BLACHY PRUSZYŃSKI

PIRTECH

SANDWICH PANELS

with rigid polyurethane
foam core PIR in steel facings

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ABOUT COMPANY

Pruszynski Group is the largest Polish producer of construction products. The structure of the Group is made up of twenty companies operating in Poland and Europe. The core of the activities are:

- **Blachy Pruszynski** - manufacturer among number of products - steel roofing, facade, sandwich panels and cold-formed profiles.
- **PUNTO Pruszyński**, manufacturer of suspended metal ceilings, facade facing, profiles and accessories for plasterboard assembly.
- **METKOL Pruszyński**, producer of non-ferrous and acid-resistant steel products.
- **EXTRAL** - manufacturer of aluminum profiles.

Since the beginning of its activity, Pruszyński Group has paid the attention to the importance of the highest quality of their products and long-term relationships with customers. Pruszynski has gained a market leader position in construction, and its products definitely stand out on it, which confirms the number of awards and diplomas of appreciation. The commercial offer is extremely wide therefore the products can be combined into systems that provide investors with complete solutions at site and shorten the finishing of the project.

PIRTECH SANDWICH PANELS SYSTEM

In the second decade of the 21st century, there was a shift in economic activity on the market for products construction. The demand for sandwich panels in metal facings with polyurethane rigid foam core (PIR) has risen. The reaction of Pruszyński Capital Group to the overwhelming transformation was the extension of the current offer (sandwich panels with mineral wool core and styrofoam) with sandwich panels with PIR type. The offer is dedicated to architects and investors who expect complex supplies of whole systems where they will find PIR sandwich panels in the metal facings, flashings and other needed accessories and professional technical support. Panels are produced according to the harmonized standard PN-EN 14509 with CE marking and Declaration of Conformity.

Production of PIRTECH **sandwich panels** with rigid polyurethane foam core (PIR) was launched in mid-2016. The production process is carried out continuously, fully automated line provided by one of the industry leaders Hennecke (GERMANY). Pentane is used as a foaming agent. Owing to that, production is environmentally friendly - it does not destroy the ozone layer and does not cause a greenhouse effect. Other components of foam are: polyol - polyurethane resin, isocyanate - hardener and activators and additives.

Technological process of production of sandwich panels with polyurethane foam core (PIR) consists of injecting the mixed components, which then form a rigid core polyurethane with a density of 40 ± 3 [kg / m3], between two moving continuously steel facings (with profiled edges and shaped surfaces of facings); at the same time there is the application of gasket and aluminum foil into the joints of the panel.

Maximum production speed is up to 15 m / min. The length of CONTIMAT (tunnel) is 45 m long - one of the longest in Europe. As a result, the higher efficiency is achieved along with high quality of produced panels. The line was fitted with 2 crowns - for the bottom plate (external facing) and for the upper plate (internal facing). Currently, the standard is only one such device installed in the production line in Europe. It improves the adhesion of the core to the metal facings. Better adhesion gives higher mechanical properties of the panels – load capacity and stiffness. In order to improve the quality of the produced panels the line was equipped in the special cooling section named as “hedgehog”. Thanks to this solution, the produced panels spend proper time to cool down. In this way, the risk of thermal shock is avoided, as it has a very negative effect on appearance of panels and their mechanical properties. Next to the production hall, there is the magazine for the panels for further cooling down. After 24 hours the panels are sent to the clients.
The production line of roofing panels is equipped with so-called overlapping - preparing panels for easy and fast assembling on the length. The main raw material base - isocyanates and polyols, are stocked in two batteries tanks - 4 pieces each (each tank 40 m3). Such a quantity of tanks ensures continuous maintenance of production - risk of breaks in production are practically eliminated to zero.
High quality and constant reproducibility of technical parameters of PIRTECH sandwich panels has been obtained by using the highest quality raw materials and continuous control of all steps of production according to Factory Production Control.

Steel facings are produced with thicknesses from 0.40 mm to 0.70 mm and they are covered with metallic and organic protective coatings. The very wide offer enables the use of PIRTECH panels in the most aggressive environments. In addition, the protective coatings are offered in number of different colours, so that they can meet the most sophisticated investors expectations.

PURPOSE AND APPLICATION

Sandwich elements are constructed from materials which consist of construction elements (external steel facings) and construction –insulation layer (core of the panel). The idea of the sandwich panels is permanent connection construction of facings with core on whole surface in order to get the static collaboration among them.

Sandwich panels are used in the building industry as:

- Curtain walls,
- Roofs,
- Internal partition walls,
- Occasionally as load-bearing walls (in the case of single-storey small buildings such a small cubic chambers, backyard facilities, rarely cottages),
- Suspended ceiling elements.

In buildings of various uses, which include objects:

- One-storey (multi-storey) and multi-storey industrial buildings.
- Public utilities (sports and entertainment halls, large commercial halls, Swimming pools, etc.).
- Agricultural construction.
- Special construction (eg. cooling towers, floating railways, back office buildings construction, floating military containers, etc.).

The use of sandwich panels in the construction industry is due to the benefits of both small mass, as well as the specificity of raising partitions from these products. To these benefits we can also include:

- Speed and ease of assembling
- Ability to exclude the heavy equipment from construction
- Clear reduction for heavy means of transport
- Easily removable and reassembled (in case of process change technological and possible change of requirements in relation to the production area of enclosure made of sandwich panels)
- Decoupling of assembly work from atmospheric conditions.
- Limitation of finishing works.
- Particular ease in obtaining required thermal insulation of partitions, without the need for technological changes in production.

Wall panels

Sandwich panels system with rigid polyurethane foam core (PIR) in metal facings from production of PRUSZYŃSKI Sp. z o. o. includes wall panels with visible joint (PWS - PIR - ST), wall panels with hidden joint (PWS - PIR - PL), roof panels (PWD - PIR) and cold storage panels (PWS - PIR - CH).

Basic modular widths are:

- Wall panels with visible joints and cold storage panels 1150 mm.
- Wall panels with hidden joint and roof panels 1050 mm.

The longitudinal contacts („joints") of the wall panels have a conical shape:

- facilitates assembly (saving time and minimizing risk of damage)
- provides water and air tightness,
- improves fire resistance, reaction to fire,
- increases the longitudinal rigidity of the boards - thus improving the bearing capacity and performance rigidity.

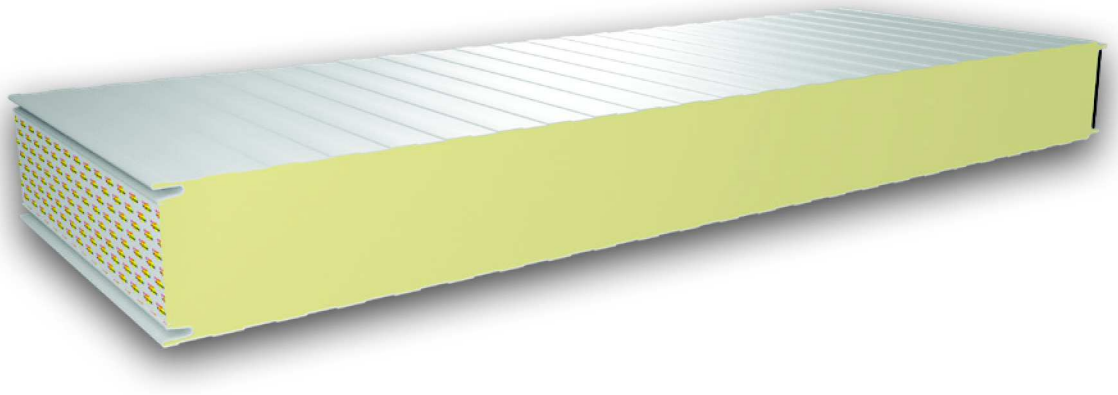
In the case of wall panels with hidden joint – they have unique geometry - „triple" feather - groove. Therefore, you can get even better fire safety properties and mechanical properties.

Roof panels

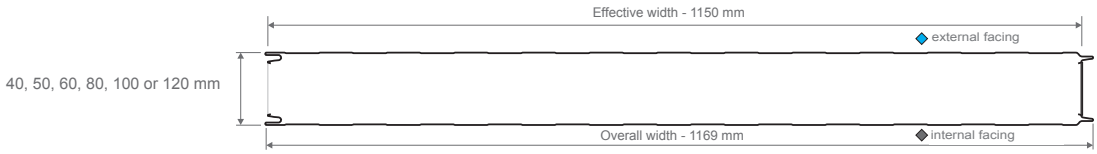
As for the roof panels, the external facing has been shaped (the main fold 40 mm high) that the load capacity is comparable to the roof panels with the main fold height 45 mm. Therefore, it is possible:

- saving on raw material
- saving on the length of assembly fasteners
- cost savings on transport

Types of PIRTECH panels				
Name	**STANDARD - ST**	**PLUS - PL**	**COLD STORAGE - CH**	**ROOF**
joint				
designation	**PWS-PIR-ST**	**PWS-PIR-PL**	**PWS-PIR-CH**	**PWD-PIR**
core	**PIR polyurethane**			
thickness (mm)	**40/50/60/80/100/120**	**60/80/100/120**	**120/160/180/200/220**	**40/60/80/100/120/160**
effective width (mm)	1150	1050	1150	1050
thickness of the facing (mm)	0,50	0,50	0,50	0,50
range of external profiling	trapezoidal - T / micro - M / wave - F			**trapezoidal T40**
range of internal profiling	trapezoidal - T			
anti-corrosion coating	Polyester / mat, polyurethane, HPS, PVDF			

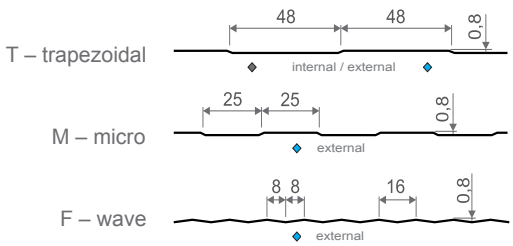


cross-section



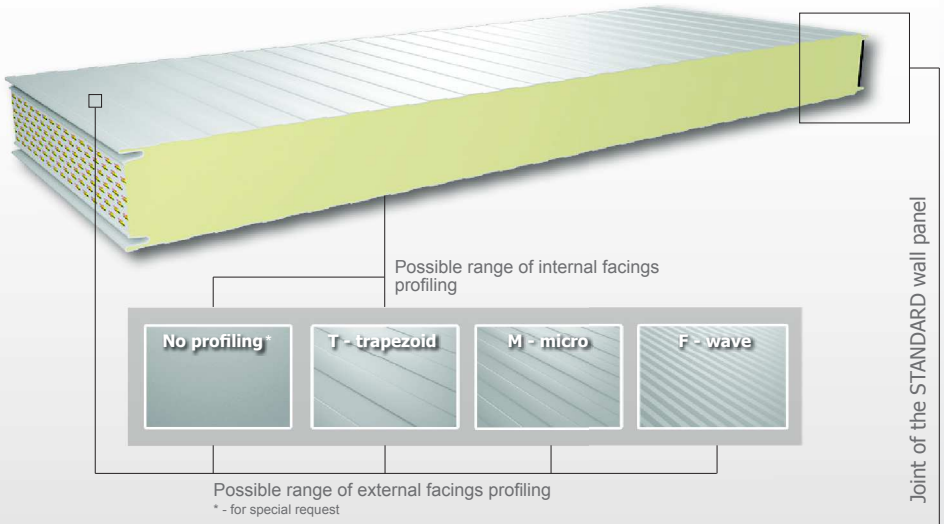
Possible range of facing profiling

Possible range of facing profiling

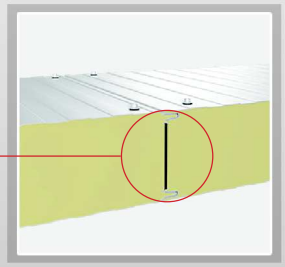


Panels with visible joints are dedicated for projects where the basic investor's criteria are the technical parameters and the exterior appearance of its façade and visible joints may be accepted. For example – warehouses, factories, food and industrial warehouses.

Profile of the STANDARD wall sandwich panel	
symbol / thickness	PIRTECH
PWS-PIR-ST 40	
PWS-PIR-ST 50	
PWS-PIR-ST 60	
PWS-PIR-ST 80	
PWS-PIR-ST 100	
PWS-PIR-ST 120	

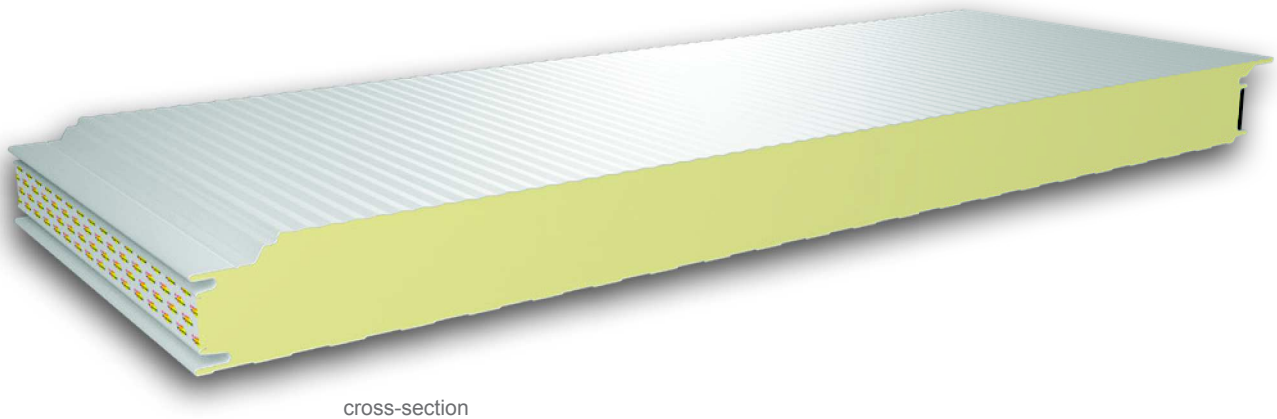


Type of the panel	Possible range of facings profiling	
	external	internal
PWS-PIR-ST	No profiling	No profiling
	T - trapezoid	T - trapezoid
	M - micro	-
	F - wave	-

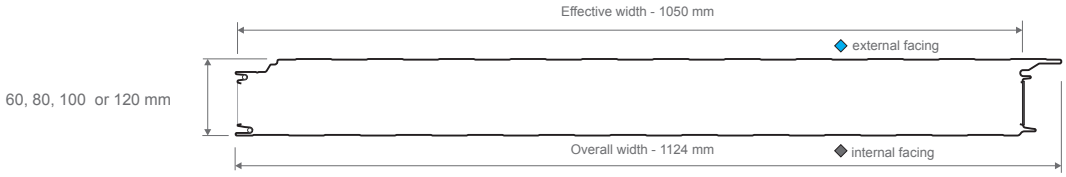


Polyurethane seal and foil

basic technical data						
core thickness (mm)	40	50	60	80	100	120
effective width (mm)	1150					
overall width (mm)	1169					
thickness of facings (mm)	external 0,40-0,70 / internal 0,40-0,63					
polyurethane foam core (mm)	with a density of 40 (±3) kg/m^3					
colours facings	Colour palette					
panel length	2,0 mb					
max panel length	16 mb **(depending on colour)**					
weight 1 m^2 (kg)	9,4	9,8	10,2	11,0	11,8	12,6
anti-corrosion coating	polyester gloss / mat, polyurethane, HPS 200					
declared heat transfer coefficient λD (W / mK)	0,023					
heat transfer coefficient - Uc (W / m2K)	0,60	0,46	0,38	0,29	0,23	0,19
reaction to fire	-	-	-	B-s2, d0	B-s1, d0	B-s1, d0
flame propagation	NRO					
fire resistance	-	-	-	-	EI30 (o↔i)	EI30 (o↔i)
water permeability	Class A - 1200Pa					
air permeability	50 Pa 0,07 m3/hm2 -50 Pa 0,01 m3/hm2					
water vapour permeability	impermeable					
sound insulation (dB)	27 (-2;-4) - 40 mm 25 (-3;-5) - 120 mm **For the whole family** 25 (-3;-5)					
absorption index α_w	0,15					
tensile strength (MPa)	0,11					
tensile Modulus (MPa)	3,1					
shear strength (MPa)	0,10					
modulus of elasticity (MPa)	3,2					
compressive strength (MPa)	0,13					
modulus of Compression (MPa)	2,8	2,8	2,8	2,8	2,8	3,3
tensile modulus at elevated temperature (MPa)	2,6	2,6	2,6	2,6	2,6	5,1

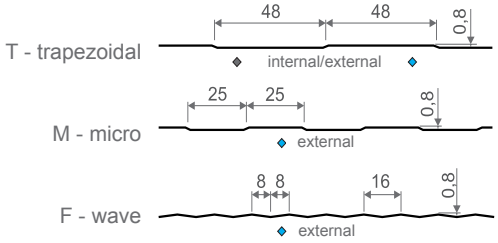


cross-section



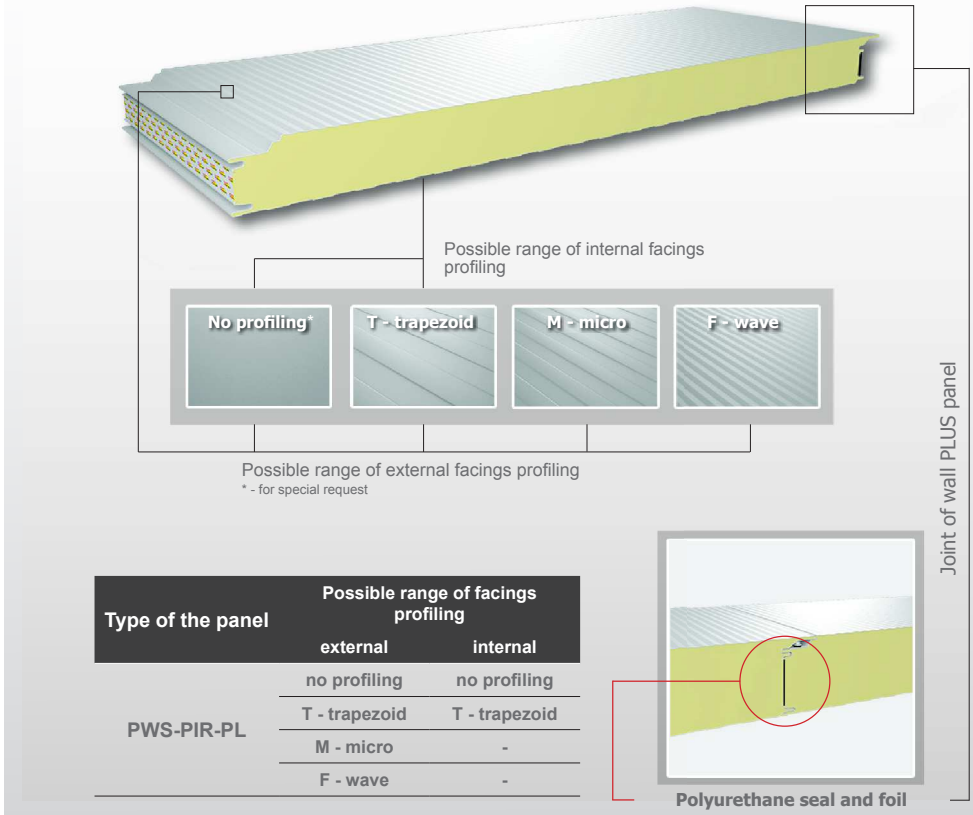
Possible range of facings profiling

Possible range of facings profiling



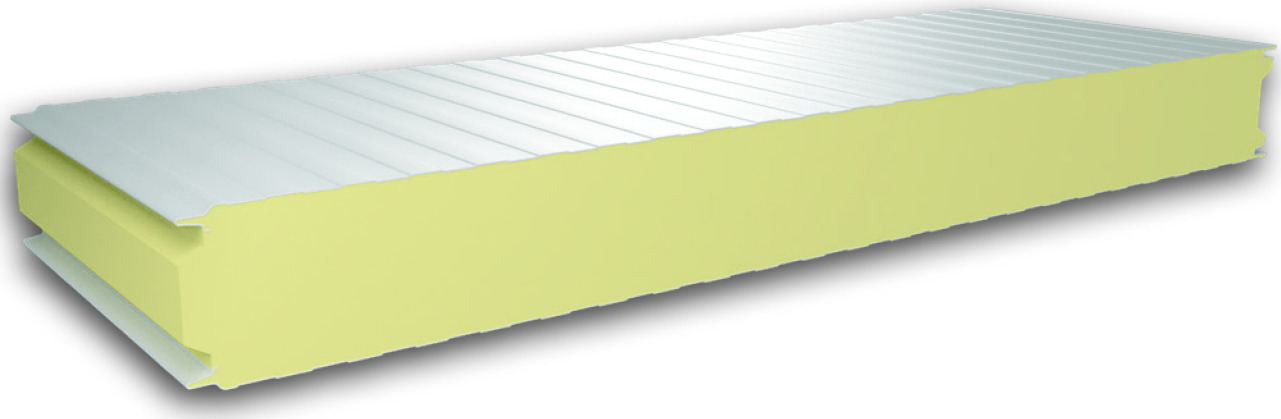
This panel has the hidden joint, designed for construction projects where one of its conditions is the aesthetic appearance of facade. Wide range of colours and its qualities allow to carry out the construction project incorporated into each urban plan. It gives the ability to combine different architectural styles in towns and villages. Panels with hidden joint can be used for facades of residential buildings, hotels, shopping facilities, office buildings, stations and other public buildings. It helps architects with the most modern construction projects.

Range of facings profiling	
Symbol/thickness	PIRTECH
PWS-PIR-PL 60	
PWS-PIR-PL 80	
PWS-PIR-PL 100	
PWS-PIR-PL 120	



Type of the panel	Possible range of facings profiling	
	external	internal
PWS-PIR-PL	no profiling	no profiling
	T - trapezoid	T - trapezoid
	M - micro	-
	F - wave	-

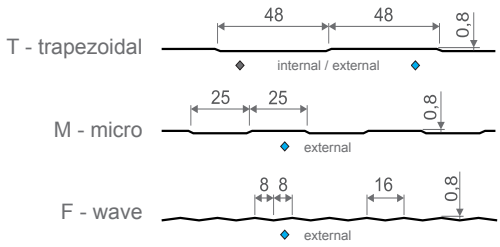
Basic technical data				
core thickness (mm)	60	80	100	120
effective width (mm)	1050			
overall width (mm)	1104			
thickness of facings (mm)	external 0,40-0,70 / internal 0,40-0,63			
polyurethane foam core	with a density of 40 (±3) kg/m^3			
colour facings	colour palette			
min. panel length	2,0 mb			
max panel length	16 mb **(depending on colour)**			
weight 1 m^2 (kg)	10,2	11	11,8	12,6
anti-corrosion coating	polyester gloss / mat, polyurethane, HPS 200			
declared heat transfer coefficient λ_D (W/mK)	0,023			
heat transfer coefficient - Uc (W/m^{2}K)	0,41	0,30	0,23	0,19
reaction to fire	B-s2, d0			
flame propagation	NRO			
fire resistance	-	-	-	EI30 (o↔i)
water permeability	Class A - 1200Pa			
air permeability	50 Pa 0,08 m3/hm2 -50 Pa 0,16 m3/hm2			
water vapour permeability	impermeable			
sound insulation (dB)	**For the whole family** 25 (-3;-5)			
absorption index α_w	0,15			
tensile strength (MPa)	0,11			
tensile modulus (MPa)	3,1			
shear strength (MPa)	0,10			
modulus of elasticity (MPa)	3,2			
compressive strength (MPa)	0,13			
modulus of compression (MPa)	2,8	2,8	2,8	3,3
tensile modulus at elevated temperature (MPa)	2,6	2,6	2,6	5,1



cross-section

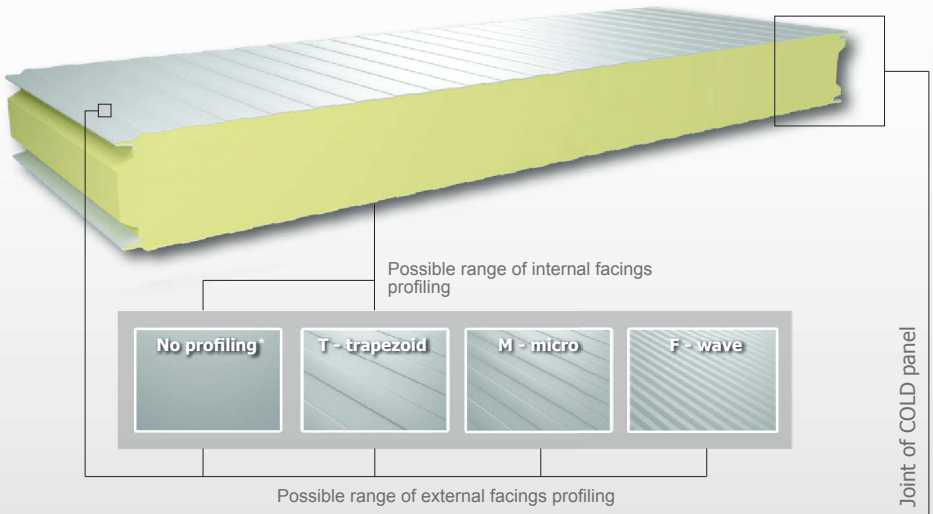
Possible range of facings profiling

Possible range of facings



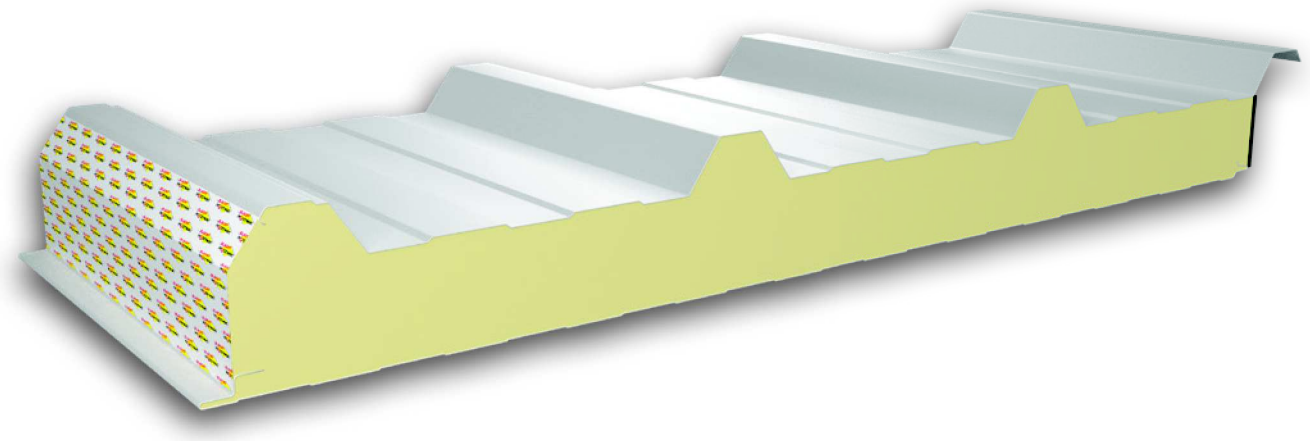
The panel is designed for cold storage such as storage rooms, icehouses and freezers.

Range of facings profiling	
Symbol/thickness	PIRTECH
PWS-PIR-CH 120	
PWS-PIR-CH 160	
PWS-PIR-CH 180	
PWS-PIR-CH 200	
PWS-PIR-CH 220	

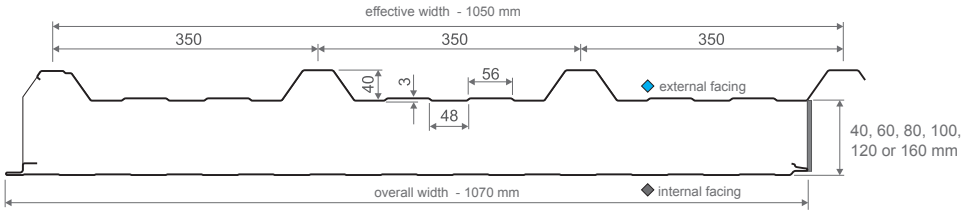


Type of the panel	Possible range of facings profiling	
	external	internal
PWS-PIR-CH	No profiling	No profiling
	T - trapezoid	T - trapezoid
	M - micro	-
	F - wave	-

Basic technical data					
core thickness (mm)	120	160	180	200	220
effective width (mm)	1150				
overall width (mm)	1169				
thickness of facings (mm)	external 0,40-0,70 / internal 0,40-0,63				
polyurethane foam core	with a density of 40 (±3) kg/m^3				
colours facings	colour palette				
min. panel length	2,0 mb				
max panel length	16 mb **(depending on colour)**				
weight 1 m^2 (kg)	12,6	14,2	15,0	15,8	16,6
anti-corrosion coating	polyester gloss / mat, polyurethane, HPS 200				
declared heat transfer coefficient λ_D (W/mK)	0,0218 temp. +5°C	0,0213 temp. 0°C	0,0213 temp. 0°C	0,0207 temp. -5°C	0,0207 temp. -5°C
heat transfer coefficient - Uc (W/m^{2}K)	0,18	0,14	0,12	0,11	0,10
reaction to fire	B-s1, d0				
flame propagation	NRO				
fire resistance	EI30 (o↔i)				
water permeability	Class A - 1200Pa				
air permeability	50 Pa 0,07 m3/hm2 -50 Pa 0,01 m3/hm2				
water vapour permeability	impermeable				
sound insulation (dB)	26 (-4;-5) - 220 mm **For the whole family** 25 (-3;-5)				
absorption index α_w	0,15				
tensile strength (MPa)	0,11				
tensile Modulus (MPa)	3,1				
shear strength (MPa)	0,10	0,10	0,10	0,10	0,11
modulus of elasticity (MPa)	3,2				
compressive strength (MPa)	0,13				
modulus of Compression (MPa)	3,3				
tensile modulus at elevated temperature (MPa)	5,1				



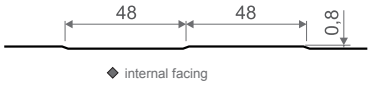
cross-section



Possible range of facings profiling

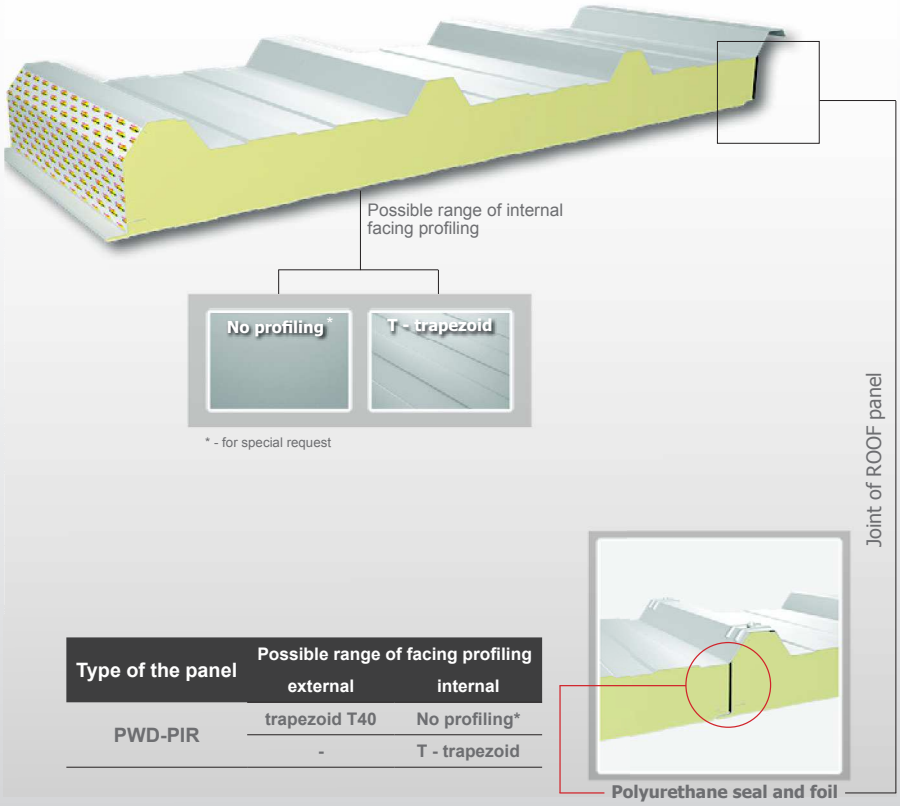
possible range of facings profiling

T – trapezoidal



Universal roof panel for all types of roofs and various slope accounts for different types of buildings.

Range of facings profiling	
Symbol / thickness	**PIR**TECH
PWD-PIR 40	
PWD-PIR 60	
PWD-PIR 80	
PWD-PIR 100	
PWD-PIR 120	
PWD-PIR 160	



Type of the panel	Possible range of facing profiling	
	external	internal
PWD-PIR	trapezoid T40	No profiling*
	-	T - trapezoid

Basic technical data						
core thickness (mm)	**40**	**60**	**80**	**100**	**120**	**160**
effective width (mm)	1050					
overall width (mm)	1069					
thickness of facings (mm)	external 0,40-0,70 / internal 0,40-0,63					
polyurethane foam core	with a density of 40 (±3) kg/m^3					
colours facing	colour palette					
min. panel length	2,0 mb					
max panel length	16 mb **(depending on colour)**					
weight 1 m^2 (kg)	9,4	10,2	11,0	11,8	12,6	14,2
anti-corrosion coating	polyester gloss / mat, polyurethane, HPS 200					
declared heat transfer coefficient λ_D (W/mK)	0,023					
heat transfer coefficient - Uc (W/m^{2}K)	0,53	0,37	0,28	0,22	0,18	0,14
reaction to fire	B-s2, d0				B-s1, d0	
external exposure to fire	B_{roof}(t1)					
fire resistance	REI30 / RE60					
water permeability	Class A - 1200Pa					
air permeability	50 Pa 0,02 m3/hm2 -50 Pa 0,37 m3/hm2					
water vapour permeability	impermeable					
sound insulation (dB)	23 (0;-3) - 40 mm 24 (-2;-4) - 120 mm **For the whole family** 23 (-1;-3)					
absorption index α_w	0,20					
tensile strength (MPa)	0,11					
tensile Modulus (MPa)	3,1					
shear strength (MPa)	0,11					
modulus of elasticity (MPa)	3,2					
compressive strength (MPa)	0,13					
modulus of Compression (MPa)	2,8	2,8	2,8	2,8	3,3	3,3
tensile modulus at elevated temperature (MPa)	2,6	2,6	2,6	2,6	5,1	5,1

Thermal loads recommendation

It was required to take under consideration the thermal differences between the facings of sandwich panels. Gradient of temperature between external temperature T_1 and internal temperature T_2 is addicted to various factors:

- Dedication of the building (temperature range in the building – T_2)
- Location of the building – situated towards the sun or not
- Colour of the external facing (T_2)

There are four different winter temperature stages depends on latitude, level above the sea and distance from the sea on a European Continent (T_1 – external facing):

- 0, -10°C,
- 0, -20°C, (e. g. Poland)
- 0, -30°C, (e. g. The Countries of Scandinavia)

External facing temperature for roof panels with snow caps is 0oC.
Outer winter temperature for calculations was assumed as -20 oC.

External facing`s temperature T1 , reach maximum in the summer and depends on the colour and surface reflection rate of the facing. T1 , which has minimal value for calculations of carrying capacity (SGN) and that value is adequate to calculations of critical state of exploiting (SGU), assumed accordingly:

- Very light colours RG = 75-90 T_1 = +55°C
- Light colours RG = 40-74 T_1 = +65°C
- Dark colours RG = 8-39 T_1 = +80°C

RG- reflection rate against magnesium oxide = 100%

All the colours are available in palette of Pruszyński Sp. z o. o. They are divided into three different groups that are listed in the table below.

Length of panels

Allowed maximal length of panels depends on facing's colour (minimum length – 2 r.m.) for single span beam panels.

Division acc. to PN-EN 14509	Maximum* length - ROOF	Maximum* length - WALL	Colours acc. to RAL and RR basic offer
grupa I very light colours	max 16 r. m.	max 16 r. m.	RAL 9010, RAL 9002
grupa II light colours	max 15 r. m.	max 12 r. m.	RAL 1002, RAL 1021, RAL 7000, RAL 7035, RAL 9006
grupa III dark colours	max 12 r. m.	max 9 r. m.	RAL 3005, RAL 3016, RAL 8016, RAL 8017,RAL 8004, RAL 7016, RAL 7024, RAL 5010, RAL 6005, RAL 6029, RAL 9007, RAL 9005, RR032, RR028

** length follow limitation of maximum elongation/shortage of panel*