

PaNELTECH Sandwich Panels Assembly Instruction

1. Preparatory works

Sandwich panels are protective elements, which are assembled to the constructions in accurately determined and prepared points. It makes the building highly aesthetic and prevents the deformation of steel cladding in the assembly points.

Before the beginning of panel assembly, the following has to be checked:

- a) building construction precision,
- b) compliance of the construction with the design,
- c) acceptable maximum support span - the compliance with the load plates offered by the company,
- d) tolerance of deviation from flatness and straightness for purlins, rafters and walls,
- e) condition of the protective organic coating.

In standard, sandwich panels are delivered to the construction site, packed in cling film on the facade (external) side only. Installing panels covered with foil on the one site, make sure the foil is situated on the facade (external) side.

Optionally, at the client's request (by an additional fee), the foil can be applied on both sides, i.e. on the external and internal facing. Below listed are guidelines for preparatory works aiming to avoid installation errors related to the colour palette of the building.

PW PUR/PIR panels.

- PW PUR/PIR polyurethane core sandwich panels (with visible joints) have protective tape on the side edges with visible arrow markings. The point chisel indicates the facade (external) side of the panel, the one with the decorative coating. During installation, make sure the arrows on the edges are pointing in one direction.

PW-CH PUR/PIR panels

- coldroom sandwich panels are laid with their external (facade) sides facing upwards, as illustrated in the following figure no. 1.

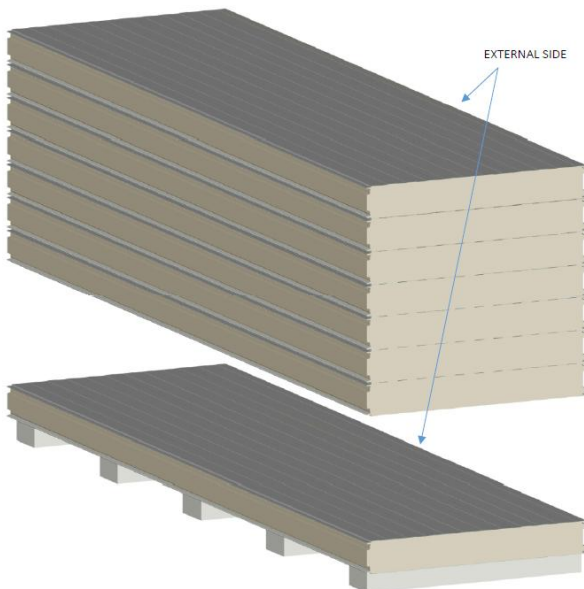


Figure 1 (packet with cold store sandwich panels with PUR/PIR cores). To maintain the continuity of facade colour, take the panels from the pile during installation, without reversing them.

PWS and PWW panels

- sandwich panels with mineral wool and EPS cores are so installed that the lower panel in the packet is reversed by 180 degrees relative to the remaining panels, i.e. the facade part always faces upwards, and the internal side always faces downwards - this installation pattern protects the facade of the first lower panel against possible mechanical damage

during unloading at the construction site. The remaining panels are laid in a standard manner, i.e. the facade (external) side faces downwards and the internal side - upwards.

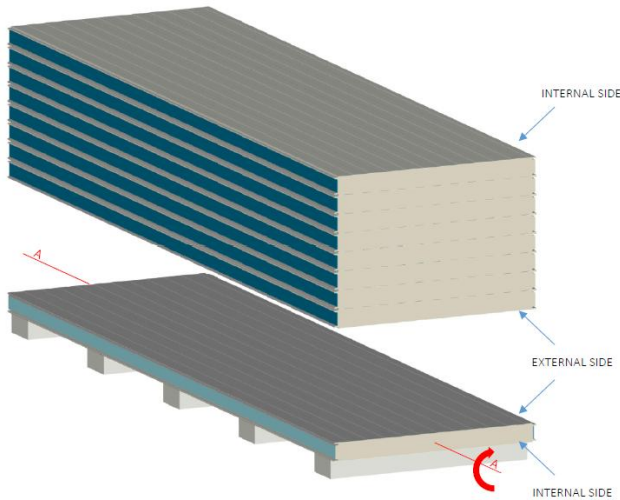


Figure 2 (packet with cold store sandwich panels with mineral wool and EPS cores). To maintain the continuity of facade colour during installation, reverse the lower panel by 180 degrees (along axis A).

The above presented installation details will serve to avoid differences in the appearance of varnished sandwich panel facings.

2. Panel assembly

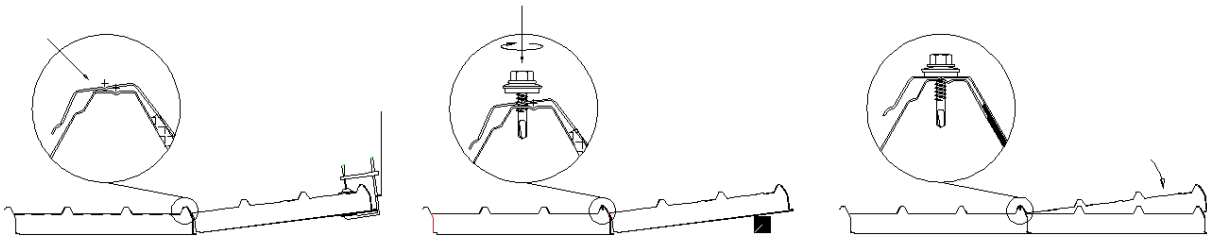
The insulation panels are formed in the production plant in concrete sizes. If there is a necessity to cut them at the construction site, it can be done using fine-toothed saws. Flashing can be done using hand scissors. You must not use angle grinders or other tools which produce high temperature during cutting, as they may damage the organic coating protecting metal sheet from corrosion. Sandwich panels have to be assembled to the foundation soil using appropriate connectors or screws, in accordance with Paneltech Technical Catalogues. Connectors should be fitted using specialist power tools. Drill-drivers have to be equipped with appropriate heads to screw the connectors of required lengths, and with a mechanical stop to ensure appropriate fitting depth. Thanks to this the assembly can be performed correctly, which includes: perpendicular positioning of the connector against the panel, minimum risk of damaging the panel surface and joint sealing.

When assembling wall panels, it is recommended to position the panel appropriately in its place of destination, and after fitting panels one next to the other, they have to be assembled using connectors. The correctness of panel positioning is checked with the level and devices used to measure length and dilation. It is necessary to check both vertical and horizontal positioning, in both planes.

The universal tolerance of connector dilation in case of wall panels (PUR/PIR - S/SU/CH) is assumed to be the basic value $\Delta C = 3$ mm, with tolerance of $+2/-2$ mm. The mandatory condition is to ensure contact in the insulating core. The above values of connector dilation are determined in accordance with the standard PN-EN 15254-5. In order to meet the above tolerance intervals, laps made of artificial materials are used, or additional self-adhesive flexible seals. Controlling the serviceability limit state ensures correct functioning of sandwich panels under the influence of operational loads. Detailed recommendations concerning the assembly of panels with mineral wool or polystyrene foam core were included in the product catalogues. It is important to assemble wall sandwich panels with mineral wool or polystyrene foam core, maintaining appropriate connector dilation tolerance intervals. It is also significant to ensure that the metal cladding does not overlap at the panel-panel joint for less than 10 mm.

When assembling sandwich panels, pay attention to the way insulating cores are connected, to ensure the correct air and water tightness. Screw the first panel to the supports, and then make an overlap on its protuberance, using a second panel. Screw in both using a bolt. Make sure the bolt passes through the overlap protuberance and through the protuberance notch. Only then lower the second panel on the first panel and screw it to the supports. To even out the pressure between the panels, use special webbing straps with buckles, which will be installed on both ends of the panel. Continue the process of gradual installation of panels with overlaps, screwing overlaps to the protuberance, and the lowering the screwing panels to supports for the entire roof.

The graphical illustration of the assembly of PUR/PIR roof panels with a core, was presented in the diagram below.



3. Sealing the connectors

The basic kinds of seals for panels with flashings and connections between the panels are:

- sealing compounds (butyl or silicone mass) counteracting air infiltration, used to fill the closed joints between click lock claddings,
- sealing compounds made of plastics (silicone or polyurethane) used to seal the joint at the panel connection from the side of room interiors,
- sealing compounds made of polyurethane foam used to fill in free spaces,
- sealing compounds made of silicone mass used to seal flashings.

The above sealing compounds are required depending on the kind of the facility.

4. How to handle protective foil

Metal sheet claddings of sandwich panels are protected against damage and soiling with protective foil. It is recommended to remove the foil from the panel surface and from flashing during the assembly. The foil has to be removed from the sheet after 14 days from the panel reception data the latest, because under the impact of atmospheric conditions it can change its mechanical properties, which will make its future removal difficult. The foil should be removed from the cladding (panel) surface, when its temperature exceeds +5 C° and does not exceed 60 C°.

5. How to use colourful panels

Sandwich panels are available in the following colour groups:

Group 1 - very pale colours,

Group 2 - pale colours,

Group 3 - dark colours.

It is recommended to choose panels in very pale and pale colours (Groups 1 and 2).

Table 1. Table of colours for sandwich panels surfaces.

COLOUR GROUP / SURFACE SELF-HEATING TEMPERATURE IN THE SUMMER	COLOUR NO. ACC. TO THE RAL SYSTEM	LIGHT REFLECTANCE GRADIENT BY THE PANEL SURFACE RG [%]
1 - very pale colours, temperature up to 55 °C	1015, 1018, 7035, 9001, 9002, 9010	75 - 90
2 - pale colours, temperature up to 65 °C	1002, 1007, 1021, 2008, 5012, 6011, 6018, 9006	40 - 74
3 - dark colours, temperature up to 80 °C	3000, 3005, 3011, 3016, 5010, 5011, 6003, 6005, 6011, 6029, 7016, 7024, 8017, 9007	8 - 39

Colours not included in the above table should be classified to the appropriate category based on the value of radiation reflectance gradient.

The manufacturer does not recommend using dark panels for multi-span systems, because the cladding can get deformed. Sandwich panels with dark claddings have high heat absorption ratio, and hence in the period of intense sunlight exposure the surface of the claddings can get deformed locally. Due to this, the possibility of thermal movements of panels has to be ensured and panels with limited length have to be used. The effect described above does not have any influence on the functional properties of the panels, nevertheless the Manufacturer emphasizes that the Customer buys panels in these colours at his own responsibility and shall bear no claims against the Manufacturer for this reason. There is a general rule of selecting the panel length depending on the colour, following the table below.

Table 2.

PROTECTIVE SHIELD COLOUR DESCRIPTION	SANDWICH PANELS PUR/PIR	SANDWICH PANELS PWS	SANDWICH PANELS PWW
Colour group 1 Maximum length	15.35 lm	10 lm	10 lm
Colour group 2 Maximum length	9 lm	7 lm	7 lm
Colour group 3 Maximum length	7 lm	7 lm	7 lm

When ordering panels in metallic colours, it is recommended to divide them depending on the type of facade surface. It has been observed that turning an element with metallic cladding by 180 degrees results in significant change of the surface colour. It is recommended to check during the assembly the colour and specular gloss of panels and the condition of the metal sheet surface on the facade, with the following frequency: we check very fifth element from approx. 25 m distance. It can prevent problems with the appearance and colour of the facade.

In case of a special order performance, the customer has to submit the so called reference sample, at least (150x100) mm large, in order to determine the colours of the sandwich panels cladding.

The manufacturer sends the metal sheet sample to the contractor in order to prepare the appropriate colour, similar to the sample submitted by the ordering party.

Once the reference sample is delivered by the manufacturer, the sample is approved by both parties and confirmed with their signatures. The sample becomes an annex to the agreement and contains the following information:

- Name of the manufacturer of the steel band continuously coated with colourful coating material,
- Coating colour - its written description and code,
- Specular gloss unit,
- Coating symbol and thickness in μm .

6. Dimensional tolerances

The tolerances have an impact on the resistance of the sandwich panels and safety of their usage. The tolerances presented in the table are the maximum acceptable values. The measurements of: profile pitch, crests, troughs, roofing width, dilation from the flatness, have all to be taken from the distance of 200 mm from the edge of the sandwich panel.

During the measurements, the sandwich panel has to be placed on at least three supports, located on a stiff and flat surface. The tolerances presented below refer to the measurements of sandwich panels in stable state acquired in the temperature of approx. 20°C. In other cases the measurements have to be corrected by the appropriate safety coefficient, taking into consideration: temperature fluctuations from the reference temperature of 20°C, local stresses related to the assembly process, thermal expansion and shrinkage of claddings causing thermal deflections, axial motion at the edges of assembled panels, etc.

Table 3. Tolerances of dimensions and shapes of Paneltech sandwich panels

THICKNESS	For thickness not larger than or equal to 100 mm Tolerance ± 2 mm	For thickness larger than 100 mm Tolerance $\pm 2\%$	
ROOFING WIDTH	For all profiles Tolerance ± 2 mm		
LENGTH	For length not larger than or equal to 3000 mm, Tolerance ± 5 mm	For length larger than 3000 mm, Tolerance ± 10 mm	
DILATION FROM FLATNESS *	For the measurement section 200 mm, Tolerance 0.6 mm	For measurement section 400 mm, Tolerance 1 mm	For measurement section 700 mm, Tolerance 1.5 mm
DILATION FROM RECTANGULARITY	Tolerance, not larger than 0.6% of the nominal roofing width		
DILATION FROM STRAIGHTNESS	Tolerance, not larger than 1 mm/1 m, but not exceeding 5 mm		
METAL PROFILE HEIGHT	For profile height from 5 to 50 mm, tolerance ± 1 mm		
STIFFENING OF LIGHTLY PROFILED CLADDING HEIGHT	For depths of stiffening smaller than 1 mm tolerance $\pm 30\%$	For depths of stiffening from 1 to 3 mm tolerance $\pm 0,3$ mm	For depths of stiffening from 3 to 5 mm tolerance $\pm 10\%$
CURVE ALONG THE PANEL	Tolerance: not more than 2 mm per one meter of length, but not more than 10 mm for the whole panel		
CURVE ACROSS THE PANEL	Tolerance: not more than 8.5 mm per one meter of width when the profile depth equals $h \leq 10$ mm	Tolerance: not more than 10 mm per one meter of width when the profile depth equals $h > 10$ mm	
PROFILE MODULE	For standard profile tolerance ± 2 mm		
WIDTH OF RIB AND TROUGH	Rib tolerance ± 1 mm	Trough tolerance ± 2 mm	

* - See 'Paneltech General Warranty Terms', chapter 'Disclaimers and limitations of Manufacturer's liability', point 8.

7. Other information

The following additional explanations are hereby introduced:

- the minimum roof slope equals 5% for roofs made of continuous panels (without any joints at their length),
- the minimum roof slope equals 9% for roofs made of panels connected with each other,
- it is recommended to assemble panels at greater roof slopes than indicated above. In case of the minimum slopes, please contact the Manufacturer.
- The minimum widths of panel supports.

Table 4

PANEL TYPE	WIDTH OF THE EDGE SUPPORT [MM]	WIDTH OF THE MIDDLE SUPPORT [MM]
PWW-S, PWW-S lite, PWS-S	50	100
PWW-D, PWS-D	60	80
PUR-S, PUR-SU, PUR-CH, PUR-D	40	60
PIR-S, PIR-SU, PIR-CH, PIR-D	40	60

- e) The designer of the built structure is responsible for applying appropriate technical solutions concerning the insulated panel roofing made of sandwich panels.
- f) The maximum spacing of the load-bearing structure (supports) of sandwich panels determined on the basis of data from the accredited fire testing laboratories. The load-bearing structure of the minimum R flame resistance class (the minute R value not lower than the fire resistance value of the barrier).

Table 5.

PANEL TYPE	PANEL THICKNESS [MM]	FIRE RESISTANCE PARAMETER	MAXIMUM SPACING OF THE SUPPORTS / COMPOSITION OF WALL PANELS OR ROOF SLOPE
PWS-S	-	NPD	-
PWS-D	-	NPD	-
PWW-S	100 ÷250	EI 60	7,5 m / horizontal and 3 m / vertical
PWW-S lite	100 ÷250	EI 30	7,44 m / horizontal and 3 m / vertical
PWW-D	100 ÷250	REI 120	dependent on the bending moment*/ to 15°
PUR-S, PUR-CH	80 ÷200	EI 20	3 m / horizontal and vertical
PUR-SU	100 ÷120	EI 15	3 m / horizontal and vertical
PUR-D	90 ÷160	RE 30	dependent on the bending moment*/ to 25°
PIR-S, PIR-CH	100 ÷200	EI 30	3 m / horizontal and vertical
PIR-SU	100 ÷120	EI 15	4 m / horizontal and vertical
PIR-D	90 ÷160	REI 30	dependent on the bending moment/ to 25°

* - detailed information to be found in the 'Fire resistance classification'.

- g) The assembly of colourful panels should be performed in such a way, so that panels of identical colours and specular gloss are used on the given surface / facade area. Due to this it is recommended to determine the colour, colour difference and specular gloss of the panels for different facades before placing an order, and to submit the colour reference sample.
- h) The assembly works have to be performed in accordance with the guidelines of the Building Research Institute 'Technical conditions of construction and commissioning'. Earthworks and constructional works Insulated panel roofing made of sandwich panels.
- i) Technical solutions not listed above are acceptable, consistent with good construction practices.
- j) To obtain sandwich panels with mineral wool core, whose claddings are to be minimally waved, you should use steel claddings 0.6 mm thick (external thickness) and 0.5 mm thick (internal thickness). This guideline is consistent with the standard PN-EN 14509. However, if the buyer does not agree for the increased thickness, then the manufacturer of sandwich panels will consider small waving of claddings as an aesthetic problem, which shall not be a subject of complaints. It is assumed that small waving of cladding surface can be classified as not meeting the requirements concerning the surface flatness, if the dimensional tolerances of the aforementioned standard are breached, subject to point 6 of the guidelines. In addition small waving of external cladding surface can also be caused by the assembly conditions, including the variable loads factor, as described in the standard PN-EN, Annex E, Design procedures. This rule applies only to the assembly of sandwich panels whose surface mass exceeds 25 kg/m² in horizontal position. Take special caution when assembling the wall of the construction structure, because the upper panel has to be assembled above the bottom panel using connectors for load-bearing structures, when it is still supported by e.g. a crane. You have to adhere to the value of connector dilation indicated in point 2 without any exceptions.

Note that the structure and appearance of standard sandwich panels with mineral wool core results from the specificity of the manufacturing process. The insulating - construction core is made of louver blocks, approx. 200 mm wide and 2000 mm long, which are put along the panel forming a stair-like structure. This way of assembling the core can result in the appearance of linear light reflexes on the cladding. Nevertheless this phenomenon does not have any impact on the heat, endurance, acoustic or fire resistance parameters.