CARBON FOOTPRINT DECLARATION No. 179 /2021

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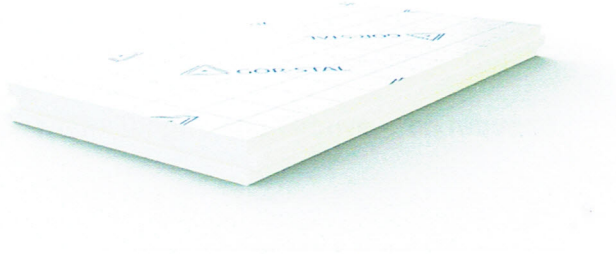
GÓR-STAL

thermPIR® insulation panels



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Basic information

This declaration is the type Carbon Footprint Declaration (EPD) based on ISO 14067:2018. Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification and verified according to ISO 14025 by an external auditor. It contains the information on the carbon impacts (as GWP indicator) of the declared construction materials on the environment. Their aspects were verified by the independent body according to ISO 14025. Basically. a comparison or evaluation of EPD data is possible only if all the compared data were created according to ISO 14067:2018.

Life cycle analysis (LCA): A1-A3. C1-C4 and D in accordance with EN 15804 (Cradle to Gate with options)
The year of preparing the EPD: 2020
Product standard: EN 13165:2012+A2:2016
Service Life: 50 years
Declared unit: 1 kg (for 1m^2 impact data is also provided)
Reasons for performing LCA: B2B
Representativeness: Polish product

[1] *ITB is an accredited and notified body for certification of products (ID number 1488) - conducts certification activities within the scope of certification of products and construction services and the factory production control by acting in accordance with the requirements of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products, the PN-EN ISO/IEC 17065 standard and having an accredited research laboratory in accordance with PN-EN ISO/IEC 17025 (accreditation number AB 023).*

CARBON FOOTPRINT DECLARATION No. 179 /2021

PRODUCT DESCRIPTION

TECHNICAL PROPERTIES and CERTIFICATES

All technical properties of PIR panels in the field of: fire reaction, fire resistance, flame propagation, thermal physics, acoustic insulation, corrosion resistance, statics are detailed in the technical catalogs which can be downloaded at https://termpir.eu/do-pobrania. Panels are manufactured in accordance with EN 13165:2012+A2:2016. CE marked and the Declaration of Performance is issued. The basic technical characteristics of panels are;

- Type of core - Rigid polyisocyanurate foam (PIR)
- Apparent density of core [kg/m^3] - 30
- Declared heat conductivity coefficient λD [W/m·K] - λD = 0.022
- Board facing – see Table 1
- Board dimensions[2] [mm] - 600 x 1200; 1200 x 2400
- Joint types - FIT - Straight edges, (LAP – Overlap, TAG - Tongue and Groove - on request)
- Thickness [mm] - from 20 to 250

Table 1. The basic technical characteristics of PIR panels

Product	Declared heat conductivity coefficient	Fire reaction classification	Compressive strength
termPIR AL	0.022	F (for20-50 mm)	120 kPa (for 20 mm)
		E (for 50-250 mm)	150 kPa (for 30 – 250 mm)
termPIR AGRO AL	0.022	D-s2, d0	120 kPa (for 20 mm)
			150 kPa (for 30 – 250 mm)
termPIR AGRO P	0.022	F	120 kPa (for 20 mm)
			150 kPa (for 30 – 250 mm)
termPIR P REV	0.022	F	120 kPa
termPIR PK REM 20≤ dn<80	0.027	F	120 kPa
termPIR PK REM 80≤ dn <120	0.026		
termPIR PK REM 120≤ dn ≤250	0.025		
termPIR MAX 19	0.019	E	100 kPa
termPIR GK	0.022	F	nd
termPIR WS 20≤ dn<80	0.027	F (for 20-50 mm)	120 kPa (for 20 mm)
termPIR WS 80≤ dn <120	0.026	E (for50-250 mm)	150 kPa (for 30 – 250 mm)
termPIR WS 120≤ dn ≤250	0.025		
termPIR ETX 20≤ dn<80	0.027	F (for 20-50 mm)	120 kPa (for 20 mm)
termPIR ETX 80≤ dn <120	0.026	E (for 50-250 mm)	150 kPa (for 30 – 250 mm)
termPIR ETX 120≤ dn ≤250	0.025		
termPIR BT 20≤ dn<80	0.027	F	120 kPa (for 20 mm)
termPIR BT 80≤ dn <120	0.026		150 kPa (for 30 – 250 mm)
termPIR BT 120≤ dn ≤250	0.025		
termPIR BWS 20≤ dn<80	0.027	F (for 20-50 mm)	120 kPa (for 20 mm)
termPIR BWS 80≤ dn <120	0.026	E/F WS/BT (for 50-250 mm)	150 kPa (for30 – 250 mm)
termPIR BWS 120≤ dn ≤250	0.025		
termPIR PK 20≤ dn<80	0.027	F	120 kPa (for 20 mm)
termPIR PK 80≤ dn <120	0.026		150 kPa (for 30 – 250 mm)
termPIR PK 120≤ dn ≤250	0.025		

APPLICATIONS

PIR panels are used as a component of thermal insulation systems. They are used to insulate foundations, walls, exterior walls, ceilings, terraces and balconies, flat roofs and pitched roofs. They

[2] *Depending on the customer's needs, Gór-Stal is able to produce any length of the board.*

provide thermal insulation as compared to other construction materials such as mineral wool or foamed polystyrene.

OTHER HEALTH ASPECTS

Polyurethane is formed by a chemical reaction between the polyol and the diisocyanate. As a result of this process a completely inert and safe for humans polyurethane foam is created (no dusting). In accordance to literature the foams are safe for humans The product has the National Hygienic Certificate and VOC emission assessment by Eurofins at "Indoor Air Comfort GOLD" level (2020).

CERTIFICATES

- Keymark – nr 021-IMBIgs-0001 z dn. 14.09.2020 r., Sieć Badawcza Łukasiewicz – Instytut Mechanizacji Budownictwa i Górnictwa Skalnego. Zakład Certyfikacji w Katowicach.
- KOMO CTG-724/1. KOMO CTG-7251/. SGS INTRON Certificatie B.V. Venusstraat 2. Postbus 267. 4100 AG Culemborg.
- ATG H966. ATG 3188. Rue du Lombard 42. 1000 Bruxelles.
- VOC emission test report 77/13.03.2020. Eurofins Product Testing A/S. Smededkovvej 38. 8464 Gal
- ISO 9001 : 2015. PCC-CERT Sp. z o.o. Sp. K., ul. Sportowa 9. 55-040 Kobierzyce
- ISO 14001 : 2015. PCC-CERT Sp. z o.o. Sp. K., ul. Sportowa 9. 55-040 Kobierzyce

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Allocation

Production of the panels is a line process. Carobon allocation for production A1-A3 (PIR) is done on a production mass basis. All impacts from raw materials extraction and production (including: steel profil faces (aluminium, glass fleet etc.), polyol, MDI, catalyst KX, n-pentane, paper gaskets, packaking, energy carriers and water) are allocated in A1 module (resources production). 100% of impacts from line production were inventoried and 100% were allocated to the PIR panels production. Utilization of packaging material (PE, PP, styrofoam) was taken into consideration. Module A2 (transport to factory) includes transport of raw materials such as faces, chemicals, additives and ancillary materials from their suppliers to manufacturing plant. Municipal wastes of factory were allocated to module A3 (factory production). Energy supply was inventoried for whole factory and 100% was allocated to the PIR based sandwich panels production. Emissions in the factory were estimated by using the national carbon/energy conversion factors (KOBiZE- 2019) and were allocated to module A3.

System limits

The life cycle analysis of the declared products covers "Product Stage", A1-A3, C1-C4 and D modules (Cradle to Gate with options) in accordance with EN 15804+A1 AND iso 14067. The input materials and energy consumption inventoried in factories were included in calculation. In the assessment all significant parameters from gathered production data are considered i.e. all material used per formulation, utilized thermal energy, internal fuel and electric power consumption. It is assumed that the total sum of omitted processes does not exceed 2% of carbon impact category. In accordance with EN 15804 machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees. Due to the fact that the biogenic carbon footprint is less than 5% of the total GWP carbon footprint, it has not been presented separately in the declaration.

A1 and A2 Modules: Raw materials supply and transport

In the case of PIR panels family a core material is a rigid PIR foam obtained in a controlled chemical reaction during production process. A vast majority of liquid components necessary for chemical reactions are sourced from inventoried foreign suppliers (Bayer located at Leverkusen). The transport to the factory has been fully inventorized (LCI questionnaire) taking into account the number of deliveries: type of vehicles, the size of the delivery and the distance from the manufacturer to the factory for all input sources and raw materials.

A3: Production

Production process itself (PIR) can be divided into stages. PIR insulation core material is being formed as a product of chemical reactions. Main components are polymeric isocyanate and polyols. To control reaction speed catalysts are being used. Pentane is used as a physical blowing agent (due to its very low thermal conductivity is also responsible for superior heat insulation properties). All components according to formulation are being dosed and mixed at high pressure in a liquid form. Such a reactive mixture is being evenly distributed across internal side of profiled facing. Foaming process starts and two facings where expanding chemical mixture fills volume with very fine cells structure foam. The belt laminator ensure dimension (thickness and width of sandwich panel) as well as necessary conditions for foam to harden. A component adhesive is being applied between facings. Later panels are being cut to length by flying saw synchronised with production line speed. Next panels are being transported into a cooling buffer. where need to spend relevant time to reach temperature stability. In the end of the process panels are stacked to form a parcel which is subsequently wrapped with foil. Next ready parcels need to stabilise for 48 hours. Finally products are being load on trucks and deliver to customer.

C1 – C4: End of life

The end of life scenario for a sandwich panel with PIR core is provided in Table 2. The product is disassembled using a mechanical jacks and hand electric tools.

Table 2. End-of-life scenario (C modules) for a sandwich panel with PIR core

Parameter	Contribution
Collection rate	100%
Reuse	20%
Incineration of PIR	40% of PIR core
Landfilling PIR	40% of PIR core

D: Re-use, recovery, recycling potential

20% of "reuse benefit" is calculated for A1-A3 values of panel production.

Data collection period

The data for manufacture of the declared products refer to year 2019. The life cycle assessments were prepared for Poland as reference area.

Data input quality

The values determined to calculate the LCA originate from LCI verified inventory data provided by Gór-Stal.

Assumptions and estimates

The impacts of the panels were aggregated using mass of production. Impacts were inventoried and calculated for all products. The impact on the panel's carbon performance from different type of facings was averaged for a product using the weighted average method. Due to the lack of good LCI

data for triethyl phosphate production (<2%) relevant data for ammonium phosphate was used which may perform the same function (fire retardant) in the final product.

Calculation rules

LCA was done in accordance with ITB PCR A document.

Databases and models

The carbon data for the processes come from the following databases: Ecoinvent v.3.7 (polyol, MDI, catalyst KX, n-pentane, paper gaskets, packaging, water, facings), foils (Plastic Europe), styrofoam (specific EPD), KOBiZE/Tauron (energy carriers: electricity, ON, natural gas and LPG). Specific data quality analysis was a part of external ISO 14001 based audit. Characterization carbon factor is CML ver. 4.2 based on IPCC 2013 (baseline model for 100 years).

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared/functional unit

The declaration refers to declared unit (DU) – 1 kg of the panels manufactured by Gór-Stal (Table 3). The following tables 4-16 present the carbon impact in relation to 1 m^2 for all offered product thicknesses.

Table 3. System boundaries (life's modules included) for the environmental characteristic of the PIR panels.

Environmental assessment information (MNA – Module not assessed. MD – Module Declared. INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse-recovery-recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
MD	MD	MD	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MD	MD	MD	MD	MD

Note: Due to the fact that the biogenic carbon footprint is less than 5% of the total GWP carbon footprint, it has not been presented separately in the declaration in following tables.

CARBON FOOTPRINT DECLARATION No. 179 /2021

Table 4. Life cycle carbon characteristic for 1 kg of thermPIR

Environmental impacts: (DU) 1 kg									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	2.09E+00	8.28E-02	2.35E-02	1.57E-01	3.80E-03	9.80E-01	1.68E-03	-4.19E-01

The table 4-15 shows the carbon footprint for products of varying thickness 20mm-250 mm.

Table 5. Life cycle carbon characteristic – 1 m^2 of thermPIR panel (20 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	1.26E+00	4.97E-02	1.41E-02	9.44E-02	2.28E-03	5.88E-01	1.01E-03	-2.51E-01

Table 6. Life cycle carbon characteristic – 1 m^2 of thermPIR (40 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	2.51E+00	9.94E-02	2.82E-02	1.89E-01	4.56E-03	1.18E+00	2.02E-03	-5.03E-01

Table 7. Life cycle carbon characteristic – 1 m^2 of thermPIR (50 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	3.14E+00	1.24E-01	3.52E-02	2.36E-01	5.70E-03	1.47E+00	2.52E-03	-6.28E-01

Table 8. Life cycle carbon characteristic – 1 m^2 of thermPIR (60 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	3.77E+00	1.49E-01	4.22E-02	2.83E-01	6.84E-03	1.76E+00	3.02E-03	-7.54E-01

Table 9. Life cycle carbon characteristic – 1 m^2 of thermPIR (80 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	5.03E+00	1.99E-01	5.63E-02	3.78E-01	9.12E-03	2.35E+00	4.03E-03	-1.01E+00

Table 10. Life cycle carbon characteristic – 1 m^2 of thermPIR (100 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	6.28E+00	2.48E-01	7.04E-02	4.72E-01	1.14E-02	2.94E+00	5.04E-03	-1.26E+00

Table 11. Life cycle carbon characteristic – 1 m^2 of thermPIR (120 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	7.54E+00	2.98E-01	8.45E-02	5.66E-01	1.37E-02	3.53E+00	6.05E-03	-1.51E+00

Table 12. Life cycle carbon characteristic – 1 m^2 of thermPIR (150 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	9.43E+00	3.73E-01	1.06E-01	7.08E-01	1.71E-02	4.41E+00	7.56E-03	-1.89E+00

Table 13. Life cycle carbon characteristic – 1 m^2 of thermPIR (180 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	1.13E+01	4.47E-01	1.27E-01	8.50E-01	2.05E-02	5.29E+00	9.07E-03	-2.26E+00

Table 14. Life cycle carbon characteristic – 1 m^2 of thermPIR (200 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	1.26E+01	4.97E-01	1.41E-01	9.44E-01	2.28E-02	5.88E+00	1.01E-02	-2.51E+00

Table 15. Life cycle carbon characteristic – 1 m^2 of thermPIR (220 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	1.38E+01	5.47E-01	1.55E-01	1.04E+00	2.51E-02	6.47E+00	1.11E-02	-2.76E+00

Table 16. Life cycle carbon characteristic – 1 m^2 of thermPIR (250 mm)

Environmental impacts: (DU) 1 m^2									
Indicator	**Unit**	**A1**	**A2**	**A3**	**C1**	**C2**	**C3**	**C4**	**D**
Total carbon emission equivallent (as GWP)	kg CO_2 eq.	1.57E+01	6.21E-01	1.76E-01	1.18E+00	2.85E-02	7.35E+00	1.26E-02	-3.14E+00

Results interpretation

The carbon impact of thermPIR panel (cradle to gate with options C and D) is mainly dependent on production of raw materials (A1) on which the manufacturer has only a little and indirect influence (in impact of production of resources is higher than 95%). The amount of eq. carbon dioxide eq. necessary to produce raw materials (A1) for production of 1 kg of thermPIR product is 2.2 kg, where only MDI production is 81% of all carbon impact. There is emitted 6.6 kg CO_2/m^2 for a 100mm panel production (A1-A3) while the energy input is 176 MJ/m^2 (where only MDI gives impact 76% and next pentane 10%). The production of faces for the cladding alone A1 gives a value of few percent of the value of the impacts of the panel production A1-A3. This means that the search for improvement of the environmental quality of the products may take place through the purchase of chemistry (mostly MDI). The impact of the PIR insulation increases with the thickness of the panel and is almost linear to its mass. For the thickest pallet variant 20mm carbon impact value is 1.32 kg/m^2 and for 250 mm is 16.5 kg/m^2 (A1-A3). The production in manufacturing plant A3 itself is not very energy demanding

and emissive. Emissions mainly come from the combustion of natural gas. The electricity consumption of 0.22 kW/kg seems not very significant. The transport of raw materials from considerable distances is rather not significant to overall values (2 % of all impact). The product utilization scenario after its disassembly from building assumes 20% re-use, 40% incineration and 40% landfill storage. PIR incineration provides heat to new systems. The sandwich panel products due to the 20% potential for reuse has some expected environmental gains provided in module D (about minus 20% of production carbon impact).

Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification. this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years. if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) [x] external [ ] internal
External verification of EPD: Ph.D. Eng. Halina Prejzner LCA. LCI audit and input data verification: Ph.D. Eng. Michał Piasecki. m.piasecki@itb.pl Verification of LCA: Ph.D. Eng. Justyna Tomaszewska. j.tomaszewska@itb.pl

Basically, a comparison or an evaluation of declaration data is only possible if all the data sets to be compared were created according to ISO 14067 and the building context, respectively the product-specific characteristics of performance are taken into account.

Normative references

- PU Europe - the European association of PU insulation manufacturers (www.pu-europe.eu)
- *ISO 14067*:2018. Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- ITB PCR A General Product Category Rules for Construction Products
- ISO 14025:2006. Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A1:2013 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- KOBiZE Wskaźniki emisyjności CO2, SO2, NOx, CO i pyłu całkowitego dla energii elektrycznej. grudzień 2019
- PN-EN 13165+A2:2016-08 Wyroby do izolacji cieplnej w budownictwie -- Wyroby ze sztywnej pianki poliuretanowej (PU) produkowane fabrycznie - Specyfikacja

p.o. KIEROWNIKA