

**SANDWICH
PANELS
INSTALLATION
MANUAL**

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1. BALEX METAL SANDWICH PANELS

Investors, architects, designers, general contractors and assembly companies are interested in products that meet the following expectations:

- aesthetic appearance;
- high-quality;
- specific technical parameters (thermal insulation, load capacity, fire resistance);
- simple assembly.

In order to meet these expectations, Balex Metal offers sandwich panels consisting of two steel sheet claddings connected with insulating material. The Balex Metal offer includes sandwich panels with two types of insulating core:

- sandwich panels with a mineral wool core with fiber orientation perpendicular to the cladding, under the trade name MW;
- sandwich panels with a polyisocyanurate core marked as PIR.

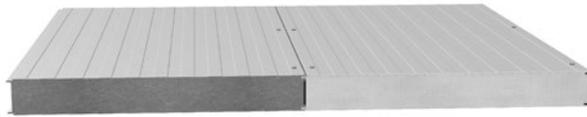
BALEX METAL WALL PANELS:

- PIR STANDARD
- PIR LIGHT
- PIR PLUS
- PIR FROST
- PIR SLATE
- PIR ALU
- MW STANDARD
- MW FIRE
- MW LIGHT
- MW DEFENDER
- MW PLUS

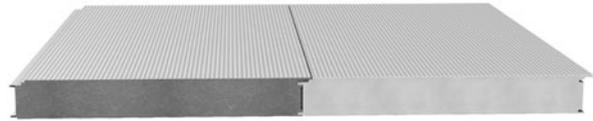
BALEX METAL ROOF PANELS:

- PIR STANDARD (roof)
- PIR ALU
- PIR FIBER
- PIR SLATE
- MW ROOF

Wall sandwich panels of different core materials fit each other under the condition of the same panel thickness and the same type of lock (Standard or Plus).



MW STANDARD & PIR STANDARD



MW PLUS & PIR PLUS

In addition to sandwich panels, the offer also includes a wide range of various elements, such as: steel flashings, accessories in the form of fasteners, screws, rivets and sealing materials, skylights, gutter systems.

2. APPLICATION SCOPE OF SANDWICH PANELS

2.1. GENERAL GUIDELINES

BALEX METAL panels are intended for use in low and moderate temperatures. The constant temperature on the surface of the boards should not exceed +60°C. Due to the low heat transfer coefficient, BALEX METAL sandwich panels are perfect for facades of heated buildings, minimizing heat loss.

The use of sandwich panels should be in accordance with the design taking into account the provisions of the harmonized European standard PN-EN 14509 and the local law.

2.2. GENERAL SAFETY RULES

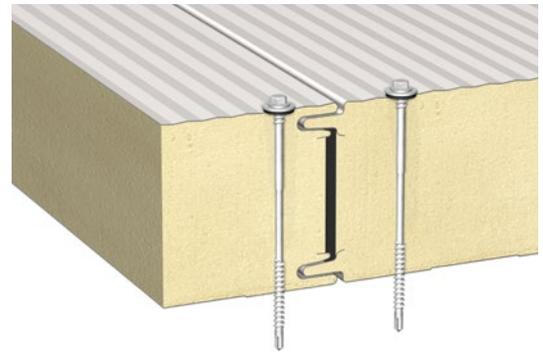
During the assembly of Balex Metal products it is crucial to follow all the general safety conditions and the rules included in this instruction, to avoid dangerous situations. Before the start, the introduction training have to be done and confirmed by signature of a worker. All the actions have to be done by the workers with valid medical report about no contraindications to do their job and under the supervision of authorized person. Particular attention should be paid to difficult weather conditions and protection against falls from heights (protective barriers, safety harnesses). It is essential to use personal protective equipment appropriately for the type of threat or exposure.

2.3. WALL PANELS

All wall panels can be installed horizontally or vertically. In both cases, the same support conditions apply - a minimum of 40 mm for extreme supports and a minimum of 60 mm for intermediate supports. The support can be made of any material (steel, reinforced concrete, wood, etc.), but this should be taken into account when selecting fasteners - selection by the fastener manufacturer. The optional application of a gasket in the production process in one or both grooves of the lock additionally increases the tightness of the connection, increasing fire resistance in some cases. Wall panels can also be used as self-supporting ceilings. This allows, in special cases, to build tight cold rooms or freezers.

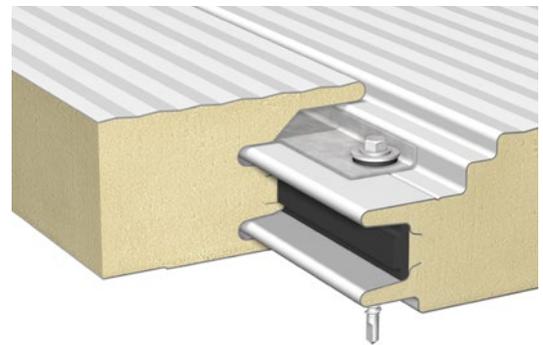
2.3.1. Sandwich panels with visible fastening

The longitudinal joint of wall panels with visible fastening (PIR STANDARD, MW LIGHT) of the tongue-and-groove type is formed by specially shaped steel cladding in the shape of a double fold, which increases fire tightness and facilitates assembly. These panels have a higher fire resistance class than panels with concealed fixing.



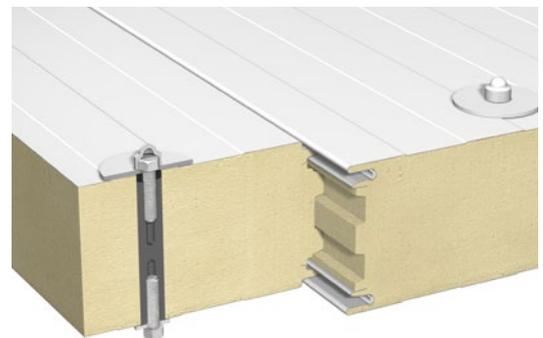
2.3.2. Sandwich panels with hidden fastening

The longitudinal joint of wall panels with hidden fastening (PIR PLUS, MW PLUS) is also of the tongue and groove type, but on the façade side the panel has an additional, specially formed cladding protrusion in the longitudinal joint, which covers the fastener that fastens the previous panel. To take full advantage of this solution, you can consider installing the panels vertically (in the case of horizontal installation, flashings on the columns will not be avoided).



2.3.3. Cold Storage sandwich panel

Balex Metal cold storage sandwich panels (PIR FROST) are intended for use as external partitions with increased thermal insulation requirements, internal partitions in stationary storage facilities, cold stores and freezers, and ceiling coverings (in this case they are covered with an additional cover, roof sandwich panels or trapezoidal sheets).



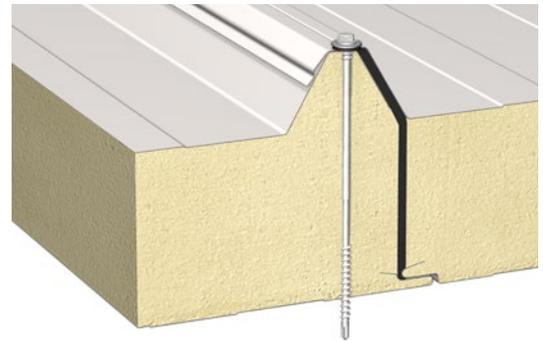
Panels as external partitions transfer thermal loads and wind loads, and as ceiling panels, covered with additional cover, they transfer their own weight and thermal loads.

Depending on the thickness of the core and the temperature difference on both sides of the partition, the following range of application is recommended (at a heat flux density of less than 10 W/m²):

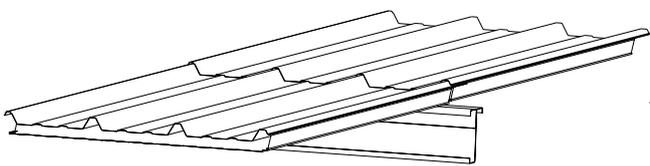
- PIR FROST 120 – temperature difference to 50 °C
- PIR FROST 160 – temperature difference to 70 °C
- PIR FROST 180 – temperature difference to 80 °C
- PIR FROST 200 – temperature difference to 90 °C

2.4. ROOF PANELS

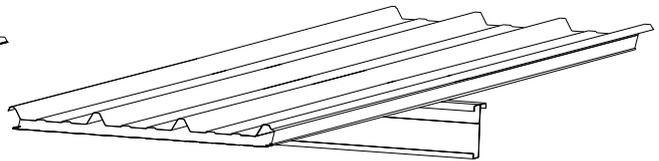
Balex Metal roof panels are the only sandwich panels in our offer capable of carrying increased loads, such as snow. This is possible thanks to the trapezoidal shape of the upper cladding. It is also possible to connect BALEX METAL roof panels with skylights - both along the width and length of the roof. Skylights should be designed with fastening to a special substructure.



The recommended roof pitch for roof panels is:



>7 % - for panels joined along the length or with skylights



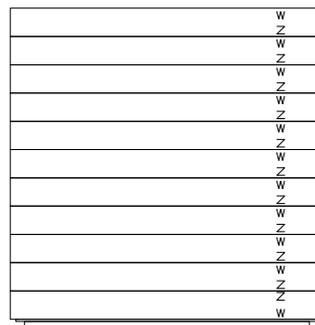
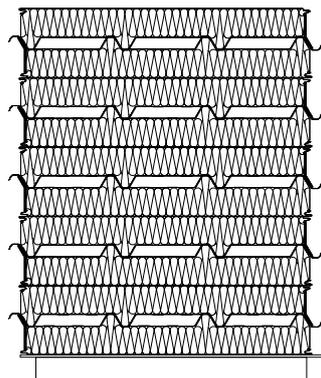
>5 % - for continuous panels and without skylights

If the conditions of minimum slopes are not met, uncontrolled water infiltration may occur and, as a result, its migration to the interior of the building.

3. TRANSPORT RECOMMENDATIONS

3.1. PACKING

As a standard, Balex Metal sandwich panels are packed with the inner cladding facing upwards, except for the first panel in a given package. This arrangement protects the exposed (external) cladding against mechanical damage during transport and unloading. At the customer's special request, it is possible to pack differently, but this requires consultation with the Sales Representative (some boards have packaging restrictions). In the case of roof panels, a different arrangement would be logistically unjustified.



w - the inside of the panel
z - outer side of the panel

3.2. TRANSPORTATION

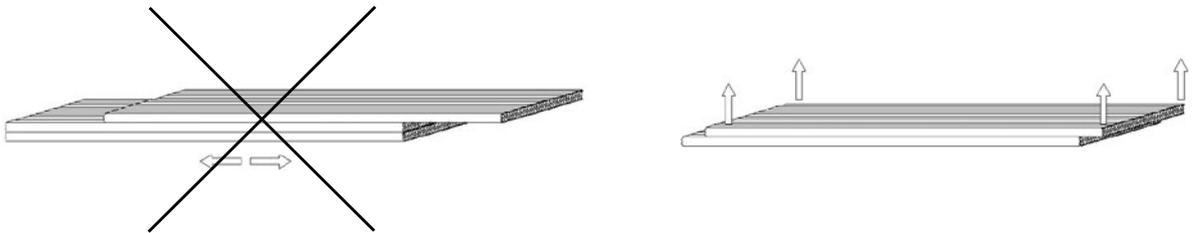
The basic means of transport for sandwich panels are trucks with a box or an open semi-trailer, enabling loading of long panels from both sides of the car. The material should be entirely on the platform and fastened with transport straps placed on the panel package at each support (the tension of the straps must not cause deformation of the panels). Long boards (exceeding 13.60 m) may protrude beyond the rear of the semi-trailer by a maximum of 2 m (according to the Road Traffic Act). However, whenever the length of the panels exceeds the length of the platform, the possibility of delivery should be consulted with a representative of the shipping company and Balex Metal.

In the case of orders involving several deliveries, the entire implementation is supervised by a Balex Metal trader in consultation with the Transportation Department.

3.3. LOADING & UNLOADING

3.3.1. Manual and using basic construction machines

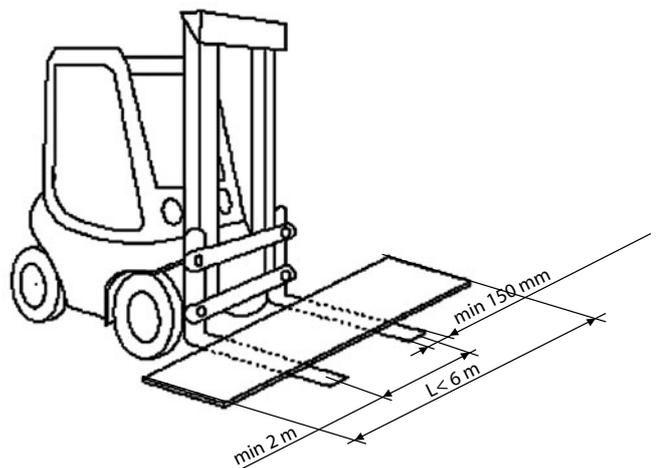
Be very careful when loading and unloading due to the weight of the panel. Point supports should be avoided as this may damage the cladding of the lowest panel. To avoid this problem, spread the load over a larger area. Also, be careful not to pull one plate over the other to avoid scratching. When lifting heavy packages, pay special attention to the proper support of the plates.



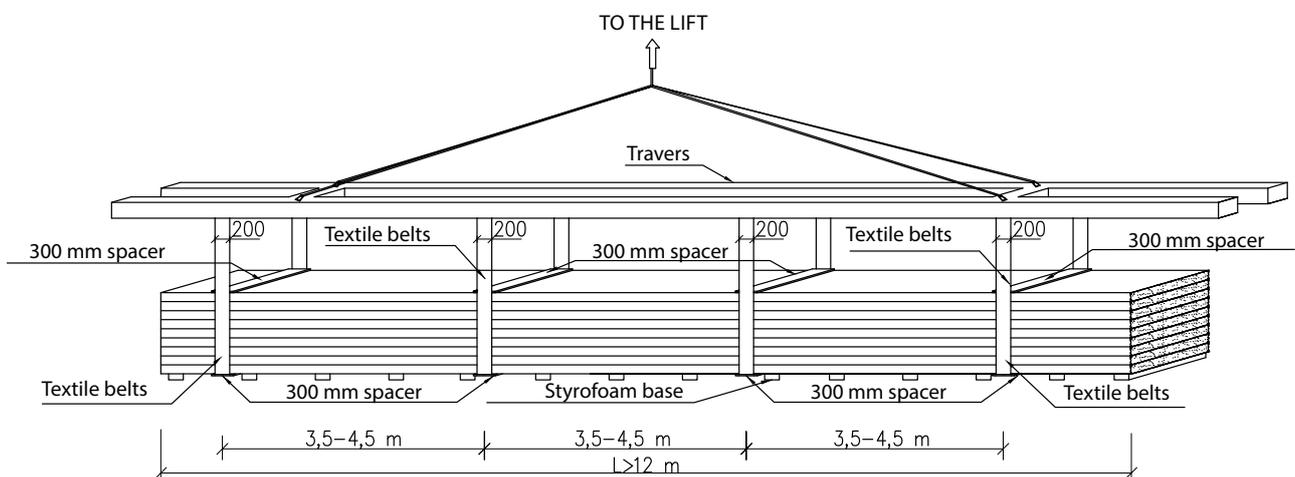
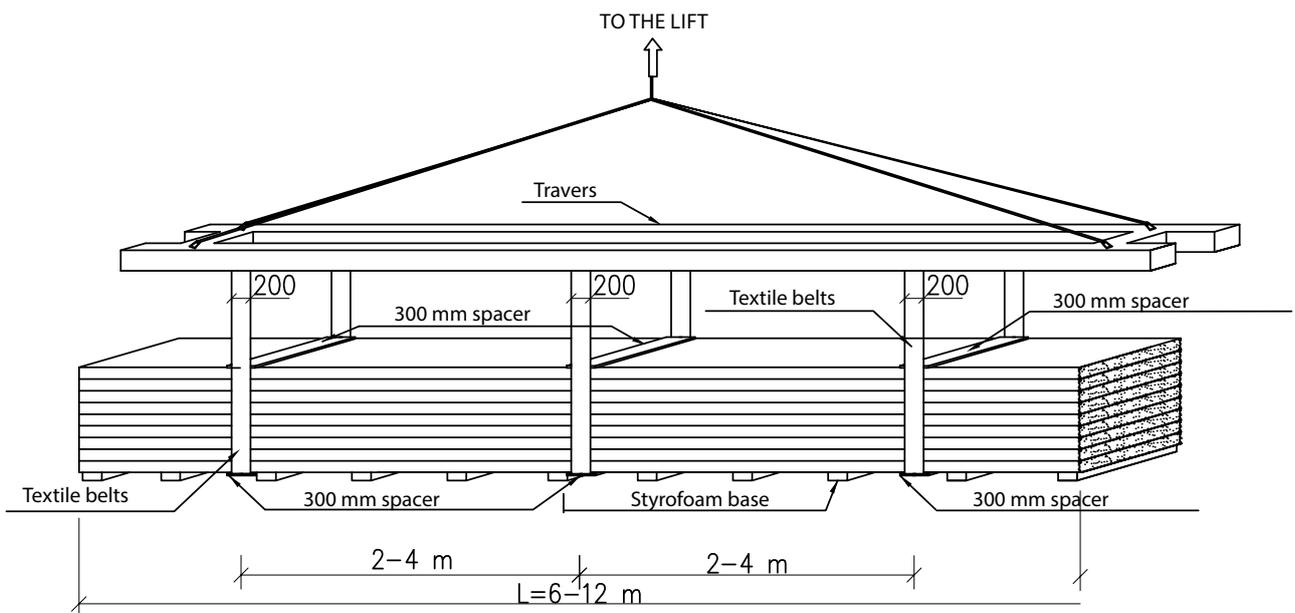
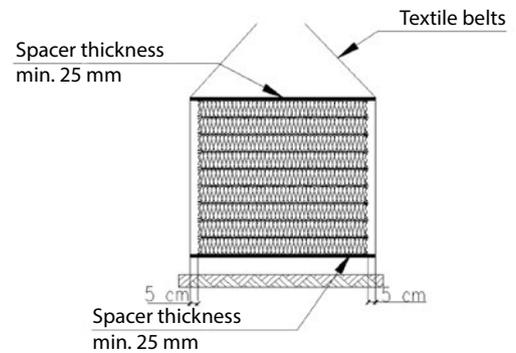
Immediately upon receipt, check the completeness of the shipment and identify any discrepancies. Any information should be included on the bill of lading and at the loading instruction (in accordance with the rules set out in the General Terms and Conditions of Sale).

When unloading manually, remember about the limitations of the maximum weight that can be carried by one person (according to health and safety rules).

For parcels up to 6m in length, it is allowed to use forklifts with adjustable fork width, min. 2 m fork spacing with a minimum width of 150 mm. When unloading products with forklifts, pay special attention to the length and thickness of the forks so as not to damage the 2nd row of products on the car and the upper lining of the lower packages.



Packages of products over 6m should be lifted on transport belts using a traverse. The recommended spacing of the straps for packages from 6 m to 12 m is 2-4 m. For parcels over 12 m, the spacing of the straps is 3.5-4.5 m. It is recommended to set the straps on wooden spacers with a minimum width of 300 mm and a minimum thickness of 25 mm placed on the bottom and top plates of the package. It is forbidden to use slings made of steel ropes or chains. It is not allowed to lift with clamping straps, crossing straps and other methods that may cause damage to the goods.



3.3.2. Vacuum lifters

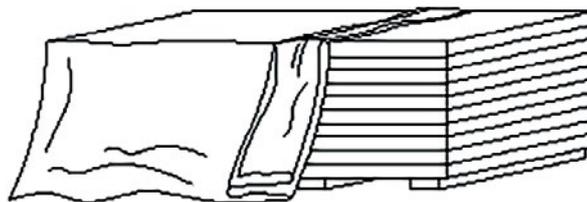
On the market, it is possible to rent specialized equipment for the installation of sandwich panels. Such machines operate on the principle of vacuum suction cups and are recommended for installation at considerable heights and when the weight of the panel does not allow free manual assembly. When using such equipment, remember about the way of arranging sandwich panels in a package. Therefore, for effective assembly, it is best to prepare stations in advance where it will be possible to rotate the panels - the supports should be protected with felt or other material that protects the paint coating from damage.



Selection of a vacuum lifter depends on the dimensions of the sandwich panels and the core material. That's why selection of number, spacing and type of suction cups need to be done for every case separately. Vacuum lifter rental companies offer such selection in standard. Such help is recommended because improperly selected equipment can (in extreme cases) lead to delamination of the panel cladding from the core.

3.4. PANELS STORAGE

Sandwich panels should be placed on sleepers, not less than 250 mm above the ground surface. It is allowed to store no more than two packages on top of each other. In this arrangement, after building in the upper package, the lower plates should be allowed to relax. Parcels should be stored on a flat, hardened surface ensuring that all underlays adhere to the surface and with a slight slope enabling the drainage of rainwater and condensation from between the products. It is recommended to store it in closed and airy rooms, away from fertilisers, acids, alkalis, salts and other corrosive substances. It is not allowed to store boards without a cover. In the case of short-term storage under a tarpaulin (up to two weeks), free air circulation should be ensured. If the storage period is longer than two weeks, panels should be placed in a properly ventilated room and left uncovered, with free access of air to all layers. Failure to comply with the above recommendations may result in discoloration of the coating.



4. INSTALLATION

4.1. GENERAL INSTALLATION GUIDELINES

Before proceeding with the installation of a lightweight casing made of sandwich panels, the following are recommended:

- checking the axial and verticality of the load-bearing structure, i.e. checking for accuracy and compliance with the structural design of the building;
- quality control of anti-corrosion coatings, whether galvanized or varnished, of the main supporting structure and additional elements, such as transoms and purlins, and the correctness of their connections;
- preparation of storage yards and assembly zones;
- getting acquainted with the detailed design of the lightweight housing and the manufacturer's technical catalogs.

4.1.1. Atmospheric conditions

Installation can only be carried out in conditions that ensure the safety of persons performing it, while maintaining all properties of the installed products. Installation is not recommended when:

- wind speed exceeds 10 m/s;
- the temperature is below 0 °C (however, keep in mind that gaskets and sealants lose their properties at temperatures below +5 °C);
- there is heavy rain/snow or thick fog.

4.1.2. Protective film

During transport, the BALEX METAL sandwich panels are protected against dirt and damage with a protective foil, which is applied to the cladding during the production process. After unpacking the package and before installation, the protective foil should be removed. Unless the panels are installed immediately and they will be stored on the construction site, the foil should be removed after a maximum of two months from the date of production, in order to avoid its permanent bonding with the protective varnish of the cladding sheets (foil vulcanization process). The production date is on the sandwich panel packaging label.

4.1.3. Symmetrically shaped panels

In the case of symmetrically shaped panels, in order to avoid errors during assembly, the following methods have been introduced to distinguish internal and external cladding:

- In addition to the BALEX METAL company logo, the aluminum foil placed in the longitudinal joint of the panels during production is additionally marked with an arrow with the inscription “str. zew.,” which means external cladding.



- Marking of the inner cladding inside the “male” part of the lock, about 50 cm from the end of the panel (refers to cold storage panels)



- Red sticker on the protective foil on the inner cladding (applies to panels with a mineral wool core)



For wall sandwich panels with both claddings:

- in the same thickness;
- with the same coating;
- in the same color (identical RAL);
- equally profiled.

any orientation of the panel is allowed (installer decides).

4.1.4. Panel processing on site

In order to avoid damage to paint coatings, it is advisable to cut boards and flashings on stands covered with a soft material, e.g. felt, polystyrene.

Saws with fine-toothed discs, reciprocating saws or jigsaws should be used to cut panels, and hand scissors for flashing. Do not use angle grinders and other tools that generate high temperatures during cutting - this may damage the paint and anti-corrosion coatings. After the cut, the filings should be removed immediately, as they will begin to corrode over time, leaving traces on the paint coating. To remove filings or other contaminants that have adhered to the coating:

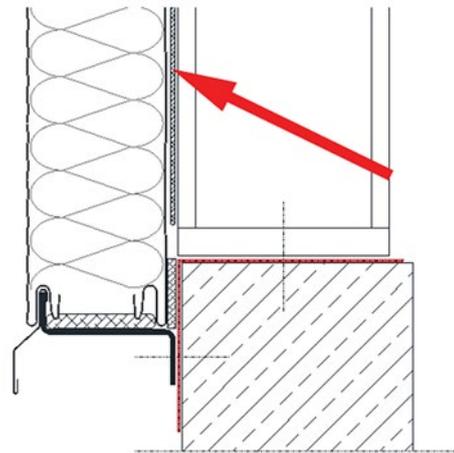
- remove the dirt using nylon brush;
- degrease the surface with a detergent (do not use petroleum products, such as petrol - visible stains remain after petrol evaporates), for slightly dirty surfaces, detergents, such as dishwashing detergent or other similar cleaning agents, can be used;
- wait until complete evaporation of cleaning agents or wipe dry.

All damages to the varnish of the cladding sheets caused during assembly should be protected with touch-up varnish - in the case of small damages, you can use a touch-up paint by applying it with a brush, and in the case of large areas, you can try a spray-on touch-up paint.

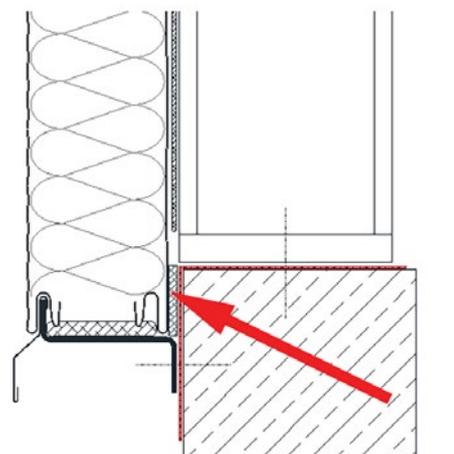
4.1.5. Gaskets and sealants

In order to ensure the declared thermal insulation of the light casing and to protect the sandwich panels against mechanical damage, remember to use the following gaskets:

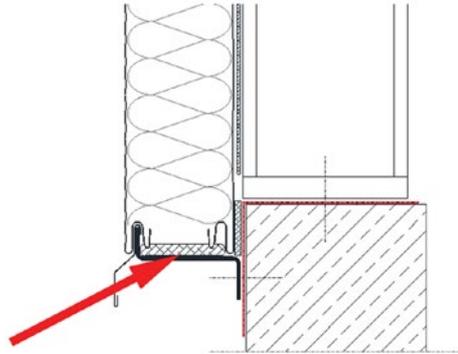
- polyethylene tape (PES) – self-adhesive seal separating the sandwich panel from the structure to which it is attached. It evens out manufacturing imperfections and protects the cladding coating against mechanical damage as a result of construction work. In the case of a wide support, it is recommended to stick the tape as close to the edge as possible. It can be glued to the structure or to the board;



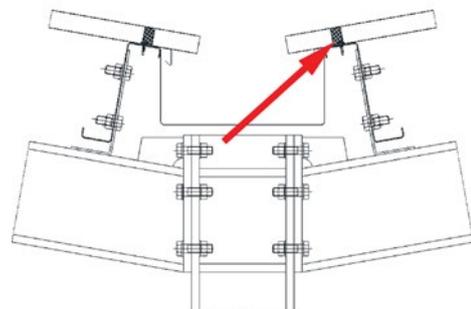
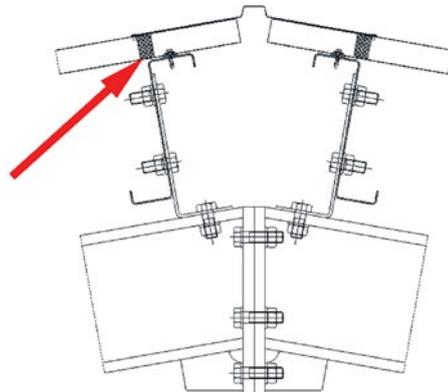
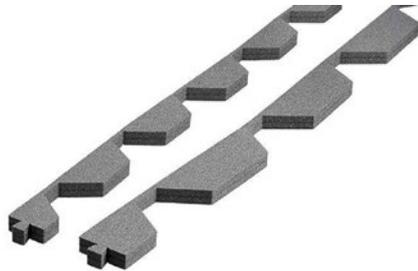
- polyurethane tape (PUS) - a gasket applied in the production process in the panel lock - after pressing the adjacent panels together, it should tightly fill the entire gap between the cores, minimizing the thermal bridge; moreover it is used between sandwich panel and not-so-plain sustructure (for example concrete), where is no need to reach for PURS yet;



- expanding polyurethane tape (PURS) - impregnated gasket, which thanks to the ability to expand (up to 5 times) is able to fill large gaps, e.g.



- polyethylene gaskets (TUN and TUP) - profiled tapes for use on and under high-profile elements - e.g. between external cladding of roof sandwich panel and ridge flashing



- EPDM round gasket - additional gasket applied in the lock during production on special order, increasing the air permability and fire resistance class by sealing the panels contact. Properly mounted sandwich panels with single or double EPDM gasket in the lock can have spacing module between panles enlarged by 1 mm. It demandes about 50 kg/m force to achieve it.

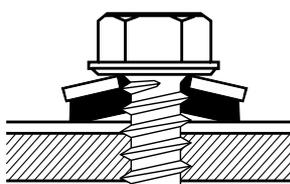


It is recommended to use sealants with a neutral reaction, based on silicone, butyl or low-pressure polyurethane foam, to fill in the empty spaces in order to protect against water. The use of acidic sealants is strongly discouraged. The type of sealants is recommended to be used in accordance with the intended use described in the detailed design of the light casing and in accordance with the manufacturer's technical data sheet. All seals should be checked regularly and replaced if necessary.

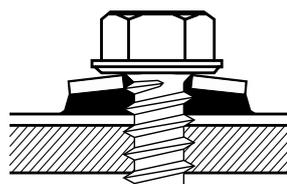
4.1.6. Fasteners

For fixing sandwich panels, it is recommended to use appropriate fasteners depending on the thickness of the panel core (fastener length) and the type of substrate (fastener type):

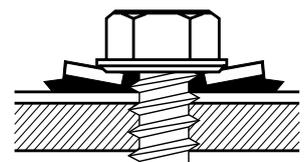
- steel - self-tapping fasteners, which are divided due to the thickness of the drilled element;
- concrete/reinforced concrete - fasteners requiring pre-drilling;
- wooden – self-drilling fasteners.



too weak (not tightened)



correct



too tight (twisted)

All fasteners are equipped with a washer with vulcanized EPDM, which allows for many years of use while maintaining the flexibility of the sealing element. In the case of installing roof panels, a washer adapted to the shape of the trapezoidal hump is recommended, the so-called calotte (in the picture beside). When fixing the panels, remember to always screw the fasteners perpendicularly to the base in the amount of at least 2 screws per support in order to balance the operation of the system.



The offer of Balex Metal also includes the so-called stress redistributors that minimize the risk of damage to the linings in the locks by distributing the load from the pressure of the fasteners through this plate to the lining. This is an exceptionally advantageous solution when installing wall panels with invisible fastening.



4.2. FIXING THE WALL PANELS TO THE LOAD-BEARING STRUCTURE

4.2.1. Horizontal layout of the panels

1) INSTALLATION OF THE STARTING PROFILE



During assembly, it is necessary to constantly check the level of the profile with a long spirit level.

2) GLUING THE POLYURETHANE IMPREGNATED TAPE TO THE STARTER PROFILE



3) GLUING PES TAPES TO THE SUBSTRUCTURE



In the case of a wide support, remember that stick the tapes as close to the edge as possible.

4) INSTALLATION OF THE PEDESTAL FLASHING



It should be remembered that the casing made of BALEX METAL sandwich panels is not a system and the assembly method shown above is only an example. More plinth detail solutions can be found in the technical catalogs available on the website.

5) REMOVING THE SAFETY FOIL



To make it easier to remove the foil, you can use an elongated element that can be wound up.

6) PLACEMENT OF THE PANEL ON THE STARTING PROFILE AND PRESSING



7) FASTENING THE PANEL TO THE COLUMNS WITH FASTENERS



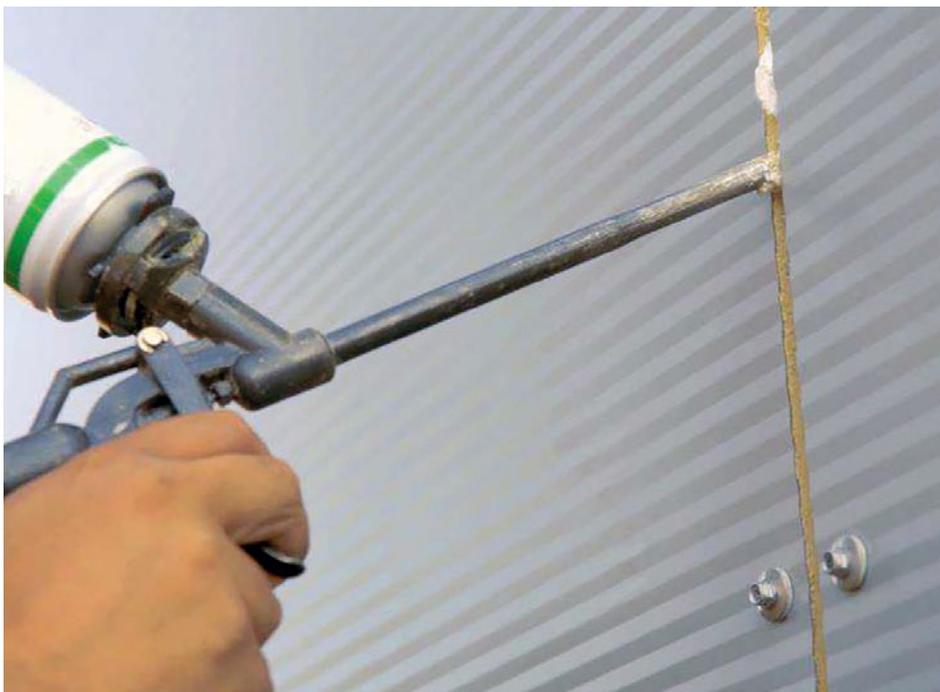
Remember to choose the right fasteners
- more information in section 4.1.6.

8) FASTENING NEXT PANELS



Subsequent panels should be pressed so that no gaps remain in the lock.

9) FILLING THE VERTICAL JOINTS WITH SEALING MATERIAL



More information in section 4.1.5. and in the Light Housing Project.

10) FASTENING FLASHINGS

- Vertical joints masking treatment
- Corner flashings
- Machining at the holes
- Individual flashings according to the Light Housing Project



4.2.2. Vertical layout of the panels

1) ASSEMBLY OF STARTING FLASHING



2) GLUING PES TAPES TO THE SUBSTRUCTURE



3) REMOVING THE SAFETY FOIL



4) PLACEMENT OF THE PANEL ON THE STARTING PROFILE

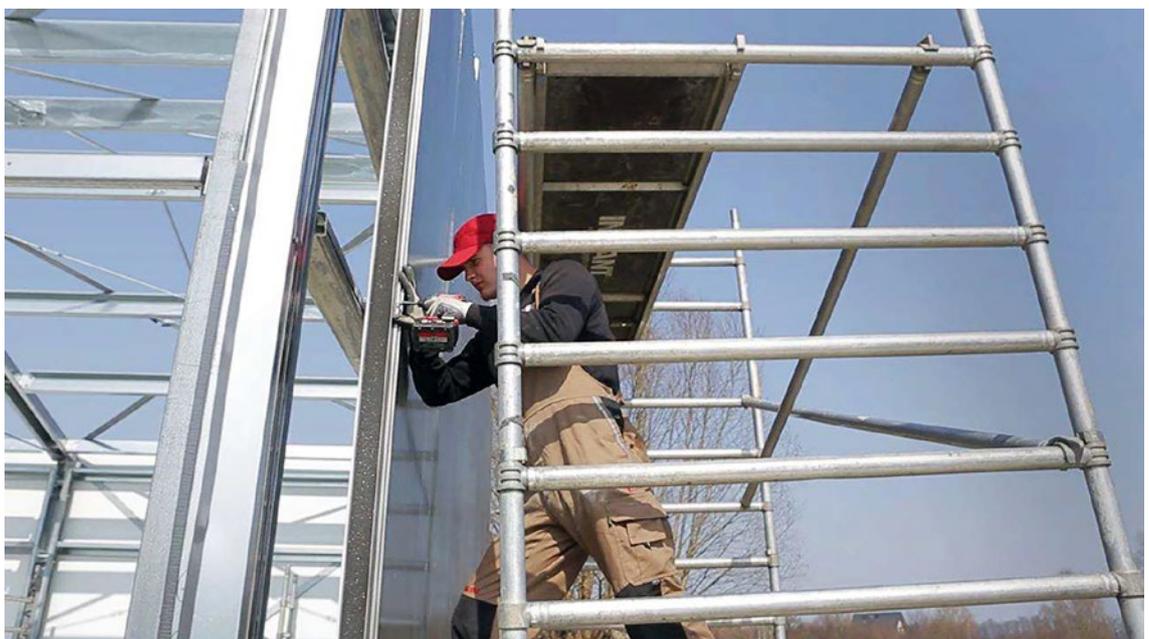


5) ATTACHING THE PANEL TO THE TRANSOMS WITH FASTENERS



Remember to choose the right fasteners - more information in section 4.1.6. When installing panels with hidden fastening, it is recommended to use stress redistributors (as in the picture above).

6) FASTENING NEXT PANELS



Subsequent panels should be pressed so that no gaps remain in the lock.

7) FASTENING FLASHINGS

- Plinth flashings



- Corner and eaves flashings



- Machining at the holes



- Individual flashings

4.3. FIXING THE ROOF PANELS TO THE LOAD-BEARING STRUCTURE

1) REMOVING THE SAFETY FOIL



2) GLUING PES TAPES ON THE SUPPORT ELEMENTS



3) TRANSPORTING THE PANEL TO THE ROOF (USE OF A VACUUM LIFTER IS RECOMMENDED)



4) LAYING THE FIRST PANEL



It is important to lay the panel precisely. A construction cord can be used for this purpose.

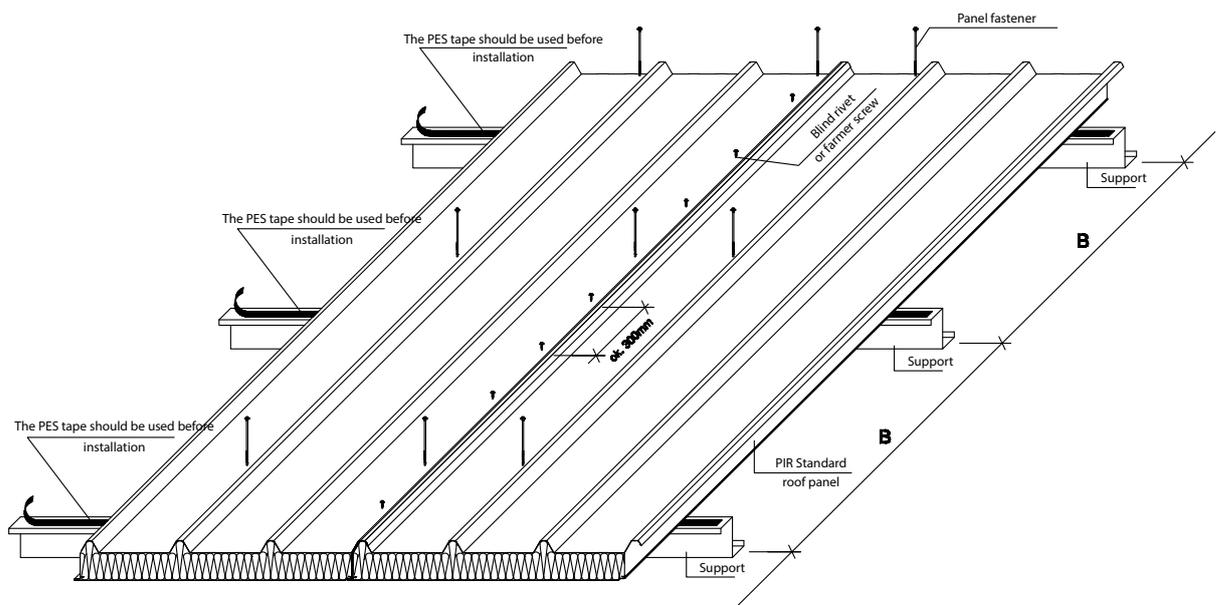


When mounting PIR FIBER sandwich panel it's necessary to remember about h-profile and filling the gap between the core and this profile with PUR foam (recommended).

5) FIXING THE PANEL TO THE STRUCTURE



Panel fixing scheme:



Stitching the panels along the length together with the sealant ensures the correct connection and consistent operation of the roofing. The recommended distance between fasteners is 30 cm.

6) PRESSING THE PLATE

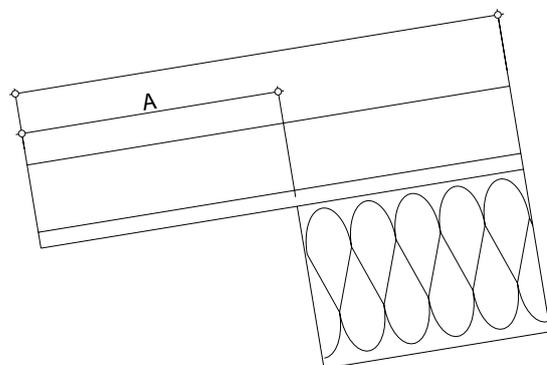


Correctly pressed BALEX METAL panel lock

7) FASTENING NEXT PANELS

Roof panels have endings shaped at the production stage to facilitate the installation of gutters at the eaves or longitudinal joining of panels. This is the so-called undercut and it can be:

- 50 mm at the eaves (standard)
- 200 mm at the overlap along the length of the panels (standard)
- 10 mm (minimum value - at the customer's request)
- 300 mm (maximum value - at the customer's request)



A - undercut

8) FASTENING FLASHINGS

- ridge flashing



- eaves flashing



- windchest

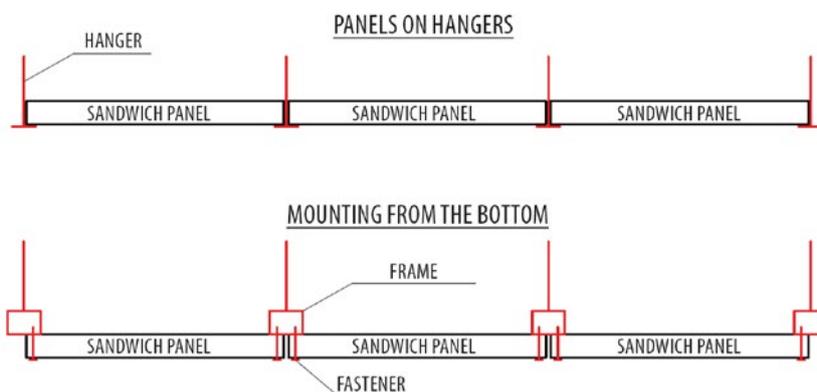


- Individual flashings

The BALEX METAL roof panel is produced as a standard as a right one. At the customer's request, it is possible to produce boards in the left variant.

4.4. INSTALLATION OF SANDWICH PANELS AS A SUSPENDED CEILING

It is possible to use sandwich panels as suspended ceilings. Then we have two options - either the sandwich panels lie on the profiles or the assembly is done from the bottom and the panels hang on the fasteners. In the first method, you can use the profiles available in the Balex Metal assortment (shown in the below). It is absolutely forbidden to rest the ceiling tiles on the walls without any substructure.

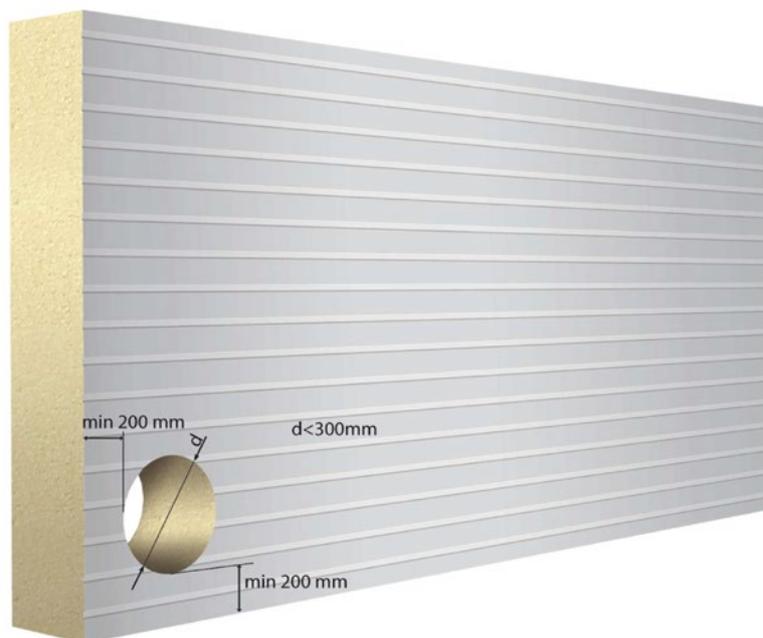


4.5. SANDWICH PANEL DRILLING GUIDELINES

At the stage of planning the cutting of sandwich panels on the façade and roof, care should be taken to properly locate the openings for windows, doors, etc., because openings obviously weaken the load capacity of the product.

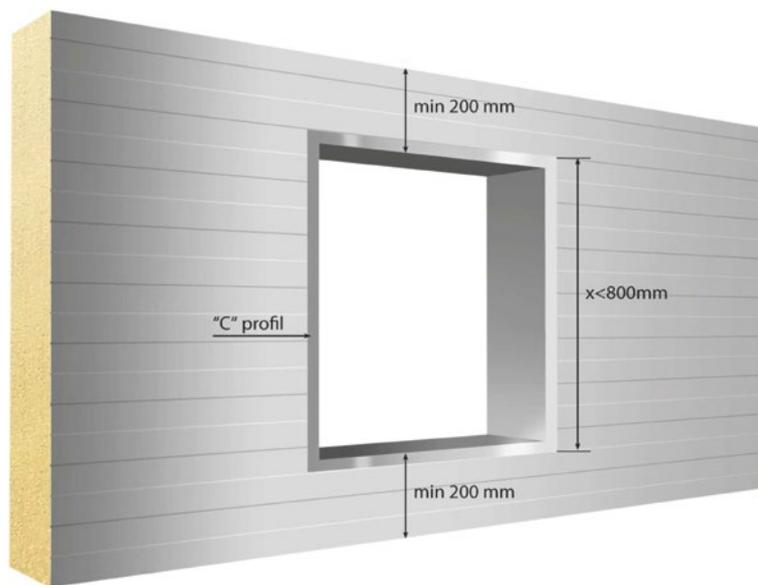
Despite the hole cut out, the sandwich panel must carry the loads acting on it. If it is impossible, e.g. due to the size of the opening, it is reasonable to use an additional substructure that will ensure the redistribution of loads to the load-bearing profiles. The final decision in this case should be made by a Project Manager with appropriate qualifications.

Small openings (e.g. for cable penetrations) can be made in BALEX METAL panels without major reservations. It is allowed to make openings in wall and roof panels as passages for round and rectangular pipes and cables with a maximum diameter of $d=300$ mm, with a 200 mm wide wall between the edge of the panel and the opening of the passage. The opening should be sealed with flexible pipe sealant.



It is also allowed to make openings in single panels for embedding windows made of PVC and aluminum, with a maximum size of 700 mm wide x 800 mm high, fixed to the wall panel. The framing of the opening should be made of channels with dimensions $(A-10) \times 30 \times 3$ mm (where A - dimension of the cut opening) and installed between the facings. A 200 mm wide wall must be maintained between the edge of the board and the opening. The Project Manager is responsible for such location of the opening in relation to the supports (transoms) of the panels and for selecting their spacing so that the deflection of the panels does not exceed the value of $L/100$.

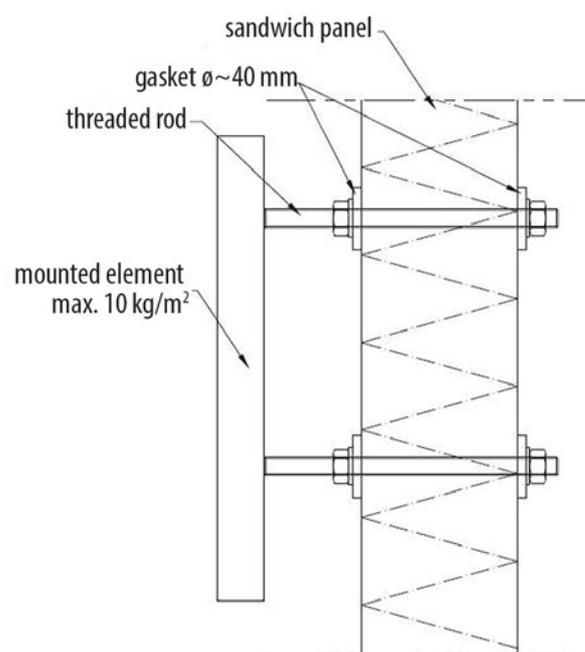
Be careful when making the hole. In order to avoid damage to the color coatings, it is advisable to cut the boards on racks covered with a soft material (e.g. felt, polystyrene). For cutting, you can use, for example, a special hole saw attached to a drill. Do not use angle grinders or any tools that generate high temperatures during cutting.



4.6. ASSEMBLING SMALL PARTS

Balex Metal allows the assembly of small elements without the need to use an additional substructure, but in this case the following recommendations should be followed:

- The maximum load from the fastened elements is 10 kg/m².
- Fasteners go through the entire panel (core and both facings, it is absolutely forbidden to fasten to only one cladding).
- On the side opposite to the mounted element, a washer with a minimum diameter of 40 mm should be used (it is necessary to distribute the loads over the largest surface possible).



4.7. VISUAL ASPECTS

Imperfections resulting from the specificity of the product, which are sandwich panels, and more precisely the cladding of these panels, are sometimes the subject of unjustified complaints and it is important to remember to be aware of certain rules when choosing both the panel operation scheme and its color scheme already at the design stage. The most sensitive cases include the use of panels in dark colors and panels with plain claddings.

4.7.1. Dark colored panels

Wall sandwich panels with claddings in dark colors have a high heat absorption capacity, which in the period of high insolation (especially in summer) may cause local deformations of the cladding surface. According to the EN 14509 standard, it is assumed that steel sheets in dark colors heat up to 80°C, which means that the load capacity of the panels should be verified each time, taking into account temperature stresses.

Panels in dark colors are recommended to be installed in single-span systems. The use of dark panels in multi-span systems may lead to deformations and damage to sandwich panels - especially in the zone of intermediate supports.

Therefore, Balex Metal is not responsible for any damage caused by high temperature, as a result of which local loss of cladding stability may occur.

Dark colors are defined in point E.3.3 of EN 14509.

Symbol	Name	Group
9010	white	very bright
9002	grey-white	
7035	light-grey	
1015	ivory	
6011	reseda-green	bright
9006	silver-metallic	
9007	grey-aluminium	
1003	signal-yellow	
9005	black	dark
5010	signal-blue	
6005	dark-green	
6020	fir-green	
7024	graphite-grey	
7016	graphite	
8019	brown-grey	
8017	chocolate-brown	
8012	red-brown	
3016	coral-red	
3011	red	
3000	fiery red	

4.7.2. Plain faced panels

Balex Metal recommends the installation of sandwich panels in plain cladding, as in the case of cladding in dark colors, only in single-span systems. Otherwise, the boards may be deformed, which is not subject to complaints. At the same time, such panels should be checked each time for load-bearing capacity.

5. ADDITIONAL INFORMATION

During the operation of a building on which Balex Metal sandwich panels have been applied, annual inspections should be carried out, paying attention to:

- accumulation of snow or other impurities on roofs and gutter elements (in case of heavy or frequent snowfall, the excess should be removed on a regular basis);
- permeability of the facility's drainage (stagnant water can freeze and cause damage);
- filings or other metal elements (corroding can damage the paint coating);
- connection of panels with flashings (improper adhesion may cause moisture to penetrate into the core);
- panel edges (in case of damage to the coating, touch-up paint should be used);
- damage to fasteners (loose ones should be tightened or replaced, and rusty ones should be replaced);
- seals (when washing, remember to use detergents that do not damage them). In case of seal defects, they should be supplemented or replaced.

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