estanterías record

Efficient storage systems

PRODUCT TECHNICAL FILE

MEZZANINE

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CONTENTS

1. SCOPE

Estanterías Record, S.L. designs and manufactures several types of metal racking, shelving and storage systems in compliance with applicable standards. Therefore, we have to document the specifications and characteristics of each product line to create a summarised view of the theoretical parameters and structural and functional elements considered in each particular solution.

This product file aims to provide a general description of the MODULAR MEZZANINE system.

It develops an outline of the individual components in the system and the different possibilities to combine them to create the structures which must bear the load of the stored goods. We also describe the materials used to manufacture the components and any other accessories incorporated in the specific, unmodified solution. Finally, it includes a normative justification of the product design calculations and the load-bearing capacities of the product's main elements.

The scope of this report is not exhaustive, but rather it is purely descriptive and aims to provide a broad view of the system's general operation. It is not intended, therefore, to explain all the combinations of uses and components in meticulous technical detail, as this would go beyond the purposes for which it has been conceived; it has been created as an educational, supporting material, so its content should not be considered as a definitive and accurate reference, but rather instructional.

This technical file has been edited strictly in line with the aforementioned objectives. The information it contains is private and must not be subject to distribution, processing, reproduction or transfer of use without the prior express permission of Estanterías Record, S.L. who reserves all of their rights.

The information in this document may be altered without prior notice because of changes related to the products' manufacturing characteristics, because of technical or functional obsolescence of certain elements which may be replaced with others, or because of other adequately justified modifications which have a direct or indirect impact on the content of the text.

2. PRODUCT DESCRIPTION

The structural system described herein constitutes an appropriate combination of its constructive elements according to the technical and functional parameters for its planned use.

The system's basic components are posts, lintels and purlins. These and some other components are described in more detail below.

The posts are arranged vertically and spaced according to the structure's dimensions. They are connected horizontally by means of lintels which in turn support perpendicular rows of purlins. This arrangement creates an open-plan horizontal surface which is covered with decking appropriate for the loads it will receive or the use for which it is intended.

The structure's stiffness is guaranteed by the coupling derived from the connection between the lintel connectors and posts, and from the fixation of the post anchoring plates with the floor using expansion bolts.

The height of these structures is based on the total space available and the elements to be placed in their interior surfaces. Accordingly, mezzanines can be erected with one or more floors and modular surfaces that are determined by the functional or constructive requirements.

The different floors are connected by access stairways which are conveniently located so they do not obstruct circulation or reduce the system's capacity.

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Modular mezzanine with stairway, guardrail and floor decking

Finally, to guarantee safety of employees and the stored goods, elevated floors are protected around their perimeter by installing safety guardrails. In turn, the guardrails can have opening sections that form loading bays to facilitate goods handling.

Modular mezzanine with two elevated floors

Main advantages:

- Each product can be located quickly and accessed directly and immediately, thus ensuring an intensive flow of stock rotation. Flexibility of use saves time and effort, while also preventing warehouse management errors.

- Modular mezzanine floors are especially suitable for awkwardly shaped loads that cannot be stored in conventional racks, different sized or irregularly shaped products, bulk materials or in containers with different capacities, storing equipment, etc.

- Easily adapted as requirements change. The range of accessories and configurations means the structure can be adapted for use with loads of all weights and volumes.

- Strict stock control. Each location corresponds to a selectively accessible and identifiable item; there is no need to move items to handle the required products.

- As the system's structural elements follow an excellent assembly design it can be disassembled and relocated quickly. Alternatively it can be reconfigured or amplified according to new storage needs. Furthermore, damaged components can be replaced easily and immediately.

- The structure is designed so that none of its elements impede load handling; it does not need to be secured to any of the building's existing structural elements because, thanks to its physical characteristics, it functions independently and does not need to transfer forces.

- The construction system means the basic structure can be extended vertically to produce additional storage surfaces and therefore taking full advantage of the space available and adapting perfectly to goods with different formats, weights and volumes.

The demountable modular mezzanine system is designed to optimise space management and maximise warehouse usage through a controlled investment that is proportional to the benefits and advantages it will bring.

The following diagram provides an example of the design:

The system's design guarantees the structure bestows absolute stability. The elevated floor provides a suitable platform for different uses within its corresponding range of force tolerances. The welding and fastening methods employed result in very strong connections that ensure the structure has the necessary stiffness for the service conditions it will endure.

The user can rest assured that their investment will never become obsolete and that it can evolve and develop in parallel with their business. Once Estanterías Record have completed the appropriate studies, the installed storage system can be reconfigured, expanded or refurbished as and when new circumstances or expansion or relocation requirements arise.

2.1. MATERIALS

Sections are cold-formed and punched from steel strips before they undergo electrostatic painting in a continuous flow, phosphate, anticorrosive coating and oven curing treatments.

The load-bearing capacity of the structure is determined directly by the quality of steel used in their construction and by the physical characteristics of each configuration in response to elastic instability phenomena associated with the individual elements and their combinations to form this type of structural system.

2.1.1. Steels

The quality of the steels used to manufacture the different elements varies depending on the structural requirements of the specific solution.

All the pickled steel strips used to manufacture the sections are certified at source.

Depending on each element's end use, nominal values for yield stress, fy, range between 235 N/mm² and 355 N/mm², in accordance with standard EN 10025.

Values for ultimate tensile strength, fu, vary from 360 N/mm² to 510 N/mm², as per standard EN 10025.

They are guaranteed to have the following mechanical characteristics:

Property	Value
Elastic modulus	$E = 210000\ N/mm^2$
Shear modulus	$G = E/2(1+\nu)\ N/mm^2$
Poisson's ratio	$\nu = 0.3$
Coefficient of linear thermal expansion	$\alpha = 12 \times 10^{-6}\ ^{o}C$
Density	$\rho = 7850\ Kg/m^3$

The system's metal elements are grade A1 (M0), according to certification at source, in compliance with Spanish Royal Decree 2267/2004, dated December 3, which approved the fire safety regulations in industrial premises. Elements with a zinc coating of less than 100 µm have a fire rating of M1, class B-s3,d0, in accordance with standard UNE-EN 13501-1:2007.

2.1.2. Finishes

All ungalvanised elements are painted to obtain a surface finish using an automated, double rail, continuous flow process with several treatment stages: cleaning, degreasing, phosphating, anticorrosive coating, pigment spraying and curing. Pieces are degreased before painting by means of phosphate and passivation treatments. A thermosetting epoxy polyester paint is then applied using a robotised electrostatic sprayer and oven cured immediately at 200 °C for 15 minutes.

This produces a glossy, uniform coating approximately 65 µm thick with a high impact, wear and corrosion resistance, a fire rating of M1, in accordance with standard UNE 23727-90, certified at source, tested according to standards UNE-EN 13823:2002 and UNE-EN ISO 11925-2:2002, and classified in line with UNE-EN 13501-1:2007 B-s2,d0, both certified at source.

The coatings' mechanical specifications are presented below:

Property	Standard	Result
Gloss	ISO 2813	84
Adhesion	ISO 2409	GTO
Direct and reverse impact	ISO 6272	70 cm
Cupping	ISO 1520	7 mm
Bend test	ISO 1519	5 mm.
MEK	IC-101	100 DF
Salt spray hours		500

Vertical and horizontal elements are painted blue (RAL 5003).

Like the paints, all other auxiliary materials used to manufacture the system's elements are selected according to the specifications and requirements of applicable standards, their production and reception processes are certified, and they are constantly subjected to the tests and inspections established by the quality assurance and management procedures in ISO 9001:2008.

2.2. STRUCTURAL ELEMENTS

2.2.1. Posts.

The posts are the structure's basic vertical elements. Each post consists of two uprights with their sides facing each other, two brackets and one anchoring plate, all connected together through high-strength welding.

The posts support the axial compression load in service conditions and transmit it to the floor. They are also subject to the lateral thrust produced by the mechanical forces acting in the system.

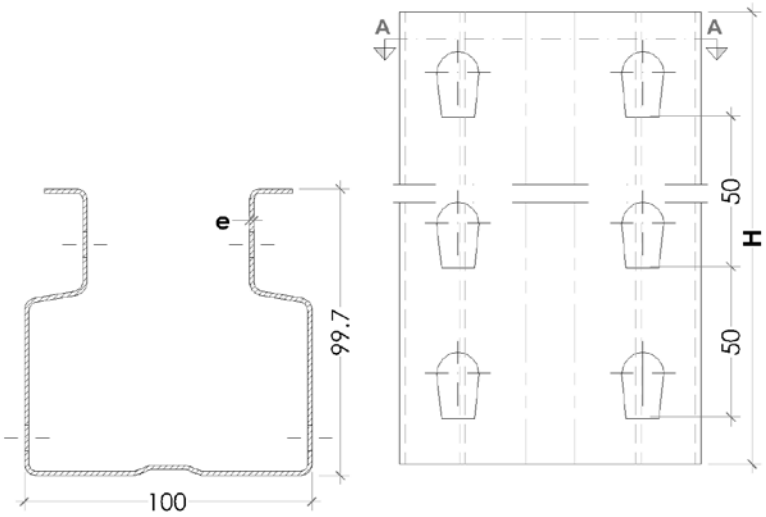
Uprights: Hot-rolled, as per standard EN 100252:2004, and cold-formed S355JR grade steel C-section profiles, with an appropriate thickness for the load they must bear.

They feature two lines of holes, each separated by 50 mm, along their front surface; the lintel connectors slot into these holes. There are also two rows of holes, measuring 9 mm in diameter and again separated by

50 mm, facing each other on both sides of the uprights. These holes are used to attach the lintels and front purlins.

As detailed above, the holes in the front of the uprights can be used to graduate the loading level every 50 mm.

Each flat element subject to compression is duly stiffened to ensure it performs correctly in case it gets dented. To this end, the uprights have nine longitudinal pleats which confer excellent stiffness against these phenomena; these pleats have been especially designed so that their inertia in function of their width, length and thickness ensures the structure is sufficiently stiffened for the service conditions which it must endure.



Plan and elevation views Upright 100 100 e = 1.5 / 1.8 / 2.0 mm

Construction of a post using uprights

Brackets. Steel plates with a guaranteed minimum grade of DC01, while higher grades, DC03 and DC04, may be used as per standard UNE-EN 10130, measuring at least 3 mm thick. Their function is to decrease the bending moment acting on the anchoring plate at the connection forming the base.

Anchoring plates. Steel plates with a guaranteed minimum grade of DC01, while higher grades, DC03 and DC04, may be used as per standard UNE-EN 10130. Their minimum thickness is 10 mm.

They serve to distribute the weight of the load to the floor slab. Each plate is fixed to the floor using four expansion bolts to anchor the structure and ensure it remains stable.

The surface supporting the mezzanine must always be of sufficient quality and strength to bear the maximum loads for which the system has been designed. Concrete reinforced with a 4 mm diameter metal mesh measuring 150x50 mm, at a minimum thickness of 150 mm, and with an allowable compressive strength of M200 (200 kg/cm2), or greater, is allowed for these pressures. What is more, it must be perfectly levelled to ensure the vertical elements are plumbed correctly. Therefore, the maximum permissible unevenness between any two points of the slab must not exceed ± 10 mm.

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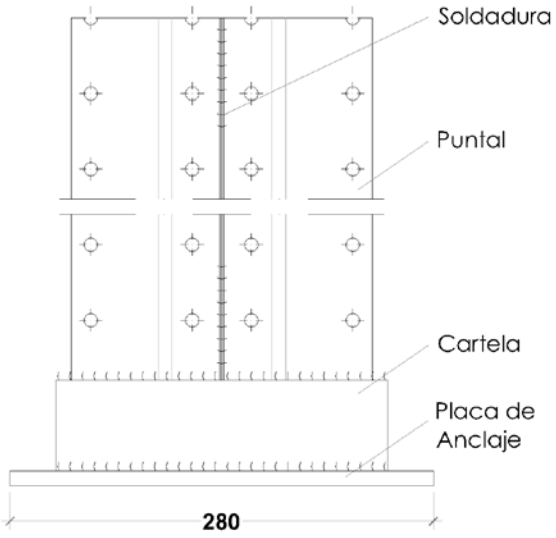
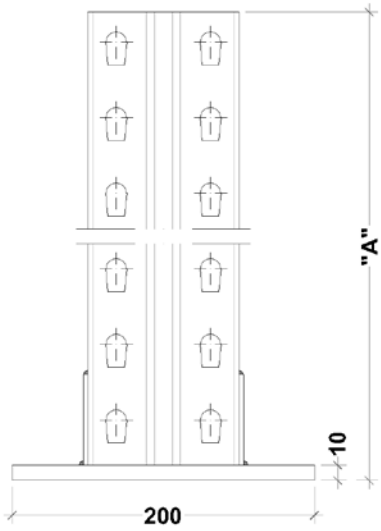
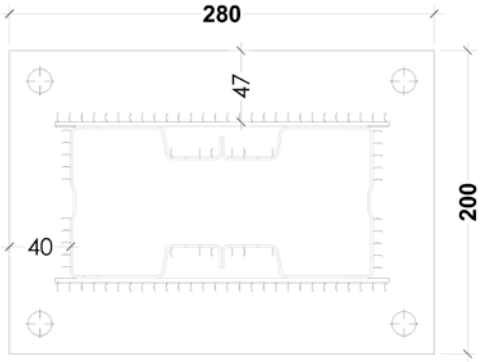


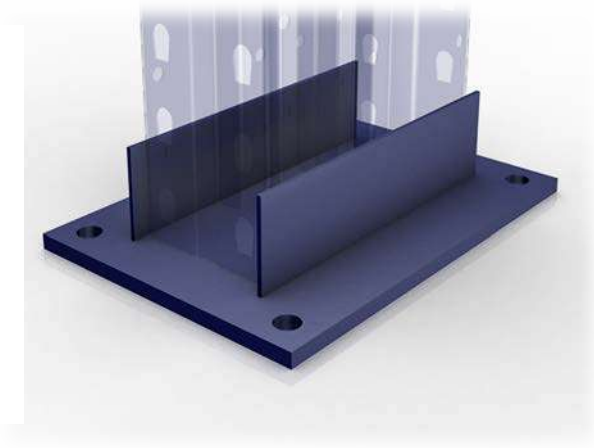
Elevation view



Cross-section



Plan view



Anchoring plate and brackets

The post assembly is especially designed to transmit the load to the floor and control any punching shear or settlement phenomena in the underlying concrete. However, this is also affected by the dimensions and characteristics of the concrete floor slab.

Posts are available in heights “A” of 2,000 to 12,000 mm, at increments of 100 mm, without including levelling plates. The total height for a 3,500 mm post is 3,510 mm from the bottom of the plate to the top of the uprights.

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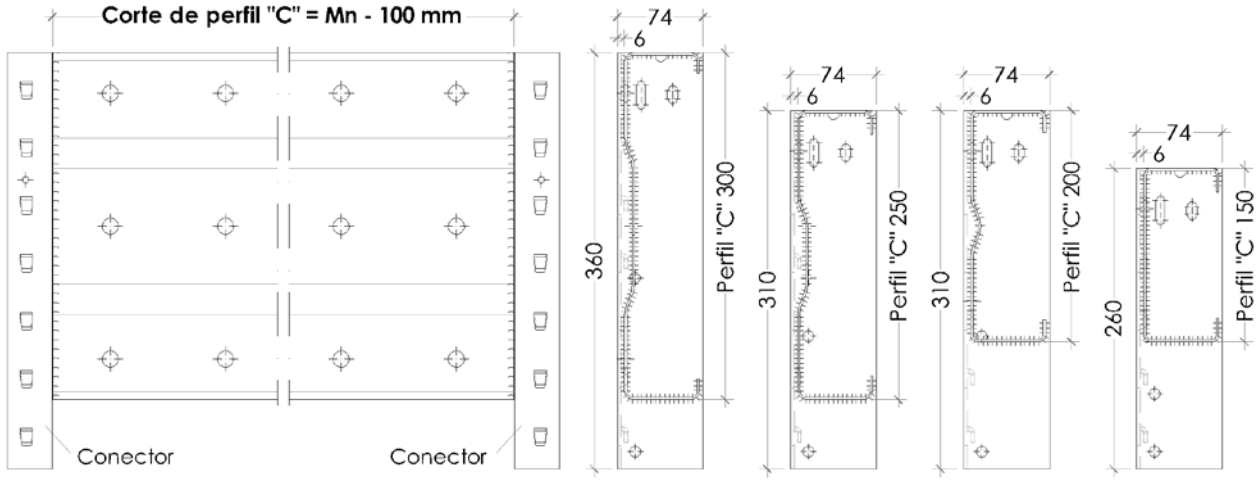
Post. Close-up of the base and attachment to the floor

2.2.2. Lintels

These are the horizontal elements that, along with the purlins, make up the structure upon which the mezzanine floor is laid. They support the load placed on the mezzanine floor and transfer it to the posts.

The lintels are C-sections formed from cold-rolled S-355-JO steel, in accordance with standard UNE-EN 10025, and with dimensions suited to the loads the structure must support. The corresponding connector brackets are fixed to their ends by means of high-strength robotic welding so they can fit together correctly with the posts.

The nominal lengths (ND) of the standard production lintels range from 900–8,000 mm, with intervals of 100 mm. The cross-section of the C-sections depends on the strength the element requires to fulfil a certain function in the system.



Elevation view | Cross-section C-300 | Cross-section C-250 | Cross-section C-200 | Cross-section C-150

The lintels are positioned on top of the posts, forming fixed-ended gantries, to which they transfer the load they receive from the purlin framework. Basically, the lintels are subject to bending and lateral-torsional buckling forces. Each flat element is duly stiffened at each point subject to compression to ensure it performs correctly in case it gets dented. Otherwise, the element could fail under shear loads, bending moments or a combination of the two. The lintels incorporate longitudinal pleats along their full length to confer greater stiffness and strength.

Lintels are fitted onto uprights by means of connector brackets. These parts transmit the load to the posts. They are formed from 3 mm thick cold-rolled S-355-JO steel in accordance with standard UNE-EN 10025. Depending on the cross-section of the lintel to which they are attached, there are three types available with dimensions of: 39x74x260 mm, 39x74x310 mm and 39x74x360 mm. The welding that attaches them to the lintel produces a high strength joint which complies with the most stringent tensile strength safety coefficients for the intended purpose.

C-sections

Connector brackets

They attach to the posts by means of 11-mm hooks projecting from the connector brackets and which fit into the corresponding holes in the uprights. This type of connection is specifically designed to transmit the thrusts from the service load correctly, thus minimising strain in the system and self-centring compressive forces to prevent risks associated with shearing stress.

Once fitted in place, the connector brackets are secured with M8x120 bolts, thus guaranteeing the connection's stiffness and preventing any vertical displacement.

This assembly system provides a great versatility of use, minimises assembly/disassembly times, and confers great longitudinal stability and strength to the overall structure.

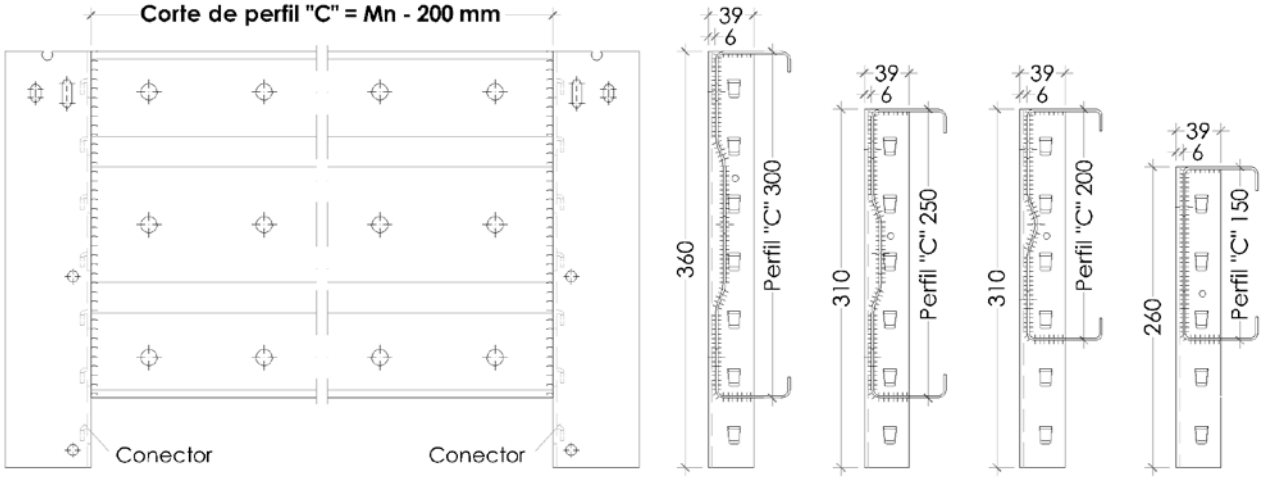
Lintels. Positioning and connection to posts using M8x120 bolts

2.2.3. Purlins

These elements, along with the lintels, form the horizontal structure upon which the elevated mezzanine floor is laid. They are supported by lintels, posts or both, and constitute the framework that supports and transfers the load placed on the floor to the system's vertical components.

The purlins are comprised of the same longitudinal C-sections used to make the lintels and have the appropriate dimensions for the service loads they must support in each case. The corresponding connectors are fixed to their ends by means of high-strength welding so they can fit together with the posts and/or lintels according to their position and function in the structure. Their position in the structure also defines their shape as follows:

Front purlins. These consist of a C-section and two connector brackets welded onto their ends by means of high-strength robotised welding. The nominal lengths (ND) of the standard production purlins range from 800–8,000 mm, with intervals of 100 mm.



Elevation view | Cross-section C-300 | Cross-section C-250 | Cross-section C-200 | Cross-section C-150

Front purlins. Positioning and connection to posts using M8x120 bolts

The front purlins are attached directly to posts, in the same manner as the lintels but positioned perpendicularly. Therefore, this produces fixed-ended gantries in the X and Y axes, resulting in greater structural stability and proper transfer of the system's load to the posts.

Normal purlin. These are comprised of a C-section and two U-65 connectors attached to their ends by means of high-strength robotised welding. U-65 connectors are inverted L-shaped elements made from 4 mm thick steel with a guaranteed minimum grade of DC01, while higher grades, DC03 and DC04, may be used as per standard UNE-EN 10130. These are used to fit normal purlins over lintels or other purlins. Once the normal purlins are fitted in place, they are secured with M10x20 bolts to prevent horizontal and vertical displacement due to external thrusts. This assembly system ensures a stiff joint and great versatility of use, minimises handling times, and confers great longitudinal stability and strength to the overall structure.

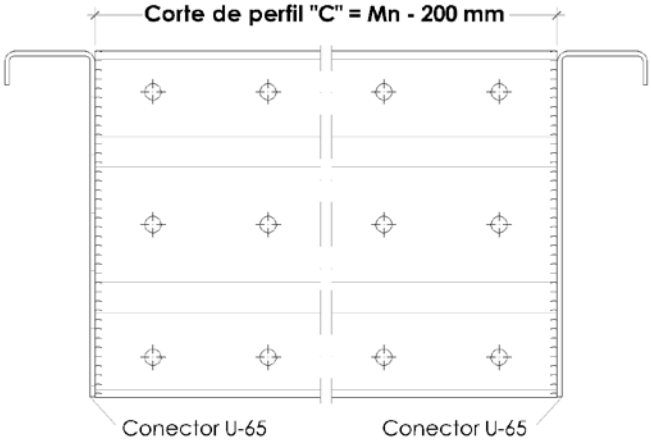
U-65 connectors come in different lengths depending on the cross-section of the purlin to which they are attached:

U-65 connectors

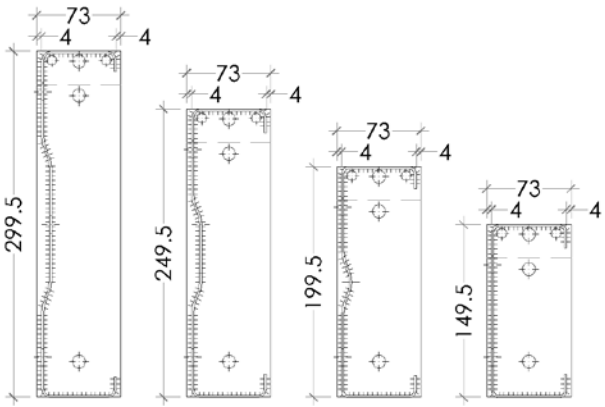
C-section	Dimension
150	149.5
200	199.5
250	249.5
300	299.5

Lengths in function of the C-section. Dimensions in mm

The nominal lengths (ND) of the standard production purlins range from 800–8,000 mm, with intervals of 100 mm.



Elevation view

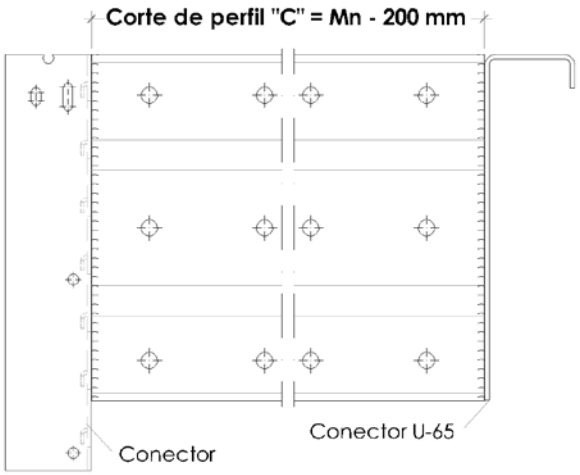


Cross-section C-300 | Cross-section C-250 | Cross-section C-200 | Cross-section C-150

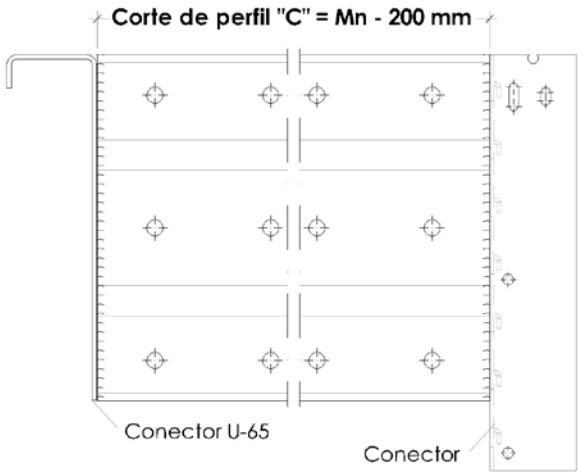
Normal purlins are fitted perpendicularly over lintels. The distance between purlins depends on the load requirements for the specific mezzanine design. Their function is to create a framework that supports the mezzanine's floor and transfers the weight to the lintels.

Normal purlins. Positioning and connection to lintels using M10x20 bolts

Left/right purlins. These consist of a C-section with one connector bracket and one U-65 connector attached to their ends by means of high-strength robotised welding. The nominal lengths (ND) of the standard production purlins range from 800–8,000 mm, with intervals of 100 mm.



Elevation view left purlin



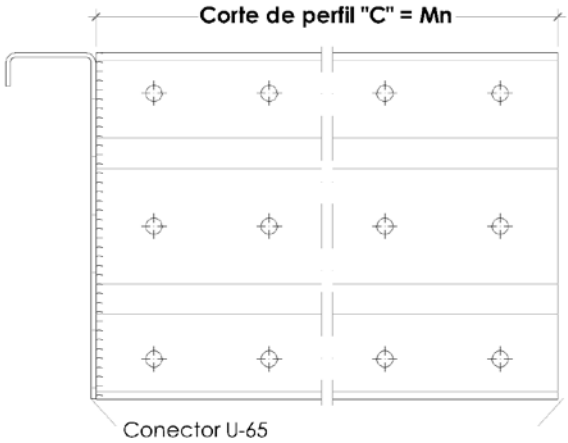
Elevation view right purlin

They assume different positions in the structure: the end fitted with a connector bracket attaches to a post and the opposite with a U-65 connector slots directly over a lintel or another purlin.

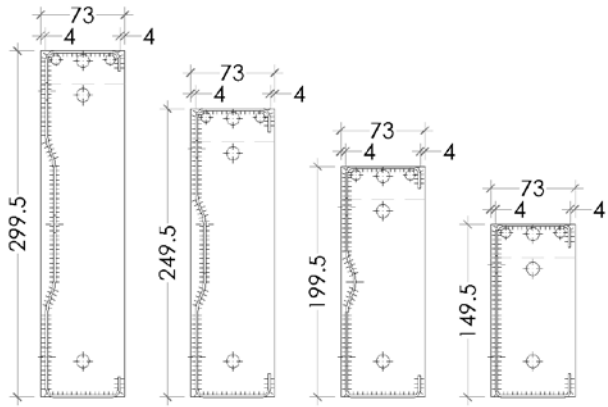
When the connector bracket is positioned at the left-hand end of the flat surface of the C-section, it is called a left purlin, and vice versa for right purlins.

Left/right purlins. Positioning and attachment at the ends

Cantilever purlin. These are C-sections with one U-65 connector attached to one end by means of high-strength robotised welding. The nominal lengths (ND) of the standard production purlins range from 300–8000 mm, with intervals of 100 mm.



Elevation view



Cross-section C-300 | Cross-section C-250 | Cross-section C-200 | Cross-section C-150

Cantilever purlins are fitted perpendicularly over lintels or other purlins. The distance between purlins depends on the load requirements for the specific mezzanine design. Their purpose is to complement the framework and transfer loads placed on the floor.

They are generally used when the characteristics of the building housing the mezzanine physically impede positioning the posts close to the wall but the specifications require that the elevated floor finishes flush with the walls and therefore covers all of the space available.

Positioning of the cantilever purlins and attachment with M10x20 bolts

The following diagram shows the arrangement of all the components described above:

No.	Description	No.	Description
1	Post	5	Right purlin
2	Lintel	6	Left purlin
3	Front purlin	7	Cantilever purlin
4	Normal purlin		

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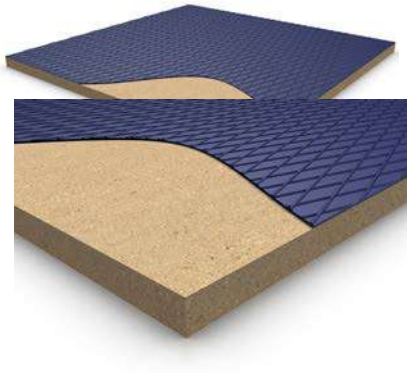
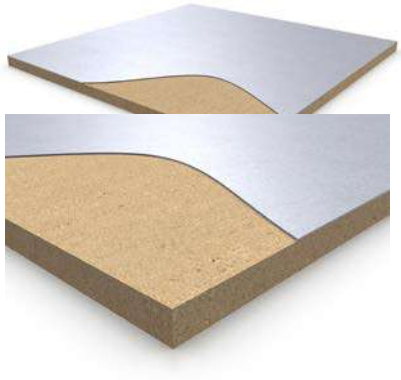
2.2.4. Floor decking

The surface designed for storing goods can be metal, fibreboard or both. It is installed over the structure formed by the framework of purlins and lintels. Where applicable, decking is assembled with the appropriate fixtures and fastenings so that it is secured correctly and to guarantee the stability and safety of the overall structure.

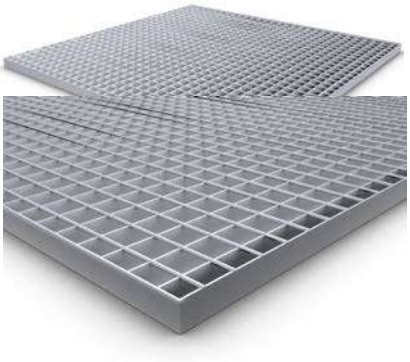
Fibre/melamine/medium-density board galv. plate 1.5 mm



Fibreboard with 3–5 mm tread plate



Fibreboard with 1.5 mm smooth



Bar grating

Coarse stamped floorboards

In each case the type of decking is selected according to the storage solution's technical specifications, the intended use and the functional characteristics of the loads and handling equipment used. Similarly, the fastening method used for each loft ensures the deck is fully immobilised and the parts fit together perfectly to produce a very neat finish.

Close-up of the metal trims used to finish boards.

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2.2.5. Guardrail

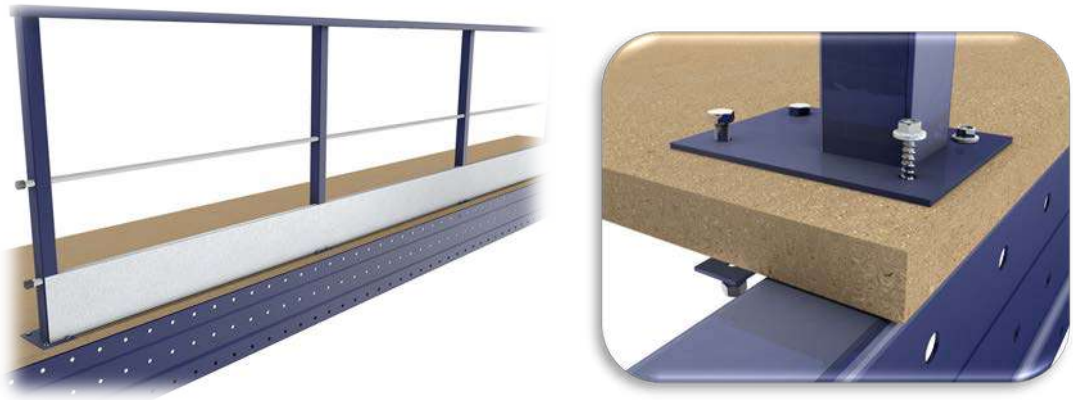
For employee safety, open areas and openings for stairways are equipped with guardrails.

Guardrails are comprised of loft guardrail uprights, handrails, skirting boards and 20 mm diameter protective railings running through the uprights, plus appropriate finishing elements.

When the open side of an elevated floor coincides with a purlin or lintel, mezzanine type guardrail uprights incorporating L-shaped connection brackets are installed. The face parallel to the boards are secured using two sheet metal screws, while the vertical face is attached to the C-section using two M10x20 bolts.

Safety guardrail and fastening elements

When the guardrail cannot be attached to C-sections, loft type guardrail uprights, which have a flat support base are used; these are secured with two sheet metal screws when they are positioned over a C-section or with two M8x45 bolts and a counter plate on the lower surface of the decking when they do not coincide with a C-section.



Safety guardrail and fastening elements

2.2.6. Stairways

Elevated surfaces are connected to the ground level using stairways that provide a safe means of access. Stairways are conveniently located for rapid, comfortable transit without reducing the structure's load-bearing capacity.

The demountable stairways are comprised of two stringers, made from cold-rolled steel U-sections, to which the treads and handrails are bolted. Handrails run along the top of the handrail uprights, while there is a 20 mm diameter protective railing running through these uprights. Stairway structures also feature appropriate finishing elements.

The treads are made from galvanised sheet metal and have round bumps stamped on their upper surface to improve grip.

Access stairways. Base of stairway and general diagram of their position

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2.2.7. Optional elements

The modular mezzanine features a wide range of accessories and elements specifically designed for integration into the model described above and to cover diverse requirements depending on the specific conditions of use. Some of these elements are described below:

Corner post protector. These are designed to protect the posts from being struck accidentally by work equipment. They are placed at the base of posts, protecting two sides in the case of single protectors or all four sides if two protectors are installed around the post.

The protectors are fixed to the floor using four anchor bolts, regardless of their height (500 or 1,000 mm). Each protector is made from 3 mm DC01 grade sheet metal.

Single and double protection and positioning

Hinged door. Opening sections can be incorporated into the safety guardrails along the loft's open sides to act as service doors, thus improving access to the storage surface and facilitating goods handling operations.

Hinged door in mezzanine guardrail

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2.2.8. Fastening elements

Shown below are the different types of fastening elements used to assemble the structures described above.

M8x15 nut and bolt

M10x20 nut and bolt

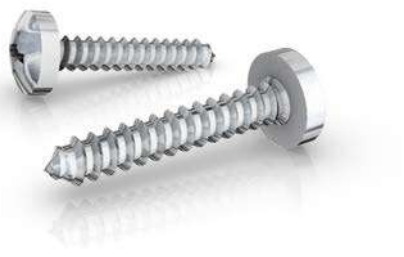
M8x45 nut and bolt

M8x120 nut and bolt

M12x100 anchor bolt

4.8x25 / 6.3x60 sheet metal screw

5.5x60 self-tapping screw



4.8x25 sheet metal round head screw

3. TECHNICAL REPORT

Calculation standards

Static stability and elastic stability verification, and stress and deformation calculations for the systems described above shall be based on mechanical methods and, in general, the theory of elasticity, which occasionally and implicitly admits local states of plastic strain.

The design procedures set out in standard EN 15512, which in turn conform to standards EN 1990, EN 1993-1-1 and EN 1993-1-3, have been taken as a reference for the calculation of stresses and deformations. The system's design takes into account the tolerances, deformations and clearances specified in standard EN 15620 and the operational requirements described in standard EN 15635.

Mechanical testing

Application of the standards implies the need to test both the individual components and the assemblies that make up the structure's configuration. These tests have been conducted by Laboratori d'elasticitat i Resistència de Materials (LERMA), at the Barcelona School of Industrial Engineering.

Calculation method and conditions

The structural designs were carried out using finite element analysis by applying second-order calculations and considering geometric nonlinearity. The elastic–plastic behaviour of semi-rigid lintel–upright and post–floor connections was also considered.

In particular, the following concepts were observed:

1. Characteristic actions and analysed actions. Their values have been taken according to specific needs; the values considered derive from the application of the safety coefficient established in standard EN 15512.

2. Permanent actions. The structure's own weight is included in the calculation.

3. Variable actions. The following actions are taken into account:
    a. Overload due to stored materials.
    b. Local imperfections. Buckling effects acting on the posts subject to compression are considered in the calculation by introducing eccentricity.
    c. Overall imperfection. Horizontal stresses equivalent to 1/200th of the vertical load being stored (according to standard EN 15512) are considered to simulate an out-of-plumb structure and/or load or defects in the material.
    d. Placement loads. The least favourable placement of the load is determined according to recommendations in standard EN 15512.

4. Static actions. As an initial assumption, loads are considered static and uniformly distributed over each structural element.

5. Dynamic actions. Dynamic loads are not considered in the structural calculation.

6. Structural safety conditions. A double action is considered: an increase in the amount of load to support by means of a load amplification factor and a decrease in the steel's yield strength by means of a load reduction factor, according to standard EN 15512.

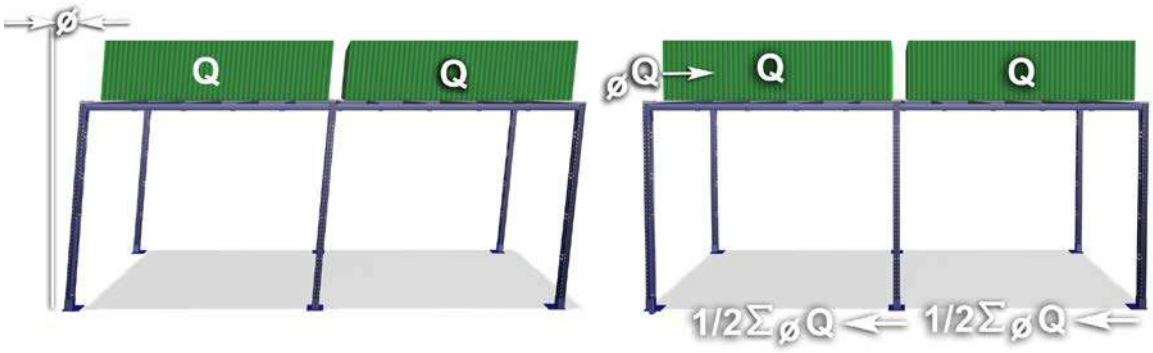
7. The design contemplates the tolerances, deformations and clearances, including interactions with the floor, in accordance with standard EN 15620. The user must ensure maintenance of the appropriate parameters for the installation's safe operation.

8. Seismic, thermal and wind actions are not considered in the system's calculation.

Structure stability

The connection between the lintel connector and the post provides a level of coupling that guarantees the structure's longitudinal and transverse stability.

The vertical elements are fixed to the floor with expansion anchor bolts, thus ensuring the structure's stiffness.



Load assumptions have been defined according to the directives in standard EN 15512 and the aforementioned calculation conditions, while verifying the strains, deformations, and longitudinal and transverse stability in consideration of the permanent and variable loads acting on the structure.

The maximum allowable deformation for purlins and lintels is set to 1/200th of their length (L/200) whenever they measure less than 5,000 mm long, and 1/300th of their length (L/300) whenever they measure equal to or greater than 5,000 mm, as set out in standard EN 15620.

Furthermore, the maximum allowable lateral deformation or displacement for the mezzanine's posts is fixed at 1/200th of their height (H/200), in accordance with the same standard.

To a large degree the safety of the mezzanine will depend on the characteristics, physical condition and evenness of the surface where it is installed. According to European standard EN 15629, it is essential that the floor can support the planned loads and intended use. The user must ensure the floor meets the requirements for the particular project.

5. GUARANTEE

Estanterías Record, S.L. guarantees the supplied materials against all manufacturing and assembly defects for a period of 5 YEARS, so long as installation and maintenance services are performed by teams allocated by Estanterías Record. In the event these circumstances are not met, the period of guarantee will be 1 year and will only cover manufacturing defects in the elements that constitute the storage system.
If assembly is contracted through Estanterías Record, the start date of this guarantee period will be taken as the date when assembly is completed and handover of the storage system is approved. However, if it is assembled by a third party, then the guarantee period will start from the materials delivery date. In either case, the term will elapse regardless of whether or not the storage system is put to use.

This guarantee only extends to the materials supplied for each specific storage system and is only valid under the following circumstances:

- All of Estanterías Record's instructions contained in the documentation provided to the customer and manuals delivered with the storage system have been followed.
- The storage system has been used in compliance with the original design and intended use, and within the levels of service for which it has been configured pursuant to the specifications in the accepted offer.
- The storage system must be free from any modifications or alterations to the initial assembly, design, function or application, and substitutions or repairs to any components, unless they have been performed with Estanterías Record's prior written consent.
- Appropriate maintenance and technical inspections, as recommended by Estanterías Record, have been completed.
- Any defects detected by the customer must be reported within a maximum of 24 hours, this includes damage or circumstances that could compromise the storage system's stability; furthermore, the customer must have followed any instructions relating to the matter provided by Estanterías Record.
- The customer has fulfilled all the obligations and responsibilities they must undertake pursuant to the contractual relationship.

During this guarantee period Estanterías Record will repair or replace any components that present serious manufacturing or assembly defects. Normal wear and tear resulting from the system's use and the passage of time are not covered by this guarantee. Repairs will be carried out in the shortest time possible and in accordance with the availability of the necessary personnel.

This guarantee will cover the replacement materials and costs of labour. Withdrawn materials will become the property of Estanterías Record.

The following points are excluded from the guarantee will be invoiced separately:

- The materials and labour used to repair or replace materials damaged as a result of their exposure to aggressive, corrosive, inappropriate or exceptional environments that were not originally planned for. Similarly, the guarantee will not extend to elements or the repair of structures located outdoors or subject to the action of atmospheric agents or meteorological phenomena.
- The materials and labour required to resolve damage caused by third parties due to inappropriate use or maintenance, the negligence of warehouse operatives or modifications on the storage system performed without Estanterías Record's consent.
- Interventions to repair damage caused by blows, fire, water, theft, exceptional occurrences or any other acts of God or force majeure.

6. STANDARDISATION AND CERTIFICATIONS

The technical report referred to the reference standards for the calculation and development of storage systems designed by Estanterías Record.

These assemblies are load-bearing metal structures for storing goods with various means of access and logistics management. As stated previously, the assembly of the system's basic components, columns, bases and arms, using specific connectors, produces three-dimensionally stable structures that enclose intervening aisles which provide access to the storage positions. The main components, while they are only standard pieces for each manufacture, differ from traditional gantry structures, with regards to the standardisation of their design, because the uprights are perforated along their entire length, connections are made with coupling fixtures and their structural elements are generally made from thin-walled, cold-formed sections.

Due to the design characteristics of the structural components, details and types of connection, the EN standards require further technical information in addition to requirements demanded by the Eurocodes. The Eurocodes are universal European regulations drafted under consensus based on the interests of the national administrations with respect to each point and therefore they have a higher status than national regulations; they are designed as a comprehensive and updated framework for structural design and are applicable to storage systems.

The European standards (EN) are developed by CEN technical committees (TCs) whose scope is to establish the EN reference standards for the specification, design, installation methods and accuracy in assembly, while also serving as a safety guide for structure users.

When this is combined with the need for harmonised standards it explains why the European Materials Handling Federation (FEM) decided to take the initiative from Technical Committee CEN/TC 344, Steel static storage systems, and draft a number of European standards regarding specific types of storage system and their particular applications; these now exist as European standards (EN) and working group (WG) activities. CEN/TC 344 Steel static storage systems is directly related to CEN/TC 250 Structural Eurocodes, CEN/TC 135 Execution of steel structures and aluminium structures and CEN/TC 149 Power-operated warehouse equipment. *Safety.*

Since the mezzanine is a load-bearing structure, there are national regulations that require it to be considered "work equipment" and consequently it must comply with European Directive 89/391/EEC, on the introduction of measures to encourage improvements in the safety and health of workers at work.

Lastly, all of these regulations must be applied in accordance with the provisions of standards EN 1990 Basis of structural design, EN 1991 Actions on structures and EN 1993 Design of steel structures.

The numerical values applicable to the partial safety factors provide an acceptable level of certainty, assuming the work is executed in accordance with appropriate quality standards.

Estanterías Record strictly fulfils the technical regulations applicable to the design and supporting calculations for our products and services. What is more, our business processes conform to mandatory sectoral, national and international regulations as they comply with applicable guidelines regarding normalisation and legislation.

Furthermore, we systematically apply the directives laid down by ISO 9001:2008 concerning quality control, assurance and management systems to our procedures involving design, development, manufacturing, installation and after-sales service. Our company registration certificate is issued by TÜV International Rheinland, under licence for use number 0.04.03229. TÜV performs regular follow-up audits to ensure the operational performance of our ISO system and verify the aforementioned standard is implemented correctly.

As approved systems must meet the highest technical demands in terms of design, guidelines for testing, calculation, manufacturing, etc., then it culminates in more solid and reliable structures. This contributes to

increased safety for the stored goods and above all it is beneficial for the storage system's end user because it will minimise handling risks in day-to-day warehouse management.

The possession of a storage system developed according to the strictest regulations applicable implies a high degree of security and confidence in the event of demands for accountability or other procedural matters involving insurance companies, financial entities, public bodies, health and safety inspections, etc.

Finally, Estanterías Record is a member of the FEM-AEM. The purpose of the FEM-AEM (Spanish Material Handling Association) is to collaborate with national and EU bodies in matters concerning the regulation, improvement and unification of its sector, while also cooperating with partner countries and European manufacturers.

As explained above, Estanterías Record is evidently very committed and engaged in terms of meeting the sector's most stringent requirements so we can offer the market products of the highest quality, safety and guarantee.

FEM AEM
Asociación Española de Manutención

TÜV Internacional Grupo TÜV Rheinland
UNE-EN ISO 9001:2008
Nº 0.04.03229

F.E.M.
European Materials Handling Federation

FEM AEM Asociación Española de Manutención
ASOCIADO
Nº 44/78 Certificado acreditativo de empresa asociada a FEM-AEM (Comité Nacional de FEM)
FEDERATION OF EUROPEAN MATERIALS HANDLING

7. AFTER-SALES SERVICES

Modular mezzanines suffer wear and tear through continuous or incorrect use, thereby reducing the functionality and load-bearing capacity for which they were designed, and significantly increasing the risk of accidents. Damaged components or which have received blows, even though the damage may not be visible, can generate dangerous stresses that could even result in its, occasionally, instantaneous and sudden collapse.

The user is responsible for ensuring that their structure is in good condition and proper working order. To assist in this respect, Estanterías Record can, upon request, provide their customers an inspection and revision service for the installed equipment in order to carry out appropriate preventive or corrective maintenance and minimise these risks.

Additionally, we can: offer our customers advice on the correct use of their storage system regarding safety or what to do in case of accidents; provide them with technical and training manuals covering maintenance;

monitor and assess preventive maintenance tasks carried out by the user; perform any corrective interventions that may be required, etc.
Standard EN 15635 concerning “Steel static storage systems. Application and maintenance of storage equipment” establishes the need for storage systems to be inspected at least once a year by an external professional expert.

Given the important consequences that could result from this situation, Estanterías Record recommends that users take note of the above and act diligently in this regard.