Installation, use and maintenance,
risk assessment manual

Drive-in *pallet shelving*

DALMINE
LOGISTIC SOLUTIONS

Contents

General Information

GENERAL RULES FOR USE OF THE DRIVE-IN SHELVING

Use

Drive-In shelving structures consist of vertical elements called upright frames complete with the exclusive steel pallet rack profile, specially designed for the storage of load units.
Drive-in shelving is particularly suitable for storing large quantities of products on a "First In - First Out" and "Last In - First Out" basis, in deep aisles accessible with fork-lift trucks for the storage and handling of goods.
This type of shelving allows the elimination of conventional service aisles, making maximum use of all the space available.

The load unit consists of pallets.
The maximum load unit weight and size limits must not be exceeded.
Pallets must be suitable for use on shelving and must be free from any damage or defects which may impair their performance (see Annex B - FEM 10.2.03).
"Disposable" pallets are not permitted.
The goods must be arranged on the pallets in such a way that the load unit is stable and well balanced. The shelving is not designed for load units stacked one on top of the other.

Overloads

Overloading the structures above the permitted loads stated on the warning signs and in the technical documentation (installation design, brochure) is absolutely forbidden.
It is essential to check that the loads do not exceed the limits stated in the contract.
In general, the load bearing capacities of horizontal structures (beams, pallet rack profiles) refer to the "evenly distributed load" condition.
Concentrated and/or unbalanced loads, even below the stated limits, may actually overload structures.

Dynamic loads

Sharp movements and sudden horizontal pulls or pushes must be avoided when placing loads on the structures.
Storage systems subject to specific dynamic loads (gravity systems, warehouses exposed to wind, snow or earthquake risks) must be specifically designed.

Material

Upright frames:
• Sendzimir S350-GD – UNI EN 10326 galvanised steel
Brackets:
• Sendzimir S280 GD – UNI EN 10326 galvanised steel
Pallet rack profiles:
• Sendzimir S280 GD – UNI EN 10326 galvanised steel

Technical Specifications

Tunnel width
1350 mm and 1400 mm net between uprights
(standard sizes)
Tunnel height:
up to 12 metres.
Safety devices:
• anti-unlocking bolt system which prevents brackets from becoming loose
• uprights protected by special painted steel profiles (optional)

Accessories:
• ground slides
• pallet stoppers
• pallet slide mouths

Variations in layout

In the event of modifications to the original design of the Drive-In shelving system, it is essential to ensure that the new layout is compatible with the load bearing capacities of the elements, individually and in combination.
Please contact DalmineLS technical department for the appropriate checks.

Storing pallets

The Drive-In is designed to take Europallets of 1200x800 and 1200x1000 mm. In the usual storage system, pallets are stowed by inserting the lift-truck forks on the 1200 mm side; in this case, the span of the shelving system compartments may be 1350 mm or 1400 mm. In general, goods must not project beyond the edge of the pallet on its 1200 mm side. Cases in which goods project from the pallet must be carefully assessed.

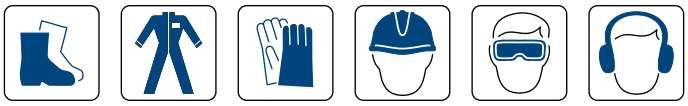
Collisions

Handling equipment must never be allowed to collide with the structures.
In the event of accidental damage, check the extent of the damage and repair and/or replace components if necessary.
If collisions occur frequently, suitable guards should be fitted.

Staff training

The person in charge of use of the warehouse must be fully informed of its technical characteristics. The load-bearing capacities of the components and structures are shown in the layout drawings and on the load capacity warning signs provided.
The basic information of which all operatives must be aware is:
• load unit max. weight
• distance between load levels
• pallet dimensions (front x depth)

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

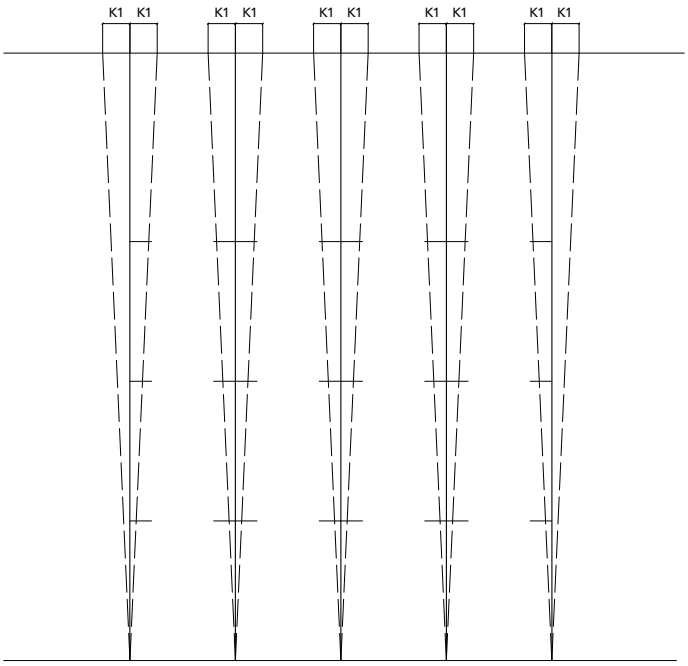


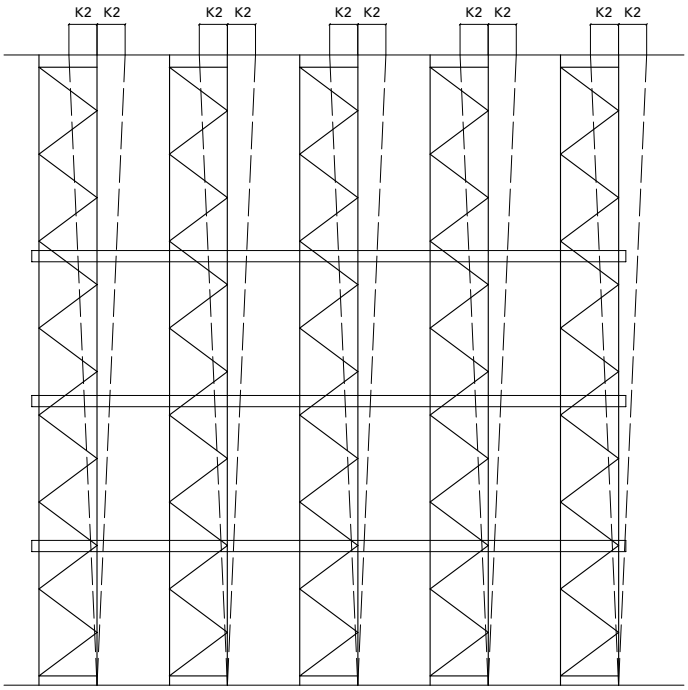
Forbidden Procedures

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





Vertical positioning:
V = deviation from the vertical < 7 mm in both directions
H = height of structure

Alignment: a = +/- 3mm
a = maximum positioning error of structure in longitudinal and transverse direction

Horizontal positioning: o = +/- 3mm
o = max. deviation of levels from rated height

Ground slide:
. +/- 3mm horizontal deviation from aisle centre line
. +/- 3mm vertical deviation from horizontal plane

LIMITS OF SUPPLY AND USE

The Drive-In shelving system is designed for use inside industrial buildings.
The floor, in suitably reinforced concrete, must be prepared by the customer. It must be level, with variations of no more than ±1 cm from the horizontal, and must be capable of withstanding the loads transmitted by the shelving system.
When shelving systems are installed on intermediate floors, checks must be made that their load-bearing capacity and deformation level are compatible with the loads transmitted by the storage system (pay special attention to concentrated loads). Floors in materials other than concrete are not recommended and must be the subject of careful consideration during design of the Drive-In system.
The load on shelving systems must not exceed the values in the load rating signs, which must always be affixed in a position clearly visible to operatives.

MANUFACTURING STANDARDS

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

Drive-In shelving system users have a number of specific responsibilities with regard to:

• 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.;

• care not to drag or push goods when in contact with the shelving system'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 Drive-IN shelving system 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, to ensure safe operation of the system.

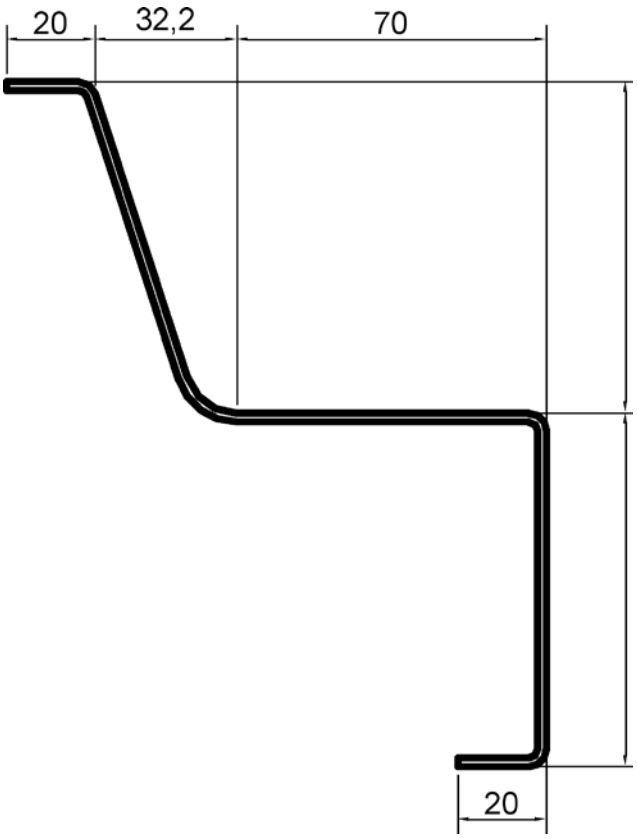
PERMITTED LOADS

Upright frames and vertical/horizontal bracing connections

The DalmineLS technical department performs the calculations and produces the construction drawings for each individual installation on the basis of the characteristics (weight and dimensions) of the pallets to be stored and the customer's requirements.

Permitted load capacities of the pallet rack profiles:

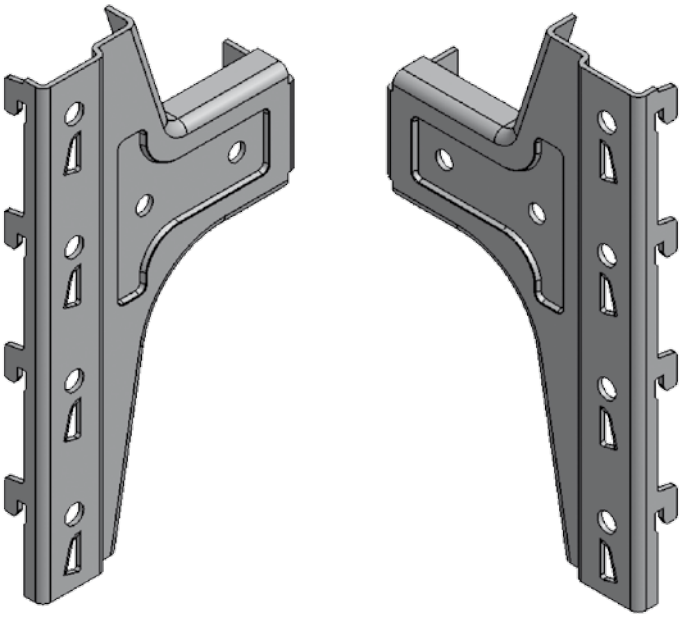
Load capacities are per pair of rack profiles and for an evenly distributed load.



STATIC VALUE TABLE		
Sp. (mm)	**Ix cm⁴**	**Wx cm³**
2	34,39	8,59

Thickness (mm)	Max. pallet weight kg
2	1500
Span (mm)	**Load capacity per pair (kg/m)**
800	1875
900	1875
1000	1875
1100	1738
1200	1460
1300	1244
1400	1073
1500	935
1600	821
1700	728

MAXIMUM PERMITTED LOADS ON PRESSED BRACKETS

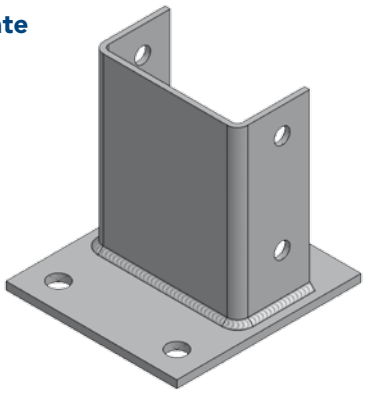


Bracket length (mm)	Load capacity daN	Code
135 rigth	835	3611911105
135 left	835	3611911115
160 rigth	780	3611911125
160 left	780	3611911135

Material: F 52812 / S275 MC
Surface treatment: Sendzimir galvanisation

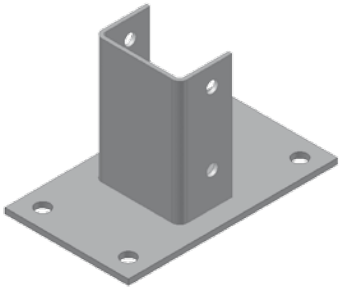
List of main components

2F base plate

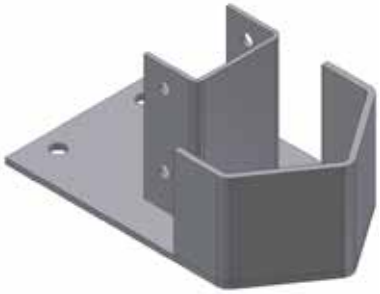


Floor slide

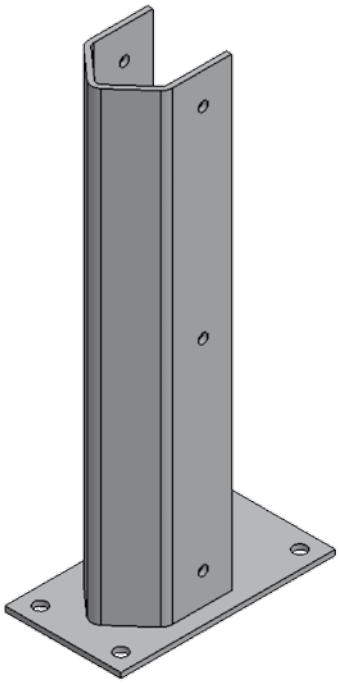
4F base plate



4F base plate with slide

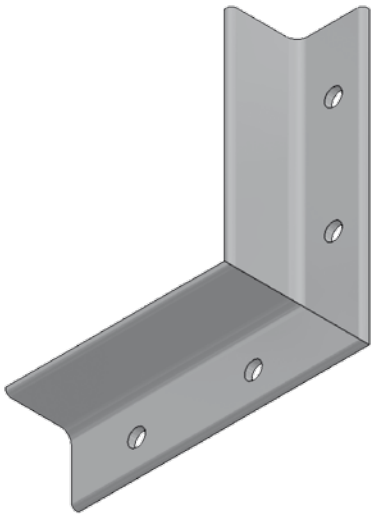


Base plate with guard

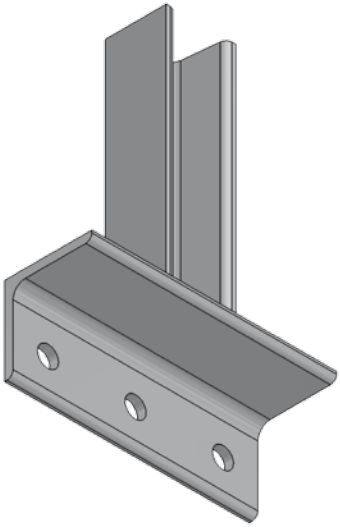


Base plate with slide and protection

Rear pallet stopper

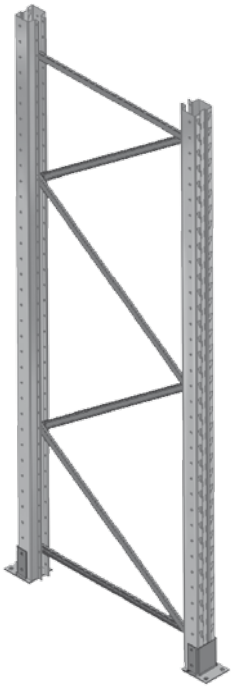


Intermediate pallet stopper

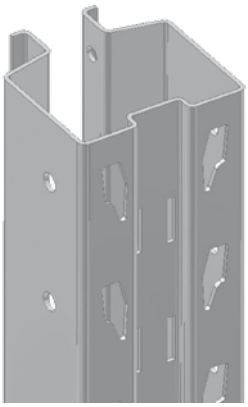


Bracing diagonals

Frames cross beams and diagonals

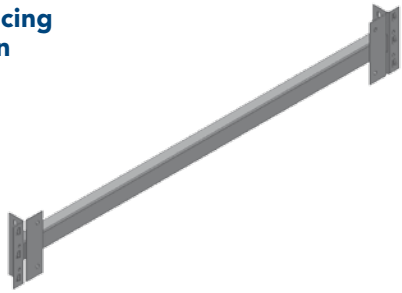


Upright

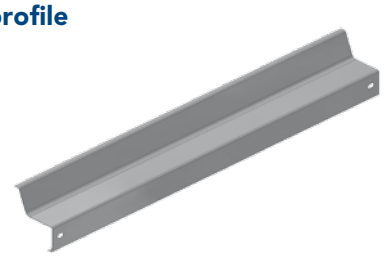


Frame connection

Frame bracing connection

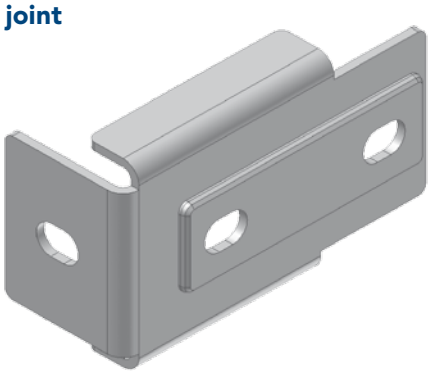


Pallet rack profile

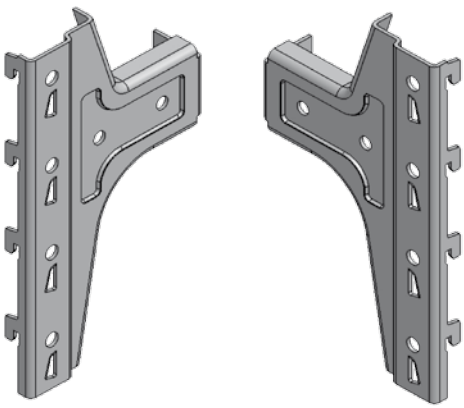


Horizontal bracing connection

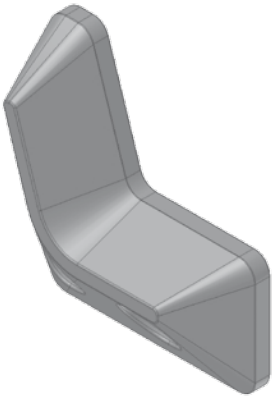
Pallet rack joint

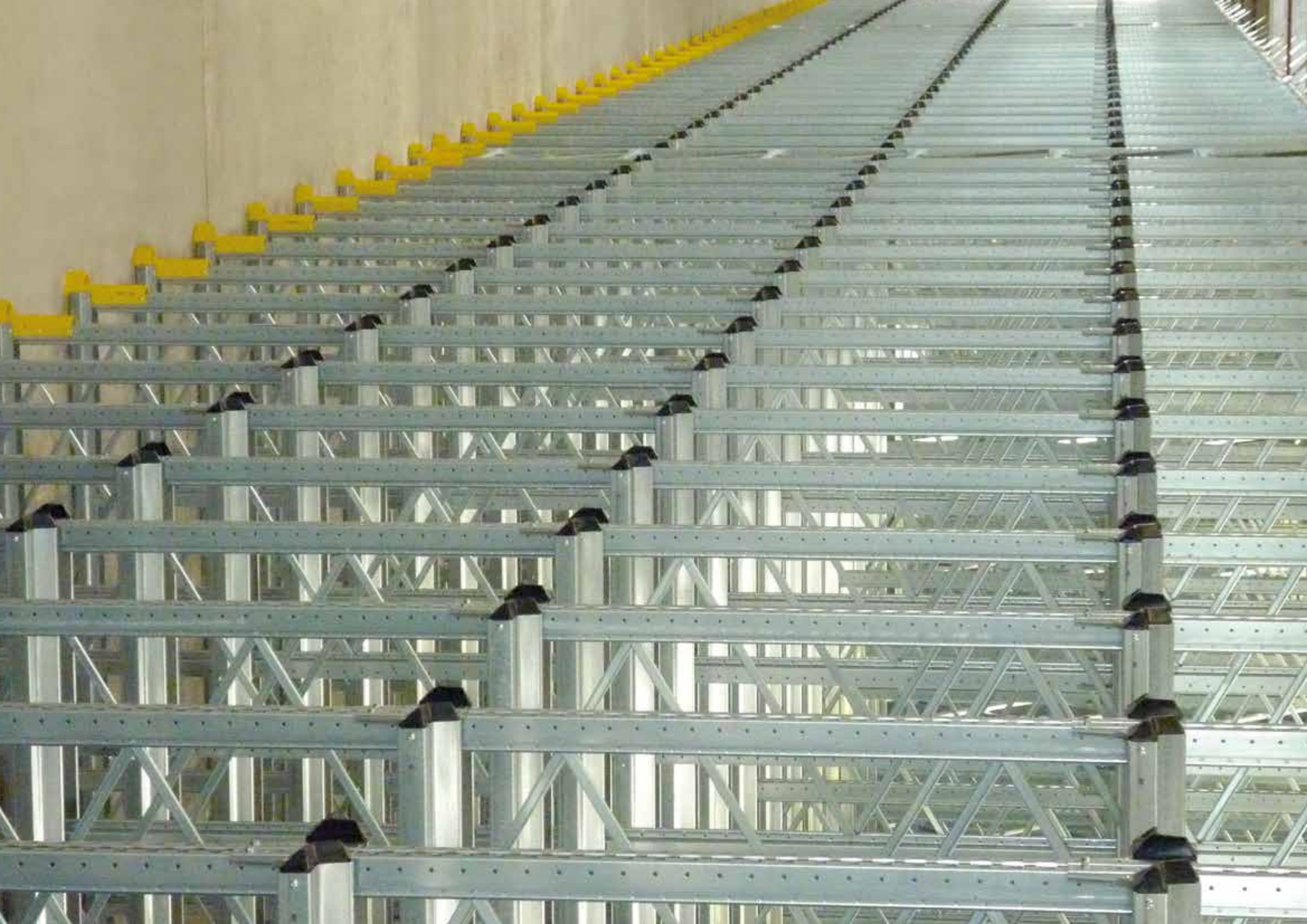


Pressed brackets



Pallet rack profile mouth





Installation

INSTALLATION PHASES

1) Mark the locator rectangles of the Drive-In block on the floor, then make a ground plan with dimensions;

2) Assemble the 2F/4F base plates, fixing them to the upright by means of four M10x25 bolts + nuts (six M10x25 for S120/121 base plates);

3) Fit the cross beams, fitting the spacer on the first hole where they do not overlap with the diagonal bracings;

4) Use M8x45 bolts and nuts to fit the cross beams and diagonals on the uprights, following the instructions on the assembly drawing; once the upright frame has been completed, screw the whole assembly down with a power screwdriver (minimum tightening torque 20 Nm);

5) Adjust the vertical position of the bracing tunnel, complete with vertical bracing connections and diagonal bracings, shimming them as indicated in the ground plan with dimensions (see point 1), and setting the upright frames vertical;

6) Place the following upright frames vertical and position them next to the bracing tunnel, connecting them with longitudinal beams along the tops of the upright frames, which must be secured with two M10x25 bolts + nuts + washers each; at least three people are needed to carry out this operation;

7) Secure these upright frames to the ground by means of BR-B M10x100 expansion plugs, after checking the consistency of the reinforced concrete floor;

8) Level the upright frames by shimming the base plates, both cross-sways and lengthways.

9) Fit the cross-links between the upright frames using two M10x25 bolts + nuts + washers for each link;

10) Place the brackets on the uprights, fixing them with the M10x25 bolts in the bottom hole, as shown in the design drawing, and then fit the profiles on each bracket using M 10x25 Allen bolts, to support and guide the pallets;

11) On each side of the aisle, fit the pallet rack mouths onto the brackets by means of two M10x25 Allen bolts + nuts + washers for each;

12) Where required, connect the pallet rack profiles together by means of the pallet support joints, using M10x25 Allen bolts;

13) On single-fronted structures, at the back of the tunnel fit two rear pallet stoppers, fixing them to the pallet rack profile by means of M10x25 Allen bolts;

14) On double-fronted structures, fit the intermediate pallet stoppers as shown in the assembly drawing, fixing them to the pallet rack profile by means of M10x25 Allen bolts;

15) Check the tightness of all the metal fasteners with reference to the enclosed tightening torque tables;

16) Fit the load-bearing capacity signs on the ends of the structure.

Floor slides

Truck slides, when possible, are to be installed after the upright assembly, ensuring that a base plate with slides or a base plate with slides and protection is installed on aisle side; all base plates must be fixed with two bolts on lower holes (2F, 4F and 4F with slide) or with four screws in upper holes (4F with slide and protection).
After these operations, the floor slides can be installed.

Floor slides may be installed at a later stage, replacing standard base plates on aisle sides with a base plate with slide, or base plate with slide and protection; upper bolts must then be removed from other standard base plates (depth of load corridors) and repositioned after floor slides have been installed.

TIGHTENING TORQUE TABLES

• Comply strictly with the manufacturers' instructions with regard to the tightening torques of the mechanical expansion plugs.
• UNI 5737 hex head screws and the like, UNI 5931 Allen screws.
• Friction coefficients on shank and threads u=0.14 (black phosphate screws, oil before fitting).
• Torque applied gradually with torque wrenches, not impact screwdrivers.
• When tightening with impact screwdrivers, reduce torque M by 10%.
• For cadmium screws, reduce torque M by 20%.
• For wide hex head screws, increase torque M by 5%.

MINIMUM TIGHTENING TORQUES FOR SHEAR JOINTS, WITH CLASS 8.8 SCREWS

d (mm)	Area (mm^2)	Tt (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
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.
Inspection of anchoring to the foundations	Every 2 years	Check the tightening torque of the expansion plugs. *Tools to be used: 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 to be used: 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.


Vernel

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 tunnels are to be 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.

TRANSPORT OF DRIVE-IN COMPONENTS

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 protective 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 DRIVE-IN COMPONENTS ON INSTALLATION SITE

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

TRANSPORT OF COLUMNS AND BEAMS TO PLANNED INSTALLATION LOCATION

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

ASSEMBLY OF THE UPRIGHT FRAMES WITH THE FIRST ROW OF BEAMS

Operation
Lifting of the upright frames and fixing by means of first row of beams as per design.

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 helmet.

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, 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
Blows from falling material.

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

Damage index: 3

Probability index: 1

Risk index: C

! Type of risk
Upright frame becoming unbalanced and falling due to incorrect handling, hitting workers.

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
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
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

FITTING THE PALLET RACK PROFILES ON THE BRACKETS.

Operation
Fitting the pallet rack profiles on the brackets.

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
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/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
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

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

ASSEMBLY OF ACCESSORIES AT GROUND LEVEL (UPRIGHT GUARD)

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
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

VERTICALITY CHECKS AND INSPECTIONS FOR CORRECT INSTALLATION

Operation
Inspections of parts of Drive-In, including parts above ground level, even at height.

Work place
Loading tunnel.

! 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
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: 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 DRIVE-IN

Operation
Inspections of parts of Drive-In,
including parts above ground level, even at height. Load tests, if any.

Work place
Loading tunnel.

! Type of risk
Falls from height involving workers/other people.

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
Falling of material placed on the pallet rack profiles for 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
Use of puncture resistant safety footwear.

Damage index: 2

Probability index: 1

Risk index: B

DALMINE LOGISTIC SOLUTIONS

Dalmine Logistic Solutions Srl
Headquarters:

29122 Piacenza - Italy
viale del Commercio, 36

phone +39 . 0523 17 37 911

news@dalminels.com
www.dalminels.com

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