree no. 547/55 and further to the installation of effective cage (or basket) safety devices as envisaged by Ministry of Labour and Social Security Circular no. 103/98.
A properly anchored safety harness can be used only where the use of equipment of this kind is not possible (e.g. during installation with aisles less than 1.70 – 1.50 metres wide).

Damage index: 3

Probability index: 2

Risk index: D

! Type of risk
Head bumps against rack elements.

Preparations and equipment required to guarantee compliance with the regulations
Use hard hats.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Foot crushing or puncturing.

Preparations and equipment required to guarantee compliance with the regulations
Use of puncture resistant safety footwear.

Damage index: 2

Probability index: 1

Risk index: B

TESTING OF BI-BLOC

Operation
Inspection of Bi-Bloc sections, including high locations.
Possible loading test.

Work place
Rack.

! Type of risk
Precipitation.

Preparations and equipment required to guarantee compliance with the regulations
Use of motorised and other equipment allowing work to be carried out using platforms fitted with parapets. Working cages lifted by lifting equipment may also be used within the limits set by art. 184 of Presidential Decree no. 547/55 and further to the installation of effective cage (or basket) safety devices as envisaged by Ministry of Labour and Social Security Circular no. 103/98.
A properly anchored safety harness can be used only where the use of equipment of this kind is not possible (e.g. during installation with aisles less than 1.70 – 1.50 metres wide).

Damage index: 3

Probability index: 2

Indice di rischio: D

! Type of risk
Risk of being hit by materials placed on racks during load tests.

Preparations and equipment required to guarantee compliance with the regulations
Use of protective helmets; fencing of the entire area involved with movable barriers and placing of a suitable number of warning signs stating “No pedestrian access” or “No unauthorised access”, as appropriate.

Damage index: 2

Probability index: 2

Risk index: C

! Type of risk
Foot crushing or puncturing.

Preparations and equipment required to guarantee compliance with the regulations
Foot crushing or puncturing.

Damage index: 2

Probability index: 1

Risk index: B

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