

TECHNICAL MANUAL

FLAT ROOF PANELS

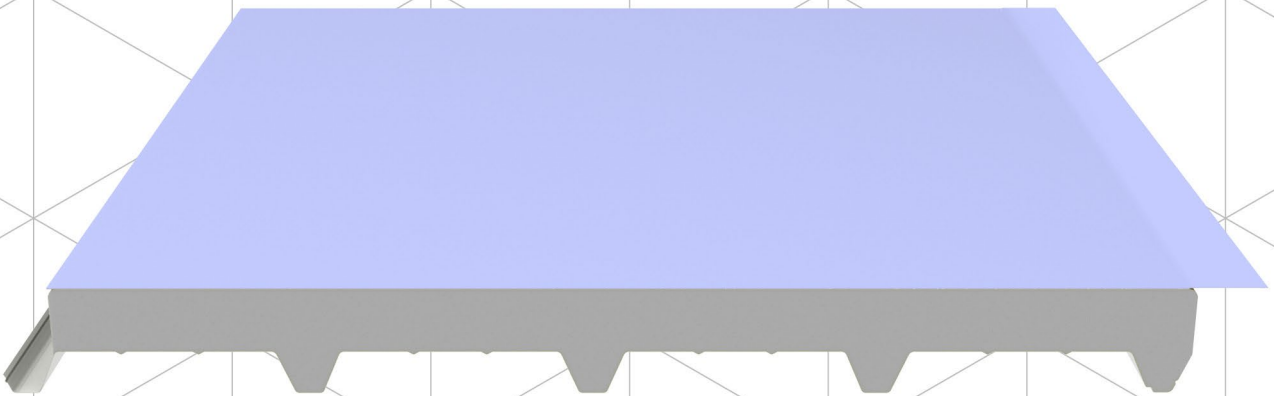


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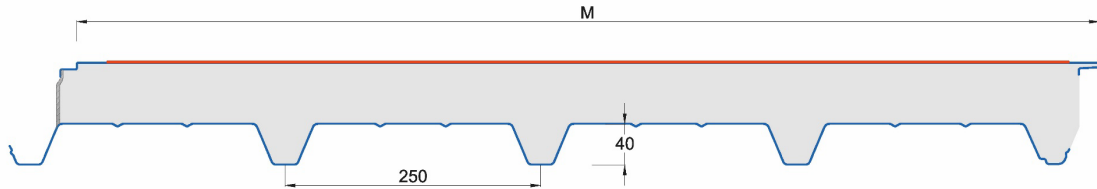
REFERENCE PRODUCTS

POLYURETHANE INSULATION		MINERAL WOOL INSULATION
DOUBLE SHEET METAL	SINGLE SHEET METAL	DOUBLE SHEET METAL
ISODECK PVSTEEL PU	ISODECK SYNTH	ISODECK PVSTEEL MW
		ISODECK PVSTEEL MW FONO

PRODUCT FEATURES

POLYURETHANE INSULATION - DOUBLE SHEET METAL

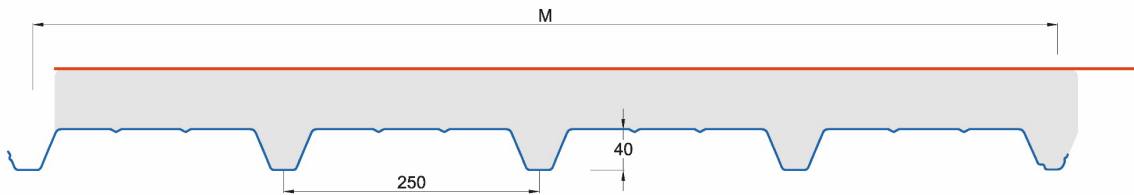
ISODECK PVSTEEL PU



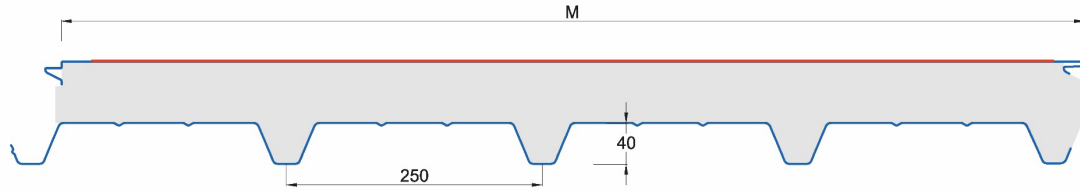
PITCH - MODULE (M)	1000mm
CORRUGATED PROFILE	Profile 5 ribs, height 40 mm
EXTERNAL FACING	Pre-painted sheet
INSULATION	Polyurethane foam (PUR) or Polyisocyanurate foam (PIR)
INTERNAL FACING	Pre-painted sheet

POLYURETHANE INSULATION - SINGLE SHEET METAL

ISODECK SYNTH



PITCH - MODULE (M)	1000mm
CORRUGATED PROFILE	Profile 5 ribs, height 40 mm
EXTERNAL FACING	Pre-painted sheet
INSULATION	Polyurethane foam (PUR) or Polyisocyanurate foam (PIR)
INTERNAL FACING	Pre-painted sheet

MINERAL WOOL INSULATION - DOUBLE SHEET METAL
ISODECK PVSTEEL MW - ISODECK PVSTEEL MW FONO


PANEL	ISODECK PVSTEELMW	ISODECK PVSTEEL MW FONO
PITCH - MODULE (M)	1000mm	
CORRUGATED PROFILE	Profile 5 ribs, height 40 mm	
EXTERNAL FACING	Pre-painted sheet	
INSULATION	Feldspathic rock mineral fibre wool	Feldspathic rock mineral fibre wool
INTERNAL FACING	Pre-painted sheet	Pre-painted sheet Microperforated

CHARACTERISTICS OF THE INSULATION LAYER

POLYURETHANE FOAM

The polyurethane foams used by Isopan can be:

- type PUR (Polyurethane)
- type PIR (Polyisocyanurate)

Please refer to Isopan's statements regarding the feasibility of each Product at the relevant Production Facility. Polyurethane foams for panel insulation are resistant to biological attack and do not promote the growth of mould and fungus. They are therefore inert and non-biodegradable materials, and their eventual disposal in landfills is therefore not a possible pollution factor.

Made with rigid polyurethane foam, having the following physical and mechanical features:

Compressive strength	≥ 0.11 MPa (AT 10% DEFORMATION)
Tensile strength	≥ 0.10 MPa
Shear strength	≥ 0.10 MPa
Thermal conductivity coefficient	λ = 0.022 W/mK
Operating temperature:	minimum - 40 °C; maximum + 80 °C
Foaming agent: N-Pentane in accordance with the Montreal protocol	
The 95% closed cells guarantee anhygroscopic structure	

MINERAL WOOL

Isopan uses mineral wool made from feldspathic rock fibres, with an average density of 100 kg/m³. The use of oriented fibres gives the product physical and mechanical strength

Made with rock wool with oriented fibres, having the following physical and mechanical features:

Incombustibility	Class A1 according to standard EN 13501
Average density	100 kg/m ³ ± 10%; other density values available on request
Melting temperature	> 1000 °C
Resistance to water/vapour penetration	μ = 1.4
Water absorption (long-term)	Wlp < 3 Kg/m ²
Specific heat capacity	cp = 840 J/kgK
Durability	class DUR2 according to standard EN 14509
Thermal conductivity coefficient	λ = 0.04 W/mK
Compressive strength	≥ 0.06 MPa (at 10% deformation)
Shear strength	≥ 0.05 MPa
Tensile Strength	≥ 0.04 MPa
Absence of fumes during insulating material combustion	

METAL FACINGS

Isopan uses metal facings of various types and thicknesses. The main types of metal cladding used in the production of sandwich panels and corrugated sheets are listed below:

- SENDZIMIR system hot dip galvanised steel by continuous process (UNI EN 10346) and pre-painted by means of a coil coating continuous process with different painting cycles based on end use (see: "Guide to Choosing Pre-painted") For stainless steel facings, one should take into account the possible appearance of flaws that are highlighted by such reflecting surfaces
- 3000 or 5000 series aluminium alloys with pre-painted finish with the cycles mentioned in the previous point, with a natural or embossed effect. In case of aluminium facings, these must be preferably applied on both sides: in fact, if different materials are used on the two sides, the panel may distort and bend due to the different thermal expansion coefficients of the faces..
- Stainless steel AISI 304, 2B finish, according to EN 10088-1.

Products in the FLAT ROOF range are supplied with a special metal coating pre-coupled with PVSTEEL Waterproof Synthetic Film. For more details, please refer to the appropriate section of this document.

Micro-perforated steel sheets (ISSODECK PVSTEEL MW FONO) – FOR INTERNAL USE ONLY

A layer of dustproof black glass fibres is placed between the perforated internal face and insulating core package to protect the inner side.

PROTECTION OF THE PRE-PAINTED FACES

All pre-painted metal facings are supplied with an adhesive polyethylene protective film that prevents damage to the paint layer. If the material is specifically requested without protective film, Isopan assumes no liability in case of damages to the paint. The protective film that covers the pre-painted panels must be completely removed during assembly and, in any case, within sixty days after the material preparation. It is also recommended not to expose the panels covered by a protective film to direct sunlight.

IMPERMEABLE SYNTHETIC FILMS

PVSTEEL-PVC TYPE PRE-COUPLED SHEET METAL

PVC coat (Polyvinyl Chloride with added plasticisers for high flexibility) developed for regions with high UV solar radiation. The single-layer membrane for roofs has an anti-UV facing for creating cold roofs with excellent performance. The membrane is able to reflect part of the solar radiation, thereby granting the building lower heat accumulation. This membrane is therefore able to represent a lasting investment with a low environmental impact.

PVSTEEL-TPO TYPE PRE-COUPLED SHEET METAL

Synthetic waterproofing membrane obtained via coextrusion of an elastomeric polyolefin based on polypropylene (TPO/FPA), resistant to ultraviolet rays and even. The membrane is made with contrasting colours between the upper and lower sides (signal layer) to allow for a visual check of its surface integrity during and after site installation stages. The coats comply with the requirements for CE marking, where required.

SYNTH-PVC SYNTHETIC COAT

Synthetic PVC coat, obtained by coating. Consisting of Plastisol with different chemical-physical properties and dimensionally stabilised. Coupled to non-woven polyester felt mat.

Produced in UNI EN ISO 9001:2000 (company quality system) and UNI EN ISO 14001 (environmental system) certified facility. Installation by skilled and experienced personnel (contact Isopan for information).

Characteristics

- High resistance to weathering and UV rays
- Absence of dimensional shrinkage
- Insensitivity to hot-cold cycles
- Resistance to piercing
- Possible RAL colour for landscaping or architectural purposes

SYNTH-TPO SYNTHETIC COAT

Synthetic waterproofing membrane obtained via coextrusion of an elastomeric polyolefin based on polypropylene (TPO/FPA), resistant to ultraviolet rays and even. The membrane is made with contrasting colours between the upper and lower sides (signal layer) to allow for a visual check of its surface integrity during and after site installation stages. The coats comply with the requirements for CE marking, where required.

ATTENTION: For welding and waterproofing of Isopan PVSTEEL-PVC and TPO synthetic blankets, please refer to the appropriate Annex in this document.

JOINT

The joint is the junction area in the tongue-and-groove combination between two panels; it represents a point where there is therefore discontinuity between two prefabricated elements. During the handling and installation of sandwich panels, care must be taken to safeguard the integrity of the joint on both the male and female sides of the panel to avoid compromising its technical and aesthetic functionality.

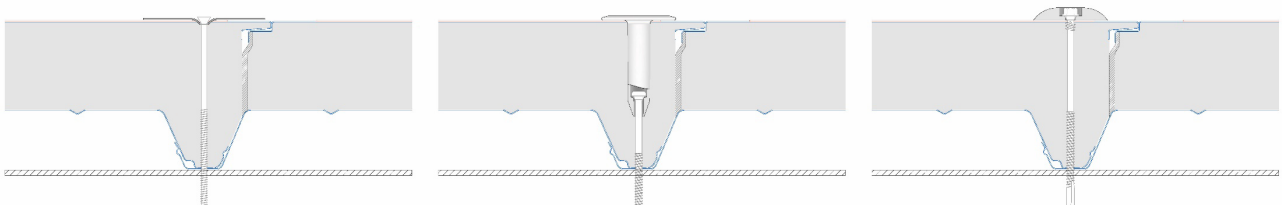
The functions of a correctly installed joint, considering the direction of installation and orientation of the outer and inner sides of the panel, are as follows:

- Ensure the correct consequential installation of sandwich panels;
- Avoid passage of water and air from the external environment to the internal environment, or at least minimise migration of liquids and air from one side of the wall/covering to the other;
- Minimise the risk of condensation forming on the inside of the building, or in any case on the protected side of the wall/covering surface;
- Ensure proper thermal insulation of the rooms enclosed by the panels.

Depending on the type of product, the joint can be made with different geometries and technologies. The joint closure may have factory tolerances, which can be found in the relevant section of this document.

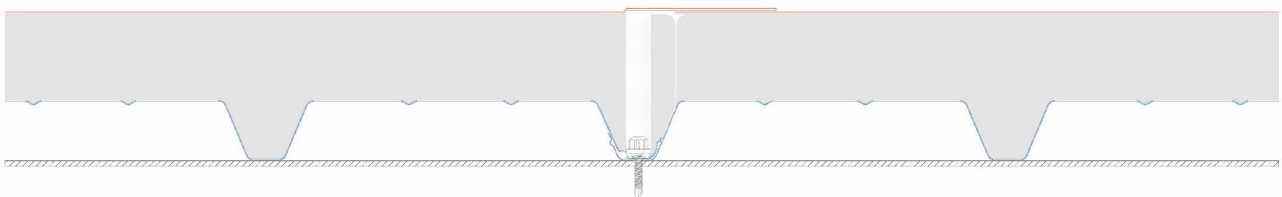
ISO DECK PVSteel

Coupling is performed at the joint rib. Waterproofing is carried out by heat sealing the bridging band according to the rules of good workmanship. Bridging is carried out with a 1.5mm-thick, variable width reinforced PVC/TPO band; the bridging band is heat-sealed for a width of 5 cm per side.



ISO DECK Synth

Coupling is performed at the joint rib. Waterproofing is assured by heat sealing according to the rules of good workmanship



The bridging strips and border sealing must be installed by heat welding, following the rules of art and instructions provided by Isopan in this document.

STANDARD GASKETS

Wool panels are produced without standard gaskets, as this could impair safety performance in the event of fire. Closure between adjacent panels during installation is ensured by the compression of the insulation layer, which is normally exerted during the joining of one panel to another.

The seal is only used as standard for ISO DECK PVSTEEL PU products.

FASTENING AND INSTALLATION

ASSEMBLY INSTRUCTIONS

PRELIMINARY OPERATIONS

- Verify that the supports are properly aligned. Please refer to the appropriate annex in this document.
- Pay particular attention to the contact points between the supports and the panel support sheets to avoid phenomena linked to electrochemical corrosion if incompatible metals are coupled. For this purpose, elastomer or expanded resin strips may be applied as separators.
- Ensure that the site area has appropriate storage and handling capacity in order to prevent material damage.
- Use suitable tools (toothed circular saw, jigsaw, shears, nibbler) for on-site cutting operations. The use of equipment that produces metallic sparks (e.g. abrasive discs, disc cutter) is strictly not recommended.
- Use suitable handling systems, particularly for long or heavy panels, in order to prevent safety risks on site and damage to the product.

Using acetic silicones is prohibited as they tend to attack the pre-painted galvanised sheet and form incipient oxidation. It is recommended to use single component sealant silicones with neutral curing that tend to harden due to the air humidity and, being free of solvents, do not attack the paint.

ASSEMBLY

- Lifting the panels at a height
- Install of the panels
- Check straightness of installed panels with respect to the structure and trace fastening positions.
- Preliminary fastening of panels in two points (e.g. head and tail)
- Perform the remaining fastenings on the previously made tracing
- Perform the sealing operation. In order to provide proper adhesion, the surfaces of the PVC/TPO coat must be cleaned and dry before sealing. Coats undergoing long periods of contact with water, snow or ice must be dried before sealing.
- **the panel is delivered with a protective film on the panel's flat side. Isopan recommends not removing the film until the end of the fastening and sealing operations, only lifting it in the points undergoing said operations.**

The panels must be installed opposite the direction of the prevailing winds, frequently checking to make sure they are parallel and aligned. The holes must have a smaller diameter than the fastening elements. The number of fastenings depends on the local climatic condition. The normal fastening density entails one on every other rib on central beams and one on every rib on terminal beams.

Note: care must be taken to ensure correct panel alignment during assembly (4 panels = 4000 mm ± 5 mm)

INSTALLATION OF FASTENINGS

The purpose of the fastening elements is to efficiently anchor the panel to the load-bearing structure; the type of fastening unit depends on the type of face. The number and position of the fastening elements must be assessed by an authorised designer, in order to guarantee resistance to the stress induced by dynamic loads, which can also exist in the event of depression.

The data and indications contained in this annex regarding the various types of fastenings are strictly without prejudice to the need for the customer to evaluate, independently, under their own exclusive responsibility and through a duly qualified designer, the number and type of fastenings gradually required based on the specific characteristics of the project and of the building on which the products of the Flat Roof Range must be installed

Isopan recommends only carrying out the fastening at the ribs.

Appropriately coated carbon steels or austenitic type stainless steels must be chosen as suitable materials to fasten panels. Pay particular attention to the compatibility of the steel and aluminium materials in order to prevent the formation of galvanic currents.

SCREWS: TYPES, LENGTH AND INSTALLATION

ISODECK PVSTEEL PU – ISODECK PVSTEEL MW

Fastening varies according to the design to be constructed and the panel application system at the construction site. Contact the Isopan Technical Department to make the right choice for the application.

Note: the correct length of the screw depends on the type of face (steel, wood). There are three ways to fastened the PVSteel panel:

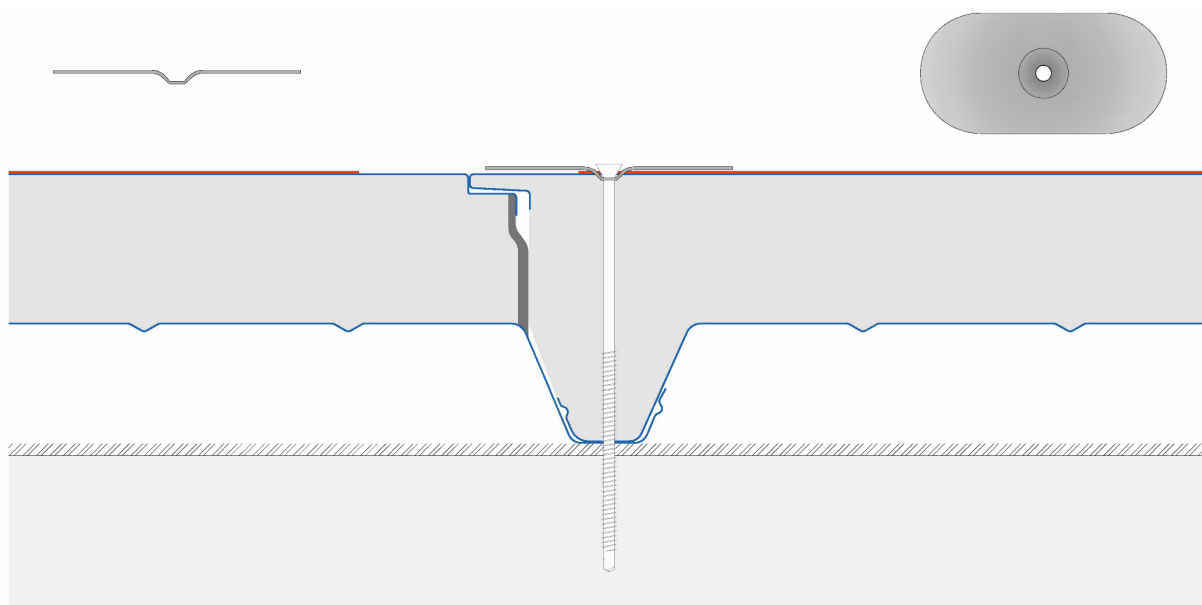
L (mm): Screw length;

T (mm): Nominal thickness of the panel

Fastening unit configuration	SCREW AND PLATE	SCREW AND SLEEVE	SCREW AND PLATE
RECOMMENDED TYPE OF SCREW	Flared head	Round head	Hexagonal head
Fastening on METAL structure (2mm)	L = S+70mm	-	-
Fastening on METAL structure (6mm)	-	-	-
Fastening on METAL structure (10mm)	-	-	L = S+70mm
Fastening on WOOD structure	L = S+80mm	-	L = S+80mm

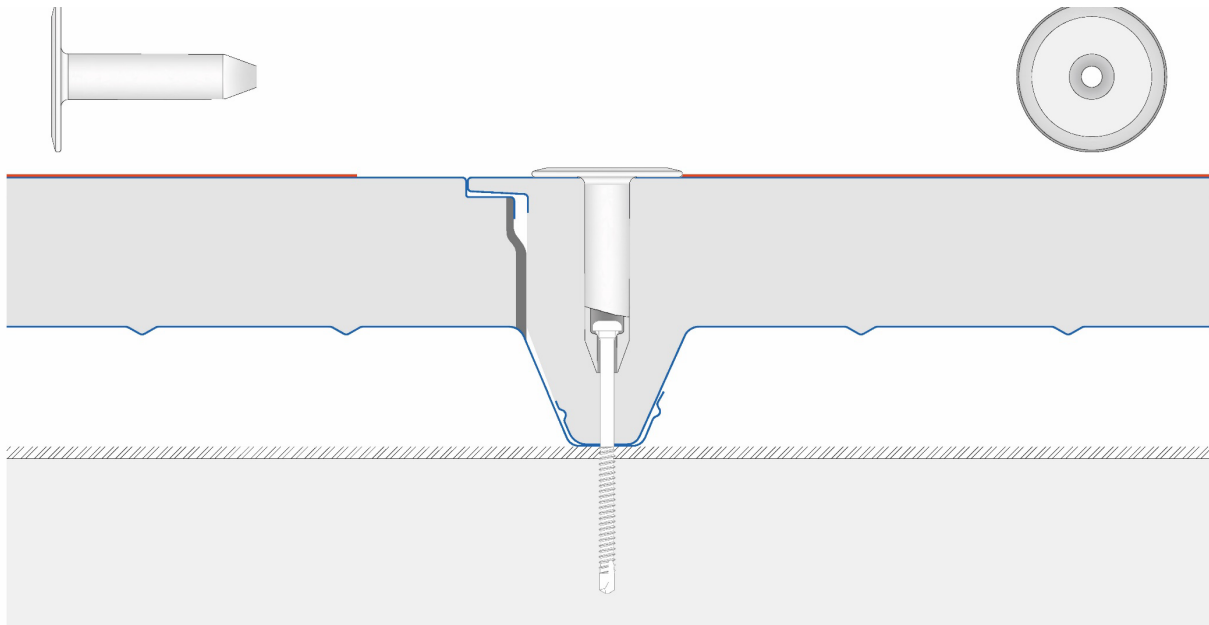
SCREW AND PLATE

Recommended for use on substructures with a thickness of approximately 2 mm. Isopan recommends the use of countersunk head screws.



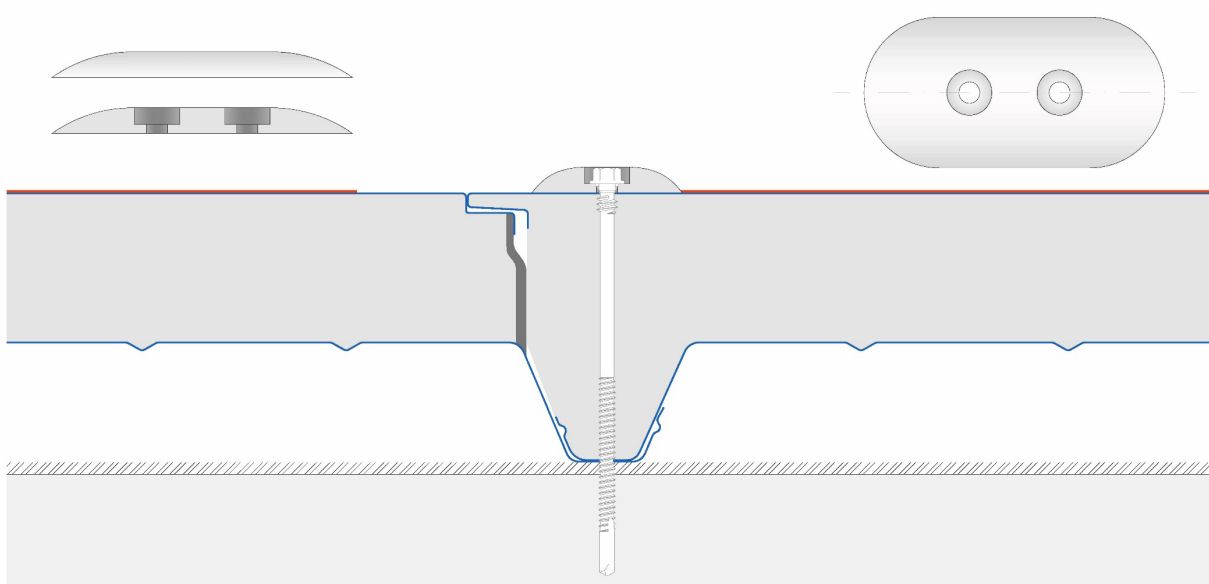
SCREW AND SLEEVE

Recommended for use on substructures with a thickness of approximately 6 mm. Before carrying out the fastening, it is required to pre-drill the external sheet and the insulating material in order to install the sleeve. Isopan recommends the use of short screws, to be positioned by using an extension.



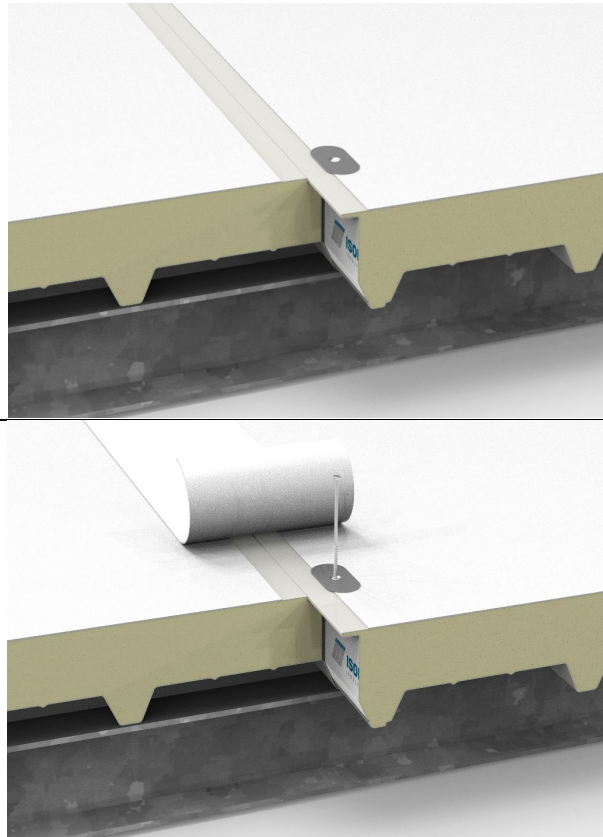
SCREW AND PLATE

Recommended for use on substructures with a thickness of approximately 10 mm. Isopan recommends the use of 5mm hexagonal head screws with double thread.



FASTENING SEQUENCE

1. Install the first panel
2. Install the second panel and couple it to the already installed first panel
3. Positioning of the metal plate or cap, where the overlapping rib rests on the metal substructure
4. Fasten by screw or screw and plate at the overlapping rib
5. Install the entire roof with panels according to the diagram described above
6. If necessary, apply an aluminium adhesive band at the joints, to temporarily waterproof the roof
7. Install the PVC/TPO bands
8. Seal the PVC/TPO bands for a width of 5 cm per side; sealing is performed by means of heat-sealing. This operation must be performed by skilled and experienced personnel.

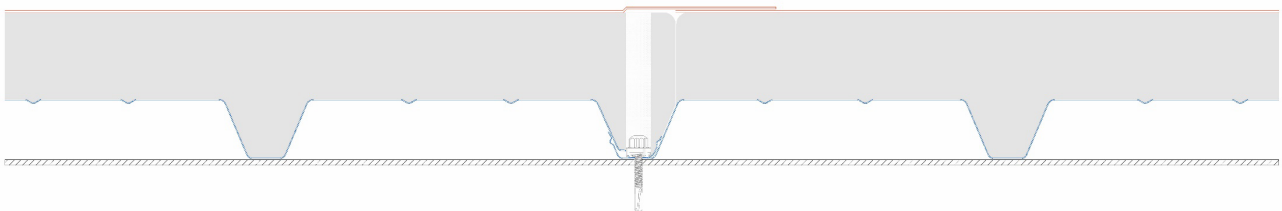


ISODECK PVSTEEL PU – ISODECK PVSTEEL MW

Fastening varies according to the design to be constructed and the panel application system at the construction site. Contact the Isopan Technical Department to make the right choice for the application.

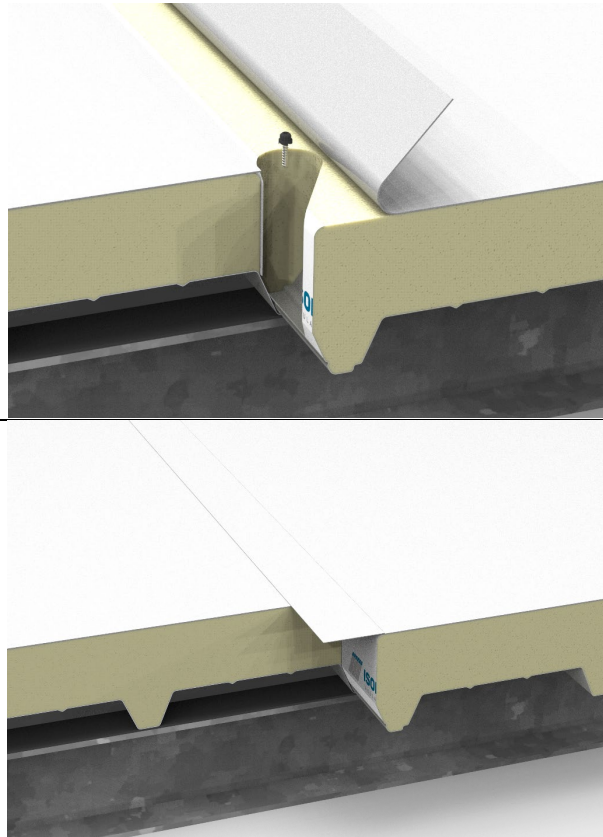
Note: the correct type of the screw depends on the type of face (steel, wood).

Isopan recommends the use of short self-locking screws, to be positioned by using an extension.



FASTENING SEQUENCE

1. Assemble the panels by means of the suitable joint rib (special attention should be paid to the integrity of the overlapping border)
2. Fasten by means of suitable screws supplied by Isopan. Fastening must be done at the joint (overlapping rib) of the panels, after lifting the overlapping border
3. Reposition the border and seal by means of the specific hot air blowers.



Note: Isopan suggests a distribution of the fastenings equal to no less than two screws per square metre, keeping in mind, in any case, the need for the customer to independently assess, through a qualified designer they trust, the number and type of fastenings required based on the specific characteristics of the project and of the building on which the products of the Flat Roof Range must be installed.

Joint sealing

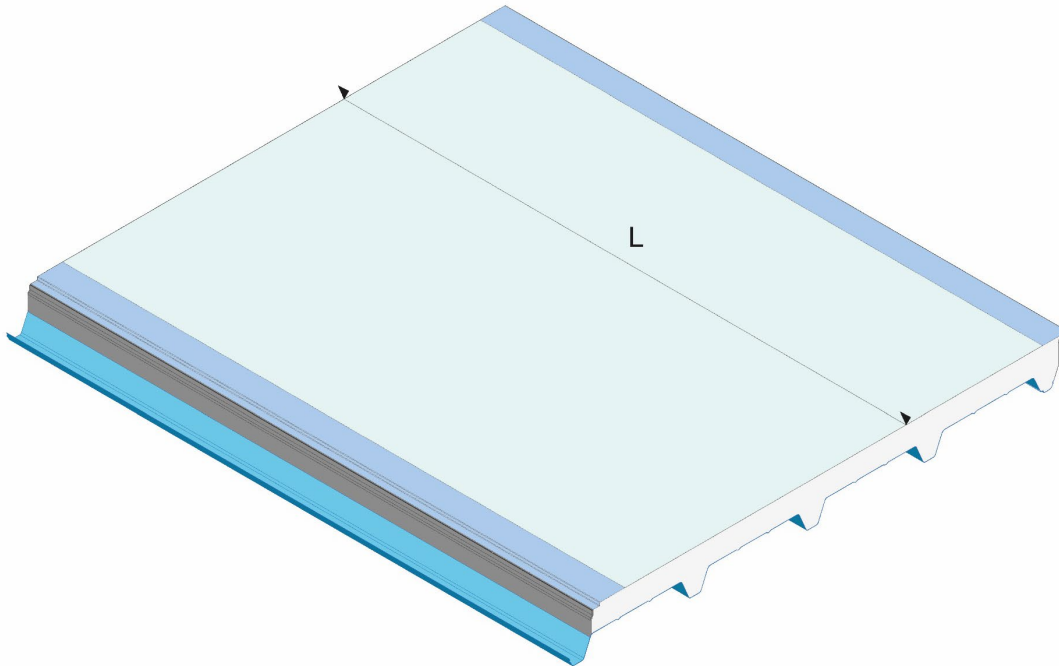
- 1) Dry and clean the areas involved in sealing
- 2) Automatic and manual sealing operations
- 3) Make any technical parts on site, such as expansion joints, downspouts, protruding bodies
- 4) Operations to check and test the coat tightness

These operations must be performed by skilled personnel adhering to the manufacturer's instructions.

Note: Isopan suggests a distribution of the fastenings equal to no less than two screws per square metre, keeping in mind, in any case, the need for the customer to independently assess, through a qualified designer they trust, the number and type of fastenings required based on the specific characteristics of the project and of the building on which the products of the Flat Roof Range must be installed.

DIMENSIONAL TOLERANCES

Dimensional tolerances are declared in accordance with EN 14509 – Annex D.



- Thickness of metal facings: in accordance with the reference product standards for the types of facings used.
 - T: Nominal panel thickness: $T \leq 100\text{mm} \pm 2\text{ mm}$; $T > 100\text{mm} \pm 2\%$
 - L: Panel length: $L \leq 3000\text{ mm} \pm 5\text{ mm}$; $L > 3000\text{ mm} \pm 10\text{ mm}$
 - M: useful width/ pitch/ module: $\pm 2\text{ mm}$
 - F: Coupling of the joint (inner side): $0+3\text{ mm}$
 - For the Isodeck PVSteel and Isodeck Synth the aesthetic appearance of the PVC/TPO lined sheet is not comparable to that of the pre-painted galvanised steel sheet. There might be small pressure marks that affect neither appearance nor roof functionality.
-

REFLECTANCE OF METAL SURFACES

Reflectance refers to the ratio of the intensity of globally reflected solar radiation to the intensity of incident radiation on a surface expressed in the form of a dimensionless parameter in the [0-1] or [0-100] scale.

High reflectance materials are suggested in order to avoid overheating of the building envelope surfaces, in order to limit the energy needs for summer air conditioning and to contain the internal room temperature. Prepainted metal surfaces in light colours (e.g. similar RAL9002, similar RAL9003, similar RAL9010, and white/grey colours) can positively influence reflectance values.

RESTRICTIONS OF USE

A thermohygroscopic check should be performed during the design stage. In certain conditions (e.g. high indoor humidity level) condensation can appear on the internal face of the panel with consequent dripping inside the building. If these conditions persist long enough, they can accelerate the natural degradation of the organic facing of the face itself.

Due to solar radiation, the external face of the panel can reach relatively high temperatures. In some cases, a temperature of 80-90 °C can be reached. A high temperature gradient can lead to panel buckling and wrinkling. The problem can be limited with an accurate design, taking into account the environmental conditions, length, colour of the panels and the number of fastening elements. (See the "Thermal expansion" section).

In view of the low aesthetic qualities of Isogrecata, Isovetro and Isodeck single skin metal faced panels, concealing them or using them in conditions with low aesthetic requirements is recommended.

WALKABILITY OF PANELS

The walkability of panels must be carefully analysed on a case-by-case basis by the designer, based on product characteristics (product thickness, sheet thickness, type of panel installed) and design characteristics (distance between supports, size of supports, site conditions).

According to Standard EN 14509, walkability means: resistance to concentrated loads, i.e. the ability of a sandwich panel to withstand non-permanent concentrated loads and occasional pedestrian access loads of operators for laying and fastening operations or maintenance (e.g. visual inspection of the state of the roof), as stated in point 5.2.3.2 of UNI EN 14509 and in accordance with test A.9.1 (Test of resistance to point concentrated loads) of the aforementioned standard. A panel is walkable if it is capable of bearing a concentrated load of 1.2KN placed in the centre of the panel as per standard UNI EN 14509:2007.

Some general notes regarding the walkability of the panels:

- If used for regular foot traffic or in work areas during installation, panels should be protected (e.g. with wooden boards); however, prolonged standing in the centre of the work area should be avoided.
- Only one person at a time must be allowed to walk on a panel during maintenance;

The above does not exempt from the obligation to carry out a proper risk assessment of access to the suspended ceiling and from the adoption of all consequently identified prevention and protection measures.

OVERHANGS AND PROJECTIONS

Cantilever assessment and verification must be carefully analysed on a case-by-case basis by the designer, based on product characteristics (product thickness, sheet thickness, type of panel installed) and design characteristics (length of cantilever, size of supports, site conditions, snow load).

In the case of overhangs and projections made with panels (in the absence of a load-bearing structure underneath them in the cantilevered part), it is a good idea to provide an appropriate maintenance plan to prevent accidental loads on the cantilevered part from becoming permanent (snow accumulation).

Mounting, fastening and design instructions according to UNI 10372 apply.

STATIC CHARACTERISTICS: LOADS AND SPANS

The resistance values refer to a panel assembled horizontally and subject to the action of a distributed load; the calculation method used by ISOPAN does not consider the thermal effects, which are verified by the designer. Depending on the weather conditions of the installation site and the colour of the external face, if the designer feels a detailed verification of the stresses caused by thermal actions and long-term effects is necessary, he/she should contact the ISOPAN Technical Office. The designer is still responsible for checking the fastening systems, based on their number and positioning.

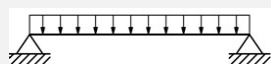
The indications contained in the following tables do not take into account the effects due to thermal load. Furthermore, the indicative values provided cannot replace the design calculations drawn up by a skilled technician, who must validate this information under the laws in force in the place of installation of the panels.

Below are some examples of indicative load bearing capacity tables:

ISODECK SYNTH

NOTE: The single skin metal faced panel can withstand its own weight by virtue of its materials and shape, and in case of a panel fastened to spaced structural supports, all applied loads (snow, wind, air pressure), and to transmit these loads to the supports, depending on the type of metal supports and their thickness. According to EN 14509, in single-sheet panels the insulation layer does not contribute to the static properties of the product; the stated data only take into account the static contribution of the metal sheet.

EVENLY DISTRIBUTED LOAD [kg/m ²]	INTERNAL STEEL SHEET				
	NOMINAL PANEL THICKNESS mm				
	0.5	0.6	0.7	0.8	1.0
	MAXIMUM SPAN cm				
60	245	260	275	290	315
80	220*	235	250	265	285
100	200*	220*	235	245	265
120	180*	200*	215*	230	250
140	165*	185*	200*	215*	235
160	155*	170*	185*	200*	225
180	145*	160*	175*	190*	215*
200	140*	155*	165*	180*	200*



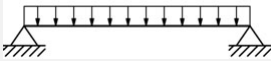
*Values with stress limitations.

EVENLY DISTRIBUTED LOAD [kg/m ²]	INTERNAL STEEL SHEET				
	NOMINAL PANEL THICKNESS mm				
	0.5	0.6	0.7	0.8	1.0
	MAXIMUM SPAN cm				
60	275	295	310	325	350
80	250*	270	285	295	320
100	220*	245*	260	275	295
120	200*	225*	240*	260	280
140	185*	205*	225*	240*	265
160	175*	195*	210*	225*	255
180	165*	180*	200*	210*	240*
200	155*	170*	185*	200*	225*



*Values with stress limitations.

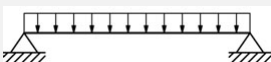
ISODECK PVSTEEL PU



0.6 mm STEEL INTERNAL SHEET - Simple support 120mm									
EVENLY DISTRIBUTED LOAD [kg/m ²]	NOMINAL PANEL THICKNESS mm								
	30	40	50	60	80	100	<i>120</i>	<i>150</i>	
	MAXIMUM SPAN cm								
80	305	335	385	405	485	495	520	580	
100	280	310	360	395	440	450	485	525	
120	250	290	325	360	410	425	450	485	
140	215	270	305	340	390	400	420	455	
160	185	245	300	310	360	370	405	435	
180	165	210	280	300	350	355	380	410	
200	150	185	235	295	320	340	365	400	
220	140	160	215	270	305	320	345	375	
250	115	140	180	225	295	305	325	355	

The values for the thicknesses 170 and 200 mm (in italics) are obtained considering a support width of 150 mm.

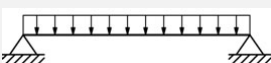
ISODECK PVSTEEL MW



0.6 mm STEEL INTERNAL SHEET - Simple support 120mm									
EVENLY DISTRIBUTED LOAD [kg/m ²]	NOMINAL PANEL THICKNESS mm								
	50	60	80	100	120	150	<i>170</i>	<i>200</i>	
	MAXIMUM SPAN cm								
80	265	285	325	340	375	420	585	595	
100	235	260	295	315	350	405	530	540	
120	225	235	270	285	315	360	475	480	
140	205	225	250	260	290	340	430	435	
160	190	205	235	250	270	315	395	400	
180	185	190	225	225	255	300	370	375	
200	170	185	215	215	240	275	340	345	
220	155	180	200	210	235	265	320	325	
250	140	155	185	195	215	250	295	300	

The values for the thicknesses 170 and 200 mm (in italics) are obtained considering a support width of 150 mm.

ISODECK PVSTEEL MW FONO



STEEL INTERNAL SHEET (microperforated) 0.6 mm - Simple support 120mm									
EVENLY DISTRIBUTED LOAD [kg/m ²]	NOMINAL PANEL THICKNESS mm								
	50	60	80	100	120	150	<i>170</i>	<i>200</i>	
	MAXIMUM SPAN cm								
80	265	285	325	340	375	420	-	-	
100	235	260	295	315	350	405	-	-	
120	225	235	270	285	315	360	-	-	
140	205	225	250	260	290	340	-	-	
160	190	205	235	250	270	315	-	-	
180	185	190	225	225	255	300	-	-	
200	170	185	215	215	240	275	-	-	
220	155	180	200	210	235	265	-	-	
250	140	155	185	195	215	250	-	-	



TRANSPORT, STORAGE, PACKAGING

Lorry loading

The packages of panels are loaded on lorries, usually two in width and three in height. The packages include polystyrene spacers at the base, which are thick enough to allow for the lifting straps.

The goods are arranged on the vehicles so as to ensure safe transportation and integrity of the material, in accordance with the requirements of the carrier, who is solely responsible for load integrity. Pay special attention to ensure the weight bearing on the bottom package, as well as the pressure exerted in the tying points, do not cause damage and the straps do not distort the shape of the product in any way.

Isopan assumes no liability for loading lorries that are already partially occupied by other materials, or that do not have a suitable loading floor.

Customers who will pick up the material must instruct the drivers accordingly.

Unloading with a crane

Use any type of crane equipped with a spreader beam and equipped straps. Isopan can advise customers on the choice of spreader beams and straps. By using correct lifting systems, the panels will not be damaged.

Never use chains or metal cables for lifting. As a general rule, sling the packages leaving about 1/4 of their length protruding from each end.

Lorry unloading with a forklift

If the lorries are unloaded using a forklift, the length of the packages and their possible bending should be taken into account in order to prevent damage to the bottom of the package.

The forks must be wide and long enough in order not to damage the product. When possible, protective material against surface abrasion and scratches should be applied between the fork and the package.

Indoor storage (Annex A)

The materials must be stored in ventilated indoor facilities that are free of dust and humidity and not subject to temperature changes.

Moisture that can penetrate (rain) or form (condensation) between two panels can damage the facings since it is particularly aggressive on metals and facings, with subsequent oxidation.

Pre-painted facings can be more exposed to the negative consequences of combined heat/humidity conditions.

Outdoor storage (Annex A)

If the packages and accessories are stored outdoors, the surface must absolutely be inclined longitudinally to prevent moisture from accumulating and to allow water run-off and natural air circulation.

If storage is not shortly followed by pick-up for installation, it is advisable to cover the packages with a protective tarp, assuring impermeability as well as adequate ventilation to prevent condensate from accumulating and puddles of water from forming.

Storage terms (Annex A)

Based on experience, in order to maintain original product performance, continuous indoor storage in closed and ventilated facilities should not exceed six months, while outdoor storage should never exceed sixty days from the date of production. These terms refer to the properly stored product, as instructed in the "storage" chapter in Annex A. However, the materials must always be protected against direct sunlight, as it may cause alterations.



In case of transport in containers, the products must be removed from them as soon as possible and, however, no later than 15 days from the loading date, to prevent deterioration of the metal supports and organic facings (e.g. blistering). Moisture inside the container must strictly be avoided. Upon customer request, Isopan can provide special packages that are more suitable for transport in containers.

PACKAGING

Isopan suggests carefully choosing the type of packaging depending on destination, type of transport, conditions and length of storage.

To choose the correct type of packaging, please refer to the "Packaging and Services" document on www.isopan.com.

DURABILITY

Product durability depends on the intrinsic features of the panel used in relation with its final use. The panel, including the features of the metal supports, must be chosen after the roof has been properly designed.

In this regard we recommend, if necessary, using the Isopan documentation, also available on the web (www.isopan.com), and/or the reference standards.

We recommend, especially for roof panels with metal facings in pre-painted galvanised steel, checking the roof pitch slope and other construction details in order to promote normal water drainage and prevent aggressive materials from accumulating, which would lead to premature oxidation.

In the event of roof pitches with longitudinal overlapping (panel overlap), we recommend paying special attention during installation to seal the sheets in order to prevent leaks or stagnation on the end part of the panel.

We recommend using accessories like ridge tinwork, caps and gaskets supplied by Isopan, as they are appropriately designed for the specific use of the manufactured products.

MAINTENANCE

All types of facings, including those made with metal sandwich panels, require maintenance.

The type and frequency of maintenance depend on the product used for the external facing (steel, aluminium); in any case, it is recommended to periodically inspect the building (at least once a year), in order to assess its conditions.

In order to maintain the aesthetic and physical properties of the elements and to extend the efficiency of the protective facing, it is also recommended to regularly clean the roof, paying special attention to the areas that could facilitate rain water stagnation, where substances that are harmful for the durability of the metal support may be concentrated.

If you notice any problems following an on-site inspection, you must act immediately in order to restore the initial general conditions (e.g. restoring the paint where there are local abrasions or scratches).

Upon customer request, Isopan can provide useful information to solve certain problems related to this.

SAFETY AND DISPOSAL

Pursuant to Directive 68/548/EEC the sandwich panel does not require labelling. To meet customer requirements, Isopan has drawn-up a "Technical details for safety" document, to be consulted for any kind of information related to safety.



Conclusion

Caution: all information contained in the product data sheets must be validated by a qualified technician according to the laws in force in the country where the panels are installed.

Technical specifications and features are not binding. Isopan reserves the right to make changes without prior notice; the latest documentation is available on our website www.Isopan.com. For whatever is not explicitly specified herein, please refer to the "General conditions of sale of the corrugated metal sheets, insulated metal panels and accessories". All the products that fall under the EN 14509 standard field of application are CE marked.

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Annex A – Loading, Unloading, Handling, Installation and Maintenance

LORRY UNLOADING WITH CRANE

For lifting, the packages must always be attached in at least two points. The distance between them must be no less than half the length of the packages.

Lifting should be possibly carried out using synthetic fibre straps (Nylon) no thinner than 10 cm, so that the load is distributed on the strap and does not cause distortion.

(see Figure 1)

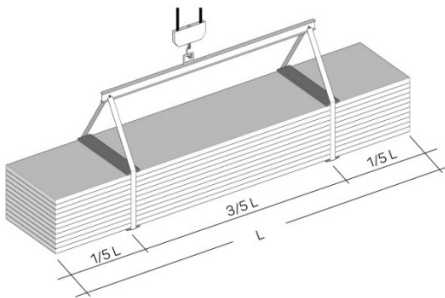


Figure 1

Suitable spacers must be placed under and above the package, made of sturdy solid wood or plastic elements to prevent the strap from coming into direct contact with the package.

These spacers must be at least 4 cm longer than the width of the package and be at least as wide as the strap.

Make sure that the straps and supports cannot move during lifting and that manoeuvres are performed cautiously.

LORRY UNLOADING WITH FORKLIFTS

If the lorries are unloaded with a forklift, take into account the length of the packages and their possible bending in order to avoid damaging the bottom of the package and/or to the extreme failure limit of the panels.

We recommend using forklifts that are suitable for handling panels and similar products.

STORAGE

The packages must always be kept off the ground both in the warehouse and, more so, at the construction site. They must have plastic foam supports with flat surfaces longer than the width of the panels and at a distance adequate to the features of the product.

The packages should preferably be stored in dry facilities to prevent stagnation of condensation water on inner, less ventilated elements, which is particularly aggressive on metals, resulting in the formation of oxidation.

The panels must be stored in dry ventilated facilities; should this not be possible, open the packages and ventilate the panels (spacing them from each other). If the panels remain packaged outdoors, the galvanised facing may oxidise (white rust) even after a few days, due to electrolytic corrosion.

The panels must be stored to facilitate water run-off, especially when it is necessary to temporarily store them outside (see Figure 2).

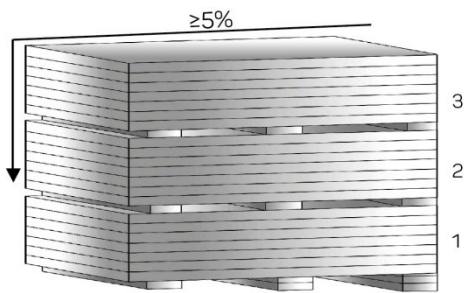


Figure 2

If storage is not shortly followed by pick-up for installation, it is advisable to cover the packages with protective tarps.

To maintain original product performance, continuous indoor storage in ventilated facilities should not exceed 6 months, while outdoor storage should never exceed 60 days.

Packages stored at a height must always be properly bound to the structure.

PRE-PAINTED FACES



In case of prolonged storage, the pre-painted products must be stored indoors or under a canopy. There is the risk that stagnant humidity may attack the paint layer, causing it to detach from the galvanised face. It is not advisable to let more than two weeks elapse from when the products were stored at the site.

In case of container transport, the products must be removed from the container within 15 days from the loading date in order to prevent the metal supports from deteriorating.

PANEL HANDLING

The panels must be handled using adequate protection equipment (accident-prevention shoes, gloves, overalls, etc.) in compliance with current regulations.

The individual element must always be manually handled by lifting the element without dragging it on the ground and turning it sideways beside the package; it must be transported by at least two people according to the length, keeping the element on its side. (see Figure 3)

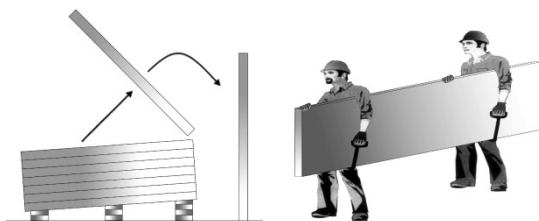


Figure 3

Handling equipment as well as gloves must be clean and such not to damage the items.

INSTALLATION

Panel installation personnel must be qualified and know the correct technique to perform the work in a workmanlike manner. If required, the seller can provide appropriate guidance and instructions.

Installation personnel must be equipped with footwear with soles that do not damage the external facing of the panel.

On-site cutting operations must be done with suitable tools (jigsaw, shears, nibbler, etc.).

We do not recommend using tools with abrasive discs.

To fasten the panels, it is advisable to use devices that can be provided by the seller.

Tighten the screws using a screwdriver with torque limitation.

For roofs with pitch elements without intermediate joints (overlaps), the slope is usually no less than 7%. For smaller slopes, adopt the seller's provisions.

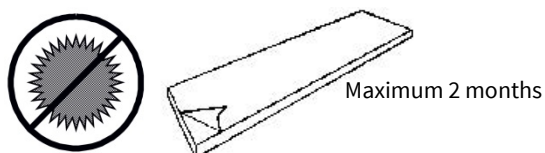
In case of head overlaps, the slope should take into account the type of joint and material used, as well as the specific environmental conditions.

During panel assembly and, in particular, in roofs, it is necessary to immediately remove all residual materials paying special attention to metal ones that may cause early deterioration of the metal supports by oxidising.

PROTECTIVE FILM

The pre-painted metal facings are supplied upon request with adhesive polyethylene protective film that prevents damage to the paint layer.

The protective film covering the pre-painted panels must be completely removed during assembly or, in any case, within 60 days from material preparation. It is also recommended not to expose the panels covered by a protective film to direct sunlight.



For panels expressly requested without protective film, special care is required during on-site handling and installation.

MAINTENANCE

The main routine maintenance operation is cleaning the panels. Panel surfaces that, following visual inspection, are found to be dirty or oxidised can be washed with soap and water using a soft brush. Cleaning water pressure can be applied up to 50 bar, but the jet must not be too close or perpendicular to the surfaces. Near the joints the water must be sprayed at a sufficient angle not to undermine their tightness.

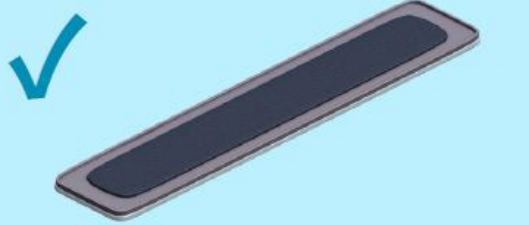
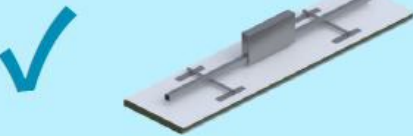
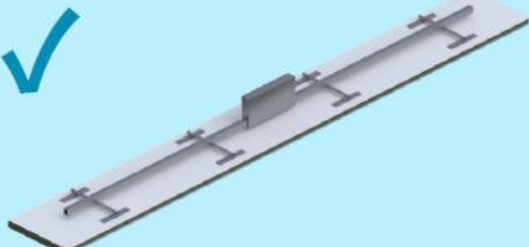
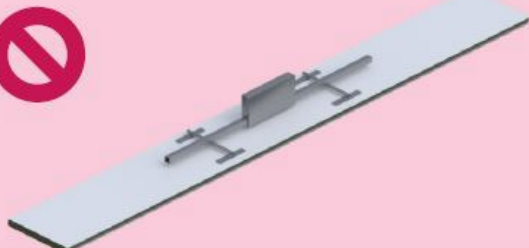
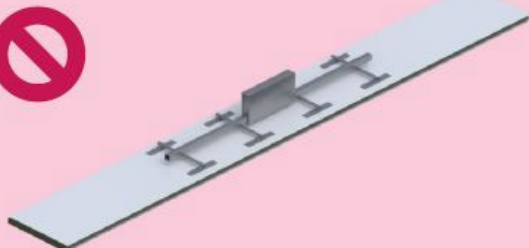
YEARLY CHECKS OF THE ISOPAN PANELS	
WHAT TO INSPECT	CORRECTIVE ACTIONS
Conditions of the pre-painted surfaces (cracks and colour unevenness)	Assess the condition of the surfaces Repaint where possible
Scratches and dents	Repaint and repair dents
Fastening screws	Remove a screw and check if oxidised Tighten the screws where necessary
Angular cut-edge parts	Check the state of oxidation Clean and repaint

These provisions are taken from the General Conditions of Sale.

Annex B – Suction cup lifters

In the event the panels are handled using suction cup lifters the operations must be carried out ensuring the panel is not deformed. The action of the suction cup on the sheet during lifting must be adequately redistributed taking into account the panel's length and weight.

To prevent excessive force by the suction cups from causing detachment of the sheet from the insulating core, Isopan recommends complying with the following restrictions:

<p>TO ENSURE THE FLATNESS OF THE METAL SHEET DURING THE AIR INTAKE YOU MUST PUT IN THE SUCTION PADS AN APPROPRIATE BUFFER STIFFENING</p>	
<p>AT LEAST 4 SUCTION PADS EQUALLY DISTRIBUTED FOR PANEL LENGTHS LOWER THAN 6 METERS</p>	
<p>AT LEAST 8 SUCTION PADS EQUALLY DISTRIBUTED FOR PANEL LENGTHS HIGHER THAN 6 METERS</p>	
<p>NOT ENOUGH SUCTION PADS</p>	
<p>SUCTION PADS NOT EQUALLY DISTRIBUTED</p>	

Annex C – Alignment of metal sub-structures

THE IMPORTANCE OF CORRECT STRUCTURE ALIGNMENT BEFORE THE ASSEMBLY AND FASTENING OF ISOPAN PANELS.

The sandwich panels are a constructive element that represents a sort of second skin that covers the structure and, as such, takes on all the level and/or aesthetic deviations in the metal sheets depending on the irregularities or misalignment of the supports on which they will have to be installed.

The metal elements may undergo static and dynamic stresses during their installation to which the effects of “thermal expansion” must inevitably be added, for example due to solar action on the outer surface of the metal sheet.

Precisely for this reason, installers must strictly check the alignment of the structures before proceeding with fastening: the supports on which the panels are fixed must be aligned, flat and free from obstructions, such as welding points, bolts and screws, as any variations may affect performance, the installation and final aesthetics.

All elements required to construct a structure are carefully designed by taking into account the production processes, the subsequent assembly operations and the technical requirements for the safety of the works.

The contractor must draw up an appropriate Assembly Method for each structure to ensure that the activities are carried out in complete safety, taking the requirements of the design documents into account. This document must be approved by the Site Manager and the Designer in order to certify that the Assembly Method does not decrease the quality level established for the structure. All structure assembly activities cannot be started before this document is viewed by the aforementioned designated people.

The following points must be included in this document, if relevant:

- position and type of connections of the structures to be carried out on site;
- maximum weights and dimensions of the elements to be assembled;
- assembly sequences;
- stability of the structure during assembly;
- conditions to remove temporary assembly braces;
- causes of risk during assembly;
- methods required to align the structures and their grouting;
- results from any pre-assembly activities;
- temporary constraints to be set to ensure stability before the welding operation on site, and to control any local deformations;
- identification of any overturning caused by the wind during assembly and indication of the method to counter them;

An integral part of the Assembly Method are the drawings that contain the plans, sections and elevations in adequate scale, the axes of the structures, the position of the supports and the assembly of the components, in addition to the permitted assembly tolerances.

The assembly of a metal structure follows rules of good practice, which are derived from the specific reference standard; first of all Eurocode 3 (EN 1993-1) - Design of steel structures, which is to be used alongside EN 1990 “Basis of structural design”, EN 1991 “Actions on structures”, EN 1090 “Execution of steel structures and aluminium structures- part 2 Technical requirement of steel structures” and lastly, in the Italian context, the Technical Standards for buildings updated to 2018.

During the construction process, it is good practice to ensure that each part of the structure is aligned immediately after assembly and that the final assembly is completed in the shortest time possible.

Permanent connections between components should not be made until the structure is aligned, levelled, plumb and subjected to temporary connections to ensure that the components do not move during subsequent construction or the subsequent alignment of the rest of the structure.

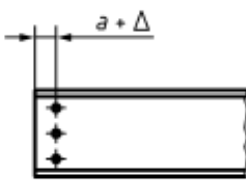
The basic operations to carry out an adequate vertical and horizontal alignment of all parts of the assembled structure involve the use of positioning templates, accurate three-dimensional surveys and partial or total pre-assembly. They can also be supported by the use of specific tools such as the laser spirit level.

Particular attention must be paid to which parts of the structure are not permanently distorted. Adjustments to the structure and the presence of gaps in connections can be resolved by the use of shims, which must be secured if they are in danger of loosening. Unless otherwise specified, they must be in flat steel and have a durability similar to that of the structure.

If the misalignment between the built components cannot be corrected with the use of shims, the components of the structure must be modified locally in accordance with the methods specified in the European standards, however the changes must not compromise the performance of the structure. This work can be performed on site.

To align the connections, the use of broaches is allowed as long as the hole elongation for the bolts does not exceed the values indicated in the tolerance tables of EN standard 1090.

Table B.8 Manufacturing tolerances- Holes for connecting elements, notches and cutting edges

No.	Criteria	Parameter	Essential Tolerances	Functional Tolerances	
			Deviation allowed Δ	Deviation allowed Δ	
2	Position of the holes for the connecting elements: 	Deviation Δ in the distance a between a single hole with diameter d_0 and a cut end: if $a < 3 d_0$ if $a \geq 3 d_0$	Class 1 and 2	Class 1	Class 2
			$-\Delta = 0$ (note the negative direction) $\Delta = \pm 3 \text{ mm}$	$-\Delta = 0$ $+\Delta = 3 \text{ mm}$ $\Delta = \pm 3 \text{ mm}$	$-\Delta = 0$ $+\Delta = 2 \text{ mm}$ $\Delta = \pm 2 \text{ mm}$

In any case, it is preferable to correct the misalignment via reaming, mechanical machining to slightly correct the axiality and diameter of the holes.

Steel shims can be used to correctly align the structure on the foundations. If levelling is carried out by means of levelling nuts, they must be chosen based on the fact that they keep the structure stable without affecting the performance of the anchor bolts.

The grouting of the base of the columns must not be carried out until a sufficient part of the structure has been aligned, levelled and braced.

The holes of the base plates of the columns for the anchor rods can have a larger diameter for adjustments, and it is required to use thick washers to be placed between the nuts and the base plate.

Each part of the structure must be aligned as soon as possible, without making permanent connections between the different components until enough parts of the structure have been levelled and connected temporarily.

ASSEMBLY TOLERANCES

EN 1090-2 covers some tolerances that should be complied with and not exceeded during assembly in order not to compromise the stability, resistance and alignment of the structure.

These tolerances are classified as “essential” which, if not complied with, may compromise the stability of the structure, and “functional”, which, on the other hand, refer to the installation and aesthetics of the latter.

The latter are divided into two classes, 1 and 2, with more restrictive requirements switching from the first to the second. The contractor or designer must choose the most appropriate class for the type of structure for these tolerances.

These tolerances are provided in the following tables.

In a purely Italian context, there is an additional document to refer to regarding the design and construction of metal structures, the UX94 “Guide to the standard specifications for metal structures”. This document, provided by UNICMI (National Union of Industries operating in the Metal, Envelope and Door and Window industry) is a contractual document that describes the object of the supply and the services to be requested in order to obtain a good quality product. It also provides technical provisions that comply with the regulations and standards in force, and the procedures and methods to control the implementation activities in order to ensure achievement of the optimal level required;

The UX94 has been drawn up in compliance with the current Italian legislation but also with the technical reference standards, first of all EN 1090-2. However, as can be seen in the following examples, the document sometimes revises it in a more precautionary manner.

Standard EN 1090-2 for single-storey buildings, with reference to the global inclination on height (h), reports as tolerance in class 1, $h/300$, and in class 2, $h/500$, while UX94 defines them as not poorly precautionary as in the version compatible with the English standards, it indicates 5 mm, or $h/600$, as long as it is not higher than 25 mm.

An additional difference between the standard and this document concerns the positioning tolerance of the columns in the plan:

In this regard, *EN 1090-2* defines the tolerances in the table based on the centre distance of the columns and the reference class, while the UNICMI *UX94* defines this tolerance by setting it to 0.002% of the centre distance of the columns, a rule of good practice that is frequently inferred from company specifications, and more restrictive.

Regarding the functional tolerances on the verticality of columns in multi-storey buildings, on the other hand, both *EN 1090-2* and the *document* provided by UNICMI require a maximum of 50 mm on 10 floors, considering 4.5 m floors on the first floor and 3.5 m to the next floors.

The analyses carried out show that the requirements for correct structure alignment are supported by standardised criteria, such as for example what is provided in standard EN 1090-2. Should these rules be too permissive, it is good practice to follow the contents indicated in UX94 provided by UNICMI that revises it in a more cautionary manner, and aims to provide a dynamic guiding tool for professionals in light of standards of good practice, of European technology and C.E. marking.

In any case, both documents agree on the fundamental rules for the alignment of steel structures, functional for the subsequent fastening of the insulating panels, that is:

- Preliminary drafting of an appropriate Assembly Method, containing the assembly stages, the axiality of the structures and any assembly tolerances;
 - During construction, do not perform permanent connections between components until the structure is aligned, level and plumb;
 - Check verticality through the use of positioning templates, accurate three-dimensional surveys and partial or total pre-assembly, using specific tools such as the laser spirit level;
 - Correctly align the structure on the foundations through steel shims and levelling nuts, keeping the holes in the base plates of the columns for the anchor rods with an increased diameter for any adjustments;
 - Correct any adjustments to the structure and gaps in connections through the use of shims, or local changes such as the use of broaches or reaming;
 - Do not exceed the assembly tolerances set by EN 1090-2;
-



- Check that the supports on which the panels will be fixed are flat and free from obstructions, such as welding points, bolts and screws, as any variations may affect the performance, installation and final aesthetics of the product.



Table B.15 Construction Tolerances- Buildings

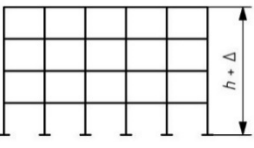
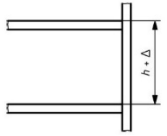
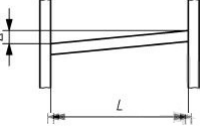
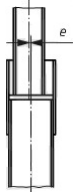
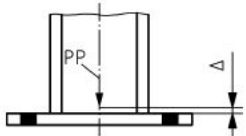
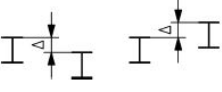
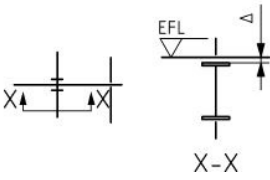
No.	Criteria	Parameter	Functional Tolerances	
			Deviation allowed Δ	
			Class 1	Class 2
1	Height 	Overall height with respect to the base level. $h \leq 20$ [m] 20 [m] < $h < 100$ [m] $h \geq 100$ [m]	$\Delta = \pm 20$ mm $\Delta = \pm 0.5 (h + 20)$ mm $\Delta = \pm 0.2 + (h + 200)$ mm	$\Delta = \pm 10$ mm $\Delta = \pm 0.25 (h + 20)$ mm $\Delta = \pm 0.1 + (h + 200)$ mm
2	Floor height 	Height with respect to adjacent levels	$\Delta = \pm 10$ mm	$\Delta = \pm 5$ mm
3	Slope 	Height with respect to the other end of the beam.	$\Delta = \pm L/500$ $ ma \Delta \leq 10$ mm	$\Delta = \pm L/1000$ $ ma \Delta \leq 5$ mm
4	Section of the column 	Eccentricity not foreseen and around one of the two axes	5 mm	3 mm
5	Base of the column 	Level of the bottom of the column well, relative to the specified level of its position point (PP).	$\Delta = \pm 5$ mm	$\Delta = \pm 5$ mm
6	Relevant levels 	Level of adjacent beams, measured at the corresponding ends.	$\Delta = \pm 10$ mm	$\Delta = \pm 5$ mm
7	Connection levels 	Beam level in a beam-to-column connection, measured against the established floor level (EFL)	$\Delta = \pm 10$ mm	$\Delta = \pm 5$ mm

Table B.16 Construction Tolerances- Beams in buildings

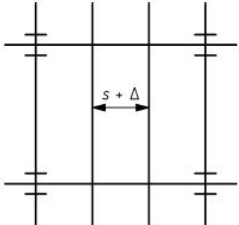
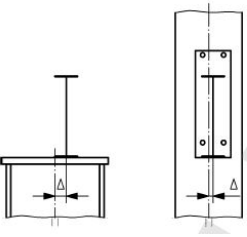
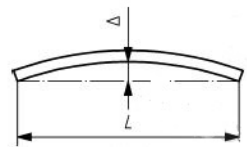
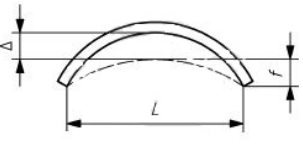
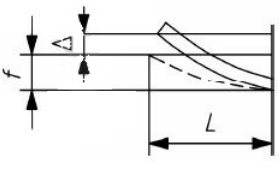
No.	Criteria	Parameter	Functional Tolerances Deviation allowed Δ	
			Class 1	Class 2
1	Spacing between the centre lines of the beam 	Deviation Δ of the predicted distance (s) between adjacent constructed beams, measured at each end.	$\Delta = \pm 10 \text{ mm}$	$\Delta = \pm 5 \text{ mm}$
2	Position on the columns 	Deviation Δ of the required distance of a measured beam-to-column connection with respect to the column.	$\Delta = \pm 5 \text{ mm}$	$\Delta = \pm 3 \text{ mm}$
3	Linearity in the plan 	Deviation Δ of the linearity of a constructed beam or of a length cantilever L	$\Delta = \pm L/500$	$\Delta = \pm L/1000$
4	Centring 	Mid-span deviation Δ with respect to the planned centring f of a constructed beam or of a truss element of length L	$\Delta = \pm L/300$	$\Delta = \pm L/500$
5	Cantilever presetting 	Deviation Δ of the presetting required at the end of a built cantilever of length L.	$\Delta = \pm L/200$	$\Delta = \pm L/300$

Table B.17 Construction Tolerances- Columns of single storey buildings

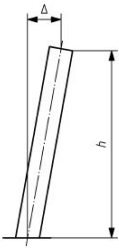
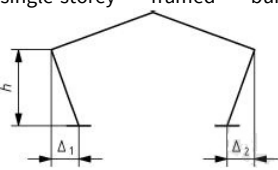
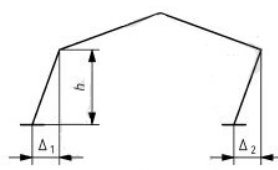
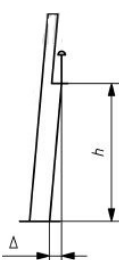
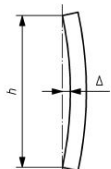
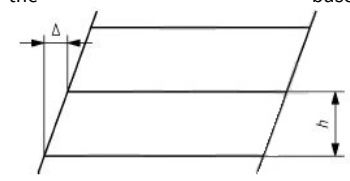
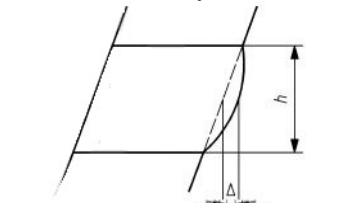
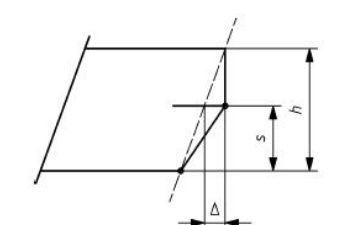
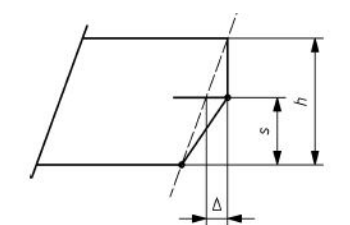
No.	Criteria	Parameter	Functional Tolerances	
			Deviation allowed Δ	
			Class 1	Class 2
1	Inclination of columns of single storey buildings 	Overall inclination in height h	$\Delta = \pm h/300$	$\Delta = \pm h/500$
2	Inclination of individual columns in single-storey framed buildings 	Inclination Δ of each column: $\Delta = \Delta_1$ or Δ_2	$\Delta = \pm h/150$	$\Delta = \pm h/300$
3	Inclination of in single-storey framed buildings 	Average inclination of all columns of the same structure. For two columns, the average is: $\Delta = (\Delta_1 + \Delta_2)/2$	$\Delta = \pm h/500$	$\Delta = \pm h/500$
4	Inclination of any column supporting a crane stand 	Inclination of the level of the floor to support the crane beam.	$\Delta = \pm 25$ mm	$\Delta = \pm 15$ mm
5	Linearity of a single-storey column 	Position of the column in the plan, in relation to a straight line between the top and bottom position points.	No requirement	No requirement

Table B.18 Construction Tolerances- Buildings with multiple floors

No.	Criteria	Parameter	Functional tolerances	
			Deviation allowed Δ	
			Class 1	Class 2
1	Position at floor level, no. of levels above the base, with respect to that of the base 	Position of the column in the plan, with respect to a vertical line that crosses its centre at the lowest level.	$\Delta = \pm \sum h / (300 \sqrt{n})$	$\Delta = \pm \sum h / (500 \sqrt{n})$
2	Inclination of the column between levels of adjacent floors 	Position of the column in the plan with respect to a vertical line that crosses its centre at the next lower level.	$\Delta = \pm h / 300$	$\Delta = \pm h / 500$
3	Linearity of a continuous column between levels of adjacent floors 	Position of the column in the plan in the joint, with respect to a straight line between the position points at adjacent storey levels	$\Delta = \pm h / 1000$	$\Delta = \pm h / 1000$
4	Inclination of any column supporting a crane stand 	Position of the column in the plan in the joint, with respect to a straight line between the position points at adjacent story levels	$\Delta = \pm s / 1000$ with $s \leq h/2$	$\Delta = \pm s / 1000$ with $s \leq h/2$



ANNEX D: PVC/TPO coat installation manual

FOREWORD

The instructions contained in this manual are to be considered only as general guidelines. Verify that products to be installed are indicated for the correct use and application for the case in question. In any case, the only person responsible for the installation of the products and any potential consequences is the installer and Isopan.

Contact Isopan's Technical Office for any information.

INTRODUCTION

This manual is intended to provide operating instructions and general guidelines for the correct installation of PVC/TPO coats covering the flat roof sandwich panels of the Isopan Flat Roof range. Namely, the construction of the bridging, i.e. the PVC/TPO coat strip at the joining of two adjacent panels, is covered. Furthermore, the ways to perform the fittings of the roof panels with elements typical of roof applications are described.

Flat roof panels of the Isopan Flat Roof range, with polyurethane or rock wool insulation, have a pre-glued PVC/TPO coat on the external sheet. By means of the bridging it is possible to create perfectly waterproof flat roofs, provided that this operation is carried out to a professional standard, as it aims to create continuity between the watertight coats, thus managing to prevent infiltration through the support joints between the various panels.

The bridging operation is therefore crucial for the correct construction of the flat roof, as the reduced slopes of the roof pitch do not allow a rapid water flow.

In the same way, attention must be paid when executing the various construction details of the roof, such as the joints of the waterproof coat with vertical facings (in sandwich or concrete panels), with waterspouts, gutters, ridge caps, tinworks, etc.



EQUIPMENT AND OPERATING PROCEDURES

EQUIPMENT

The following equipment is required for the correct installation of the overlaps and PVC/TPO coats:

<ul style="list-style-type: none"> Hot air manual welder (recommended model with temperature indicator) 	
<ul style="list-style-type: none"> 40 mm nozzle: main welds 20 mm nozzle: detail welds 20 mm elbow nozzle: detail welds 	
<ul style="list-style-type: none"> Silicone roller for PVC, width 28 mm Teflon roller for TPO, width 28mm Brass roller, width 6 mm 	
<ul style="list-style-type: none"> Chamfering tool, automatic Dremel or a manual one 	
<ul style="list-style-type: none"> Spark tester for non-destructive welding tests Hook for non-destructive welding tests Shears 	
<ul style="list-style-type: none"> Automatic single-nozzle hot air welding machine Automatic double-nozzle hot air welding machine 	
<ul style="list-style-type: none"> Synthetic coat cutter Nozzle cleaning brush 	

OVERLAP CLEANING AND PREPARATION PROCEDURE

In order to perform a correct welding, the PVC/TPO overlapping coat section must be clean and dry. Cleaning must be carried out as follows:

- Remove dust with a broom
- Clean with water and a brush
- Clean with a suitable non-aggressive solvent for PVC/TPO
- Wait for the complete drying and then proceed with the welding.

Do not rub or introduce dust or dirt inside the overlapping, as this may affect the continuity and strength of the weld. Apply the cleaning liquid to the surface and overlapping, remove dirt with a clean white cloth or paper.

The solvent-based detergent for cleaning the coats must be suitable for application on PVC/TPO, to avoid potential damage to the waterproof surface. We recommend using the detergent indicated by Isopan's Technical Office.

BRIDGING

The application of the **bridging** aims to create continuity between the waterproof coats of two panels placed side by side. This operation consists in positioning a suitably thick PVC/TPO strip and variable width to cover the overlap, at the level of the external sheet, of the tongue-and-groove joint of the panels.

During this operation, care must also be taken to cover the mechanical fastenings of the panels, which will be applied at the ends of the panel. The fastenings must be made only with systems that cannot damage the bridging. The bridging operation is therefore crucial for the correct construction of the flat roof, as the reduced slopes of the roof pitch do not allow a rapid water flow.

In the same way, attention must be paid when executing the various construction details of the roof, such as the joints of the waterproof coat with vertical facings (in sandwich or concrete panels), with waterspouts, gutters, ridge caps, tinworks, etc.



These mechanical fastening methods of the flat roof panels have been specifically developed to avoid damaging the PVC/TPO strip covering them, forming the bridging, and therefore are the most suitable ones for this type of application.

OVERLAP WELDING

MANUAL WELDING

- Before welding, make sure the overlaps are clean and dry.
- The minimum welding width of the covering strip on the pre-glued coat of the Isopan Flat Roof range must be 20 mm.
- Make sure that the welding nozzle is clean and that the leakage section is constant throughout its width.
- The welding temperature must be suitable to the operating and application conditions.
- PVC: the base welding temperature is 400/450 °C, with a speed of 1 m/min.
- TPO: the base welding temperature is 350 °C with 40 mm nozzle and 300°C with 20 mm nozzle, with a speed of 0.5 m/min.
- Carry out a welding test to identify the correct temperature with reference to the actual environmental and site conditions.
- Use the 20 mm nozzle for both main and detail linear welds.
- Make sure that the power cables are suitable in terms of diameter and length, in order to avoid voltage losses or safety risks and to maintain an ideal welding temperature.

WELDING SEQUENCE

SPOT WELDING: It consists of spot welding, required to install the coat.

Perform spot welding on the overlaps approx. every 400 mm. Spot welding must be carried out in the most internal part of the overlapping at no less than 80 mm from the edge of the upper coat. After welding the first end, pretension the bridging strip and proceed with its spot welding.



PRE-WELDING: This is a linear welding, backward in relation to the edge of the upper coat.

Weld the inner part of the overlapping along its entire length, leaving a free width towards the edge of the covering of 20 mm for final welding. Use the silicone (for PVC) or Teflon (for TPO) roller in a position parallel to that of the welding, with the welding machine nozzle in an orthogonal position.

The pressing roller must be fully resting on its entire width, and not placed at an angle.

Check the continuity of the pre-welding before proceeding with the final welding.



FINAL WELDING: It consists of welding of the edge of the upper coat on the lower one.

Position the nozzle at an angle of 45° in relation to the welding line. Use the pressure roller at an angle of 45° in the direction opposite the nozzle, positioned 10 mm further ahead than the current welding position. By using the roller, apply a light pressure on the upper part of the overlapping in a continuous and fluid manner, with an alternating forward-backward movement.



AUTOMATIC WELDING

- For automatic welding, it is possible to use the single-nozzle welding machine, or the double-nozzle welding machine, which allows both sides of the bridging strip to be welded simultaneously.



- The minimum welding width of the covering strip on the pre-glued PVC/TPO coat of the Isopan Flat Roof range panel must be 20 cm.
 - When using the automatic welder, make sure that it is positioned correctly and that the temperature is adjusted appropriately for welding the PVC/TPO coat. Check that the standard nozzle is clean and that the air flow is not obstructed.
 - PVC: the base welding temperature is 500/550°C, with a speed of 2÷3 m/min.
 - TPO: the base welding temperature is 450°C, with a speed of 2 m/min.
 - The base temperature and speed are affected by the environmental and climatic conditions on site, by the surface temperature of the coat, by the degree of humidity and the wind. Before starting welding operations, it is advisable to carry out a welding test by using two coat strips 2 m x 30 cm long. Check the quality of the welding thus carried out via the destructive method on page 65 and correct if required.
 - To ensure the correct sealing of the weld, prevent the automatic welding machine from moving on the fastenings.
-

TYPICAL CASES

In order to achieve a flat roof with panels from the Isopan Flat Roof range in a workmanlike manner, it is required to pay attention not only to their assembly, but also to other construction details. In this case continuity of the waterproof coat must be ensured, to guarantee the water tightness in all points where infiltrations may occur. This translates into the positioning of PVC/TPO sheaths covering the various elements that are located on the roof and welding them to the panels of the Isopan Flat Roof range.

These elements can be positioned by mechanical fastenings (screw and small plate) or via gluing.

The width of the weld between adjacent PVC/TPO coats must be at least 20 cm for glued or weighted systems

- 11 cm for mechanical fastening systems (risers and spandrels)

T-JOINT WELDING

T-joints are formed when coat overlaps overlap more than once.

On coats 1.5 mm thick or more, chamfer the step along the edge of the overlapping where the coats are welded together. This process prevents any risk of capillarity through the overlapping, allowing for the correct application of the outer coat. This procedure is carried out by using a specific automatic chamfering scraper (of the Dremel type) or a manual one.



Once the welding is completed, soften the cutting edge of the bridging strip by using the brass roller.



MECHANICAL FASTENING SYSTEM FOR VERTICAL SURFACES

For details such as vertical welts of external and internal perimeter walls of height over 50 cm, skylights, dormers, fan stands, etc. a mechanical fastening must be made to anchor the waterproof coat.

The quantity and centre distance of the fastenings must be defined according to their height from the ground, the location, the topography of the building and the surrounding area (wind calculation).

In any case the centre distance between the fastenings must not exceed 25 cm. The fastening lines must be placed 6 cm from the edge of the tarp. The overlap of the tarps must ensure the coverage of the fastenings, with a minimum width of 11 cm.

Manual welding must be carried out according to the procedure previously described: spot welding, pre-welding, final welding.



PERIMETER FASTENING

The coats must be mechanically fastened along all perimeters and openings with pre-drilled bars or small metal plates. The welts must be fixed to the base, on the horizontal or vertical surface.

Application of perimeter fastening is recommended along all perimeters and at all the interruptions and openings present in the roof, e.g. drain outlets, fans, chimneys, skylights, etc.

Leave 1 cm between the pre-drilled metal bars to ensure free thermal expansion. To protect the coat from any mechanical damage, the terminals of the metal profiles must be covered with a piece of coat.

Fastening with small plates is recommended around small elements, such as exhaust outlets, fans, pipe fittings, etc.



VERTICAL SURFACE GLUING

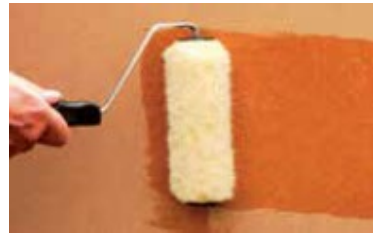
On internal and external perimeter welts, skylights, chimneys, plant footings, etc. the coats must be glued via a specific solvent-based contact adhesive.

The adhesive must be applied with a roller on the surface of the welts and of the coats. Once the solvents have evaporated, join the two surfaces to be glued together from the bottom to the top, taking care to avoid the formation of folds or bubbles on the waterproof coat, pressing with a suitably sized rubber roller, in order to obtain uniform adhesion.

Supports suitable for gluing: cement, wood, sheets (with previous thorough surface cleaning), tiles, etc. Do not glue on surfaces that tend to cause leakage of binders with consequent material chalking, such as expanded and extruded polystyrene, cellular concrete, bituminous coats in general, panels containing perlite, exposed rock wool, non-solvent-resistant materials, fibrous or wet surfaces, etc.

Do not apply the adhesive on the areas of the coat that must be welded. Should this happen accidentally, immediately remove the adhesive by using a suitable product, to prevent the welding from being carried out afterwards.

Fastening with adhesive is not suitable for a height greater than 300 mm. Beyond that, a mechanical fastening is recommended.



PREFABRICATED INTERNAL CORNER

Mechanically fasten the end of the roof coat with pre-punched metal profiles or small plates. The coat must be fixed to the welt base, on the horizontal or vertical surface.

Apply the profiles or small plates at a distance of 15 cm from the corner, to allow for easier corner welding.

Fold the excess coat in the corner at 45°, forming a pocket and weld the flaps together.

Weld the pocket to the roof coat.

glue or mechanically fasten the coat to the vertical welt.

To facilitate this operation, it may be useful to fold the coat beforehand in order to give it the required shape via the hot air welder and the roller, before applying the welt.

Fold the coat and cut the top up to 2 cm from the corner.

Place one flap of the coat below the other

Cut the edge, rounding it with the scissors, and flat weld it.



Perform pre-welding and check it before completing with the final welding.

Position the upper flap so that the edge has an inclination of about 45°, round the edge by using a pair of scissors.

Flat weld the upper flap.

Perform pre-welding and check it before completing with the final welding.

Position the prefabricated internal corner.

Starting from the centre of the corner towards the outside, perform spot welding and pre-welding, before completing with the final welding. Perform welding on both horizontal and vertical surfaces of the prefabricated corner.

Use the 20 mm nozzle and the small brass roller for uncomfortable positions.

Before welding, make sure that the coat and the prefabricated corner are clean.

If required, treat with a specific product, applied with a clean white cloth.



INSIDE CORNER WITH UPWARD FOLD

Mechanically fasten the end of the roof coat with pre-punched metal profiles or small plates. The coat must be fixed to the welt base, on the horizontal or vertical surface.

Apply the profiles or small plates at a distance of 105 cm from the corner, to allow for easier welding.

Fold the excess coat in the corner at 45°, forming a pocket and weld the flaps together. Weld the pocket to the roof coat.

Cut the coat for a length sufficient for the vertical welt, fold the coat on the lower edge beforehand to give it the required shape and facilitate installation, using the hot air welder and the roller.

Apply the contact adhesive on the vertical welt support and on the waterproof coat, taking care not to soil the surfaces to be welded with the adhesive.

Wait for the solvent to evaporate before joining the two surfaces to be glued together, taking care to avoid the formation of folds or bubbles on the waterproof coat.

Weld the vertical welt to the roofing coat. Perform spot-welding and pre-welding before completing the operation with the final welding.

Cut, round and apply the adjacent welt as previously described. On coats 1.5 mm thick and thicker, chamfer the step along the edge of the overlapping where the coats are welded together. This procedure is carried out by using a specific automatic chamfering scraper (e.g. Dremel) or a manual one.

Fold the excess coat and form a fold; weld the flaps together.

Fold the coat behind the opposite side. Draw a vertical line along the edge of the fold in line with the welded bottom corner, cut the excess material by using a pair of scissors, before welding in place.

Complete the corner with the thermal welding of the flap.

Do not apply the adhesive to the areas that must be welded. Should this happen accidentally, the adhesive must be immediately removed by using a suitable product, otherwise it will no longer be possible to carry out the welding.



EXTERNAL CORNER

External corner

Mechanically fasten the end of the roof coat with pre-punched metal profiles or small plates. The coat must be fixed to the welt base, on the horizontal or vertical surface. Apply the profiles or small plates at a distance of 150 cm from the corner, to allow for easier welding.

Cut the vertical welt of the coat to adapt it to the shape of the support. Cut the lower flap of the welt and open it at 90°.

Glue or mechanically fasten the coat on the vertical welt, fold the coat on the lower edge beforehand to give it the required shape and facilitate installation, using the hot air welder and the roller. Weld the vertical welt to the roof coat, perform spot welding and pre-welding, before completing the operation with the final welding.

Place a sufficiently wide coat section to cover the corner. Starting from the centre of the corner towards the outside, perform spot welding and pre-welding, before completing the operation with the final welding.

Use the 20 mm nozzle and the small brass roller for uncomfortable positions.



LINING OF PIPES AND DOWNPIPES

Cut a hole in the roof coat and insert the coat on the pipe.

If this operation is not possible, cut a suitably wide coat section, cut a hole in the centre having a diameter slightly smaller than that of the pipe in order to have sufficient material to perform the welding; round the corners by using a pair of scissors.

Heat the hole via the hot air welder, spread it with your hands and insert the piece on the pipe.



PREFABRICATED FACING

Insert the prefabricated facing onto the pipe, weld the base flange to the roof coat with hot air. Using the 20 mm nozzle, aim the facing as close as possible to the pipe, proceeding outwards to make the pre-welding and the final welding to the roof coat.

If upper access is not allowed or the pipe has a particular size, use a prefabricated facing of a larger diameter, cut it on one side and wrap it around the pipe and then close it again by welding with hot air. Weld the flange to the roof coat.

Apply a silicone mastic on top of the facing to seal the upper part.

Complete the detail by applying a stainless steel hose clamp.



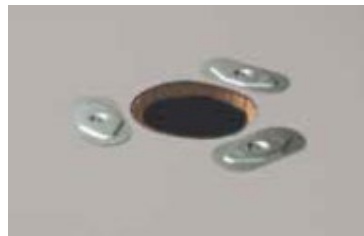
DRAIN OUTLET

Cut the roof coat at the drain waterspout.

Apply fastening plates to prevent movements due to the wind in the mechanically fastened systems.

Insert the prefabricated inlet into the waterspout.

Using the 20 mm nozzle, aim the facing as close as possible to the waterspout, proceeding outwards to make the pre-welding and the final welding to the roof coat.



EXISTING COAT WELDING

Existing coat welding

When applying a new coat to an existing one, e.g. for expansion operations, make sure that the existing coat is free of dirt and dust. This can be ensured by a washing it with pressurised water followed by a cleaning and preparation treatment, as indicated on page 46.

Once the coat is dry, use an automatic welding machine to weld the new coat to the existing one.



FASTENING BAR FOR ROOFING COMPLEMENTS (EXCLUSIVE FOR PVC)

In cases where the installation of walkways, photovoltaic systems and any other type of system above the flat roofs made with panels from the Isopan Flat Roof range is required, we recommend using the fastening bar for roofing accessories.

This is made of an aluminium core coated with a thick layer of PVC/TPO, thus combining the mechanical capacity properties to the waterproof membrane protection on which it is placed.

This roofing accessories bar is a multi-purpose connecting element that creates a fastening base for a wide range of systems, which can be installed on top of it using screws.

This system makes it possible to avoid puncturing the waterproof coat, as it is fastened to it by means of hot air welding, thus joining the base of the bar to the coat itself. This way the tightness of the roof is ensured by means of a simple but resistant fastening type.



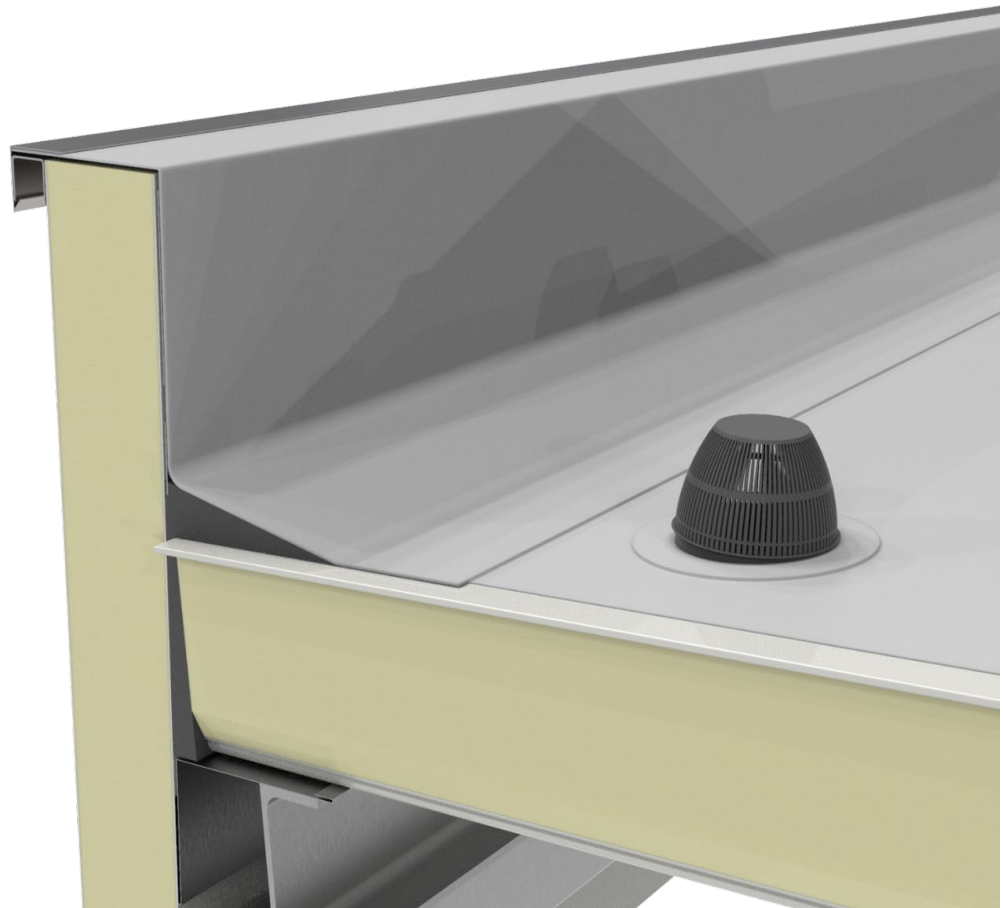
ROOF PANEL FITTING – VERTICAL SPANDREL

The vertical spandrel on the roof can be made up of Isopan wall panels, concrete structure, etc.

Waterproofing of the joining node between the roof panel and the spandrel must be ensured by applying a section of PVC/TPO coat. This must be fixed to the spandrel, along its vertical length, by means of mechanical fastenings or gluing and must be welded in its lower flap to the panel of the Isopan Flat Roof range and to the spandrel at the top. If the spandrel is made of concrete, this last welding cannot be carried out directly, but a pre-coupled flashing must be prepared, suitably anchored to the spandrel, on which the PVC/TPO coat can be welded.

When carrying out the connection, it is important to avoid excessively tight curvatures of the PVC/TPO coat, to prevent it from being damaged: in the case of perpendicular joining between the roof and the spandrel, place a strip of compressible material at the corner formed by the two, fasten it with spot gluing and place the PVC/TPO coat over it, which can then be installed with a softer curvature when forming the connection.

If other elements, such as drainage channels, gutters, waterspouts, pipes, etc. are placed between the roof panel and the spandrel, extend the PVC/TPO coat covering them, in order to obtain a continuous water seal through any unevenness encountered. Make sure that the PVC/TPO coat is always adherent to the surfaces to be covered, securing it via gluing or mechanical fastenings.



WELDING CHECK

NON-DESTRUCTIVE TESTING METHOD

The highest standard required that all the welds carried out are checked via the non-destructive testing method.

The check must be carried out when the welding has cooled, using a specific test hook. The hook is passed at the edge of the welded overlapping, applying a sufficient pressure, searching for any welding imperfections/unevenness.

If an imperfect weld is identified, follow the cleaning and preparation instructions on page 46 before resuming welding with the manual hot air welder. In extreme cases it may be required to apply a strip of new waterproof coat on the faulty weld. Overlap cleaning and preparation is also required in this case.

After cooling, carry out the check again with the test hook. To avoid mechanical damage to the waterproof coat, the test hook must have a rounded tip.

A further method of non-destructive testing of welding is the spark test. This is done using an instrument (Spark Tester) which, run along the welding line, detects any discontinuity points by emitting a small electric spark.



DESTRUCTIVE TESTING METHOD

Cut a strip of width 10 mm and length 150 mm from the welded overlapping. Pull both edges of the weld (peeling test) by applying a suitable force.

The welding is correct if the breakage occurs outside it, as indeed the weld must not yield.

When setting the daily welding parameters, it is recommended to perform test welds on strips at least 2000 mm long, to be checked with the destructive method as indicated above.



REPAIRS AND DAMAGE

It is easy to verify if the upper side of the coat, of a light grey colour, is damaged, since the lower side, being black (signal layer), is evident in case of damage.

The repair operation consists in applying a piece of coat that fully covers the damaged area. Mark the outline of the piece on the damaged roof coat.

Thoroughly clean the surface of the coat by using a clean white cloth and a specific cleaning product. Wait for the complete evaporation of the solvents and for the coat to fully dry.

Then proceed with welding of the new piece starting from the centre outwards, gradually checking the quality and continuity of the welding.

Do not rub/transport dust/dirt in the overlapping. Apply the cleaning liquid and remove dirt by using a clean cloth. Wait for the solvents to fully evaporate before carrying out the welding.



USE, CONTROL AND MAINTENANCE MANUAL

Roof access

Roof access must be allowed only to authorised personnel, trained and adequately informed on the hazards and risks present in the roof.

Roof access must always be carried out in complete safety, in compliance with all the accident prevention regulations required for by current legislation. To prevent falls from above, it is required to provide adequate collective protection devices (parapets, scaffolding, etc.) and/or personal protective equipment (PPE), such as anchorage points, lifelines, harnesses, etc.

All employees accessing the roof must be equipped with appropriate PPE in accordance with the operations to be carried out.

Practicability and walkability

Roofs made with panels from the Isopan Flat Roof range can be used and walked on only for the maintenance of the same or any systems present on the roof.

If systems that require periodic maintenance or cleaning are present on the roof, it is recommended to create walkways, in order to provide a safe and guided preferential path for all operators.

To walk directly on the waterproof coat it is required to be equipped with suitable footwear, for your own safety and to avoid damage to the coat itself. If using heavy-duty sole shoes we recommend, before walking on the coat, to always check the absence of gravel or other abrasive material accidentally present in the tread, in order to avoid the risk of abrasion or puncturing of the coat itself.

Pay the utmost attention and caution if accessing the roof in the presence of standing water, frost, or heavy rain, to avoid slipping.

Do not place anything heavy or sharp directly on the waterproof coat before setting up a special protection, support and distribution of the load, for example by means of wooden planks.

In case of ballasted roofs, the walkability/practicability depends on the type of ballast used, as shown below:

- gravel ballast: accessible only for maintenance of the roof and/or any machinery and systems present
- ballast in squares on supports (floating floor): accessible and walkable
- walkable flooring (cement substrate and finned tiles): accessible and walkable
- ballast with green roof: accessible, with both extensive and intensive green roofs.

Roof cleaning

If required, the waterproof coat can be washed with water and a non-aggressive, non-foaming household detergent. Apply the cleaning solution by using abrasive sponges, brushes, soft brooms, then rinse with running water. Do not use solvents or other aggressive products.

Systems and machinery

Technological systems and the machinery present in the roof must be suitably positioned on the roof and connected with the waterproof coat (bases, support beams, etc.).

The systems and the machinery must not be directly placed on the waterproof coat but on the bases with a support surface suitable for the correct distribution of the load, moreover they must be made of materials and shapes suitable for not damaging the waterproof coat and the panel itself.

Technological systems and machinery must not release or leak aggressive, polluting and harmful substances (liquids, solids or fumes), which may compromise the functionality of the insulating coat.

In case of maintenance on technological systems and machinery, all operations carried out on the roof must be performed with the utmost care not to damage the waterproof coat, suitable temporary protective operations must be conducted. Avoid spreading



substances or materials that may damage the waterproof coat on the roof. In case of accidental spillage or spreading, all the waste materials and/or percolation must be removed promptly and the waterproof coat must be properly cleaned. Use running water if required, always in compliance with the environmental safety regulations in force.

In case of doubt, contact the Installer Company, which will be able to provide information and support based on the needs of the case.

Presence of snow on the roof

The waterproof coats pre-glued to the panels of the Isopan Flat Roof range and the correctly made bridging strips have an excellent resistance to low temperatures, therefore, in general, the presence of snow directly above the roof does not cause any damage and does not require specific operations.

In special cases, however, it may be required to access the roof to free outlets, in order to promote the flow of water due to the melting of snow, or to verify that the thickness of the snow is not too high and reaches the upper level of skylights, aerators, chimneys and any other openings present on the roof, with the risk of overflow and infiltration, or if overload problems due to the capacity of the structure are present. In these situations it may be required to reduce the thickness of the snow layer on specific points or areas of the roof.

Access to the roof must always be carried out with the utmost care and caution, using appropriate personal and collective PPE, taking into account the greater difficulty due to the presence of snow.

Snow removal must be carried out with manual tools that cannot damage the waterproof coat and/or the layers of ballast and the flooring. Do not use spades and metal shovels, rather use plastic blades with rounded edges. Remove the surface layers of snow, avoiding removing the lower layers directly in contact with the waterproof coat and/or the ballast layers and the flooring, in order to avoid accidental mechanical damage.

Repair and/or modification operations of the waterproof coat

In case of accidental damage to the waterproof coat, do not perform improper repairs, always contact the Specialised waterproofing Company. Do not apply bitumen-based membrane pieces (improper repair) on waterproofing coats.

In case of extreme necessity and urgency it is possible to carry out simple and fast repairs by using mono-adhesive butyl tape with aluminium laminate, after cleaning the waterproof coat with water. These operations are to be considered an emergency and temporary, of limited duration over time, subsequently it will be required to always contact the Specialised waterproofing Company that can carry out a compliant and lasting repair operation. In case of modification or expansion of the waterproof coat (e.g. new chimneys, modification of systems, etc.), do not carry out improper operations, always contact the Specialised waterproofing Company beforehand.

Periodic checking and cleaning operations on the waterproof coat

In order to ensure the full functionality and performance maintenance of the waterproof system over time, periodic checks and cleaning of the roof are required. These operations are summarised in the list below, divided between:

- General checks
- Specific checks

It is possible that, depending on the specific case, other types of check and cleaning/maintenance, or a higher frequency, may also be useful and required; The Designer and the specialist must therefore adequately integrate our suggestions.

General checking operations must be carried out by the owner of the building, or by the specialised company through the stipulation of a control and maintenance contract.

General checks	Frequency	Notes
Cleaning of the leaf guards and outlets	Half yearly	To prevent clogging and limiting or compromising the functionality of the drains
Cleaning and removing any dirt (earth, sand, etc.) on the roof and on the waterproof coat	Half yearly	To avoid creating a breeding ground for vegetation or micro-organisms
Cleaning and removing any debris or waste on the roof	As required	To prevent improper materials and waste from damaging the waterproof coat
General visual check of the roof and of the elements installed above in search of any obvious anomalies (waterproofing, skylights, systems, etc.)	Half yearly	To ensure timely reporting of any anomalies to the relevant figures
Cleaning and removal of any vegetation grown on the roof	Half yearly	PVC/TPO coats are resistant to roots, but it is good practice to prevent the growth and proliferation of vegetation

Specialised checking operations must be delegated to a specialised company through the stipulation of a checking and maintenance contract.

Specific checks	Frequency	Notes
Visual inspection of ridges and metal tinworks	Yearly	Checking the fastenings, the sealing, the presence of corrosion
Visual inspection of silicone seals	Yearly	Checking the sealing and adhesion
Visual inspection of the waterproof coat, details and accessories connected to it	Yearly	Searching for any anomalies that may limit or compromise its functionality
Visual check on the intrados of the roof floor	Yearly	Searching for any traces of infiltration or other anomalies

The checks carried out must be recorded on appropriate forms, showing the result, the date of the inspection and that of the next planned inspection.

ANNEX E: FASTENINGS

The data and indications contained in this annex regarding the various types of fastenings are strictly without prejudice to the need for the customer to evaluate, independently, under their own exclusive responsibility and through a duly qualified designer, the number and type of fastenings gradually required based on the specific characteristics of the project and of the building on which the products of the Flat Roof Range must be installed

DISTRIBUTION PLATE HTV 82/40 TK

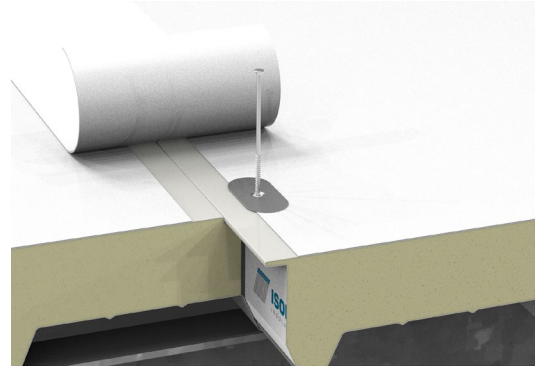
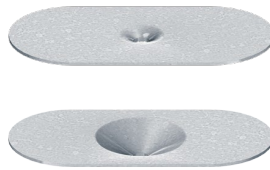
HTV 82/40

For metal substructure up to 2 mm thick

In combination with screw

DABO TKR - 4.8xL

DABO TKE - 4.8xL



EcoTek SLEEVE

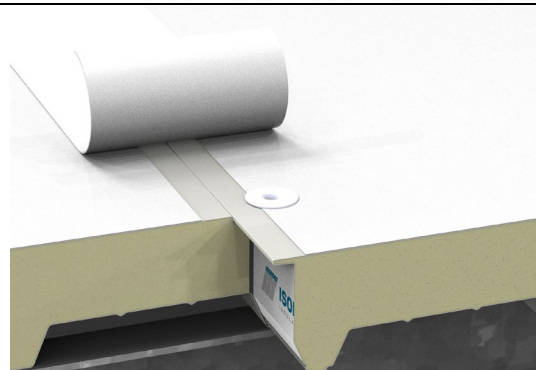
For metal substructure up to 6 mm thick

In combination with screw

FBS-R 6.3xL

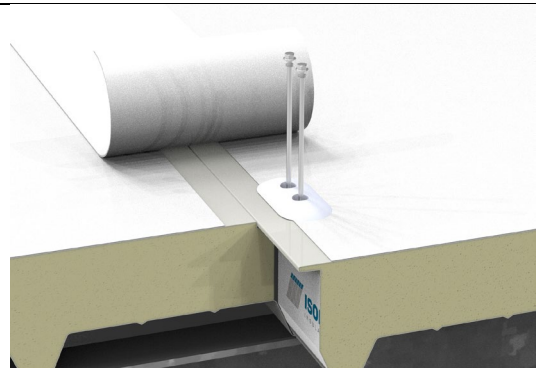
DABO TKR - 4.8xL

DABO TKE - 4.8xL



PLATE

For metal substructure up to 10 mm thick



DISTRIBUTION PLATE

HTV 82/40 TK with DABO TKR - 4,8xL

No. EJOT 3-009-070013-2013

Washer with drillscrews for fastening roof membranes

Characteristic Values of Axial Load Resistance

Metalsheet, S280GD – EN 10346 $t_{min} = 0.75 \text{ mm} = 1.06 \text{ kN}$

Structural timber, EN 338/ C24, $t \geq 25 \text{ mm} = 1.42 \text{ kN}$

Plywood, EN 12369-2, $t \geq 21 \text{ mm} = 1.70 \text{ kN}$

OSB/3, EN12369-1, $t \geq 18 \text{ mm} = 1.08 \text{ kN}$

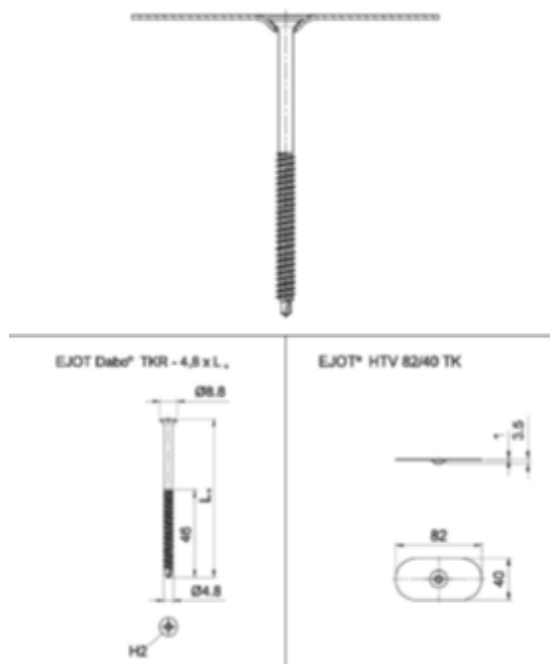
Mean Values of Axial Load Resistance

Metalsheet, S280GD – EN 10346 $t_{min} = 0.75 \text{ mm} = 1.28 \text{ kN}$

Structural timber, EN 338/ C24, $t \geq 25 \text{ mm} = 3.07 \text{ kN}$

Plywood, EN 12369-2, $t \geq 21 \text{ mm} = 3.14 \text{ kN}$

OSB/3, EN12369-1, $t \geq 18 \text{ mm} = 2.04 \text{ kN}$



HTV 82/40 TK with DABO TKE - 4,8xL

Nr. EJOT 3-010-070013-2013

Washer with drillscrews for fastening roof membranes

Characteristic Values of Axial Load Resistance

Metalsheet, S280GD – EN 10346 $t_{min} = 0.75 \text{ mm} = 1.06 \text{ kN}$

Structural timber, EN 338/ C24, $t \geq 25 \text{ mm} = 1.42 \text{ kN}$

Plywood, EN 12369-2, $t \geq 21 \text{ mm} = 1.70 \text{ kN}$

OSB/3, EN12369-1, $t \geq 18 \text{ mm} = 1.08 \text{ kN}$

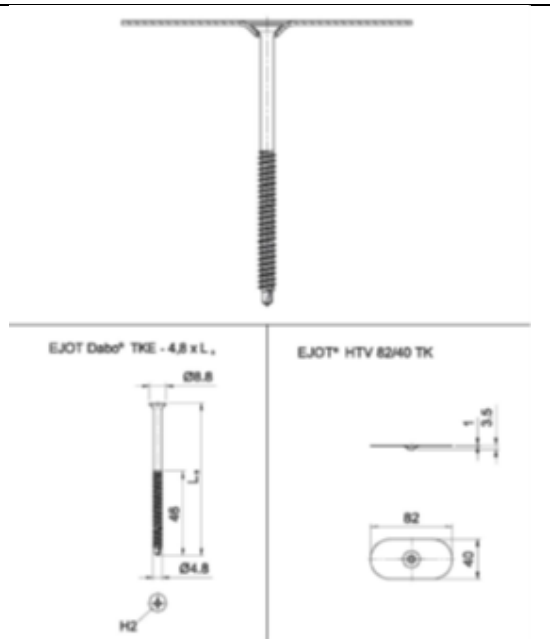
Mean Values of Axial Load Resistance

Metalsheet, S280GD – EN 10346 $t_{min} = 0.75 \text{ mm} = 1.28 \text{ kN}$

Structural timber, EN 338/ C24, $t \geq 25 \text{ mm} = 3.07 \text{ kN}$

Plywood, EN 12369-2, $t \geq 21 \text{ mm} = 3.14 \text{ kN}$

OSB/3, EN12369-1, $t \geq 18 \text{ mm} = 2.04 \text{ kN}$



MANICOTTO

EcoTek 50xL with FBS-R 6,3xL

Nr. EJOT 3-023-070013-2013

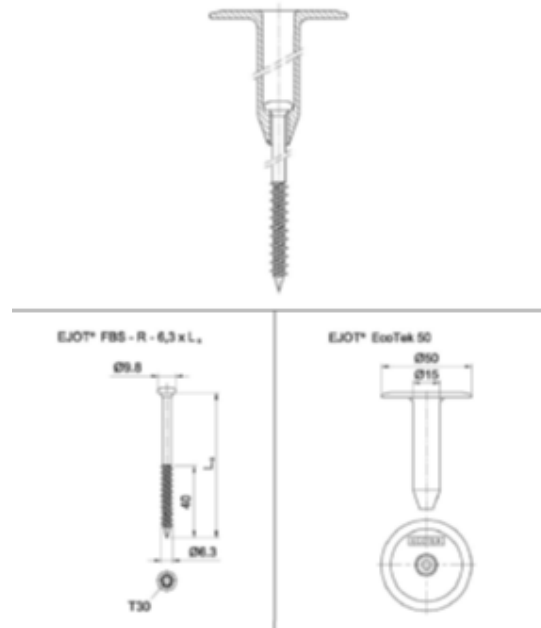
Washer with concrete screw for fastening roof membranes

Characteristic Values of Axial Load Resistance

Concrete, C 12/15 EN 206, effective anchorage depth ≥ 30 mm
= 1.58 kN

Mean Values of Axial Load Resistance

Concrete, C 12/15 EN 206, effective anchorage depth ≥ 30 mm
= 1.61 kN



EcoTek 50xL with DABO TKR - 4,8xL

EcoTek 50xL with DABO TKE - 4,8xL

Characteristic Values of Axial Load Resistance

Metalsheet, S280GD – EN 10346 $t_{min} = 0.75$ mm = 1.06 kN

Structural timber, EN 338/ C24, $t \geq 25$ mm = 1.42 kN

Plywood, EN 12369-2, $t \geq 21$ mm = 1.58 kN

OSB/3, EN12369-1, $t \geq 18$ mm = 1.08 kN

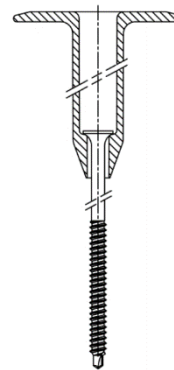
Mean Values of Axial Load Resistance

Metalsheet, S280GD – EN 10346 $t_{min} = 0.75$ mm = 1.28 kN

Structural timber, EN 338/ C24, $t \geq 25$ mm = 1.61 kN

Plywood, EN 12369-2, $t \geq 21$ mm = 1.61 kN

OSB/3, EN12369-1, $t \geq 18$ mm = 1.61 kN





TECHNICAL MANUAL

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