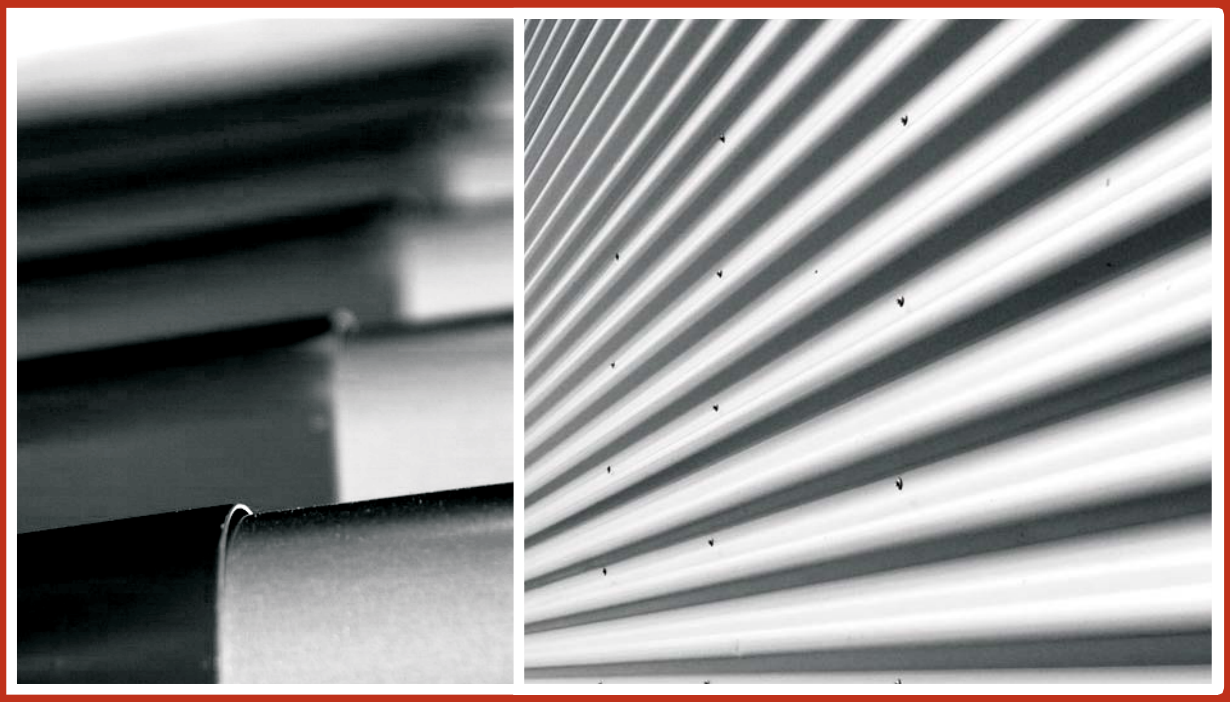
Technical Dossier

Metal Claddings

2007 Revision

Protecting what matters most



INCOPERFIL®
INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL

Technical Dossier

Metal Cladding

Protecting the most important thing

Ingeniería y Construcción del Perfil S.A.

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INCOPERFIL
INGENIERÍA Y CONSTRUCCIÓN DEL PERFI

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Introduction 1

1.1. FIRST USES OF IRON AND STEEL

Iron is a natural metallic chemical element characterized by a high mechanical resistance (Fe). From the time of its appearance to the present day, we may highlight the following events:

In 3000 b.c. in ancient Egypt, iron ornamentation was used in the Cheops pyramid.
***1000 years b.c*.** The Iron Age began in what is believed to have been an accidental manner with a mountain forest in ancient Troy (Turkey), which melted ferrous deposits and produced iron.
490 a.d. The Athenians were victorious at the battle of Marathon (Greece), defeating the bronze-armed Persians with their iron weapons.
1000. It is believed that the first steel was manufactured accidentally by heating iron with charcoal, which was absorbed by the iron's outer layer of iron, giving rise the creation of a hardened layer of steel upon hammering. It was in this manner that swords were manufactured in Toledo.
1779. The 30m-span Coalbrokedale Bridge was built over the River Severn. This bridge is said to have changed the history of the industrial revolution with the introduction of iron as a structural material.
1819. Laminated angles manufactured in US.
1840. The more malleable wrought iron begins to take over from cast iron in the manufacture of laminated profiles.
1884 The first skyscraper (10 storeys) is constructed with brick-clad steel columns. The beams of the first six floors were manufactured from wrought iron, whilst those of the remaining floors were made of steel.
1889. The 300m-tall Eiffel Tower is built in Paris.

The arrival of the Industrial Revolution to Spain in the 18th century brought with it an economic development that generated new demands for iron, especially for the construction of machines, tools, bridges, factories and markets and, above all, railways.

In 1882, two large companies were created: La Vizcaya and Altos Hornos, as well as iron- and steel—works, which were concentrated in the Biscay due to the ease of importing raw materials into the province from England. The sector also benefited from a strong presence of British capital.

1.2. PROTECTIONS FOR STEEL

The origins of electroplating date back to the 19th century in the form of the immersion of steel sheets in vat containing molten zinc. Following their immersion, the sheets were removed.

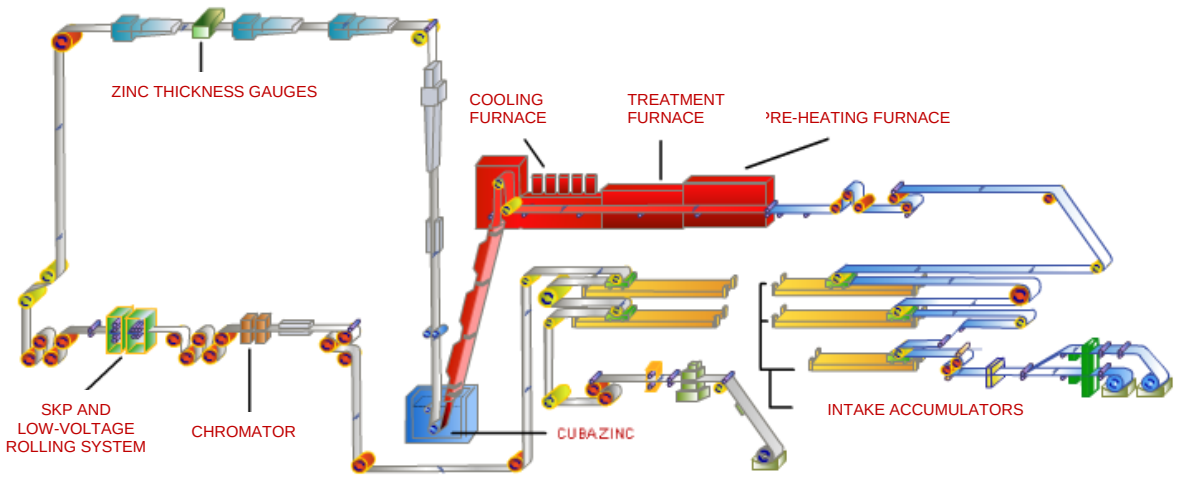
The zinc was deposited on the plate, although the process had some drawbacks: the difficulty of controlling the deposited zinc, the presence of excess zinc, etc.

Introduction 1

Galvanization by means of continuous hot immersion, also known as the "Sendzimir" process, was introduced into Spain in the mid-20th century. The process leaves layers of molten zinc on steel, with uniform combined thicknesses of between 100 and 650 g/m2 on both sides and allows for greater control of the zinc's characteristics.
Galvanization is a coating that protects the steel against corrosion through sacrifice (see Web document "Protection of edges").

Organic coatings that are highly-resistant to deformation (bending and profiling) are applied to the galvanized strip, greatly improving the corrosion-resistant and aesthetic properties and available in a wide variety of colours. It may be said that it is currently very difficult to come across a material that offers a comparable value for money and the mechanical characteristics of steel.

For more than 20 years, INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL S.A. has manufactured a wide range of profiles designed to cover the majority of the market's requirements. This experience, together with the years the company has dedicated to tests, research and development in conjunction with the most prestigious universities, has enabled us to offer a quality, certified product that is backed by its excellent acceptance among our clients.



Galvanizing Process (Arcelor)

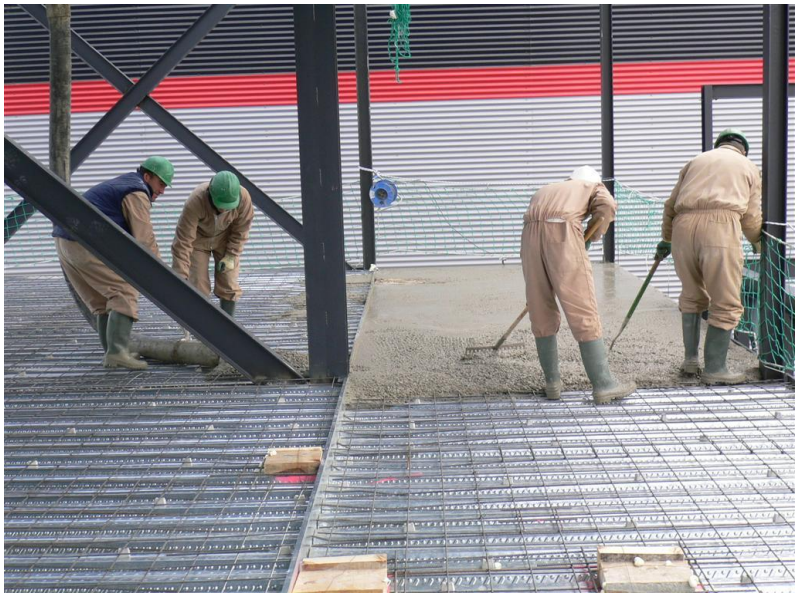
Areas of Application 2

In the building sector, it is mainly used as an exterior facing for roofs and facades in industrial buildings and warehouses. It may be installed in interiors as a separating element (division walls, etc.). The atmospheric ambient in which the installation is to take place must be taken into account when choosing the facing (see document on atmospheric exposure).

Roof Facing (Deck)

Facade Facing (Sandwich).

Another relevant application is its uses in the implementation of composite slabs.



Composite Slab

Areas of Application 2

Curved Roofing

In addition to the above-mentioned examples, steel has other applications in sectors such as:

Construction (blinds, silos, doors...)
Car manufacturing (bodywork, structural elements, filters…)
Household appliances (washing machines, refrigerators, air-conditioning...)
Furniture (cabinets, filing cabinets, writing desks…)
Various (signs, packaging, toys...)

Functions 3

The main function of metallic profiles is to be found in roof and facade facings. In general, they are supported on structural purlins (metallic, wooden or concrete) to which they transmit the fixed action (dead weight) and variable loads.

Metal profiles are sized to provide resistance against the variable actions of occupancy load, wind action and snow. They also act to protect against the penetration of water and wind.

For sandwich facings (in situ), formed by two sheets with a hat-purlin type separator that allows for the installation of thermal insulation.

In the case of a deck roofs, metal profiles act as a resistant support for the rest of the elements, as well as against the actions.

Warehouses with vaulted roofs made from pre-curved ribbed profiles are self-supporting and require no intermediate structure (see dossier on curved profiles and resistance tables).

The sheets are also used for composite slabs (see technical dossier), in which is covers the formwork, resistant element, work platform, etc.

Product Range 4

4.1. MATERIALS AND FACINGS

4.1.1. Carbon Steel

The coatings applicable to this type of steel are shown below:

1 - Galvanized Zn
2 - Aluzinc 55% AZ
3 - Organic facings.

4.1.1.1. Galvanized Zn

The galvanizing process consists of coating the steel with layer of continuous zinc. The cold- or hot-rolled steel panels go through a process that ensures their prior deoxidization and subsequent annealing and controlled cooling before introduction into a bath of molten zinc.
Another characteristic is the union between the iron material and the zinc. This is achieved by means of a layer of Fe-Zn alloy uniformly distributed in the interface between the coating and the steel and which provides the necessary adhesion during subsequent deformation operations.
The minimum elastic limit is 230N/mm2
DX51D steel is recommended. For the more demanding projects, the UNE36-137-96 standard is applied, with thickness tolerances under the EN 10148 standard.

Steel Grade	Elastic Limit R_{eH}	R. Traction R_m
	N/mm^2 (min.)	N/mm^2 (min.)
S250GD	250	330
S280GD	280	360
S320GD	320	390

For nominal thickness ≤ 0.70 mm (including the thickness of the Zn), the minimum A80 values may be reduced by two units.

Mechanical properties depending on the type of steel under Regulations.

a) Aspect and finish

There are two different aspects, according to the type of spangle:

- Normal spangle (N): A characteristic metallic shine
- Minimum spangle (M): Obtained when the solidification process is properly controlled or by removing lead (view document)

In relation to the Ordinary finish (A), small craters, inhomogeneities in the spangle, light scratches and small passivation blemishes are permitted.

b) Surface treatment

In order to reduce the risk of the appearance of white blemishes (white rust) during transport or long periods of storage, the product is subjected to a surface protection treatment consisting of a passivation with chromic acid (C) or oiling (O).

c) Regulations

Zn-coated materials are covered by the following standards:

- EN 10142
- EN 10147

d) Minimum coating

In the absence of an organic coating, the minimum mass of Zn is 275 g/m² (sum of both sides).
A 100 g/m² coating-mass on both faces is approximately equivalent to a 7.1-micron thickness per face.

4.1.1.2. 55% Al Zn-coated steel

This finish is obtained by immersing a cold-rolled steel strip in Aluminium (55%), Zinc (43.4%) and Silicon (1.6%).

Product Range 4

a) Aspect and finish

Uniform normal (N) or extra smooth (E) spangle

b) Surface treatment

Passivation: A chemical surface passivation treatment to prevent the formation of zinc oxide.
Oiled: On request, an antioxidant oil can be applied to both faces.
Important: This material must be handled with clean, dry gloves (otherwise the direct contact with hands will give rise the appearance of blemishes).

c) Regulations

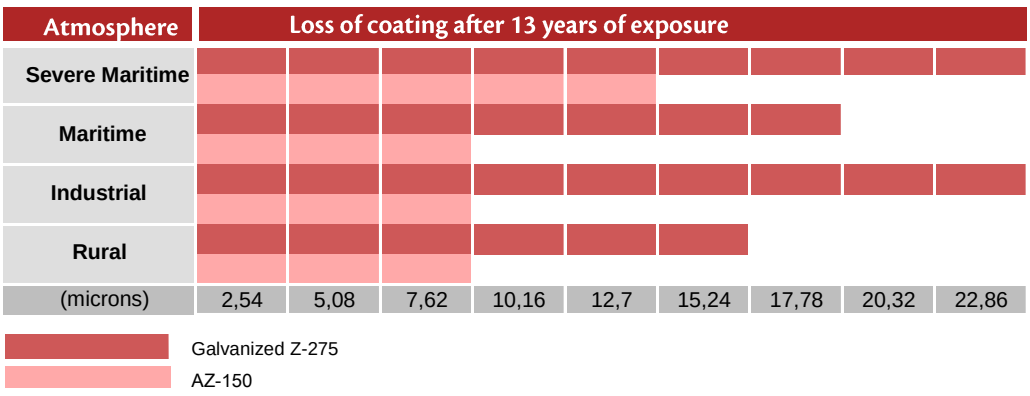
Covered by the EN 10125 standard

d) Minimum coating

The minimum coating is 150 g/m² (AZ 150)

e) Resistance to atmospheric corrosion

Excellent resistance to atmospheric corrosion resulting from the combination of the corrosion-resistant properties of aluminium and zinc. The table below shows a comparison between the loss of the galvanization and Aluzinc coating thickness after 13 years of exposure to the elements.



Comparative loss of galvanized coating - Aluzinc. Trials in the USA by Bethlehem Steel Corporation

f) Resistance and reflectivity at high temperatures

Resists oxidation up to temperatures of 675°C
The average reflectivity to heat, in emission measurements, is 88%

4.1.1.3. Organic coatings (see Materials and Coatings on our website)

The application of a continuous layer of organic paint to a sheet of galvanized (55% Al-Zn) steel (Zn).

The process begins with the degreasing of the sheet, followed by a chemical treatment that improves the anchorage of finishing paint and its anticorrosive properties, ending with the drying of the single or multiple layers of paint applied.
This method of application produces a continuous, uniform and coating that is highly-resistant in terms of formability and durability. It is also resistant to corrosion and abrasion. A wide range of colours are available.

Coatings	Symbol	Thickness per face (microns)	
Polyesters	SP	5	20
Plastisols	PVC	80	200
Polyvilidene fluoride	PVDF	25	35

Organic coatings

a) Regulations

Zn-coated materials are covered by the following standards:

- EN 10142
- EN 10147

Steel products (pre-painted strip) are covered by the UNE 36-150-90 standard

b) Minimum coating

For galvanized strips (Zn), the minimum zinc coating is 225 g/m²
For 55% AL-Zn strips, the minimum mass of metallic coating is 150 g/m2

c) Mechanical properties

The minimum elastic limit is 230N/mm2
DX51D steel is recommended. For the more demanding projects, the UNE36-137-96 standard is applied, with thickness tolerances under the EN 10148 standard.

4.1.2. Stainless Steel

The types of stainless steel that can be used for enclosure profiles are as follows:
F-3112
F-3113
F-3504
F-3534

The above is in the 36-016 (stainless steel) standard.
Manufactured and rolled according to ASTM A-240 manufacturing specifications
Tolerances according to UNE-EN 36565 (ATSM A480) standard, with the chemical composition for roofings applications according to UNE-EN 10088 standard and certified under UNE-EN 10204-3.1.B.

Grade	Cr (min.)	Ni (min.)	Mo (min.)
Ferritic	16	0	0
Austénitic	16	6	0
Austénitic with Molybdenum	16,5	10,5	2

Tolerances in the chemical composition of stainless steel

Grades AISI -304 -2B and AISI -316 -2B are recommended for enclosures (subject to the analysis of the type of atmosphere and the external agents that may attack the steel).

4.1.3. Aluminium

The types of aluminium that can be applied are:

L-3810
L-3811
L-3820
L-3360

Its properties are covered in the Standards (aluminium and alloys for forging):

UNE 33381-84-2R
UNE 33383-84
UNE 33382-83-3R
UNE 38336-81-2R

Aluminium can be supplied primed. The same characteristics and conditions detailed in paragraph 1.1.2.3 on Organic Coatings and relevant to painting are applicable. The ECCA QUALITY LABEL 4000-E-73 standard is applicable.

4.1.4. Recommendations for use of coatings

4.1.4.1.. Coating (Galvanized)

In accordance with the Z-275 grading, galvanized steel sheets must have a minimum coating of zinc. The appearance of efflorescence (zinc oxide) resulting from the formation of a layer of hydrated zinc oxide does not alter the steel's mechanical characteristics. In order to halt this problem, the sheets receive a chromatic treatment after the galvanizing which delays the formation of the oxide.

EXTERIOR				INTERIOR	
Uncontaminated rural	*Normal Industrial*	*Heavy Industrial*	*Maritime*	*Weak*	*Aggressive*
■	□			■	

■ Recommended
□ On request

Recommendations for use of galvanized sheet steel enclosures.

4.1.4.2. Coatings (primed):

A minimum coating of 225 g/m² of Zinc or 150 g/m² of Al-Zn is required. The following table shows the usage recommendations for each of the coatings:

Product Range 4

	EXTERIOR				INTERIOR		
					Aggresivity		
	Rural	Industrial	Maritime	UV. Rad.	Weak	Medium	Strong
Standard Polyester	■				■		
High-durability Polyester	■	■	■	■	■	■	■
Metallized Polyester	■	■		■			
PVDF Standard	■			■			
Plastisol	■	■	■		■	■	■

■ Recommended

On request

Recommendations for use of primed sheet enclosures.

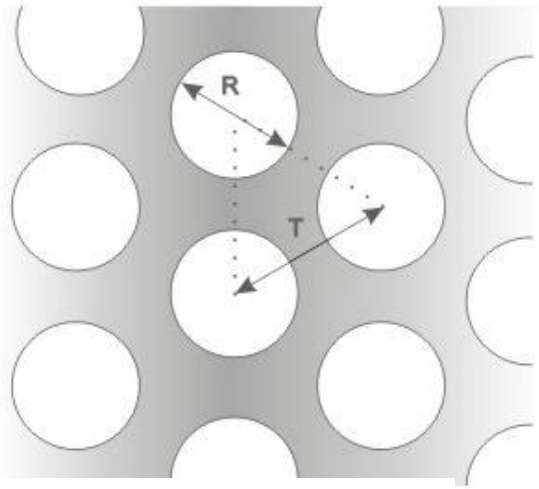
4.1.5. Perforated

The perforated finish consists of perforations made in the sheet prior to forming. This treatment is available for all INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL S.A. profiles and trim. The use of perforated sheet obeys aesthetic and technical requirements such as:

- Interior acoustic insulation.
- Lighting of interior spaces.
- Complement to the exterior facing in buildings that require a specific type of design.

Types of Perforation			
Coding	**Diameter (R)**	**Separation (T)**	**Surface**
	mm	mm	%
R3 T5	3	5	33
R3 T6	3	6	23
R4 T6	4	6	40
R5 T7	5	7	46
R6 T8,5	6	9	44

Types of Perforation.



R: Perforation diameter (mm)
T: Distance between perforations (mm)
Free surface = 0.906 x $[R/T]^2$

Sheet perforation scheme.

4.2. PROFILES

4.2.1. Geometry

The cold-formed profiled sheets employed in the construction of roofs, walls and similar applications are defined. There are three main types of profiles, depending on the geometry of the profile.

a) Corrugated profiles

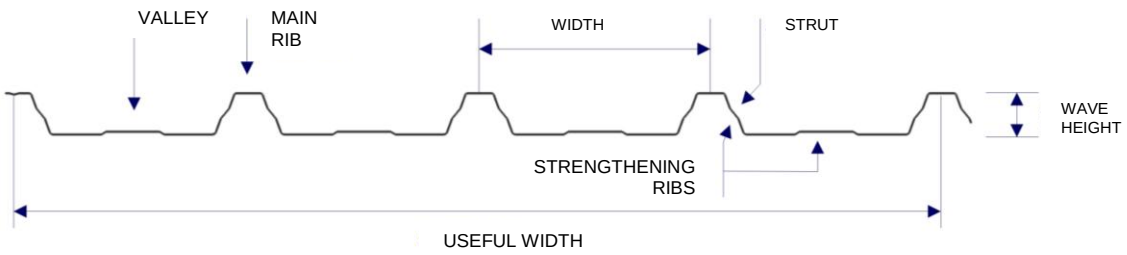
Profiled sheet whose cross-section has an approximately sinusoidal form

INCO 44.6 Corrugated

b) Ribbed profiles

Corrugated sheet whose section is formed by trapezoidal waves and which may have strengthening ribs.

Product Range 4



INCO 44.4 PROFILE

c) Cladding

Profiled sheet with a single wave per module and characterized by a practically flat surface between the extremes.

INCO 72.2 Profile Cladding

4.2.2. Range of profiles

INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL S.A. offers the following types of profiles:

Profile	Type	Height	Waves	Width	Useful Width	Slope (minimal recommended)
		mm.		mm.	mm.	%
INCO 30.4	Ribbed	30	4	275	1100	8%
INCO 30.5	Ribbed	30	5	210	1050	8%
INCO 44.4	Ribbed	44	4	245	980	5%
INCO 44.6	Corrugated	44	6	155	930	5%
INCO 70.4	Ribbed	70	4	210	840	5%
INCO 70.4	Composite	70	4	210	840	-
INCO 72.1	Cladding	72	1	425	425	-

Range of profiles

As can be seen in the table, all of our profiles are designated by the INCO root, followed by the CORRUGATED HEIGHT and the NUMBER OF ONDULATIONS.

Each of the profiles is also characterized by its separation between waves and the useful width of the same. The technical specifications included at the end of this dossier contain sketches with the height dimensions of each of the profiles.

4.2.3. Thicknesses

The thicknesses are expressed in mm. Standard values:

Galvanized:	0.50 – 0.60 – 0.70 – 0.75 – 0.80 – 1.00 – 1.20 (mm)
Primed:	0.50 – 0.60 – 0.70 – 0.80 – 1.00 (mm)

*For primed or other thickness upon request.

The thickness tolerances under the 10143 standard establish minimum thickness values. INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL S.A. restricts the tolerances even further.

THICKNESS	
Nominal	**Minimum**
0,50	0,45
0,60	0,55
0,70	0,64
0,80	0,74
0,90	0,83
1,00	0,93
1,20	1,12

EN 10143 standard tolerances. Minimum thickness.

4.2.4. Lengths

The manufactured length of the profiles is limited to:

Maximum length = 600 mm
Maximum length = 14,000 mm

The length tolerances are as follows:

L ≤ 3000 mm (+ 10 mm / - 5 mm.)
L > 3000 mm (+ 20 mm / - 5 mm.)

where L is the nominal length of the profile

4.3. ACCESSORIES

Rock Wool: insulating felts and rigid volcanic rock wool panels impregnated with phenolic resin. In some cases one of the faces is coated to adapt to the different construction requirements.

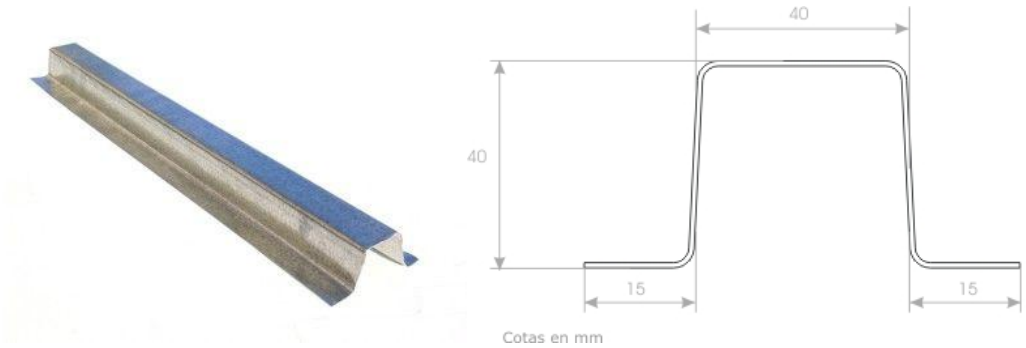
Rock wool roll

Sealed joint: Flexible and elastic corrugated joints for sealing the passage of water and air in the junctions between profiles and flashing.

Sealed joint for each profile

Spacer profile: secondary structure placed between the two profiles that make up the sandwich roof. It has a two-fold function: to serve as a spacer between profiles in order to accommodate insulating material, and as a strut onto which the roof's exterior profile is attached.

Product Range 4



Spacer Profile, standard dimensions

Outlet: The outlets serve as connectors between the guttering and the drainpipe. They are available in cylindrical- and conical-form, and their size is determined by the drain to which they are to be connected. The exclusively manufactured in galvanized steel.

Conical and cylindrical outlets.

Fastenings: The attachment elements and accessories must comply with a series of minimum specifications that allow them to meet such demands as: mechanical resistance, the water-tightness and duration. The different attachment solutions for INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL S.A. products must conform to the corresponding manufacturer's recommendations.

Fastenings.

Connectors: L-shaped cold-formed steel elements that increase resistance to the longitudinal sheer of the INCO 70.4 COMPOSITE SLAB profile. Hilti X-HVB connectors are installed using the Hilti DX fastening system, which stands out for its rapid on-site installation and its suitability in all weather conditions. They must be installed over a metallic structure (in the middle of the profiled sheet's valleys and parallel to the direction of the same.

HILTI X-HVB Connectors.

Calculations and Tests Undertaken 5

5.1. APPLICABLE REGULATIONS

EUROCODE - 3: Metallic structures project
UNE-ENV 1993 - 1-1: General regulations and building regulations.
ENV 1993 - 1-3: Cold Formed Thin Gauge Members and Sheeting
NBE-EA-95 Part 4: Calculation of Formed Steel Metal Elements in Buildings

5.2. ACTIONS TO BE CONSIDERED

The main actions that assert an influence on the metal enclosure are:

5.2.1. Permanent actions (see Basic Document SE AE Actions in Buildings)

The permanent actions to be considered for the calculation of roofs are focussed mainly of the profile's dead weight. To calculate the dead weight of the profile (kg/m²):

$$PP = (d \bullet e \bullet A)/ A_u$$

where:

d = density of steel (7.85 kg/dm3)
e = thickness in mm.
A = full coil width 1.250 m / INCO 70.1 Cladding 0.625 m
A_u = useful width of profile

The safety factor for the Permanent Actions is 1.35. For INCO 70.4 Composite Slabs, consult the technical dossier.

5.2.2. Variable actions (see Basic Document SE AE Actions in Buildings)

5.2.2.1. Occupancy load

The occupancy load is defined as the weight of all the elements that may gravitate on a resistant element, in accordance with the use. (Consult the Technical Building Code for the characteristic occupancy load values).

5.2.2.2. Action of the wind

In general, wind is acts as perpendicular force to the surface of each exposed point, or static pressure, which can be expressed as:

$$Q_e = Q_b \times C_e \times C_p$$

Qe = dynamic pressure of the wind
Ce = the exposure coefficient
Cp = wind coefficient

Buildings are to be tested for the wind action in all directions.

The action of the wind also generates tangential forces parallel to the surface. They are calculated as the product of the external pressure multiplied by the surface type's coefficient of friction.

5.2.2.3. Snow

The distribution and the intensity of the snow load on a building's roof depends on the local climate, rainfall, relief, the shape of the building or the rood, the effects of the wind and the thermal exchanges in the interior faces.

The specific weight of accumulated snow is highly variable: we may adopt 0.12 KN/m3 for the newly fallen snow, 0.20 KN/m3 for compact or saturated snow and 0.40 KN/m3 when mixed with hail.

Calculations and Tests Undertaken 5

5.3. CALCULATIONS

5.3.1 Profiles *(see Profile Calculation Report document)*

All *INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL S.A.,* have been calculated by the Valencia Polytechnic University Department of Continuum Mechanics and Structural Theory's College of Industrial Engineering Unit, in collaboration with our Technical Department, which was responsible for calculating the maximum working loads of all the profiles:

INCO 30.4 (roof and facade) / INCO 30.5 (roof and facade)
INCO 44.6 Corrugated / INCO 44.4 (roof and facade)
INCO 70.4 (roof and facade) / INCO 70.1 Cladding (facade, wind suction-pressure)

5.3.2 Curved Profiles *(see dossier and calculation reports)*

Similarly, the cured profiles have been subjected to calculations by the Valencia Polytechnic University Department of Continuum Mechanics and Structural Theory's College of Industrial Engineering Unit. These profiles act as arched roofs once assembled.

INCO 44.4 (curved) / INCO 44.6 (curved)

5.3.3. INCO 70.4 Composite Slab profiles *(see dossier and calculation reports)*

INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL S.A., employs a "slab calculation program" that allows us to provide personalized calculations for each project in the form of a calculation report detailing the thickness of the INCO 70.4 Composite Slab profile, the slab edge and framework, indicating any necessary shoring of the span. This calculation program was developed by Valencia Polytechnic University Department of Continuum Mechanics and Structural Theory's College of Industrial Engineering Unit. The technical properties of the slab and the sheet employed by the program were initially obtained through theoretical calculations, which were later corroborated by means of trials (see trials).

5.4. TRIALS

5.4.1. Metallic Profiles

Different spanned versions of all the profiles have been subjected to trials in order to verify the effective properties of each one's sections. In this way, the Valencia Polytechnic University Department of Continuum Mechanics and Structural Theory was able to corroborate the results of its own theoretical calculations.

Calculations and Tests Undertaken 5

Calculations and Trials Undertaken

5.4.2. Curved Profiles

Three different types of trial are carried out on straight and curved pieces of different thicknesses and spans. The purpose of these trials is to obtain experimental information in order to compare the results of the theoretical calculations.

- Verification of the sections' effective characteristics obtained according to Eurocode -3.
- To determine the relative rigidity of the elastic support, numerous in-situ trials were carried out in the company to refine the modelling carried out by computer.
- The maximum admissible load originating the plastic exhaustion and the consequent collapse of the arch.

Calculations and Tests Undertaken 5

5.4.3. Composite Slab

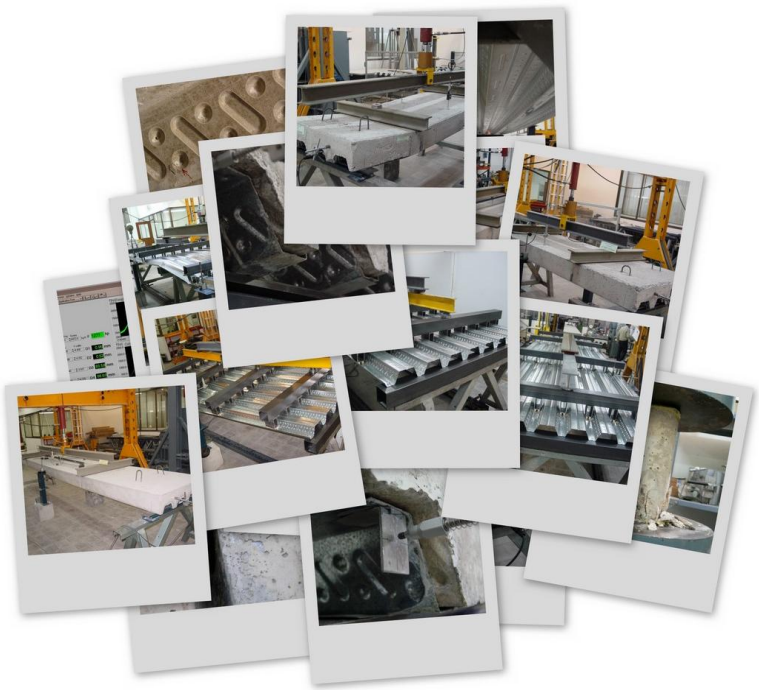
Mixed slab trials were carried out with the INCO 70.4 Composite Slab profile for nominal thicknesses of 0.80-1.00-1.20 mm, under the Eurocode-4 EN 1994 Part 1-1:2004 standard. Additionally, trials with X-HVB110 (Hilti) connectors fitted to the slab's extremes (for a nominal sheet thickness of 0.80 mm) were carried out. .

The following trials were carried out at Barcelona's Higher Industrial Engineering Technical College's LERMA Laboratory (Materials Elasticity and Resistance Laboratory), Catalonia Polytechnic University's Department of Engineering Materials and Structures Resistance Department:

The study and analysis of the improvement of the design of the special stampings applied to the INCO 70.4 Composite Slab profile, which guarantees the maximum collaboration between the profile and the concrete.

The experimental determination of the mechanical properties of the INCO 70.4 Composite Slab profile with thicknesses of 0.80 - 1.00 - 1.20 mm, under the Eurocode-3(EN 1993-1-3:2006) regulations.

The real data from the trials (both the mechanical properties of the sheet and the "m" and "k" parameters) allow us, through the use of the calculation program, to offer our clients a personalized service backed by a product that is at the forefront of the market.



Fire Safety 6

Royal Decree 2267/2004, 3 December, gave approval to the Fire Safety Regulation applicable to industrial premises (R.S.C.I.E.I.). The prescriptions of the regulation approved by means of this royal decree will be applicable, following its entry into force, to new industrial establishments which are built or implemented, as well as existing establishments which are transferred or which change or modify their activity.

6.1. CHARACTERISTICS OF INDUSTRIAL ESTABLISHMENTS

6.1.1. Industrial establishments located inside a building

TYPE A: The industrial establishment partially occupy a building that also hosts other industrial and non-industrial premises.

TYPE B: the industrial establishment fully occupies a building that is attached to one or more other buildings, or is located at a distance equal to or less than three metres from another or other buildings or another establishment, whether these are dedicated to industrial use or otherwise.

For industrial establishments which occupy a warehouse adjacent to another warehouse with which it shares it structure, and which in all cases must be equipped with an independent roof, compliance with the requisites established for Type B is permitted, insofar as technical justification is provided showing that the possible collapse of the structure will not affect the adjacent warehouses.

TYPE C: the industrial establishment entirely occupies one or several buildings located more than three metres from the nearest building hosting other establishments. This distance must be free of combustible goods or intermediate elements susceptible to spreading the fire.

6.1.2. Industrial establishments in open spaces

Those industrial establishments which carry out their activities in open spaces which do not constitute a building:

TYPE D: the industrial establishment occupies an open space, which may be fully covered, and which has facades completely lacking lateral enclosures.

TYPE E: the industrial establishment occupies an open space, which may be fully covered (up to 50% of the surface area), and which has facades in the covered section which are completely lacking lateral enclosures.

6.2. LEVEL OF INTRINSIC RISK.

6.2.1. Fire Area

Industrial establishments are classified according to their degree of intrinsic risk, taking into account the simplified criteria and according to the procedures set out below.

In general, industrial establishments are to be composed of one or more configurations of the types A, B, C, D and E. Each of these configurations is to constitute one or several areas (fire sectors or areas) of the industrial establishment.

- For types A, B and C, a “fire sector” is considered as a space within the building that is closed off be means of fire-resistant elements during the time established for each case.
- For types D and E, the surface area that they occupy is considered an open "fire area", defined only by its perimeter.

n

Each fire sector or area’s level of intrinsic risk is to be calculated using the following expression, which determines the fire sector or area’s weighted and corrected fire load density:

$$Q_s = \frac{\sum_1^i G_i \, q_i \, C_i}{A} \ldots R_a \; (MJ/m^2) \; o \; (Mcal/m^2)$$

Q_S = the fire area or sector’s weighted and corrected fire load density, in MJ/m2 or Mcal/m2.

G_i = mass, in Kg, of each of the combustibles (i) present in the fire sector or area of fire (including the combustible building materials).

q_i = calorific power in MJ/kg or Mcal/kg of each of the combustibles (i) present in the fire sector.

C_i = dimensionless coefficient that ponders the degree of hazard (due to the combustibility) of each of the combustibles (i) present in the fire sector.

R_a = dimensionless coefficient that corrects the degree of hazard (due to activation) inherent in the industrial activity that takes place in the fire, assembly, processing, repair, storage sector, etc.

A = built-up surface area of the fire sector or area, in m2.

According to the QS value, we obtain the level of intrinsic risk of each sector, in accordance with the attached table.

LEVEL OF INTRINSIC RISK		WEIGHTED AND CORRECTED FIRE LOAD DENSITY	
		Mcal/m^2	MJ/m^2
LOW	1	$Q_s < 100$	$Q_s < 425$
	2	$100 < Q_s \leq 200$	$425 < Q_s \leq 850$
MEDIUM	3	$200 < Q_s \leq 300$	$850 < Q_s \leq 1275$
	4	$300 < Q_s \leq 400$	$1275 < Q_s \leq 1700$
	5	$400 < Q_s \leq 800$	$1700 < Q_s \leq 3400$
HIGH	6	$800 < Q_s \leq 1600$	$3400 < Q_s \leq 6800$
	7	$1600 < Q_s \leq 3200$	$6800 < Q_s \leq 13600$
	8	$3200 < Q_s$	$13600 < Q_s$

Table of intrinsic risk levels.

6.3. CONSTRUCTION MATERIALS

6.3.1. Fire Behaviour Requirements *(under R.D.2267/2004)*

The fire behaviour requirements for construction products are defined by determining the class to be achieved, according to UNE-EN 13501-1 for those materials for which there is a harmonized standard and for which the "CE" marking is already in force.
The fire reaction conditions applicable to the construction elements are to be justified:

a) By means of the class applicable in each case, firstly, in accordance with the new European classification.
b) By means of the following class that appears in parentheses, in accordance with the classification established by the UNE-23727 standard.

Fire Safety 6

The class required for products used as surface coating or finishing must be the class specified in the following table, or alternatively the most favourable:

COATING OR FINISH	FIRE REACTION CONDITIONS	
	EUROCLASS	UNE-23727
Walls and Ceilings	C-s3	(M2)
Discontinuous skylights	D-s2d0	(M3)
Continuous skylights	B-s1d0	(M1)
Roof-mounted smoke elimination installation	D-s2d0	(M3)
Exterieur façades	C-s3d0	(M2)
	or more favorable	*or more favorable*

Fire reaction conditions table for coatings or finishes.

When a product which constitutes a layer contained in wall or ceiling belongs to a class that is below the class required for the corresponding coating, according to the preceding section, the layer and its coating, as a whole, are to be EI 30 (RF-30), as a minimum.

This requirement will not be applicable in the case of products used in industrial sectors and classified according to Table I as having a low intrinsic risk (Qs 200 Mcal/m2), located in Type B or Type C buildings, for which the Ds3 d0 (M3) classification or higher will be sufficient for the elements forming part of the products used for the enclosures.

6.3.2. Building materials fire behaviour classification

INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL S.A. provides the fire behaviour presented by the supplied materials, in accordance with the reports supplied by the manufacturers, determining the class to which they belong in accordance with the European UNE EN 13501-1:2002 classification. As can be seen in the following table, we offer a varied range of construction materials in accordance with the fire behaviour required for each specific project:

Fire Safety 6

MATERIALS

Metal		Coating	EUROCLASSES
Steel	Galvanized	Zinc	A1
	Prelacquated	Polyester 25 µ	B_{ROOF}
		Polyester 35 µ	B_{ROOF}
		Plastisol 100 µ	B_{ROOF}
		Plastisol 200 µ	B_{ROOF}
		PVDF 25 µ	B_{ROOF}
		PVDF 35 µ	B_{ROOF}

Insulation		Reference	EUROCLASSES
Rock Wool	Felt + paper	Roulrock 121	F
	Felt + Aluminium	Roulrock 122	A2
	Felt + perf. paper	Roulrock 125	F
	Panel	Monorock 365	A1
	Panel Étanche	Roclaine	A2-s1,d0
	Panel + bitumen	Monorock 366	F
	Panel (+dens.)	Panel 360	A1
	Panel + bitumen (+dens.)	Panel 369	F
	Panel (x2 dens.)	Durock 386	A1
		Hardrock 391	A1
	Panel (x2 dens.)+bitumen	Hardrock 393	F
Fibreglass	Felt	IBR Nu	A1
	Felt + paper	IBR	F
	Felt + Glass filament	IBR Velo	A2-s1,d0

Translucent		Type	EUROCLASSES
Polyester	Standard	Class II	(M4)
	Standard + flame-retardant	Class II	C-s3,d0
	Standard + flame-retardant	Class III	B-s3,d0
Acrylic	Standard	--	(M4)
Cellular Polycarbonate	Standard	--	B-s1,d0
	Arcoplus	684 - 626 - 547	B-s1,d0
		Wave	B-s1,d0
		1000	B-s1,d0
	Polyvalent	--	B-s2,d0
	Complet	--	B-s2,d0

Table showing fire behaviour classification of the different building materials.

Fire Safety 6

6.4. REGULATORY EQUIVALENCES UNE-23727:1990 / UNE-EN-13501-1:2002.

The table below show the equivalences between the fire classifications established by the previous UNE-23727:1990 and the current UNE EN 13501-1:2002 regulations.

Class required in accordance with the UNE 23727:1990 standard	EUROCLASSES UNE EN 13501-1:2002 (1)
	Wall or ceiling coatings, thermal (non-linear) or acoustic insulations
M0	A1 ó A2-s2,d0
M1	B-s3,d0
M2	C-s3,d0 (2)
M3	D-s3,d0

(1). It is accepted that any class whose ratings are equal to or more favourable than the corresponding ratings of another class satisfies the conditions of the latter. The greater the value of the main rating (A1, A2, B, C, D or E), the smoke production rating (s1, s2, or s3) and the drops/inflamed particles (d0, d1o, d2) rating, the more favourable.

(2) When this class belongs to a material whose thickness is less than 1.0 mm and whose mass is less than 1.0 kg/m2, it will also be valid for those applications for which the M1 class is required.

On site Installation 7

The general recommendations indicated in the preceding paragraphs shall apply.

On-site cutting is to avoid insofar as possible. When necessary, special attention is to be paid to the protective coating, which must adequately protected by zinc-rich paints. (see protection of edges document)

Galvanized steel is not to be used in roofs in which it may enter into contact with acidic or alkaline products or with other metals, except aluminium, capable of forming galvanic pairs the produce corrosion. (for further information on this topic, please visit our website and consult the technical document **Galvanizing: Reaction with other Metals / Materials**).

It is not to be used in contact with the following materials:

- Steel which has no anti-corrosion protection
- Fresh plaster
- Fresh cement or lime
- Oak or chestnut wood
- Water derived from copper.

It may be used in contact with:

- Aluminium, lead, tin, tin-plated copper, stainless steel.
- Fresh cement, to support the wall trim.
- If the copper is located below the galvanized steel, it may be isolated by a strip of lead.

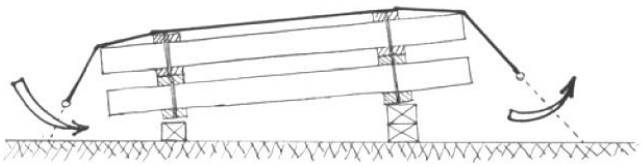
It is very important to be aware of the type of atmosphere in the location in which the galvanized sheet is to be installed and to choose the most suitable type of coating. (for further information on this topic, please visit our website and consult the technical documents **Galvanizing: Atmospheric action and Galvanizing: Materials and coatings)**

On site Installation 7

7.1. STORAGE AND TRANSPORT

The packages must be protected against moisture during transport and storage.

During storage, the packages must be kept in a ventilated area and protected from moisture by means of an awning that allows for air circulation, or in a covered area. They must be inclined in parallel to the corrugations and separated from the ground by wooden chocks. Canvas slings with protected edges, hoists, protective elements for corners, etc, are to be used in order to avoid damage to the sheet during the unloading or hoisting operations. The packages must be balanced and firmly held in order to avoid any possible movement slipping.



Protection and arrangement of packages.

7.2. SAFETY

The works are to be suspended during periods of rain, snow or wind exceeding 40 Km/h. In the latter case, any materials and tools that may be dislodged must be safeguarded. Work is not to be carried out in the vicinity of high-voltage powerlines.

The regulations detailed in the GENERAL HEALTH AND SAFETY IN THE WORKPLACE ORDENANCE must be observed, as must those detailed in the BUILDING, GLASS AND CERAMIC WORK ORDENANCE.

The use of safety belts, attached by means of a rope to the safety rings directly attached to the structure, is mandatory. Perimeter protections are to be installed during the assembly, as a nets located under the structure, in order to avoid the risk of people falling.

Workers must not tread on any skylights or other glass-fibre reinforced polyester accessories located on the roof.

Sheet roofs of less than 0.60 mm are considered inaccessible for installation and maintenance tasks, and thus permanent or provisional loading-bearing elements (walkways) forming circulation paths are to be installed.

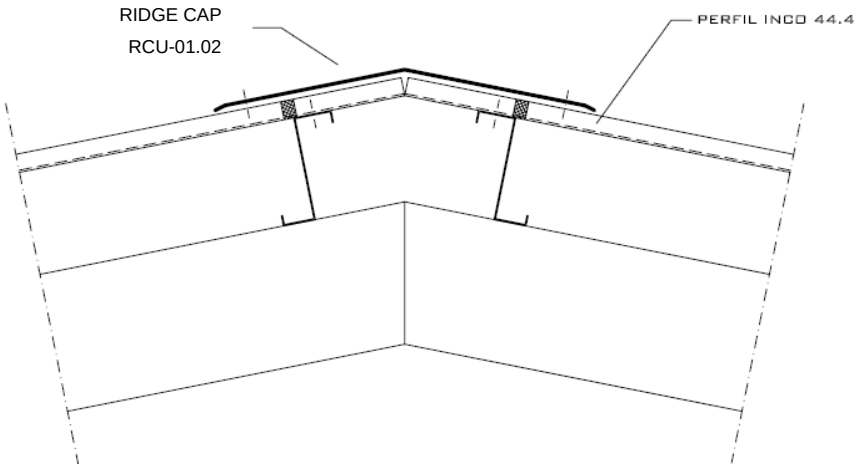
Access to the roof is gained by means of lift or fixed platforms equipped with ladders with the necessary personal safety protection elements.

On site Installation 7

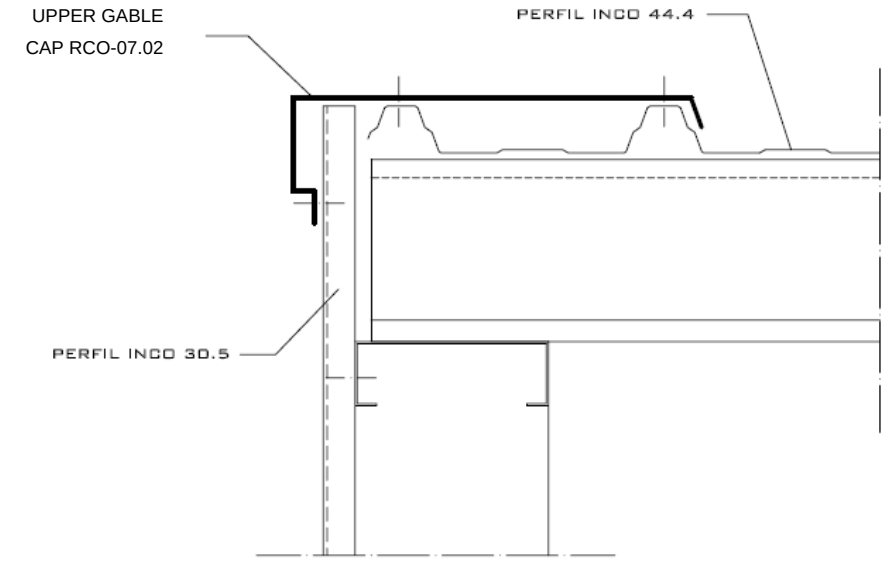
7.3. ROOF AND FACAD SYSTEMS

7.3.1. Single Roofs and Facades

Formed of a single sheet.



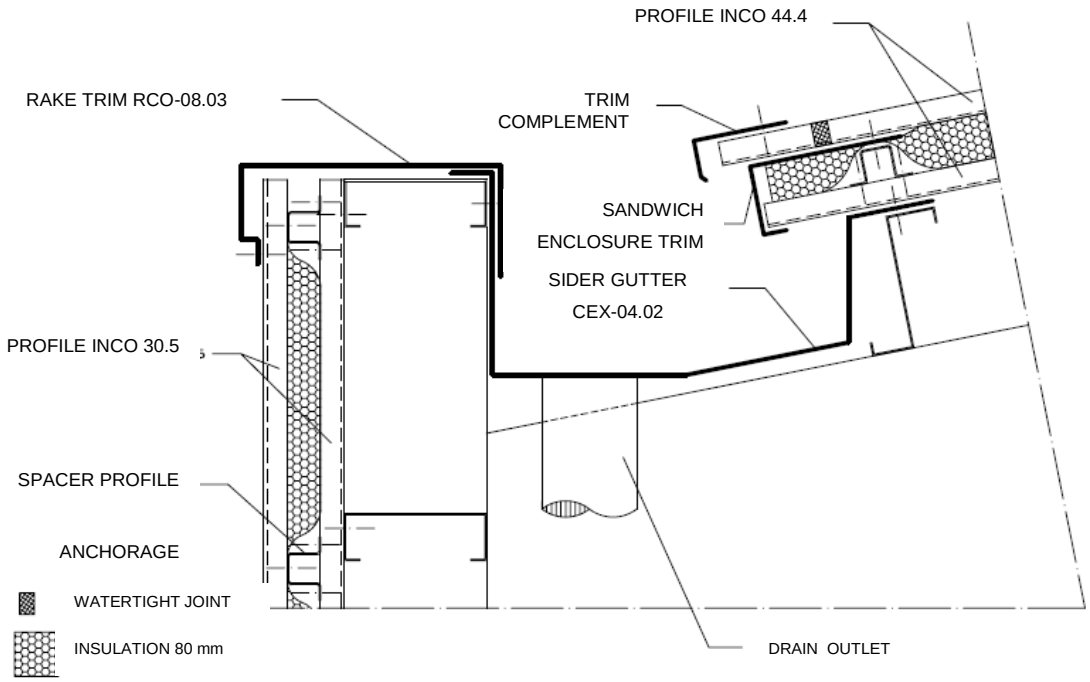
Constructive detail of a Single Roof.



Constructive detail of a Single Facade.

7.3.2. Sandwich Roofs and Facades

Composed of two ribbed sheets separated by auxiliary profiles (separator), and between which an insulating material – general fibre-glass or rock wool (see accessories, rock wool) – is installed. This type of roof is called in-situ Sandwich Roofs and facades.



Constructive detail of a Sandwich Facade (Interior Profile + Rock Wool + Exterior Profile)

The lower ribbed sheet represents the facing's initial skin and is installed and attached directly on the main structure beams. The type of selected sheet is to meet the mechanical and resistant requirements requested in draft.

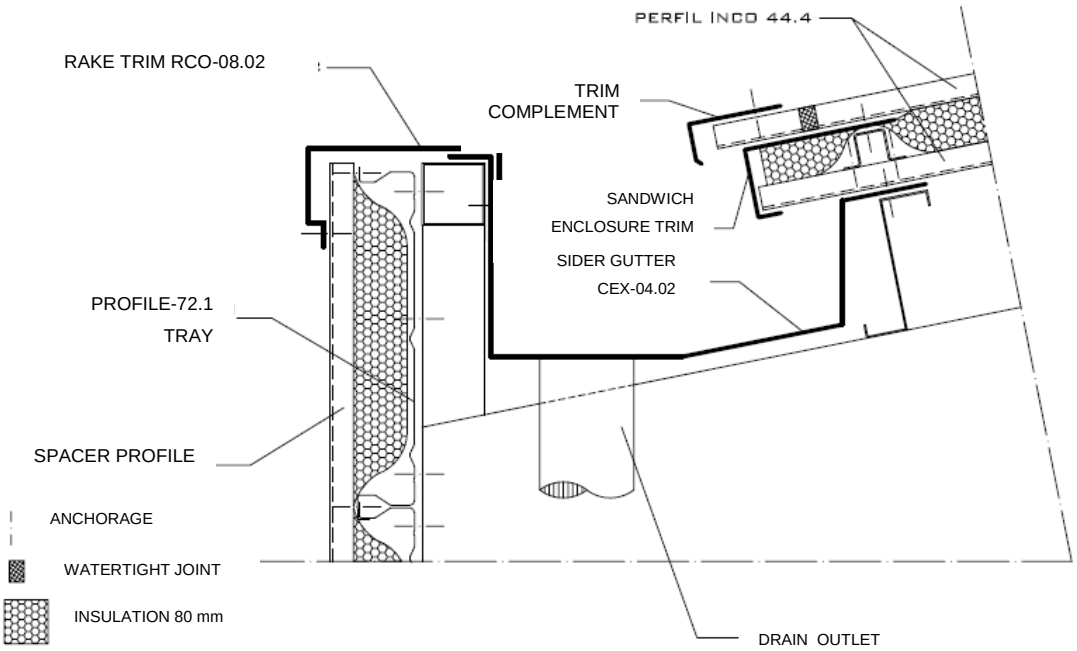
The auxiliary profiles or secondary structure, installed over the first skin of the sandwich, has a dual function. The first is to serve as a separator between the two skins, leaving room for the insulation, and the second is to attach the enclosure's exterior skin. This profile is composed of zinc-coated hat-shaped elements. It is advisable to attach them directly to the main structure through the first skin. The separation between screws should be no more than the width of the sheet's corrugation. The screws should be installed alternatively. A minimum thickness of 0.80 mm is recommended, unless a greater gauge is necessary in order to comply with the resistance requirements.

On site Installation 7

The insulation is a material with an insulating capacity installed between the enclosure's two skins, complying with the requisites necessary for its function and avoiding the formation of condensation (in order to carry out the appropriate calculations for the insulation, visit our website and use the Insulation Calculation tool). Rock-wool is generally supplied (visit our website to consult the product's data sheet).

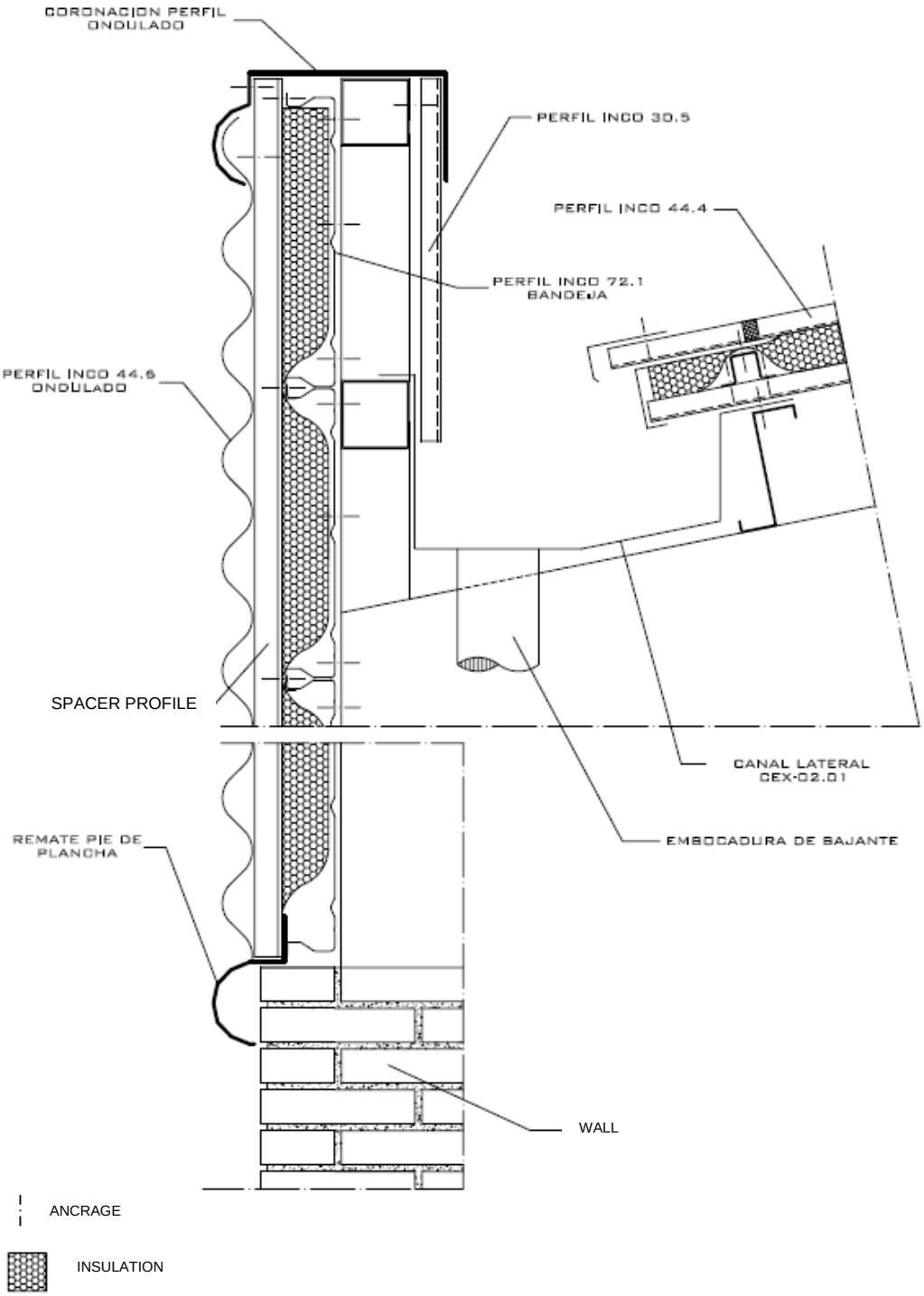
The exterior ribbed sheet constitutes the enclosure's second skin. It is attached to the auxiliary profiles. The density of the fastenings is set out in point 9. The type of sheet selected is to meet the mechanical and resistant requirements requested in draft.

Note: In the case of sandwich facades with cladding (inner skin), and exterior façade with vertically-installed corrugated or ribbed profiles, the auxiliary profiles are not necessary as the outer skin is directly attached to the cladding's rib.



A special case for this enclosure model is the horizontal installation of the exterior skin, for which the installation of auxiliary profiles attached to the cladding (perpendicular to its ribs) is necessary.

On site Installation 7



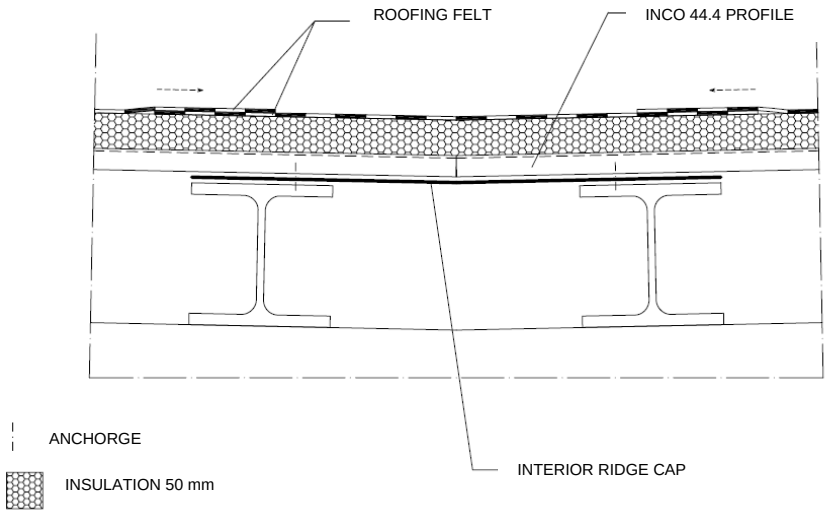
Constructive detail of a Sandwich Facade (Horizontal Profile + Rock Wool + Cladding)

On site Installation 7

7.3.3. Deck Roofs

a) Traditional Deck Roofs

Traditional deck roofs are formed by a support base (metal profile), a rigid insulation and a waterproofing system.



Constructive detail of a Light Deck Roof

Deck roofs are composed of the following elements:

A Resistant Support. Deck roofs consist of a system composed of a support based on an INCO 44.4 metallic profile mounted in the facade position (see the profile's data sheet to determine the thickness in accordance with the loads, spans between purlins and number of openings).

Thermal Insulation, composed of one or more layers on insulating material that controls the different temperatures, impedes thermal loss and avoids the formation of condensation. The use of 150, 175 kg/m3 density rock wool sheets anchored to the support by means of special fastenings is recommended (see data sheet in products-accessories-rock wool).

Waterproofing membrane. A coating consisting of overlapped sheets that are welded together forming, a continuous layer whose function is to ensure the roof's watertightness.

- *Unattached membrane*. The membrane is separated from the support by a separating layer.

On site Installation 7

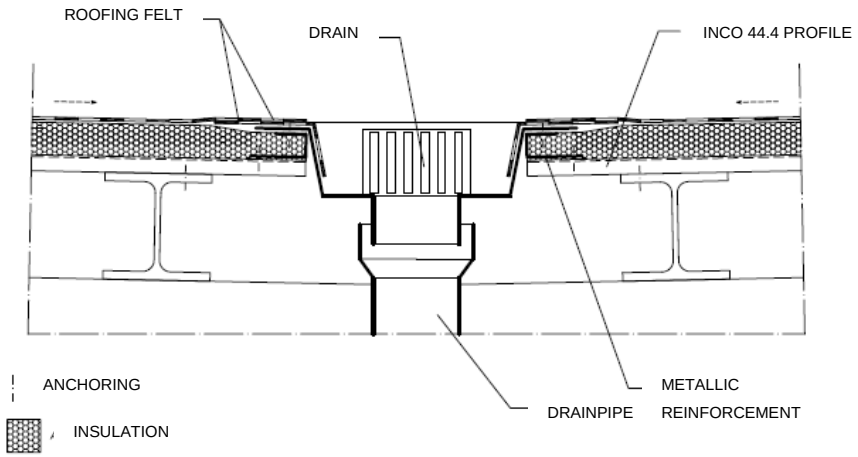
- *Attached membrane.* Fully attached to the support using a cold primer, hot bitumen or the partial softening of the lamina.
- *Semi-attached membrane*. Partially attached to the points or strips on the support using a cold primer, hot bitumen or the partial softening of the lamina. This type of membrane supports deformation.
- *Mechanically fixed membrane*, attachment to the support by means of mechanical anchors. They are installed each 40 cm, 5 cm of the edge of the sheet, with a 10cm overlap. An interior strip situated 5cm from the line of fastenings is welded to the side 5cm of the upper sheet.

Auxiliary Elements

- *Separating, puncture resistant layers* which prevent adhesion between the waterproofing system's different layers and thermal insulation in inverted roofing. They may be puncture resistant when the protective elements are heavy.
- *Vapour barrier*: the protective membrane against the passage of water vapour. It is installed beneath the thermal insulation.

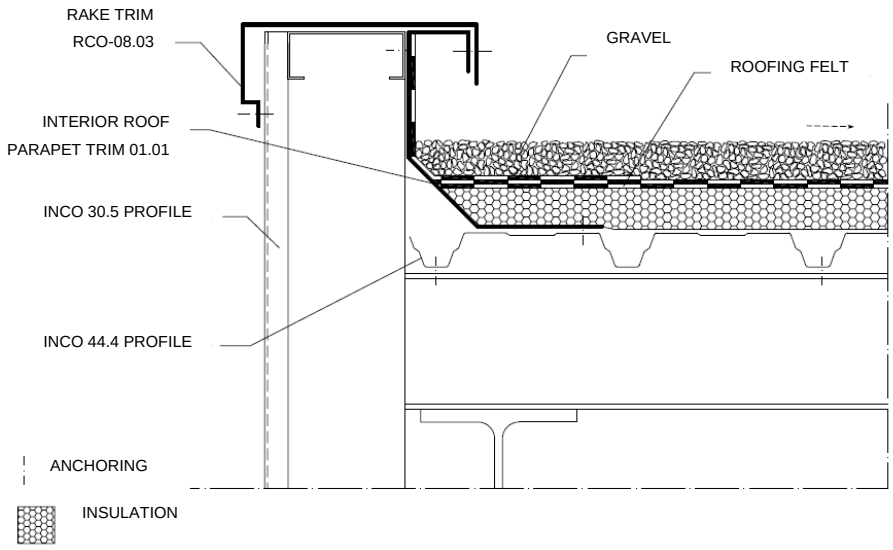
Protection and Finishing, aimed at providing the waterproof membrane with mechanical protection against the effects of circulation, as well as against atmospheric aggressions.

- *Heavy protection*, independent of the waterproofing membrane and formed by pebble gravel ø16-32 mm. Minimum thickness 50 mm. A separating, puncture-proof layer is installed between the waterproofing and the pebbles. Loose gravel can only be used on roofs with a slope of less then 5%.
- *Light protection*, the finishing layer is composed of a sheet covered with a mineral grain protection, or an aluminium finishing.



Constructive detail of a Light Deck Roof

On site Installation 7



Constructive detail of a Heavy Deck Roof

Depending on the inclination, we distinguish between:

Flat roof: all roofs with a slope less than 5%. May be Passable and Non-passable.

Sloping roof: all roofs with a slope of more than 5%. These roofs are not considered passable.

b) Inverted Deck Roofs

Light: formed by and INCO 44.4 resistant metallic support installed in the facade and onto which the following are installed in the following order:

1. A support base formed by perlite sheets mechanically fastened to the INCO 44.4 profile
2. Waterproofing profile.
3. Anti-puncture or separating layer.
4. Thermal insulation, formed by extruded polyester sheets, with a +1cm layer of modified mortar on their inner face. These sheets are installed staggered, making sure that the male connectors are fitted correctly.

Heavy. The system is identical to that described in the above point, but finished with pebble agglomerate:

1. A support base formed by perlite sheets mechanically fastened to the INCO 44.4 profile

2. Waterproofing profile.
3. Anti-puncture or separating layer.
4. Thermal insulation, formed by extruded polyester sheets. These sheets are installed staggered, making sure that the male connectors are fitted correctly.
5. Anti-puncture or separating layer.
6. Finished with ø16-36 mm pebble gravel. Minimum thickness 30 mm

7.4. FASTENINGS

7.4.1. Types of Fastenings

The fastenings may be as follows:

Hook, geometrically adapts to the form and type of support. The hooks' rods are installed adjacent to the ridge in relation to the purlins. F-111 steel, under the EN 36 011 standard, is used, whilst the metric thread is to be adapted to the support profile.

Profile Height	Metric Thread
(mm)	(mm)
80	M7
100	M7
120	M8
140	M8

Metric threads in accordance with profile height

Self-tapping screws and self-drilling screws, made from cadmium-coated, galvanized or stainless steel, with a shear resistance of not less than 1100 kg and a minimal resistance to torsion of 180 cm-kg. M6 metric screws are to be used. They are to be installed with appropriate tools equipped with automatic pressure devices with torque limiter and a depth stop. Due precautions are to be taken to respect the drill diameter, following the advice of the screw supplier.

7.4.2. Distribution and minimum density of fastenings

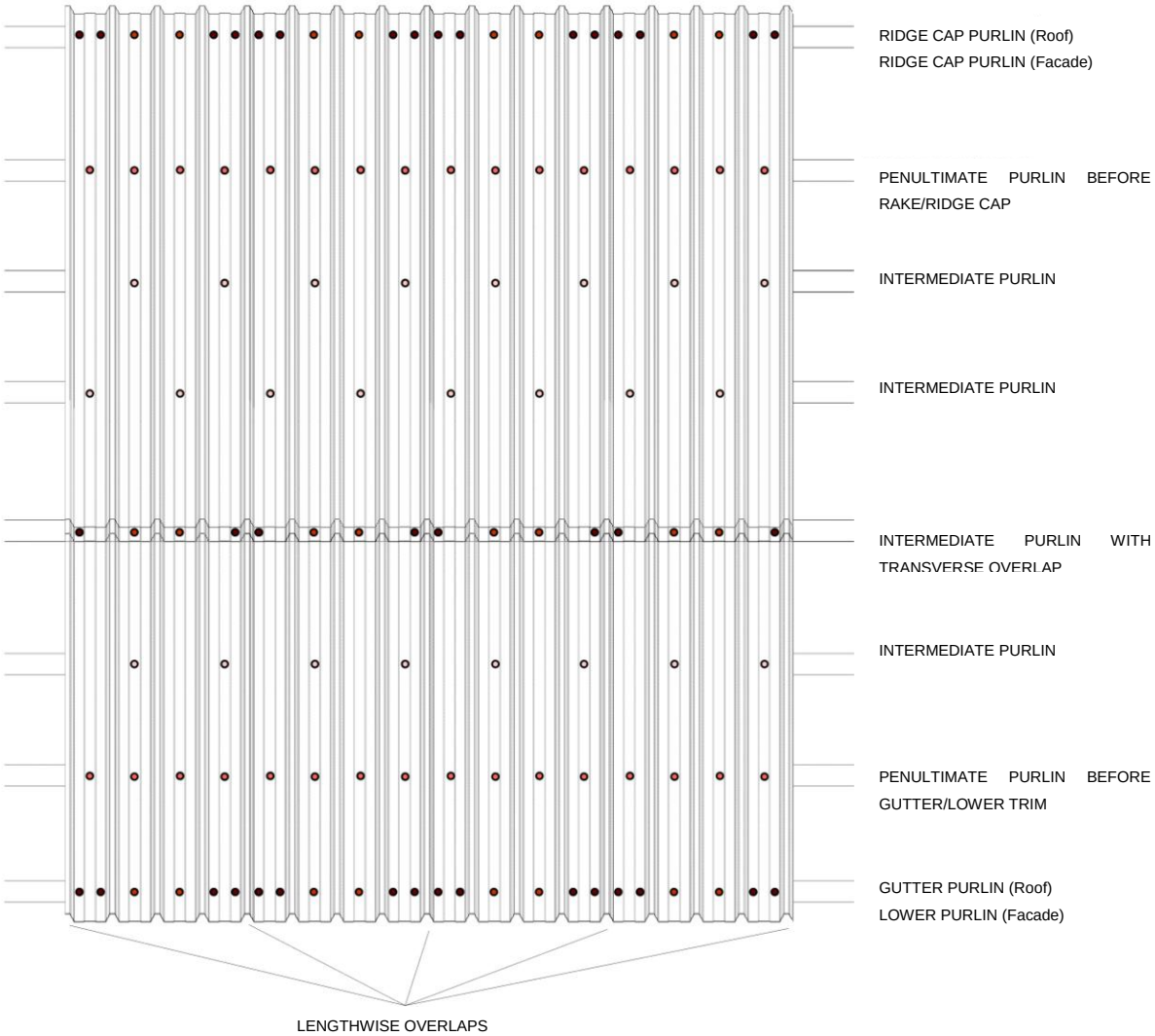
Independently of the chosen fastening system, the minimum recommended fastenings are to take into account the following points:

On site Installation 7

In **intermediate purlins**, the fastenings are to be installed in alternate corrugations, as can be seen in the fastening scheme below.

In ridge or guttering purlins, one fastening per intermediate corrugation is to be installed. In the end corrugations adjacent to lengthwise overlaps, two fastenings are to be installed, as can be seen in the fastening scheme below.
Distribution scheme for recommended minimum fastenings.

One fastening per corrugation to be installed in the **penultimate purling before a ridge or a gutter**, as can be seen in the fastening scheme below.



On site Installation 7

The incrustation of metal particles when drilling the steel is to be avoided. Such particles must be eliminated to prevent their rusting on the coating.

The fastening is to be installed in the sheet's valley and must be fitted with a metallic and an elastic washer with a minimum diameter of 19 mm.

7.5. MINIMUM OVERLAPS AND SLOPES

7.5.1. Determination of the lengthwise overlap (Under QTG Technological Standard)

The minimum longitudinal overlap S in mm, its watertight complement T and the watertight complement L of the lateral overlap are determined the following table in accordance with the wind, storm and topographic altitude zone as per the roof's slope (%), according to the Climatic Zones Map (consulting the values in the national anexes of the EUROCODE).

The longitudinal overlap is to run in the opposite direction to the prevailing winds.

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When installing the watertight complement, care must be taken to ensure that the surfaces are clean and dry. The complement is to be installed as close as possible to the fastening's axis and over the lower sheet of the extreme of the sheet located immediately above. When the length of the inclined plane exceeds 40m, the suitability of the proposed solution must be justified by means of calculation. If the height of the profile is equal to or less than 35 mm, the length of the plane is to be limited to 30 m. In all cases, the overlap is to measure at least 200mm, and in general may be reduced to 150 mm for slopes exceeding 30%. They must coincide with the supports or purlins.

The recommended minimum slope, under the QTG Technological Standard, for each of our profiles is:

Profile	Type	Slope (recommended minimum)
		%
INCO 30.4	Ribbed	8%
INCO 30.5	Ribbed	8%
INCO 44.4	Ribbed	5%
INCO 44.6	Corrugated	10%
INCO 70.4	Ribbed	5%
INCO 70.4	Composite	-

Table of recommended minimum slopes under QTG Technological Standard

7.6. INSULATION AND CONDENSATION

There is a specific tool in our website for the calculation of the insulation necessary for your project. (Downloads >Calculation Tools >Calculation of Insulation)

7.6.1. Thermal Insulation

a) Fibreglass Wool

Made from three main elements:

- A vitrifier, silica in the form of sand
- A flux, to ensure a lower fusion temperature (sodium carbonate and sodium sulphate and potassium)
- Stabilizers, mainly sodium carbonate and magnesium (dolomite), which confer resistance to moisture

A certain proportion of finely ground calcium is added to all of this. The composition is introduced into a furnace, with the fibre produced through the holes of a perforated plate. After spraying, the products are impregnated with resins and passed through a stove that ensures the polymerization of the resin.

The thermal properties are characterized by their heat conductivity value; the lower the conductivity, the higher the insulating capacity, (the value varies between 0.032 and 0.045 W/m°C (at 10 ° C).

b) Rock wool

Made from basaltic rocks, it is specially designed to withstand high temperatures. It is obtained by converting the material consisting of silicates and metallic oxides into fibre via centrifugation. It must ensure great stability up to 750°C. Its chemical composition is:

Raw materials	Raw material paste
Basaltic rock	Linseed oil
Gravel	Escorez resin
Phosphate	Manganese naphthenate
Iron mineral	Bakelite
	Mineral oil

Rock wool raw materials

On site Installation 7

The product is made in a cupola, which is used for melting slag. The jet of molten material collides with the outer edge of a metal rotor, producing the mechanical stretching and the appearance of fibres.

The fibres, once impregnated with a paste composed of mineral oil and resin, fall on a mat in which a hot air circuit ensures the paste's polymerization.

c) Definitions

- Quantity of heat: The amount of heat supplied to one kilogram of water in order to raise its temperature from 14.5°C to 15.5°C. *(1kcal = 4.186 J)*
- Coefficient of thermal conductivity: the amount of heat that passes during a unit of time through the area unit of a sample of infinite extent with flat-parallel faces and a unit of thickness unit (L), when a temperature difference of 1 degree is established between its faces.
- Thermal conductivity (A): in Kcal./hmºC (W/m°C). Its inverse is called thermal resistivity r = 1/A and is given in *h m ºC/Kcal. (m ºC/W)*

- Surface thermal resistance rsi and rse: defined as 1/hi and 1/he, with he and hi the internal and external surface heat transfer coefficients, given in Kcal/h m2 °*C (W/m2 °C).* Thus, the total thermal resistance (Rt) can be expressed as follows:

$$R_t = 1/h_i + 1/h_e + R = 1/h_i + 1/h_e + 1/\lambda \qquad [\text{h m}^2\,^{\circ}\text{C/Kcal}\ (\text{m}^2\,^{\circ}\text{C/W})]$$

- Heat transfer coefficient, (K), the inverse of the total thermal resistance, expresses the heat flow per area and time unit and by the degree of temperature difference between the two environments, i.e.:

$$K = \frac{1}{R_t} = \frac{1}{1/h_i + 1/h_e + L/\lambda} \qquad [\text{Kcal / h m}^2\,^{\circ}\text{C}\ (\text{W / m}^2\,^{\circ}\text{C})]$$

A compound enclosure or an enclosure composed of multiple layers (sandwich)

$$K = \frac{1}{R_t} = \frac{1}{1/h_i + 1/h_e + L/\lambda_1 + L/\lambda_2 + ... + L/\lambda_n} \qquad [\text{Kcal. / h m}^2\,^{\circ}\text{C}\ (\text{W / m}^2\,^{\circ}\text{C})]$$

7.6.2. Condensations

Atmospheric humidity is the amount of water vapour in the air. It can be expressed in absolute terms by means of **absolute humidity**, or in relative terms by means of **relative humidity** or moisture content.

Absolute humidity is the amount of water vapour present in the air. It is expressed in grams of water per kg of dry air (g/kg), grams of water per unit of volume (g/m³) or as vapour pressure (Pa or KPa or mmHg). The higher the temperature, the greater the amount of water vapour that can be accumulated in the air.

The relative humidity is the moisture that can be contained by an air mass, in relation to the maximum absolute humidity, without causing condensation, retaining the same conditions of temperature and atmospheric pressure. This is the most common way of expressing humidity. It is expressed as a percentage.

In practice, the worst possible case example must be adopted. For example, with an outside temperature of 10°C in winter and a relative humidity of 30%, the user wishes to create a satisfactory indoor climate (such as 20°C and a minimum relative humidity of 40%).

It seems that there is a direct relationship between relative humidity and the psychological well-being of humans. Humans feel most comfortable at a relative humidity of 40% or more. These data are based on estimates, as relative humidity cannot be measured with precision in the outside air. When it rains, relative humidity reaches almost 100%, whilst on a cold day the relative humidity is very low. Primarily, the warmer the air, the more fluids it can contain. When the air is heated, but is not moistened, the relative humidity will decrease, while the number of grams of water per kilogram of air remains the same.

What is the right amount of relative humidity to obtain a comfortable atmosphere?

In order to guarantee a pleasant working atmosphere, it is important to ensure that the relative humidity does not fall below 40%. When the relative humidity falls between 40%, the risk of illnesses increases. In general terms, it can be said that the symptoms caused by dry air vary, but can be distinguished by three main factors: static electricity, the stability of the humidity and health effects.

On site Installation 7

Health effects

As the temperature increases, the relative humidity decreases. Dry air can have effects on health, such as dryness of the nose and throat. This causes an increased susceptibility to pathogens, such as viruses.

When it's cold, a higher air humidity makes people think that the temperature is warmer. This leads to a lesser usage of radiators.

It seems that bacteria growth is worse when the relative humidity is between 40 and 60%.

Viruses are less likely to survive at a relative humidity of between 47% and 70%. The most comfortable relative humidity for people is between 45% and 55%.

A high relative humidity may cause constriction.

Desirable relative humidity and temperature for each activity

The table below shows the ideal relative humidity and temperature for each sector in a given situation (this table was taken from the JDK air handling).

You can use our Insulation Calculation tool to *calculate the condensation* and the necessary isolation. *(Downloads >Calculation Tools)*

On site Installation 7

Activity	Temperature (°C)	Relative Humidity	Activity	Temperature (°C)	Relative Humidity
		(%)			(%)
Bakery			Leather	1	
Biscuits	16-18	50.00	Warehouse	10.16	40-60
Fermentation	24-27	70-75			
Flour warehouse	18-27	50-65	Libraries and Museums	21-27	40-50
Cakes	21.00	60-70			
Bread cooler	24-27	65-70	**Paper products**		
Bread dough-	24-27	40-50	Bookbinding	21.00	50-65
Yeast warehouse	0-7	60-75	Folding	24.00	60-65
-			Printing	24-27	45-55
Grains					
Packing	24-27	45-50	**Textile**		
Sweets and desserts			Cotton processing	24-27	50-55
Chocolate sales	17-18	50-65	Cotton spinning	16-27	50-70
Warehouse	16-20	50-65	Artificial silk spinning	20-24	85.00
			Cotton weaving	27.00	56-60
Food industries			Silk thread twisting	21.00	60.00
Apple warehouse	-1.00	75-85	Silk processing	24-27	65-70
Banana maturing	20.00	90-95	Wool refining	27-29	50-60
Banana warehouse	16.00	85-90	Wool spinning	27-29	60.00
Citrus fruit warehouse	16.00	85.00	Wool weaving	27-29	
Egg warehouse	2.13	75-80			
Grain warehouse	0.16	30-45			
Mushroom warehouse	0-2	80-85	**Tobacco**		
Potato warehouse	4.16	85-90	Cigarette	21.00	55-65
Sugar	27.00	30.00	Processing, storage	24.00	70-75
Tomato warehouse	1.00	85.00	Packaging	32.00	88-95
Tomato maturing	21.00	85.00	Wood processing		
Hospitals			Final products	18-21	35-40
Children's room	24.00	50-65	Fastening	24-24	40-50
Operating theatre	24.00	55.00	Processing	18-24	35-40
Hospital room	24.00	40-50			
			Greenhouses	27.00	70-80
Paint companies	22-24	40-50			

Relative Humidity and Ideal Temperatures per Sector Table

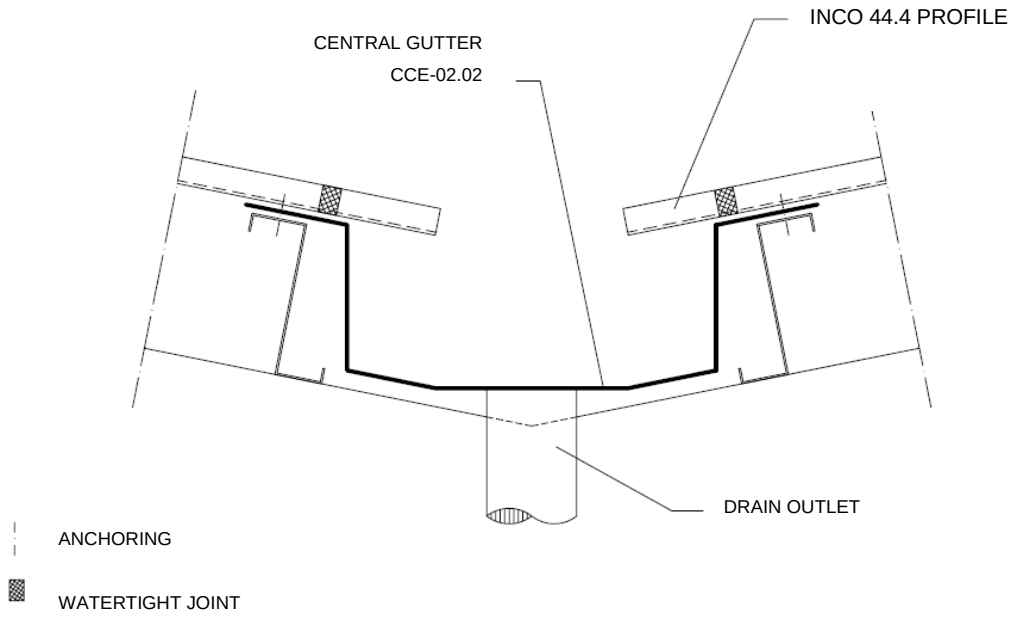
On site Installation 7

7.7. WATER DRAINAGE

Guttering: A trim which has the function of collecting and conducting rain water from the roofs.

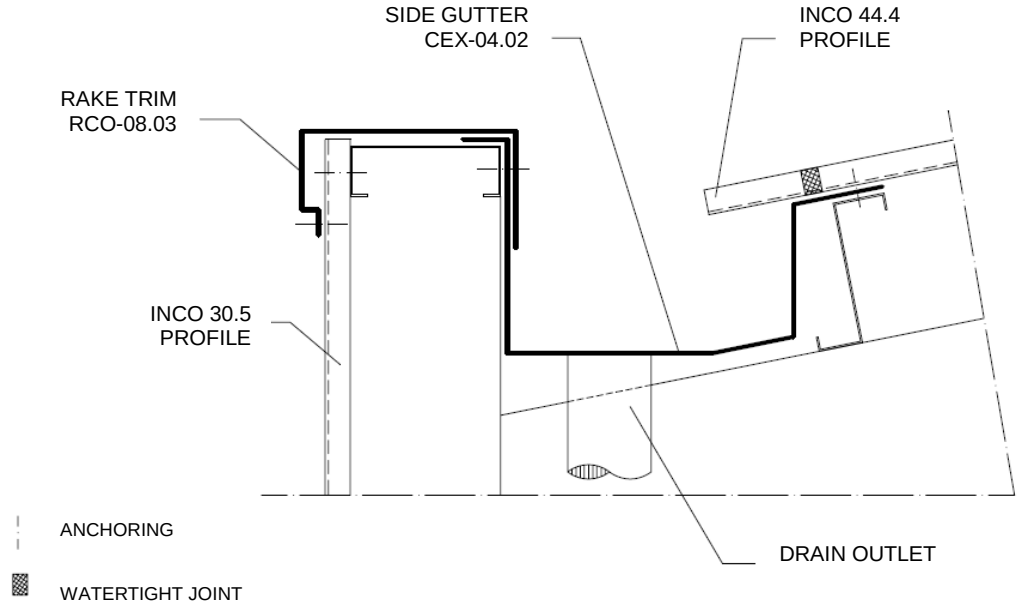
7.7.1. Gutter Types

They may be made from steel (primed or galvanized), stainless steel, zinc, copper, PVC, etc. Their sections may be rectangular, trapezoidal, variable, etc.
In accordance with their location on the roof, they are known as central, lateral or overhang gutters.

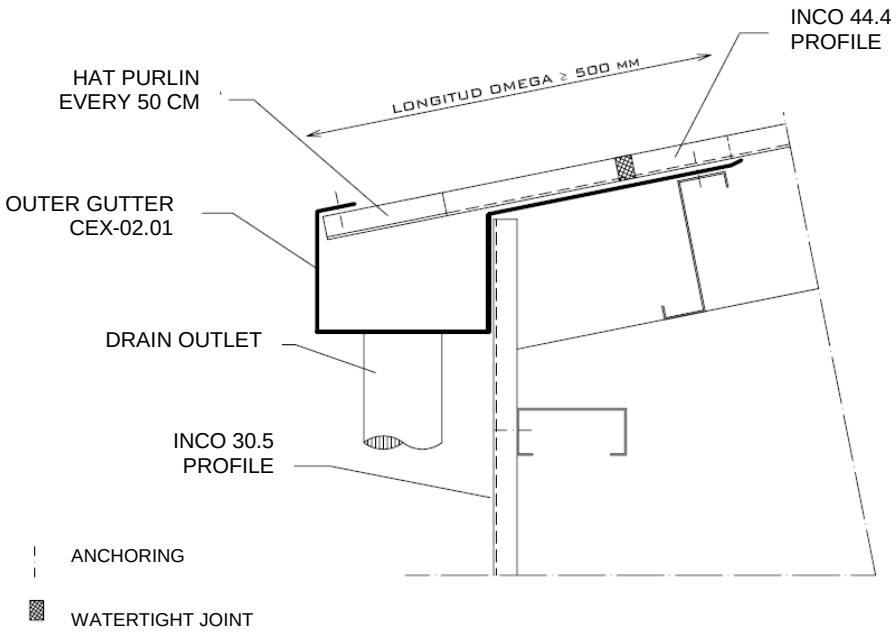


Constructive detail of a Central Gutter.

On site Installation 7



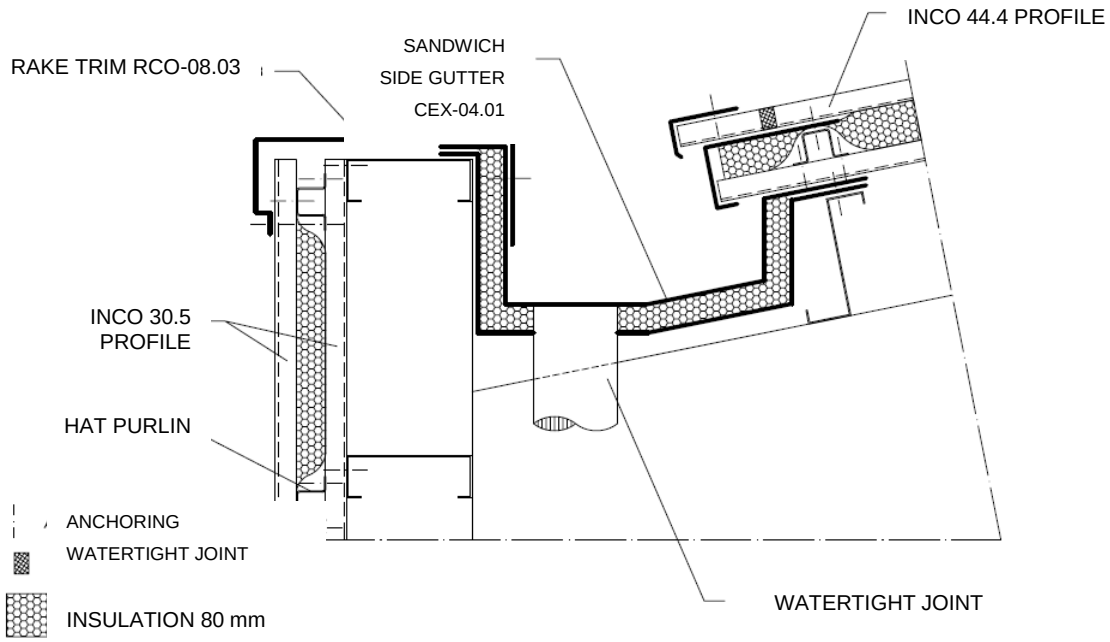
Constructive detail of a Side Gutter.



Constructive detail of an Overhang Gutter.

In accordance with the constructive position, the gutter may be simple, insulated, sandwich, waterproofed.

On site Installation 7



Constructive detail of a Side Sandwich Gutter.

7.7.2. Guttering accessories

Gutter cover: Close the gutter at its ends, expansion joints or at any interruption of its continuity. These elements are made of the same material as the gutter and folded into the corresponding position, with 30 mm flanges and the same form as that of the gutter's section

Outlet: An element installed in the junction between the gutter and the drainpipe. Its diameter matches that of the drainpipe section and they are made of the same material as the gutter.

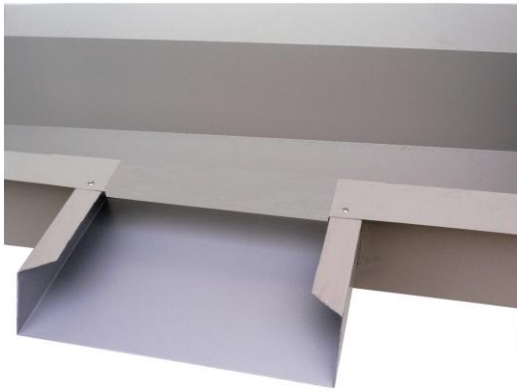
Gravel filters: An element which is mainly used in deck roofs to impede the entrance of solids into the down pipes through the inlet.

Drainpipes: A tube used to conduct rainwater from the gutters to the sinks or drain. The distance between the drainpipes must be equal to or less than 12 metres, unless specified to the contrary by the works management.

Gargoyles: Used to evacuate water from the facades.

Guttering accessories Gargoyle.

Overflow: Located in the upper section of the gutter as safety measure for the evacuation of rainwater in the event of the gutters overflowing.



Guttering accessories Overflow.

7.7.3. Calculation and dimensions

To calculate the gutter area necessary for the evacuation of water from a roof under certain conditions, see the Calculation Tools in our web site (incoperfíl.com>Downloads>Calculation Tools>Calculation of Gutters and Drainpipes).

On site Installation 7

Thickness of material: For galvanized steel gutters (Z-275), with or without additional coating (Z -225), the thickness will be determined by the project requirements. The minimum thickness is 0.80 mm.

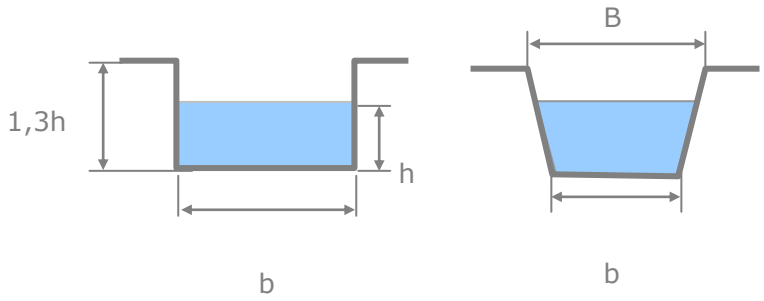
Slope of the gutters: It is advisable that the gutters be set with a minimum slope of 5mm/m. If the work's particular conditions so allow, this slope should be increased further. The effectiveness of a gutter's drain is guaranteed by three basic concepts:

• Greater slope.
• Greater height of the gutter
• Trunk-conical outlet

It is advisable to create the slope in the gutter itself by means of a specific variable development design. Gutters must not exceed 12 m in length without a modification of the corresponding slope.

7.7.4. Guttering section geometry

The height of the gutter must be equal to or *greater than 1.3h*, in which h is the maximum height of the water determined in the calculation of the section.



Guttering Geometry.

7.7.5. On-site implementation

Assembly

The gutter is the first element to be assembled on the roof and must be supported along its entire length by the structure, platens or rigid supports that ensure its stability. The first piece to be mounted is the outlet for the drainpipe. The assembly is to be carried out in the opposite direction to the water flow.

On site Installation 7

Gutter junctions

The gutters are joined together by means of a minimum 150mm overlap. The joints may be riveted or screwed, to be later sealed with two cords of plastic putty.

Fastenings

The gutters are to be fitted with fastenings prior to installation in order to guarantee their safety and stability. They are to be subsequently attached to the structure by means of the same fastenings used for the roofing sheets. Watertight seals are to be installed in the sections where the roof meets the gutter.

Outlets

It is advisable to use ≥ 0.80 mm-thick sheet. The outlet may be cylindrical or conical-trunk shaped, whilst their dimensions are conditioned by the drainpipe into which they run. In order to assemble the outlet, a hole of the same diameter as the outlet is made in the gutter, to which the outlet is riveted. Silicone is used to seal the joint.

Gutter maintenance

The gutters, valleys and drains must be subject to periodic reviews in order to ensure both their condition and their correct operation. Thus, the gutters must be cleaned of leaves, earth, moss, etc., at least once a year.

Outlets covered with gravel filters must be carefully cleaned.

Special attention must be paid to the condition of the gutter's joints, covers, outlets and expansion joints, with any defects being resealed.

In areas in which there are large accumulations of objects on the roofs, the revision and cleaning is to be carried out more frequently.

Comfortable, safe systems for accessing the roof should be sued for cleaning and maintenance operations.

7.8. OPENING OF CAVITIES

When creating openings in the sheet for the passage of conduits or for any other reason, a support must be installed when the size of the opening exceeds 250 mm, or when the opening concides with a corrugation.

The opening is made in the sheet and then the support is attached.

A cover trim must be made for installation over the sheet's valleys, running from the ridge cap to some 300mm beyond the opening. (see Trim Catalogue, valley covers). The opening, to be sealed with a perimeter trim and the corresponding watertightness complement, is to be made in the valley trim.

7.9. WELDING

Following a welding operation, the affected coating must be reconstructed using paint with a minimum 92% zinc content (in weight), as well as finishing paint with the same characteristics as the coating. These paints are to be applied cold.

7.10. OVERHANGS

Any overhangs in the ribbed sheets must not exceed 1/10 of the span indicated in the data sheet. Overhangs in guttering zones must measure at least 100 mm.

7.11. TRIM

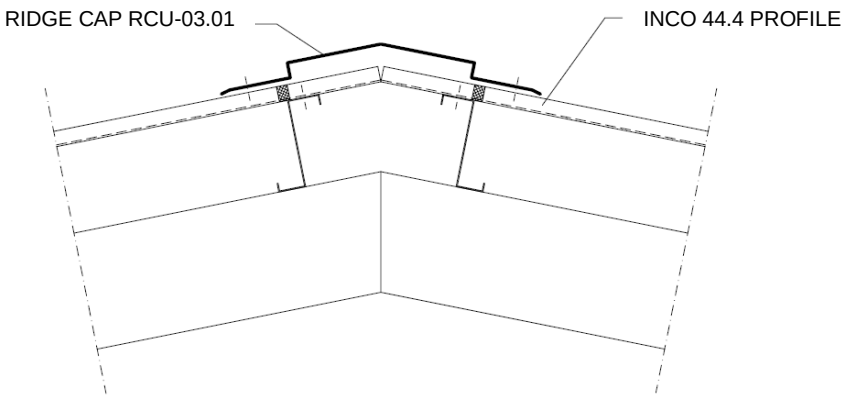
To resolve the different joints that arise in the construction of an industrial warehouse, visit our website and consult the **Trim Construction Details document**.

The minimum overlap allowed between trims is 100 mm

Ridge trim, which can be in roofs with a slope greater than or equal to:

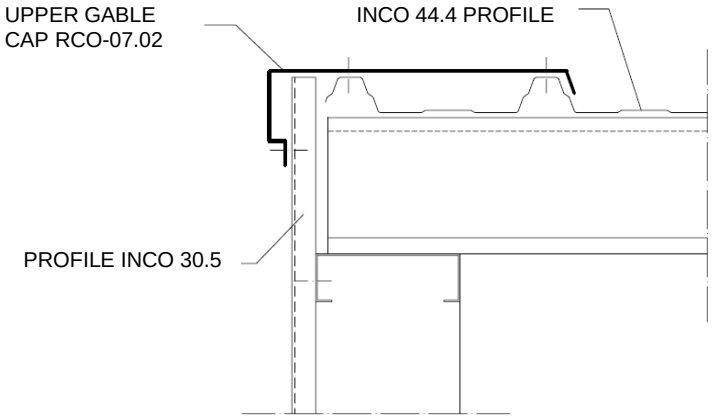
7%, when watertight joints are used and the sheets are installed with the valley edge raised. 10% when watertight joints are used.

On site Installation 7



Constructive detail of a Ridge Cap Trim.

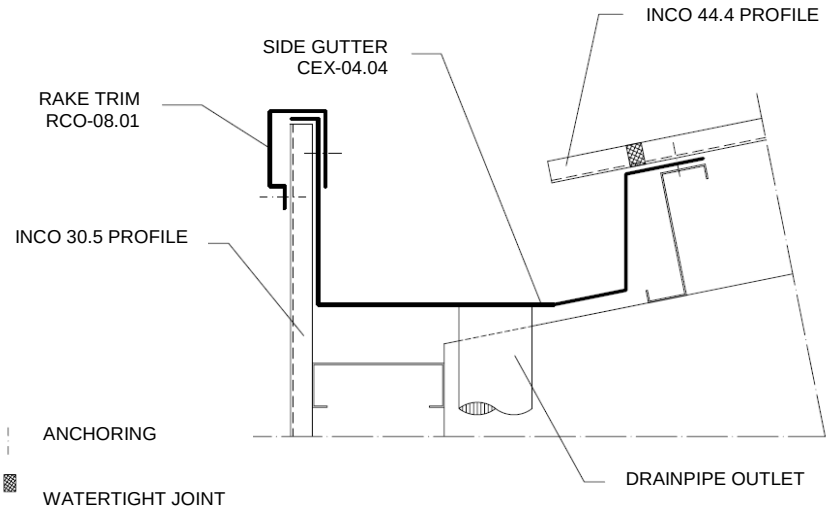
Rake or side trim, which must cover at at least one corrugation, which will be positioned at a distance less than its width from the roof edge.



Constructive detail of a Rake Trim.

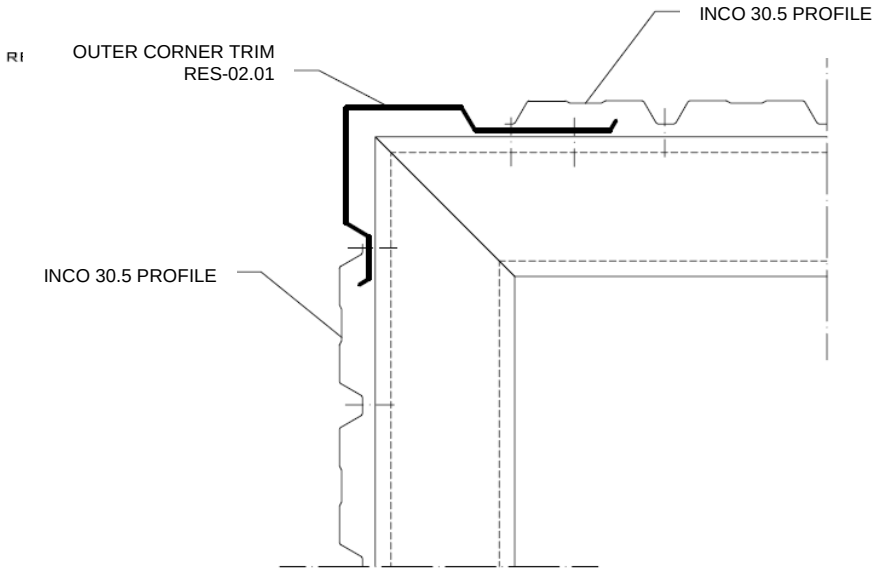
Gutters, the function of which is to collect rainwater from the roof (see Guttering and Drainpipe Calculation Tools)

On site Installation 7



Constructive detail of a Guttering Trim.

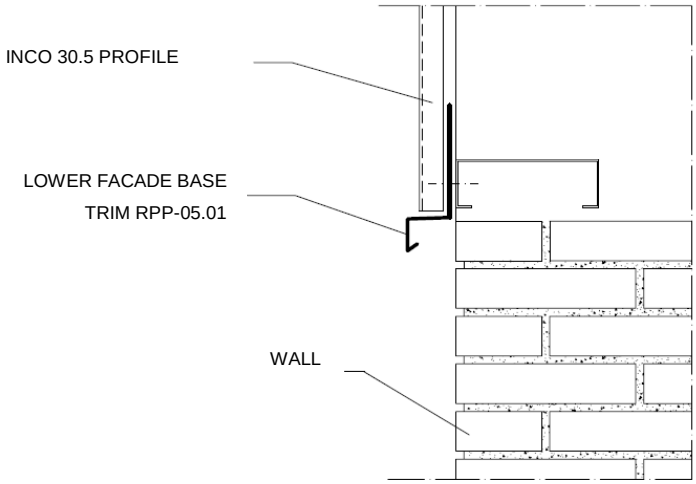
Corner Trim, used to resolve the vertical junction of two facade planes at the outer angle. The trim is attached vertically before the installation of the definitive screws that are to hold it to the sheet.



Constructive detail of a Corner Trim.

On site Installation 7

Facade Base Trim, the lower finishing for the facade sheeting or for lintels in door- and window-cavities. The vertical part of the trim is installed behind the facade sheet, which it overlaps by a minimum of 100 mm. The façade sheet is not to rest on the trim. The trim is preliminarily attached in a horizontal position before the installation of the definitive screws that are to hold it to the sheet. The horizontal part of the trim must be inclined at 2% or more to prevent the accumulation of dust and water.



Constructive detail of the Facade Base Trim

7.12. SKYLIGHTS (NTE Synthetic Roofs QTE)

The polyester sheets must have the same form as the ribbed sheet profiles. The polyester sheets must not be installed at the edge of the roof

Profile	Type	Recommended Minimum Slope
INCO 30.4	Ribbed	10%
INCO 30.5	Ribbed	10%
INCO 44.4	Ribbed	5%
INCO 44.6	Corrugated	10%
INCO 70.4	Ribbed	5%
INCO 70.4	Composite	-
INCO 72.1	Clladding	-

Recommended Minimum Slopes.

On site Installation 7

7.12.1. Light transmission

There are three type of sheeting, depending on the light transmission;

Translucent (> 20%)
Semi-opaque (10% -20%)
Opaque (<10%)

The calculation of the required luminous surface in any given project can be carried out using our **Lighting Calculation Tool**, which can be found on our website www.incoperfil.com.

7.12.2. Overlaps

As a general rule, the minimum transverse overlap is 200 mm, and the waterproofing complements are to be applied in accordance with NTE Synthetic Roofs QTS.

7.12.3. Fastenings

Fastenings of the same characteristics as those used for the sheet are to be employed. The recommended diameter of the sealing washers is equal to or greater than 22 mm. Insofar as the distribution and minimum density of fastenings, the same characteristics applicable to the sheet apply.

7.12.3. Resistance Tables.

The table below shows the resistances of the polyester sheets, in accordance with the distance from the purlins and the profile type.

		Admissible loads(kp/m²)			
		INCOLUX 30.4	INCOLUX 30.5	INCOLUX 44.4	INCOLUX 44.6
Separation of purlings	80	119	127	298	300
	90	83	90	209	211
	100	61	65	152	154
	110	46	49	115	115
	120	35	38	88	89
	130	28	30	69	70
	140	22	24	56	56
	150	18	19	45	46

Table of admissible loads for polyester sheets.

Apendix : Technical Specifications

Technical Specifications Catalogue

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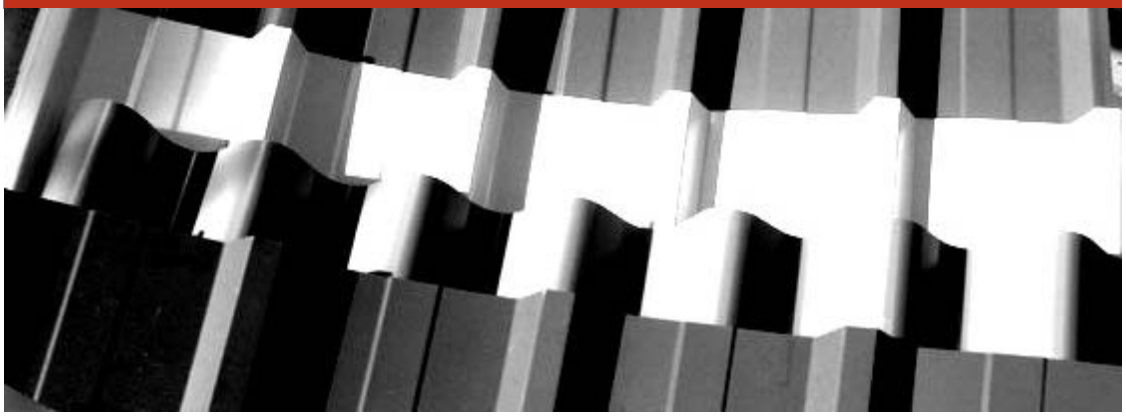
INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL

Metallic Profiles: Roofing



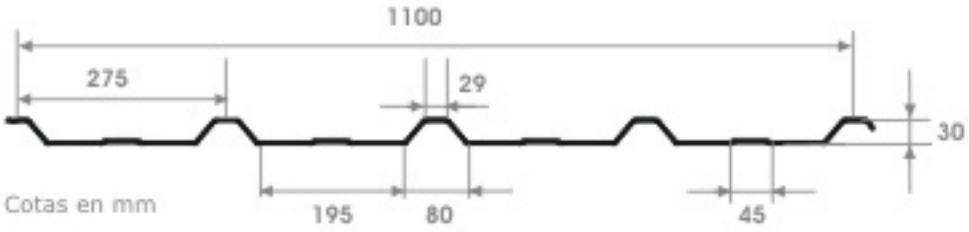
Mas documentación en: www.incoperfil.com

Revisión 2005

Certificado ISO 9001 por
BVQI

PERFIL ROOFING
INCO 30.4.

DIMENSIONS



APPLICATIONS

Simple roofing
Sandwich roofing
Permanent shuttering
False ceilings

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,5	4,43	51.740	2.135	2.223
0,6	5,32	69.623	2.951	2.770
0,7	6,20	84.748	3.614	3.284
0,8	7,09	100.183	4.294	3.803
1	8,86	126.533	5.410	4.848
1,2	10,64	151.735	6.460	5.899

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Reinforcement: It exists the possibility of increasing the splice between sheets in order to avoid span intake because of poor sheet formation.
Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Curved sheet: Possibility of curved sheets by inlay curving. See technical product specification.
Perforated sheet: Availability of perforated material for acoustic reduction.
Skylights: Available in polyester and acrylic profile.

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	241	152	102	72	52	39	30	24	19	15
	0,60	325	205	137	96	70	53	41	32	26	21
	0,70	395	249	167	117	85	64	49	39	31	25
	0,80	468	294	197	139	101	76	58	46	37	30
	1,00	590	372	249	175	128	96	74	58	46	38
	1,20	708	446	299	210	153	115	89	70	56	45

2 Spans		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	195	155	126	104	88	75	65	57	46	37
	0,60	258	203	164	136	114	98	84	74	62	50
	0,70	322	253	204	168	141	120	104	90	75	61
	0,80	389	304	245	201	169	143	123	107	89	72
	1,00	531	413	330	270	225	191	164	140	112	91
	1,20	680	526	419	342	284	240	206	168	134	109

3 Spans		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	233	185	151	125	98	74	57	45	36	29
	0,60	308	243	198	164	133	100	77	60	48	39
	0,70	385	303	246	203	161	121	93	73	59	48
	0,80	467	366	295	244	191	143	110	87	69	56
	1,00	639	498	400	328	241	181	139	110	88	71
	1,20	821	637	509	396	289	217	167	131	105	86

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
UNE-ENV 1993.1-1: General Rules and Rules for Buildings
ENV 1993 – 1-3: Cold Formed Thin Gauge Members and Sheeting.
NBE-EA-95 Part 4: Cálculo de las piezas de Chapa Conformada de Acero en Edificaciones

:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV).

Ingeniería y Construcción del Perfil S.A. reserves the right to carry out any general and/or particular modification in the characteristics and engineering details of its profiles, due to production requirements or technological improvement.
Ingeniería y Construcción del Perfil S.A. is not responsible for the failure to comply with the recommendations of installation of the profiles

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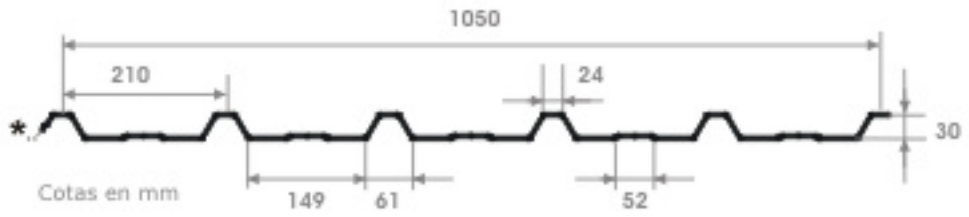

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Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,5	4,64	61.700	2.705	2.658
0,6	5,56	77.846	3.443	3.252
0,7	6,50	94.361	4.199	3.849
0,8	7,43	108.705	4.836	4.450
1	9,28	135.747	6.009	5.654

ALTERNATIVES AND MANUFACTURING CONDITIONS

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Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
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Single Span		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	288	181	121	85	62	47	36	28	23	18
	0,60	363	229	153	108	78	59	45	36	29	23
	0,70	440	277	186	130	95	71	55	43	35	28
	0,80	507	319	214	150	110	82	63	50	40	32
	1,00	633	399	267	188	137	103	79	62	50	41

2 Spans		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	243	192	156	129	109	93	80	68	55	44
	0,60	318	249	201	166	139	119	102	86	69	56
	0,70	396	310	249	205	171	146	125	104	83	68
	0,80	478	372	298	244	204	173	149	120	96	78
	1,00	649	502	400	327	272	230	191	150	120	98

3 Spans		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	290	230	187	155	117	88	68	53	43	35
	0,60	380	300	242	200	148	111	86	67	54	44
	0,70	475	373	301	246	180	135	104	82	65	53
	0,80	575	449	361	284	207	155	120	94	75	61
	1,00	783	608	486	354	258	194	150	118	94	77

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
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NBE-EA-95 Part 4: Cálculo de las piezas de Chapa Conformada de Acero en Edificaciones

:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV).

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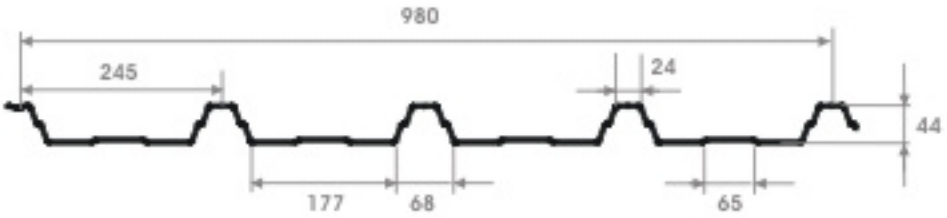
DIMENSIONS



Cotas en mm

APPLICATIONS

Profile suitable for medium spans and resistances
Simple roofing
Deck roofing
Permanent shuttering

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,5	4,97	137.173	4.071	3.937
0,6	5,97	172.265	5.186	4.842
0,7	6,96	208.516	6.338	5.764
0,75	7,46	226.991	6.922	6.232
0,8	7,96	245.402	7.512	6.701
1	9,95	308.598	9.359	8.594

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Curved sheet: Possibility of curved sheets by inlay curving. See technical product specification.
Perforated sheet: Availability of perforated material for acoustic reduction.
Skylights: Available in polyester and acrylic profile.

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	190	138	104	80	63	50	41	34	28	24
	0,60	238	174	130	100	79	63	51	42	35	30
	0,70	288	210	158	122	96	77	62	51	43	36
	0,75	314	229	172	132	104	83	68	56	47	39
	0,80	339	247	186	143	113	90	73	60	50	42
	1,00	426	311	233	180	141	113	92	76	63	53

2 Spans		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	152	130	112	98	86	77	69	62	56	51
	0,60	201	171	147	128	113	100	89	80	72	66
	0,70	254	215	185	160	141	124	111	99	90	81
	0,75	281	238	204	177	155	137	122	109	99	89
	0,80	310	262	224	194	170	150	134	120	108	98
	1,00	420	354	302	261	228	200	178	160	143	128

3 Spans		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	181	155	134	117	104	92	77	64	53	45
	0,60	240	204	176	154	136	119	97	80	67	56
	0,70	304	258	222	193	170	145	118	97	81	68
	0,75	337	286	246	214	188	157	128	105	88	74
	0,80	372	315	270	235	206	170	138	114	95	80
	1,00	507	428	365	317	267	214	174	143	120	100

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

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:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
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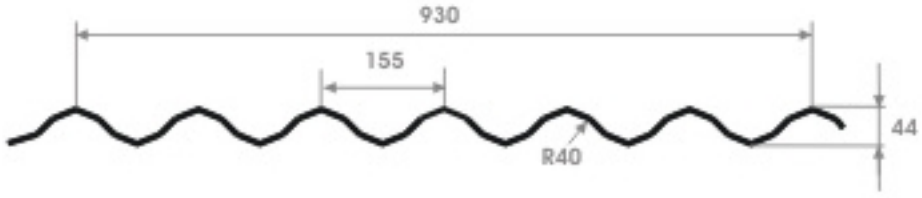
PERFIL ROOFING

INCO 44.6. Corrugated

DIMENSIONS



Cotas en mm

APPLICATIONS

Profile suitable for medium spans and resistances
Simple roofing
Deck roofing
Permanent shuttering

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness mm	Weight Kg/mm^2	Inertia mm^4	Section Modulus (positive) mm^3
0,5	5,24	143.987	6.460
0,6	6,29	172.793	7.738
0,7	7,34	201.604	9.012
0,8	7,86	216.011	9.648
1	8,39	230.420	10.282
1,2	10,48	288.072	12.803

ALTERNATIVES AND MANUFACTURING CONDITIONS

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Curved sheet: Possibility of curved sheets by inlay curving. See technical product specification.
Perforated sheet: Availability of perforated material for acoustic reduction.
Skylights: Available in polyester.

INCO 44.6. Corrugated

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	183	133	100	77	61	49	40	33	27	23
	0,60	220	160	120	93	73	58	47	39	33	27
	0,70	256	187	140	108	85	68	55	46	38	32
	0,80	293	214	160	124	97	78	63	52	43	37
	1,00	366	267	201	155	122	97	79	65	54	46
	1,20	440	320	241	185	146	117	95	78	65	55

2 Spans		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	237	195	163	138	118	102	89	78	65	55
	0,60	321	262	218	184	157	136	114	94	79	66
	0,70	413	336	279	235	201	164	133	110	92	77
	0,80	514	418	346	291	234	187	152	126	105	88
	1,00	709	576	477	372	293	234	191	157	131	110
	1,20	847	688	570	447	351	281	229	188	157	132

3 Spans		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	288	237	189	146	115	92	75	62	51	43
	0,60	394	302	227	175	138	110	90	74	62	52
	0,70	484	353	265	204	161	129	105	86	72	60
	0,80	553	403	303	233	184	147	119	98	82	69
	1,00	692	504	379	292	229	184	149	123	103	86
	1,20	830	605	455	350	275	221	179	148	123	104

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
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:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV).

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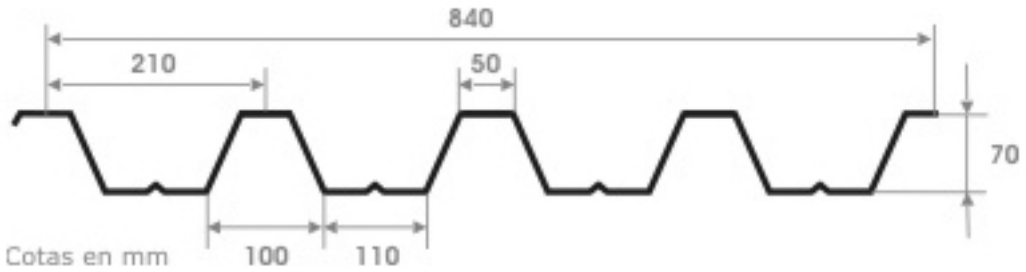
DIMENSIONS



APPLICATIONS

Profile suitable for maximum spans and strong resistances
Simple roofing
Sandwich roofing
Permanent shuttering

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,6	6,96	462.532	9.858	12.196
0,7	8,13	592.251	13.135	16.255
0,75	8,71	698.464	16.127	17.837
0,8	9,29	778.881	18.405	19.159
1	11,61	1.055.920	25.899	24.499
1,2	13,93	1.267.597	31.038	29.834

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Perforated sheet: Availability of perforated material for acoustic reduction.

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		2,80	3,00	3,20	3,40	3,60	3,80	4,00	4,20	4,40	4,60
Thickness (mm)	0,60	169	138	113	95	79	68	58	50	43	38
	0,70	217	177	145	122	102	87	74	64	56	49
	0,75	256	209	171	143	120	103	88	76	66	58
	0,80	286	233	191	160	134	114	98	85	73	65
	1,00	387	315	259	217	182	155	133	115	99	87
	1,20	465	378	311	260	219	186	159	138	120	105

2 Spans		Span Lenght (m)									
		2,80	3,00	3,20	3,40	3,60	3,80	4,00	4,20	4,40	4,60
Thickness (mm)	0,60	175	159	144	132	121	112	103	96	89	83
	0,70	233	212	192	176	161	149	137	128	118	111
	0,75	261	237	215	197	180	166	153	142	132	123
	0,80	288	261	237	216	198	183	168	156	145	135
	1,00	403	363	329	300	274	252	231	215	199	185
	1,20	525	472	427	387	354	324	265	275	255	237

3 Spans		Span Lenght (m)									
		2,80	3,00	3,20	3,40	3,60	3,80	4,00	4,20	4,40	4,60
Thickness (mm)	0,60	207	159	171	132	144	112	110	96	82	83
	0,70	276	212	228	176	192	149	140	128	105	111
	0,75	310	237	255	197	215	166	166	142	124	123
	0,80	342	261	282	216	236	183	185	156	139	135
	1,00	480	363	393	300	328	252	251	215	188	185
	1,20	628	565	512	465	413	351	301	260	226	198

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

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:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV).

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Apendix: Technical Specifications

Technical Specifications Catalogue

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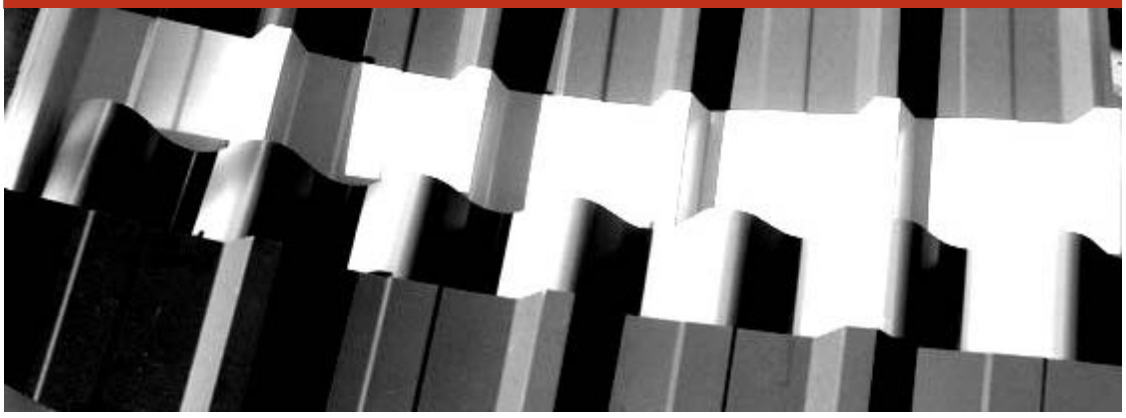
Metallic Profiles: Façades



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Revisión 2005

Certificado ISO 9001 por
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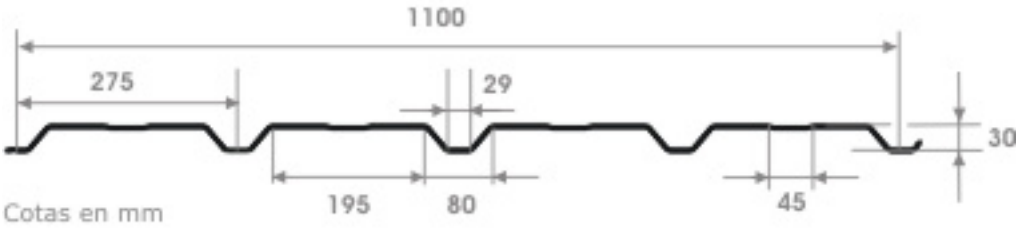
PERFIL FAÇADE
INCO 30.4.

DIMENSIONS



APPLICATIONS

Simple façade
Sandwich façade
Permanent shuttering
False ceilings

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,5	4,43	34.192	2.223	2.135
0,6	5,32	43.712	2.770	2.951
0,7	6,20	53.727	3.284	3.614
0,8	7,09	64.307	3.803	4.294
1	8,86	86.732	4.848	5.410
1,2	10,64	110.480	5.899	6.460

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Curved sheet: Possibility of curved sheets by inlay curving. See technical product specification.
Perforated sheet: Availability of perforated material for acoustic reduction.
Skylights: Available in polyester and acrylic profile.

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span	Span Lenght (m)									
Thickness (mm)	1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
0,50	222	140	94	66	48	36	28	22	18	14
0,60	280	176	118	83	61	45	35	28	22	18
0,70	340	214	144	101	74	55	43	33	27	22
0,80	402	253	170	119	87	65	50	40	32	26
1,00	528	333	223	157	114	86	66	52	42	34
1,20	658	414	277	195	142	107	82	65	52	42

2 Spans	Span Lenght (m)									
Thickness (mm)	1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
0,50	192	151	123	102	86	73	64	53	42	34
0,60	266	210	171	141	119	102	84	66	53	43
0,70	339	267	216	179	150	128	103	81	65	52
0,80	417	327	264	218	183	156	121	95	76	62
1,00	568	443	355	292	244	207	159	125	100	81
1,20	721	559	447	365	304	257	198	156	125	101

3 Spans	Span Lenght (m)									
Thickness (mm)	1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
0,50	228	181	147	122	91	68	53	41	33	27
0,60	317	252	205	157	114	86	66	52	42	34
0,70	405	320	260	190	139	104	80	63	51	41
0,80	499	393	318	225	164	123	95	75	60	49
1,00	682	534	421	296	215	162	125	98	79	64
1,20	869	676	524	368	268	201	155	122	98	79

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

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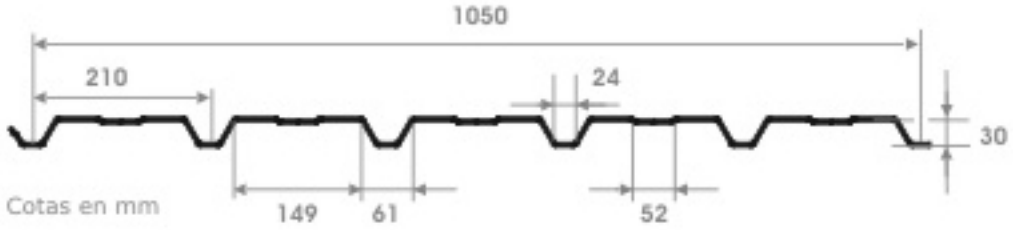
PERFIL FAÇADE
INCO 30.5.

DIMENSIONS



APPLICATIONS

Profile suitable for minimum spans and resistances.
Simple façade
Sandwich façade
Deck roofing
Permanent shuttering
False ceilings

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,5	4,64	55.900	2.658	2.705
0,6	5,56	70.033	3.252	3.443
0,7	6,50	84.564	3.848	4.199
0,8	7,43	99.374	4.450	4.836
1	9,28	129.514	5.654	6.009

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
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Skylights: Available in polyester and acrylic profile.

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	261	164	110	77	56	42	33	26	21	17
	0,60	327	206	138	97	71	53	41	32	26	21
	0,70	395	249	166	117	85	64	49	39	31	25
	0,80	464	292	196	137	100	75	58	46	37	30
	1,00	604	381	255	179	131	98	76	59	48	39

2 Spans		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	246	194	157	130	110	94	79	62	49	40
	0,60	328	258	208	172	145	123	98	77	62	50
	0,70	416	326	263	217	182	154	119	93	75	61
	0,80	502	392	315	259	217	181	140	110	88	71
	1,00	675	523	418	341	284	236	182	143	115	93

3 Spans		Span Lenght (m)									
		1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Thickness (mm)	0,50	293	232	189	146	106	80	62	48	39	32
	0,60	392	309	251	183	133	100	77	61	49	39
	0,70	499	392	314	221	161	121	93	73	59	48
	0,80	603	472	369	259	189	142	109	86	69	56
	1,00	814	633	481	338	246	185	143	112	90	73

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
UNE-ENV 1993.1-1: General Rules and Rules for Buildings
ENV 1993 – 1-3: Cold Formed Thin Gauge Members and Sheeting.
NBE-EA-95 Part 4: Cálculo de las piezas de Chapa Conformada de Acero en Edificaciones

:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV).

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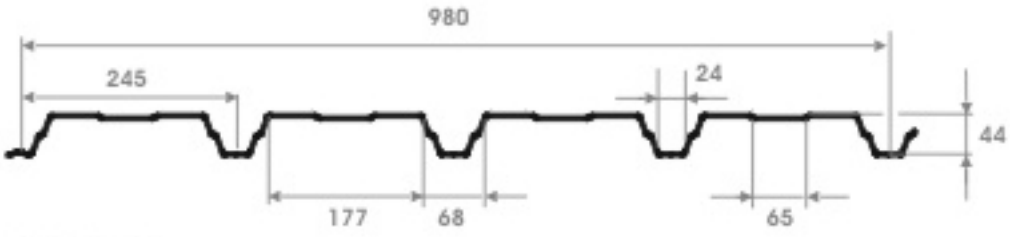
PERFIL FAÇADE
INCO 44.4.

DIMENSIONS



Cotas en mm

APPLICATIONS

Profile suitable for medium spans and resistances.
Simple façade
Sandwich façade
Deck roofing
Permanent shuttering

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,5	4,97	137.173	4.071	3.937
0,6	5,97	172.265	5.186	4.842
0,7	6,96	208.516	6.338	5.764
0,75	7,46	226.991	6.922	6.232
0,8	7,96	245.402	7.512	6.701
1	9,95	308.598	9.359	8.594

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Curved sheet: Possibility of curved sheets by inlay curving. See technical product specification.
Perforated sheet: Availability of perforated material for acoustic reduction.
Skylights: Available in polyester and acrylic profile.

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	163	119	90	69	54	43	35	29	24	20
	0,60	206	151	113	87	69	55	45	37	31	26
	0,70	251	183	138	106	83	67	54	45	37	31
	0,75	274	200	150	116	91	73	59	49	41	34
	0,80	297	217	163	125	99	79	64	53	44	37
	1,00	392	285	214	165	130	104	85	70	58	49

2 Spans		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	174	148	127	110	97	86	77	69	58	49
	0,60	234	198	170	147	129	114	102	89	74	62
	0,70	299	252	216	187	163	144	128	108	90	76
	0,75	333	281	240	207	181	160	142	117	98	82
	0,80	368	310	264	228	199	176	155	127	106	89
	1,00	443	374	320	277	242	213	190	168	140	118

3 Spans		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	208	177	153	130	102	82	67	55	46	39
	0,60	281	238	205	164	129	104	84	69	58	49
	0,70	360	304	260	200	157	126	102	84	70	59
	0,75	401	339	283	218	172	137	112	92	77	65
	0,80	443	374	307	237	186	149	121	100	83	70
	1,00	533	451	386	312	245	196	160	132	110	92

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
UNE-ENV 1993.1-1: General Rules and Rules for Buildings
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NBE-EA-95 Part 4: Cálculo de las piezas de Chapa Conformada de Acero en Edificaciones

:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV).

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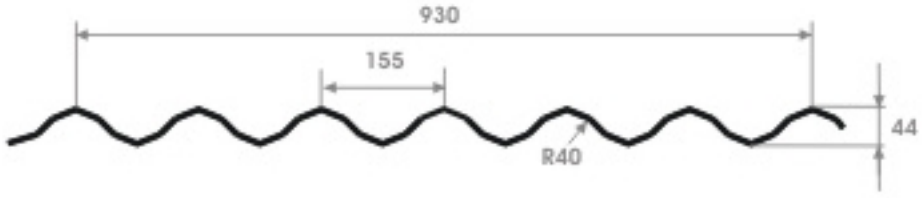
PERFIL FAÇADE

INCO 44.6. Corrugated

DIMENSIONS



Cotas en mm

APPLICATIONS

Profile suitable for medium spans and resistances.
Simple roofing
Sandwich roofing
Simple façade

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)
mm	Kg/mm^2	mm^4	mm^3
0,5	5,24	14.398	6.460
0,6	6,29	172.793	7.738
0,7	7,34	201.604	9.012
0,75	7,86	216.011	9.648
0,8	8,39	230.420	10.282
1	10,48	288.072	12.803

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Curved sheet: Possibility of curved sheets by inlay curving. See technical product specification.
Perforated sheet: Availability of perforated material for acoustic reduction.
Skylights: Available in polyester profile.

INCO 44.6. Corrugated

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	183	133	100	77	61	49	40	33	27	23
	0,60	220	160	120	93	73	58	47	39	33	27
	0,70	256	187	140	108	85	68	55	46	38	32
	0,75	275	200	150	116	91	73	59	49	41	34
	0,80	293	214	160	124	97	78	63	52	43	37
	1,00	366	267	201	155	122	97	79	65	54	46

2 Spans		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	237	195	163	138	118	102	89	78	65	55
	0,60	321	262	218	184	157	136	114	94	79	66
	0,70	413	336	279	235	201	164	133	110	92	77
	0,75	462	376	312	263	220	176	143	118	98	83
	0,80	514	418	346	291	234	187	152	126	105	88
	1,00	709	576	477	372	293	234	191	157	131	110

3 Spans		Span Lenght (m)									
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60
Thickness (mm)	0,50	288	237	189	146	115	92	75	62	51	43
	0,60	394	302	227	175	138	110	90	74	62	52
	0,70	484	353	265	204	161	129	105	86	72	60
	0,75	519	378	284	219	172	138	112	92	77	65
	0,80	553	403	303	233	184	147	119	98	82	69
	1,00	692	504	379	292	229	184	149	123	103	86

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
UNE-ENV 1993.1-1: General Rules and Rules for Buildings
ENV 1993 – 1-3: Cold Formed Thin Gauge Members and Sheeting.
NBE-EA-95 Part 4: Cálculo de las piezas de Chapa Conformada de Acero en Edificaciones

:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV).

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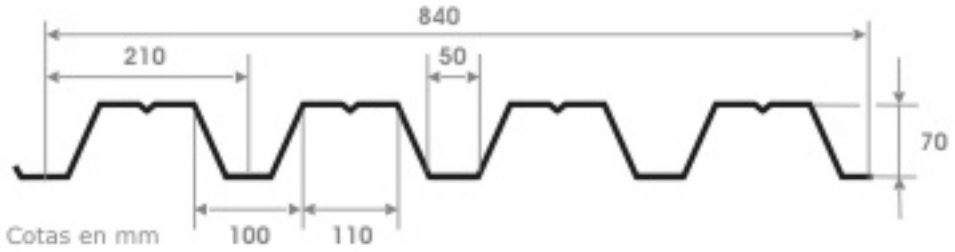
PERFIL FAÇADE
INCO 70.4.

DIMENSIONS



APPLICATIONS

Profile suitable for maximum spans and strong overloads.
Simple façade
Sandwich façade.
Permanent shuttering.
Deck roofing.

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,6	6,96	553.004	12.196	9.858
0,7	8,13	673.259	16.255	13.135
0,75	8,71	745.233	17.837	16.127
0,8	9,29	790.900	19.159	18.405
1	11,61	1.029.987	24.499	25.899
1,2	13,93	1.267.597	29.834	31.038

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Perforated sheet: Availability of perforated material for acoustic reduction.

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		2,80	3,00	3,20	3,40	3,60	3,80	4,00	4,20	4,40	4,60
Thickness (mm)	0,60	203	165	136	113	95	81	69	60	52	46
	0,70	247	201	165	138	116	99	84	73	63	56
	0,75	273	223	183	153	128	110	93	81	70	62
	0,80	290	236	194	162	136	116	99	86	74	66
	1,00	378	308	253	211	178	151	129	112	97	85
	1,20	465	378	311	260	219	186	159	137	120	105

2 Spans		Span Lenght (m)									
		2,80	3,00	3,20	3,40	3,60	3,80	4,00	4,20	4,40	4,60
Thickness (mm)	0,60	158	143	129	118	108	99	91	85	78	73
	0,70	211	191	172	158	144	132	122	113	104	98
	0,75	249	226	204	187	171	157	145	134	124	116
	0,80	283	256	232	212	194	179	164	153	141	132
	1,00	414	374	338	309	282	260	239	222	205	192
	1,20	537	482	436	397	362	332	306	282	282	243

3 Spans		Span Lenght (m)									
		2,80	3,00	3,20	3,40	3,60	3,80	4,00	4,20	4,40	4,60
Thickness (mm)	0,60	188	170	154	141	129	119	109	102	94	86
	0,70	251	227	206	188	172	159	146	136	120	105
	0,75	296	268	243	223	204	188	173	153	133	117
	0,80	336	304	276	253	231	214	188	163	141	124
	1,00	493	446	404	369	336	286	245	212	184	161
	1,20	641	578	523	476	413	352	301	260	226	198

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
UNE-ENV 1993.1-1: General Rules and Rules for Buildings
ENV 1993 – 1-3: Cold Formed Thin Gauge Members and Sheeting.
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ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV)

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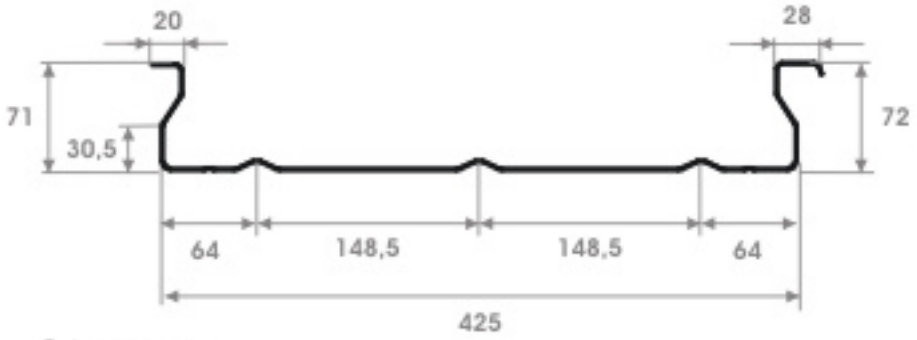
PERFIL FAÇADE

INCO 72.1. Tray

DIMENSIONS



Cotas en mm

APPLICATIONS

Sandwich façade

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,6	6,88	346.843	5.840	5.697
0,7	8,03	420.630	7.114	7.383
0,75	8,60	458.714	7.772	8.174
0,8	9,18	497.439	8.444	8.994
1	11,47	658.635	11.251	12.529

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.
Perforated sheet: Availability of perforated material for acoustic reduction.

INCO 72.1. Tray

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)									
		4,00	4,20	4,40	4,60	4,80	5,00	5,20	5,40	5,60	5,80
Thickness (mm)	0,60	45	39	34	29	26	23	20	18	16	15
	0,70	54	47	41	36	31	28	25	22	20	18
	0,75	59	51	44	39	34	30	27	24	21	19
	0,80	64	55	48	42	37	33	29	26	23	21
	1,00	84	73	63	55	49	43	38	34	31	28

2 Spans		Span Lenght (m)									
		4,00	4,20	4,40	4,60	4,80	5,00	5,20	5,40	5,60	5,80
Thickness (mm)	0,60	43	40	38	35	33	31	29	28	26	25
	0,70	58	54	50	47	44	41	39	37	35	33
	0,75	65	61	56	53	49	46	44	41	39	37
	0,80	73	68	63	59	55	52	49	46	43	41
	1,00	107	99	92	86	80	75	71	67	63	59

3 Spans		Span Lenght (m)									
		4,00	4,20	4,40	4,60	4,80	5,00	5,20	5,40	5,60	5,80
Thickness (mm)	0,60	52	48	45	42	39	37	35	33	31	28
	0,70	69	64	60	56	53	49	46	41	37	33
	0,75	78	72	68	64	60	55	50	45	40	36
	0,80	87	81	75	70	66	62	55	49	44	39
	1,00	128	119	110	103	92	81	72	64	58	52

Calculations are made taking into account bending, vertical shear, lateral-torsional bucking and shear buckling

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
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NBE-EA-95 Part 4: Cálculo de las piezas de Chapa Conformada de Acero en Edificaciones

:: CALCULUS NOTES

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ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV).

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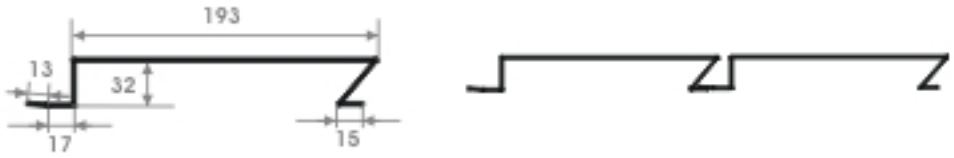
PERFIL FAÇADE

INCO 30.200 Tray

DIMENSIONS

A: Montaje con Llaga



Cotas en mm

APPLICATIONS

Facades in horizontal or vertical position
False ceilings
Internal divisions
Acoustics (perforated profile)

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/m^2	mm^4/m	mm^3/m	mm^3/m
0,6	7,38	107.620	4.137	3.926
0,7	8,62	132.130	5.152	5.007
0,8	9,85	157.320	6.225	6.202
1	12,31	208.220	8.496	8.523

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.

Perforated sheet: Availability of perforated material for acoustic reduction.

INCO 30.200 Tray

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span

Espesor (mm)	Span Lenght (m) 1,00	1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60
0,60	562	390	287	212	149	108	82	63	-
0,70	699	486	357	260	183	133	100	77	61
0,80	845	587	431	310	218	159	119	92	72
1,00	1153	801	588	410	288	210	158	121	96

2 Spans

Espesor (mm)	Span Lenght (m) 1,00	1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60
0,60	533	370	272	208	165	133	110	93	79
0,70	680	472	347	266	210	170	140	118	101
0,80	842	585	430	329	260	210	174	146	125
1,00	1157	804	590	452	357	289	239	201	171

3 Spans

Espesor (mm)	Span Lenght (m) 1,00	1,20	1,40	1,60	1,80	2,00	2,20	2,40	2,60
0,60	666	463	340	260	206	167	138	116	93
0,70	850	590	433	332	332	212	176	146	114
0,80	1052	731	537	411	411	263	217	173	136
1,00	1446	1004	738	565	565	362	298	229	180

:: NORMATIVE

EUROCODE-3: Design of Steel Structures
UNE-ENV 1993.1-1: General Rules and Rules for Buildings
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NBE-EA-95 Part 4: Cálculo de las piezas de Chapa Conformada de Acero en Edificaciones

:: CALCULUS NOTES

ULE: Total Applied Load = 1,35 *Permanent loads (including slab self weight) + 1,50 Live Loads
ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV)

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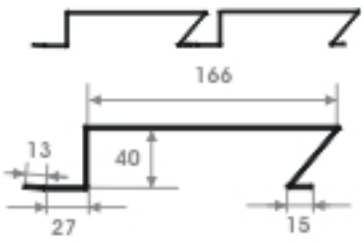
PERFIL FAÇADE

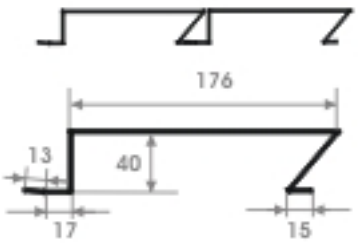
INCO 40.176 Tray

DIMENSIONS

A: Montaje con Llaga



H: Montaje a Hueso



Cotas en mm

APPLICATIONS

Facades in horizontal or vertical position
False ceilings
Internal divisions
Acoustics (perforated profile)

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/m^2	mm^4/m	mm^3/m	mm^3/m
0,6	8,85	242.810	7.531	7.037
0,7	10,33	297.520	9.347	8.873
0,8	11,80	354.290	11.280	10.886
1	14,75	471.670	15.432	15.420

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.

Perforated sheet: Availability of perforated material for acoustic reduction.

INCO 40.176 Tray

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)								
		1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Espesor (mm)	0,60	522	399	316	245	184	142	111	89	73
	0,70	647	496	392	300	225	174	137	109	89
	0,80	781	598	473	357	268	207	163	130	106
	1,00	1069	818	647	475	357	275	216	173	141

2 Spans		Span Lenght (m)								
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40
Espesor (mm)	0,60	487	373	295	239	197	166	141	122	106
	0,70	615	471	372	301	249	209	178	154	134
	0,80	754	577	456	369	305	257	219	188	164
	1,00	1068	818	646	523	433	363	310	267	233

3 Spans		Span Lenght (m)								
		1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40
Espesor (mm)	0,60	609	466	369	299	247	207	177	152	133
	0,70	768	588	465	376	311	261	223	192	167
	0,80	942	722	570	462	382	321	273	236	200
	1,00	1335	1022	808	654	541	454	387	327	266

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EUROCODE-3: Design of Steel Structures
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ENV 1993 – 1-3: Cold Formed Thin Gauge Members and Sheeting.
NBE-EA-95 Part 4: Cálculo de las piezas de Chapa Conformada de Acero en Edificaciones

:: CALCULUS NOTES

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ELS: Total Applied Load= 1,00 *Permanent Loads (including slab self weight) + 1,00 *live loads. – Maximum deflection < L/200
Calculations made by the Department of Cont. Medium Mech. And Theory of Structures (UPV)

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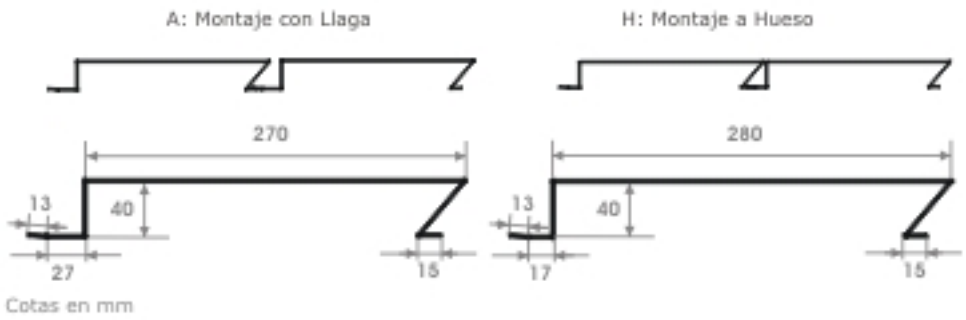
INCO 40.280 Tray

DIMENSIONS



Cotas en mm

APPLICATIONS

Facades in horizontal or vertical position
False ceilings
Internal divisions
Acoustics (perforated profile)

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/m^2	mm^4/m	mm^3/m	mm^3/m
0,8	9,66	248.010	7.137	6.768
1	12,08	331.750	9.759	9.640

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.

Perforated sheet: Availability of perforated material for acoustic reduction.

INCO 40.280 Tray

:: LOAD TABLES

MAXIMUM LOADS (kp/m²)

Single Span		Span Lenght (m)								
		1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Espesor (mm)	0,80	494	379	299	242	188	145	114	91	74
	1,00	676	518	409	331	251	194	152	122	99

2 Spans		Span Lenght (m)								
		1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Espesor (mm)	0,80	469	359	284	230	190	160	136	117	102
	1,00	668	511	404	327	270	227	194	167	143

3 Spans		Span Lenght (m)								
		1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Espesor (mm)	0,80	586	449	354	287	237	199	170	146	128
	1,00	835	639	505	409	338	284	242	209	182

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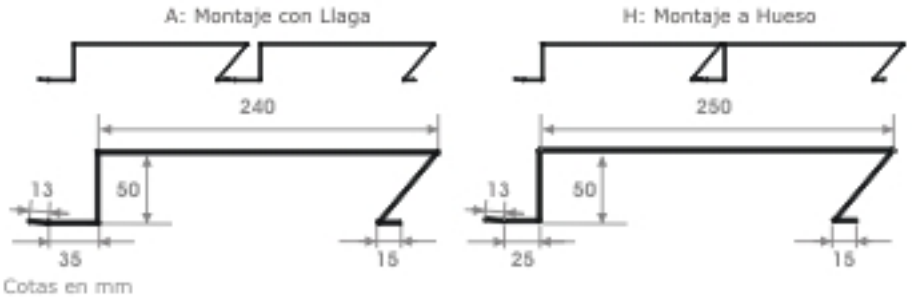
PERFIL FAÇADE

INCO 50.250 Tray

DIMENSIONS



Cotas en mm

APPLICATIONS

Facades in horizontal or vertical position
False ceilings
Internal divisions
Acoustics (perforated profile)

MECHANICAL PROPERTIES OF THE MATERIAL

Yield strength >= 250 N/mm2
Quality base material S250GD
Tensile strength >= 330 N/mm2
Modulus of elasticity = 210.000 N/mm2
Minimum Tensile Lengthening 19%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/m^2	mm^4/m	mm^3/m	mm^3/m
0,7	8,45	386.980	9.286	8.514
0,8	9,66	461.210	11.170	10.395
1	12,08	616.550	15.232	14.626

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m2 both sides)
Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.

Colours: The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.

Perforated sheet: Availability of perforated material for acoustic reduction.

INCO 50.250 Tray

:: LOAD TABLES

CARGAS MÁXIMAS (kp/m²)

1 VANO		Luces (m)								
		1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Espesor (mm)	0,70	643	492	389	315	260	219	178	142	126
	0,80	774	592	468	379	313	263	212	169	138
	1,00	1055	808	638	517	427	359	283	226	184

2 VANOS		Luces (m)								
		1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Espesor (mm)	0,70	590	451	357	289	239	201	171	147	128
	0,80	720	551	436	353	292	245	209	180	157
	1,00	1013	776	613	496	410	345	294	253	221

3 VANOS		Luces (m)								
		1,40	1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00
Espesor (mm)	0,70	737	564	446	361	298	251	214	184	161
	0,80	900	689	544	441	364	306	261	225	196
	1,00	1266	969	766	620	513	431	367	317	276

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Apendix: Technical Specifications

Technical Specifications Catalogue

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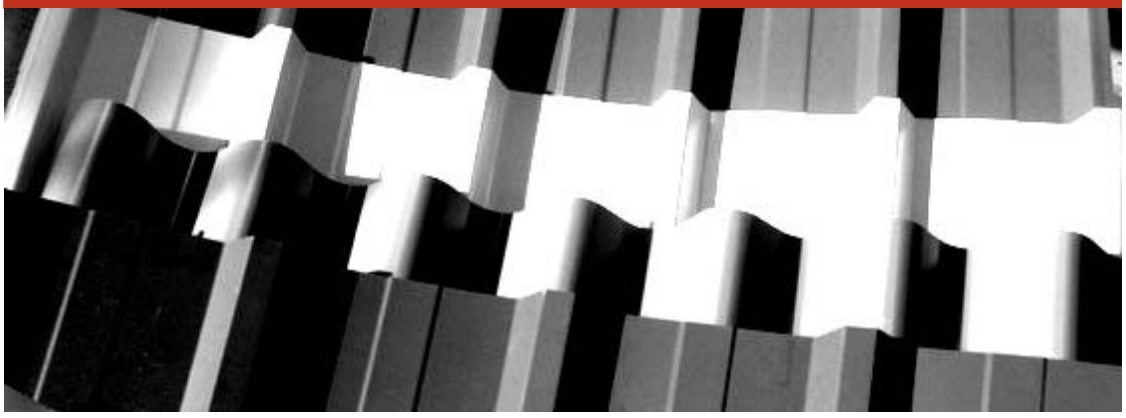
INGENIERÍA Y CONSTRUCCIÓN DEL PERFIL

Composite Slab



Mas documentación en: www.incoperfil.com

Revisión 2005

Certificado ISO 9001 por
BVQI

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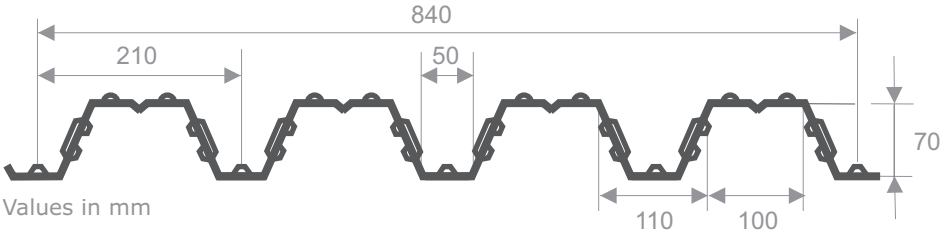
COMPOSITE SLAB
INCO 70.4 STEEL DECK

DIMENSIONS



Values in mm

DECK EFFECTIVE VALUES

		Weight (kg/m²)	Moment of Inertia (mm⁴ / m)	Section Modulus Negative Bending (mm⁴ / m)	Section Modulus Positive Bending (mm⁴ / m)
Thickness (mm)	0,75	9	698.464	16.127	17.837
	1,00	12	1.055.920	25.899	24.499
	1,20	14	1.267.597	31.038	29.834

COMPOSITE SLAB EFFECTIVE VALUES

		Composite Slab Weight (kp/m²) Slab Depth (cm)					
		12	14	16	18	20	21
Thickness (mm)	0,75	193	241	289	337	385	449
	1,00	196	244	292	340	388	452
	1,20	198	246	294	342	390	454

Concrete Density: 2400 kp/m^3

Concrete Volumes & Slab Inertias

		Concrete Volume (m³ /m² Slab)	Gross Inertia (cm⁴ / m)
Slab Depth (cm)	12	0,077	6.917
	14	0,097	11.042
	16	0,117	16.313
	18	0,137	22.981
	20	0,157	31.256
	21	0,167	36.064

MATERIALS

Structural Steel Properties: Yield Strenght > 320 N/mm² — Steel Quality S320GD

Tensile Strenght = (370, 480) N/mm² — Mod. de Elasticity = 2,1x10^6 daN/cm²

Minimum Tensile Lengthening: 25% — Protective Coating: Z-275 Galvanized

Concrete Properties:

Type C-25; fck = 25 N/mm² ; $fctk$=1,8 N/mm² — Aggregate Size < Max ((0,4h_c),(b_0/3),(Sieve C, 31.5mm))

Modulus of Elasticity = 20314,4 daN/cm² — h_c = Thickness of the concrete compression layer ; b_0/3= 26 mm

Reinforcing Steel Properties: Welded mesh and round steel with a high adherence

Yield strength = 500 N/mm²

REINFORCEMENT

Distribution Mesh: Electro·welded mesh 150x150x5 mm

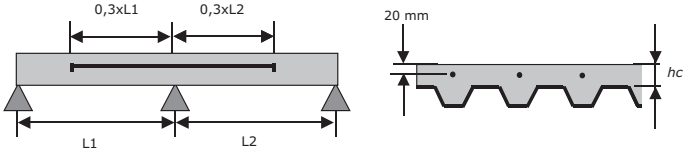
Negative Reinforcement: The spacing of the reinforcement bars should be 210 mm. between them and its diameter is in accord with to the below table. The single span slabs do not need negatives.

Reinforced Bars Diameter

		Slab Depth (cm)					
		12	14	16	18	20	21
2 or more spans	0,75	8	10	12	14	16	16
	1,00	10	12	12	14	16	16
	1,20	10	12	14	14	16	16

Values in mm

Laying Detail of the Reinforcements



The resistance calculations have been made in accordance with the standard Norma UNE ENV 1994-1-1: Junio 1995 EC. Parte 1-1 UNE ENV 1994-1-2 Junio 1995-EC4.Parte 1-2 by the *School of Industrial Engineering, Cont. Medium Mech.&Theory of Structures Department, of the Polythecnic University of Valencia (UPV).*

INCO 70.4 COLABORANTE

LOAD TABLES

Temporary supports in the middle of the span

Slab Depth (mm) / Span (m) / Max. Live Loads (kp/m²)

THICKNESS 0,75 mm

Span (m)	12	14	16	18	20	21
2,0	1180	1478	1776	2074	2372	2515
2,2	952	1193	1433	1674	1914	2029
2,4	778	975	1172	1368	1565	1658
2,6	642	805	967	1130	1292	1368
2,8	534	670	805	940	1075	1138
3,0	447	560	673	786	899	951
3,2	375	470	565	660	755	797
3,4	315	395	475	555	635	670
3,6	258	332	399	467	534	563
3,8		279	335	392	448	471
4,0		233	280	328	375	393
4,2			233	272	311	326
4,4				224	256	267
4,6					208	216
4,8						
5,0						

Span (m)	12	14	16	18	20	21
2,0	1369	1715	2061	2406	2752	2883
2,2	1110	1390	1670	1950	2231	2366
2,4	912	1142	1372	1603	1833	1943
2,6	757	948	1139	1331	1522	1613
2,8	634	794	954	1114	1275	1350
3,0	534	669	804	939	1074	1137
3,2	452	566	681	795	910	962
3,4	384	481	578	676	773	817
3,6	327	409	492	575	658	694
3,8	278	348	419	490	560	590
4,0	236	296	356	416	476	501
4,2	200	251	302	353	404	425
4,4			255	298	341	358
4,6			214	250	286	299
4,8				208	238	248
5,0						202

Span (m)	12	14	16	18	20	21
2,0	1327	1662	1997	2333	2668	2830
2,2	1075	1346	1618	1889	2161	2291
2,4	882	1105	1328	1551	1773	1880
2,6	731	916	1101	1286	1471	1558
2,8	612	766	921	1076	1230	1303
3,0	515	645	775	905	1036	1096
3,2	435	545	655	765	876	925
3,4	369	462	556	649	742	784
3,6	313	392	472	551	630	665
3,8	266	333	400	468	535	564
4,0	225	282	339	397	454	477
4,2		238	287	335	384	403
4,4		200	241	282	322	338
4,6			201	235	269	281
4,8					222	231
5,0						

THICKNESS 1,00 mm

Span (m)	12	14	16	18	20	21
2,0	1596	2000	2404	2774	3125	3273
2,2	1296	1624	1952	2280	2609	2751
2,4	1066	1337	1607	1878	2148	2261
2,6	888	1113	1338	1564	1789	1879
2,8	745	935	1124	1314	1503	1576
3,0	582	791	951	1111	1272	1330
3,2	448	672	809	945	1082	1128
3,4	343	574	691	808	924	961
3,6	255	470	592	692	792	820
3,8		351	507	593	679	700
4,0		257	435	509	583	598
4,2			332	437	500	510
4,4			243	373	428	433
4,6				306	365	366
4,8				222	309	307
5,0					260	255

Span (m)	12	14	16	18	20	21
2,0	1575	1921	2084	2441	2815	2863
2,2	1416	1726	1871	2190	2527	2566
2,4	1240	1555	1692	1982	2287	2319
2,6	1037	1300	1542	1805	2083	2110
2,8	875	1097	1318	1540	1762	1851
3,0	743	932	1121	1310	1499	1571
3,2	636	798	959	1121	1283	1341
3,4	546	686	825	964	1103	1150
3,6	471	591	712	832	952	990
3,8	407	512	616	720	824	854
4,0	353	443	534	624	714	737
4,2	306	384	463	541	620	637
4,4	265	333	401	469	537	549
4,6		288	347	406	465	473
4,8			300	351	402	406
5,0				302	346	346

Span (m)	12	14	16	18	20	21
2,0	1614	1969	2137	2502	2886	2936
2,2	1451	1769	1918	2246	2591	2633
2,4	1202	1506	1736	2033	2346	2380
2,6	1004	1258	1513	1767	2022	2127
2,8	846	1061	1275	1490	1705	1790
3,0	718	901	1083	1266	1449	1518
3,2	614	770	926	1082	1238	1294
3,4	527	661	795	929	1063	1108
3,6	454	569	685	801	916	952
3,8	392	492	592	692	792	820
4,0	338	425	512	598	685	706
4,2	293	368	443	518	593	609
4,4	253	318	383	448	513	523
4,6	218	274	331	387	443	449
4,8		236	284	333	381	384
5,0		202	244	285	327	326

THICKNESS 1,20 mm

Span (m)	12	14	16	18	20	21
2,0	1651	2038	2413	2776	3127	3293
2,2	1485	1833	2170	2496	2811	2959
2,4	1303	1632	1961	2262	2547	2681
2,6	993	1365	1640	1916	2192	2324
2,8	759	1152	1385	1618	1851	1962
3,0	584	981	1179	1377	1575	1669
3,2	450	780	1009	1179	1349	1428
3,4	346	614	869	1015	1161	1229
3,6	258	472	750	877	1003	1061
3,8		353	583	760	869	919
4,0		260	445	660	755	797
4,2			335	536	656	692
4,4			246	410	570	601
4,6				308	487	521
4,8				225	373	451
5,0					278	348

Span (m)	12	14	16	18	20	21
2,0	1578	1923	2087	2443	2818	2883
2,2	1418	1728	1873	2193	2529	2586
2,4	1285	1566	1695	1985	2289	2339
2,6	1173	1428	1544	1808	2086	2130
2,8	1073	1311	1415	1657	1912	1950
3,0	916	1148	1303	1526	1761	1795
3,2	788	988	1187	1387	1586	1659
3,4	682	854	1027	1200	1372	1453
3,6	592	742	892	1042	1192	1262
3,8	516	647	778	909	1040	1100
4,0	451	566	680	795	909	962
4,2	395	496	596	696	797	842
4,4	347	435	523	611	699	738
4,6	304	382	459	536	614	647
4,8	267	335	403	470	538	567
5,0	234	293	353	412	472	497

Span (m)	12	14	16	18	20	21
2,0	1617	1971	2346	2505	2888	2955
2,2	1454	1772	2108	2249	2594	2652
2,4	1318	1606	1911	2036	2348	2399
2,6	1203	1465	1743	1855	2140	2186
2,8	1039	1302	1564	1701	1962	2002
3,0	887	1111	1336	1560	1784	1843
3,2	762	955	1148	1341	1534	1625
3,4	658	825	992	1159	1325	1404
3,6	571	716	861	1006	1150	1218
3,8	497	624	750	876	1002	1060
4,0	434	545	655	765	875	925
4,2	380	476	573	669	766	809
4,4	332	417	501	586	670	708
4,6	291	365	439	513	587	619
4,8	255	320	384	449	514	541
5,0	223	279	336	393	450	473

Fire Resistance:
Due to the characteristics of the composite slabs, 30 minutes resistance fire (R30) is assured. In case of needing a higher resistance than this one, the following alternatives should be considered:

-Protective material projected under the composite slab.
-Installation of false ceilings
-Additional reinforcing steel against fire, for further information about this consult with our **Technical Department.**

Load Combinations

ELU: Total applied load = 1,35*Permanent loads(including slab self weight) + 1,50*Live loads
ELS: Maximum Overloading = 1,00 * Permanent loads (including slab self weight) + 1,00* Live loads
Span < 3,5 m ------- Maximum deflection < L/350
Span > 3,5 m ------- Maximum deflection < (L/700) + 5 mm

Our **Technical Department** is at your disposal for calculating composite slabs with different span length. Furthermore, if you have any doubt, you will receive technical supporting as well as the technical information you need.

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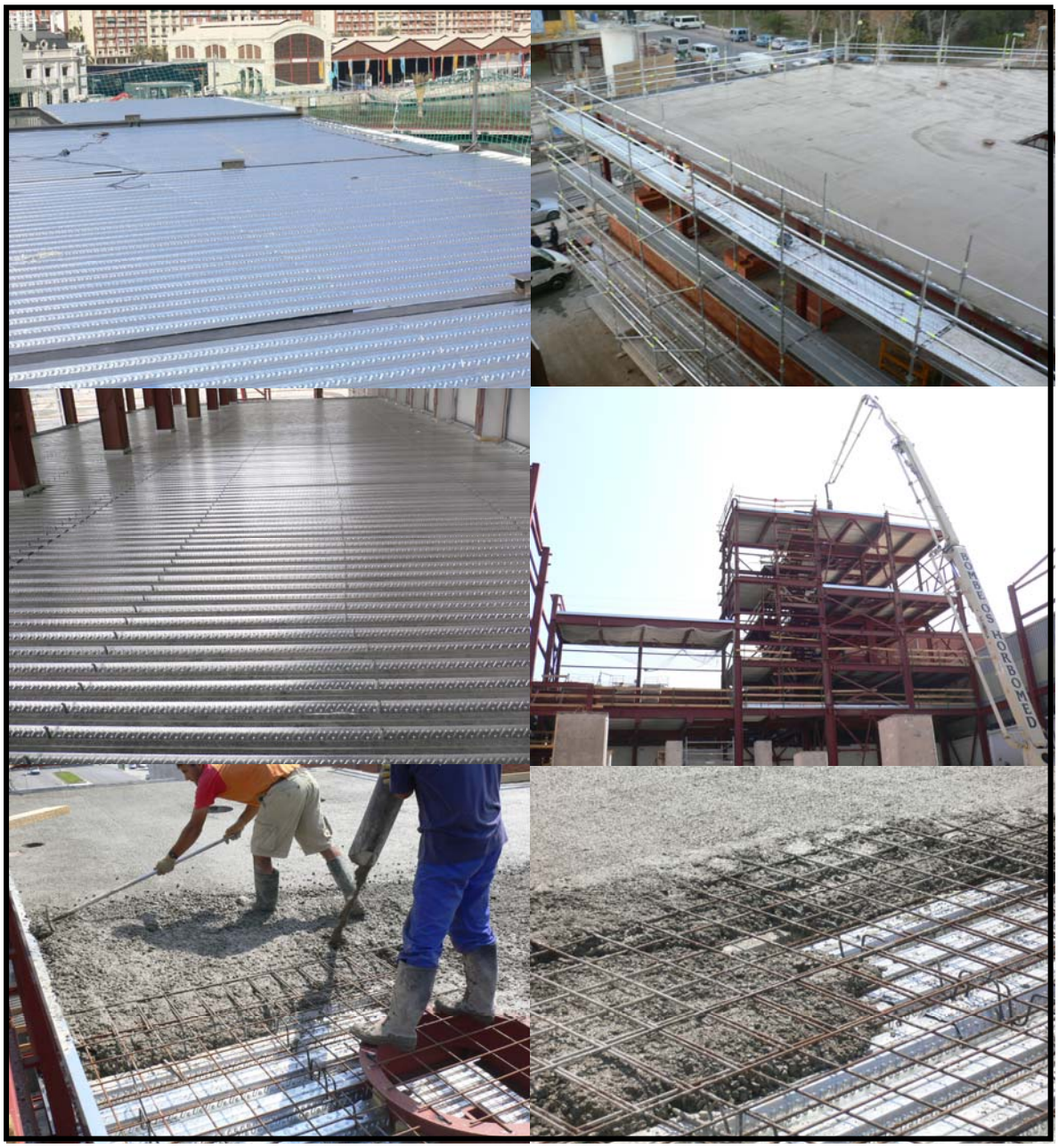
Apendix: Technical Specifications



Technical Specifications Catalogue

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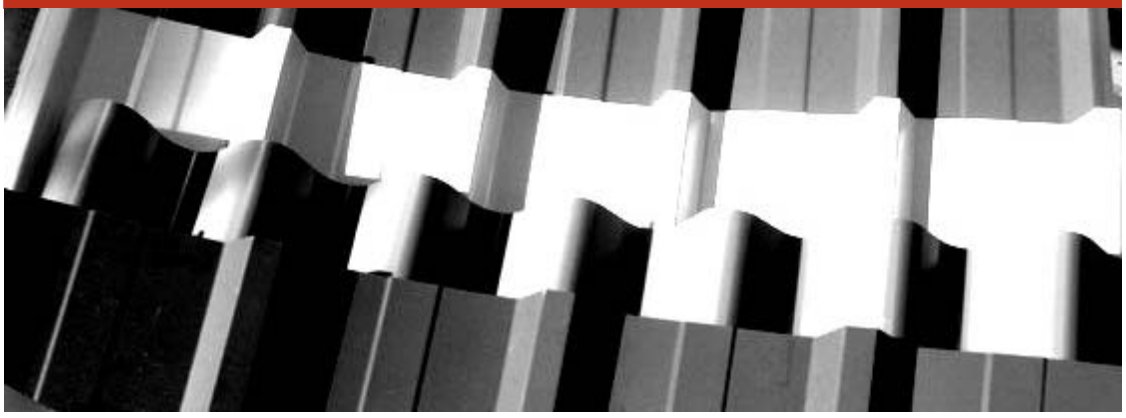
Curved Profiles



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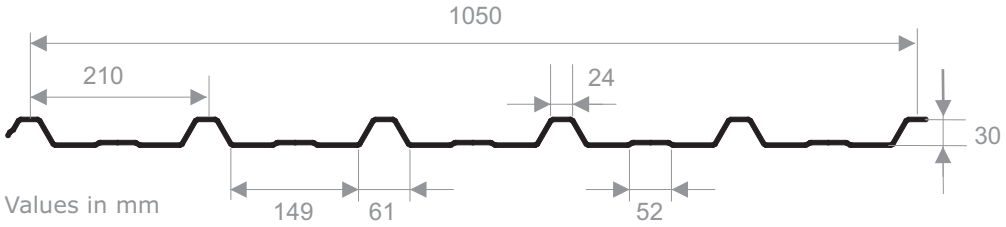
Revisión 2005

Certificado ISO 9001 por
BVQI

CURVED PROFILE
INCO 30.5.

DIMENSIONS



APPLICATIONS

Curved roofing with supporting structure
Corner trim
Crowning trim
Ridge trim
Canopies

MECHANICAL PROPERTIES

Yield strength>240 N/mm2
Quality base material S280GD
Tensile strength=(370,480) N/mm2
Modulus of elasticity= 210.000 N/mm2
Minimum Tensile Lengthening 25%

EFFECTIVE VALUES OF THE PROFILE

Thickness	Weight	Inertia	Section Modulus (positive)	Section Modulus (negative)
mm	Kg/mm^2	mm^4	mm^3	mm^3/m
0,5	4,64	61.700	2.705	2.658
0,6	5,56	77.846	3.443	3.252
0,7	6,50	94.361	4.199	3.849
0,8	7,43	108.705	4.836	4.450
1	9,28	135.747	6.009	5.654

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:

Galvanized steel Z-275 (275 gr/m2 both sides)

Pre-lacquered steel Z-225 (225 gr/m2 both sides)

Special coatings:

High durability, Plastisol, PVDF. See finish chart.

These coatings can be on both sides only upon request.

Minimum Radius: 375 mm.

Colours:

The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.

Perforated sheet:

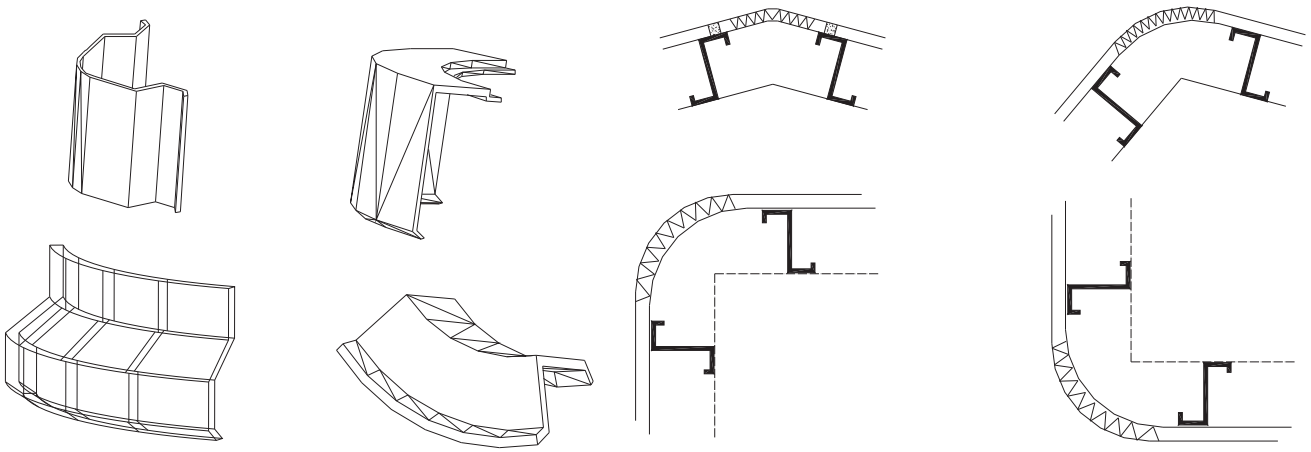
Availability of perforated material for acoustic reduction applications

LOAD TABLES

WARNING

This profile is not a self-supporting profile since it is not able to support the loads by itself so it needs a supporting structure. Its applications are restricted to aesthetic and design purposes.

APPLICATIONS



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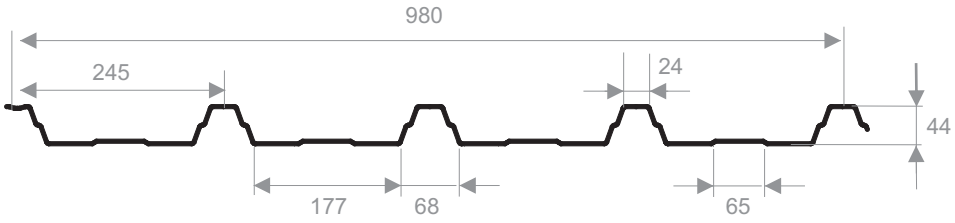
CURVED PROFILE
INCO 44.4.

DIMENSIONS



Values in mm

APPLICATIONS

Self-supporting profile for façade and roofing
Corner trim
Crowning trim
Ridge trim
Saw toothed trim
Canopies

MECHANICAL PROPERTIES

Yield strength>240 N/mm2
Quality base material S280GD
Tensile strength=(370,480) N/mm2
Modulus of elasticity= 210.000 N/mm2
Minimum Tensile Lengthening 25%

EFFECTIVE VALUES OF THE PROFILE

Thicknes mm	Weight Kg/mm^2	Inertia mm^4	Section (positive) mm^3	Section Modulus (negative) mm^3/m
0,5	4,97	137.173	4.071	3.937
0,6	5,97	172.265	5.186	4.842
0,7	6,96	208.516	6.338	5.764
0,75	7,46	226.991	6.922	6.232
0,8	7,96	245.402	7.512	6.701
1	9,95	308.598	9.359	8.594

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m² both sides)
Pre-lacquered steel Z-225 (225 gr/m² both sides)
Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.
Minimum Radius: 750 mm.

Colours:

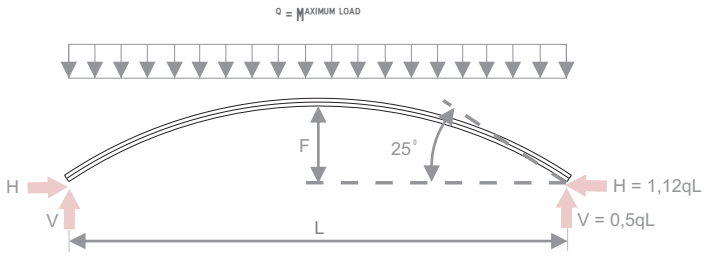
The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.

Perforated sheet:

Availability of perforated material for acoustic reduction applications

LOAD TABLES

L= span lenght
F= Rise
H= Horizontal shear
V= Vertical shear
Radius= L2/8F + F/2
Minimum radius = 750 mm.



		q = Maximum Loads (kp/m²) L = Span Lenght (m)													
		1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60	3,80	4,00	4,20
THICKNESS (mm)	0,50	199	173	156	144	136	130	126	123	121	119	117	115	112	109
	0,60	286	248	223	206	195	187	181	170	162	155	149	144	140	137
	0,70	375	326	293	271	255	239	220	206	196	187	180	175	170	165
	0,75	419	364	327	302	285	260	240	224	213	204	196	190	185	180
	0,80	464	403	363	335	312	281	259	243	230	220	212	206	200	195
	1,00	622	540	486	445	392	354	326	305	290	277	267	258	251	245
Radius (m)		1,90	2,13	2,37	2,61	2,84	3,08	3,32	3,55	3,79	4,03	4,26	4,50	4,74	4,97
F = Rise (mm)		177	199	221	243	266	288	310	332	354	376	399	421	443	465

		q = Maximum Loads (kp/m²) L = Span Lenght (m)													
		4,40	4,60	4,80	5,00	5,20	5,40	5,60	5,80	6,00	6,20	6,40	6,60	6,80	7,00
THICKNESS (mm)	0,50	106	104	101	98	95	91	88	84	80	75	71	67	64	62
	0,60	134	131	130	129	128	128	125	119	113	107	101	95	91	88
	0,70	162	159	157	156	155	154	154	152	148	140	132	124	118	110
	0,75	176	173	171	169	169	168	167	165	161	156	147	138	132	128
	0,80	191	187	185	183	182	182	181	179	175	169	162	153	146	139
	1,00	240	235	232	230	229	229	227	225	220	212	203	196	195	180
Radius (m)		5,21	5,45	5,68	5,92	6,16	6,39	6,63	6,87	7,10	7,34	7,58	7,81	8,05	8,29
F = Rise (mm)		487	509	532	554	576	598	620	642	665	687	709	731	753	775

It is recommended to consult with the Technical Department in order to clarify the loads shaded in grey.

NORMATIVE

Eurocode 3: "Design of Structures-Part 1-3 : General Rules-Supplementary rules for cold formed thin gauge members and sheeting".
NBE-EA-95-Parte 4 Cálculo de las piezas de chapa conformadas.
DIN 18800."Structural Steelwork".-Analysis of safety against buckling of linear members and frames".

CALCULUS NOTES

Load Combinations:
ULE:Total applied= 1,35*Permanent loads(including slab self weight) + 1,50*Live loads
ELS:Total applied= 1,00*Permanent loads (including slab self weight)+ 1,00* Live loads Maximum deflection < L/200

The calculation of the deflection arc fits a 25º angle from the base. The fixation of the profile must be made with two screws per hollow in each one of the supports. The manufacturer is not responsible for the failure to comply with the given values. Calculations made by the Teaching Staff of the School of Industrial Engineering, Cont. Medium Mech.&Theory of Structures Department, of the Polythecnic University of Valencia (UPV).

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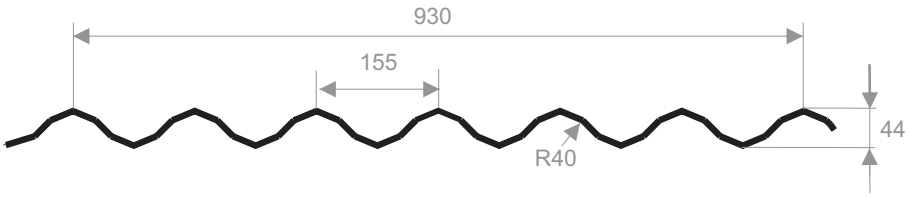
CURVED PROFILE
INCO 44.6. Corrugated

DIMENSIONS



Values in mm

APPLICATIONS

Self-supporting profile for façade and roofing
Corner trim
Crowning trim
Ridge trim
Saw toothed trim
Canopies

MECHANICAL PROPERTIES

Yield strength>240 N/mm2
Quality base material S280GD
Tensile strength=(370,480) N/mm2
Modulus of elasticity= 210.000 N/mm2
Minimum Tensile Lengthening 25%

EFFECTIVE VALUES OF THE PROFILE

Thickness mm	Weight Kg/mm^2	Inertia mm^4/m	Section Modulus mm^3
0,5	5,24	143.987	6.460
0,6	6,29	172.793	7.738
0,7	7,34	201.604	9.012
0,75	7,86	216.011	9.648
0,8	8,39	230.420	10.282
1	10,48	288.072	12.803

ALTERNATIVES AND MANUFACTURING CONDITIONS

Covering with Zinc:
Galvanized steel Z-275 (275 gr/m² both sides)
Pre-lacquered steel Z-225 (225 gr/m² both sides)
Special coatings:
High durability, Plastisol, PVDF. See finish chart.
These coatings can be on both sides only upon request.
Minimum Radius: 900 mm.

Colours:

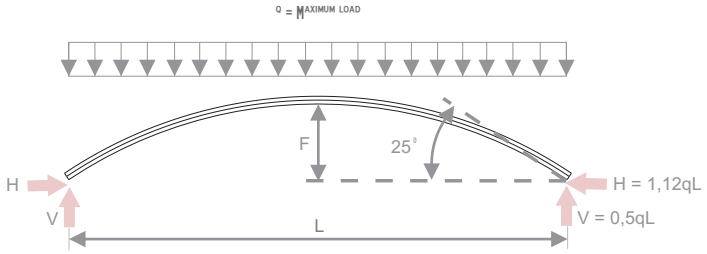
The colours are in accord with Aceralia colour chart. The RAL is also available under consultation.

Perforated sheet:

Availability of perforated material for acoustic reduction applications

LOAD TABLES

L= span lenght
F= Rise
H= Horizontal shear
V= Vertical shear
Radius= L2/8F + F/2
Minimum radius = 750 mm.



		q = Maximum Loads (kp/m²) Span (m)													
		1,60	1,80	2,00	2,20	2,40	2,60	2,80	3,00	3,20	3,40	3,60	3,80	4,00	4,20
WIDTH (mm)	0,50	199	173	156	144	136	130	126	123	121	119	117	115	112	109
	0,60	286	248	223	206	195	187	181	170	162	155	149	144	140	137
	0,70	375	326	293	271	255	239	220	206	196	187	180	175	170	165
	0,75	419	364	327	302	285	260	240	224	213	204	196	190	185	180
	0,80	464	403	363	335	312	281	259	243	230	220	212	206	200	195
	1,00	622	540	486	445	392	354	326	305	290	277	267	258	251	245
Radius (m)		1,90	2,13	2,37	2,61	2,84	3,08	3,32	3,55	3,79	4,03	4,26	4,50	4,74	4,97
F=Deflection(mm)		177	199	221	243	266	288	310	332	354	376	399	421	443	465

		q = Maximum Loads (kp/m²) L = Span (m)													
		4,40	4,60	4,80	5,00	5,20	5,40	5,60	5,80	6,00	6,20	6,40	6,60	6,80	7,00
WIDTH (mm)	0,50	106	104	101	98	95	91	88	84	80	75	71	67	64	62
	0,60	134	131	130	129	128	128	125	119	113	107	101	95	91	88
	0,70	162	159	157	156	155	154	154	152	148	140	132	124	118	110
	0,75	176	173	171	169	169	168	167	165	161	156	147	138	132	128
	0,80	191	187	185	183	182	182	181	179	175	169	162	153	146	139
	1,00	240	235	232	230	229	229	227	225	220	212	203	196	195	180
Radius (m)		5,21	5,45	5,68	5,92	6,16	6,39	6,63	6,87	7,10	7,34	7,58	7,81	8,05	8,29
F=Deflection(mm)		487	509	532	554	576	598	620	642	665	687	709	731	753	775

For the loads shown in grey, we recommend that you consult the Technical Department.

NORMATIVE

Eurocode 3: "Design of Structures-Part 1-3 : General Rules-Supplementary rules for cold formed thin gauge members and sheeting".
NBE-EA-95-Parte 4 Cálculo de las piezas de chapa conformadas.
DIN 18800."Structural Steelwork".-Analysis of safety against buckling of linear members and frames".

CALCULUS NOTES

Load Combinations:
ULE:Total applied= 1,35*Permanent loads(including slab self weight) + 1,50*Live loads
ELS:Total applied= 1,00*Permanent loads (including slab self weight)+ 1,00* Live loads Maximum deflection < L/200

The calculation of the deflection arc fits a 25º angle from the base. The fixation of the profile must be made with two screws per hollow in each one of the supports. The manufacturer is not responsible for the failure to comply with the given values. Calculations made by the Teaching Staff of the School of Industrial Engineering, Cont. Medium Mech.&Theory of Structures Department, of the Polythecnic University of Valencia (UPV).

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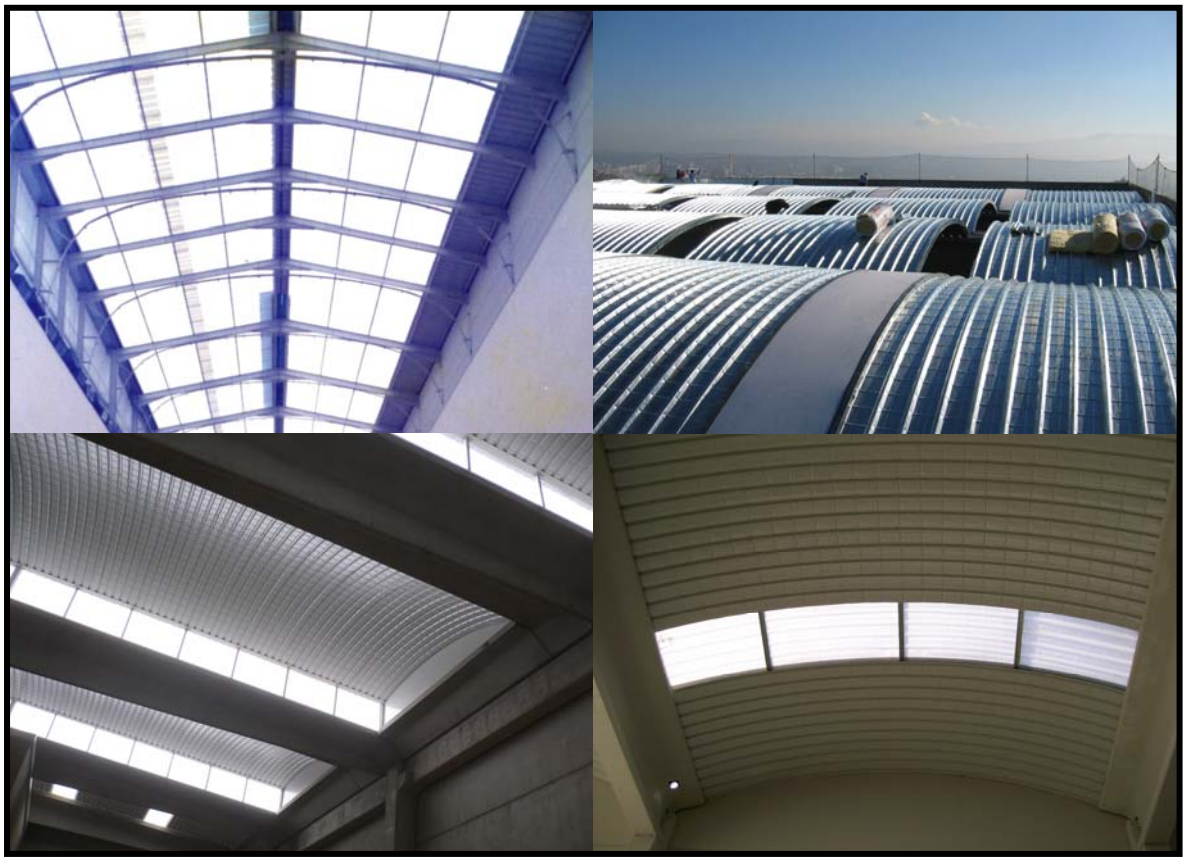
Apendix: Technical Specifications

Apendix: Technical Specifications



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