Environmental Product Declaration Type III ITB No. 269/2021

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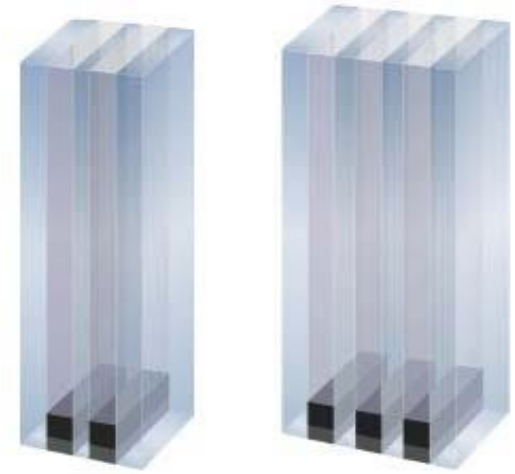
Bohflam Fire-Resistant Glass



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Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts 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 EN 15804 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1-A4, C1-C4 and D modules in accordance with EN 15804
(Cradle to Gate with options)

Product standard: PN-EN 12543-4

The year of preparing the EPD: 2021

Service Life: depending on application type, up to 50 years

PCR: ITB-PCR A (PCR based on EN 15804+A1)

Declared unit: 1 m^2 of specific BOHFLAM glass product in the following classes: EI30, EI60, EI90, E120

Reasons for performing LCA: B2B

Representativeness: Polish production, year 2020

PRODUCTS DESCRIPTION

BOHAMET is a recognised manufacturer in the glass industries. Manufacturing plant is located in Ciele (Poland). Within the glass production portfolio covers the following sectors: fire-resistant glass, automotive glass, bullet proof glass, heated glass, EMI shielding glass.

Bohflam Fire-Resistant Glass covered by this EPD is available in the following classes: EI30, EI60, EI90, E120. Technical specifications of representative products are provided in Table 1 and Table 2.

Table 1. Technical specification in the following classes of Bohflam products: EI30, EI60

1	fire resistance classification	EI 30	EI60
2	nominal thickness	16mm	24mm
3	minimum production size	200 x 200mm	200 x 200mm
4	maximum production size with nominal thickness	2200 x 3000mm (bigger sizes upon request)	2200 x 3000mm (bigger sizes upon request)
5	maximum tested size	information upon request	information upon request
6	thickness tolerance	+2 / -1mm	+3 / -2mm
7	external size tolerance	+2 / -2mm	+2 / -2mm
8	weight for minimum thickness	34kg/m²	52kg/m²
9	temperature range	+45 / -10°C	+45 / -10°C
10	light transmission	87%	86%
11	sound reduction	Rw 38dB	Rw 42dB
12	U-value	5,0W/m²K	5,0W/m²K
13	UV stable	EN ISO 12543-3 Pt. 6.5.2	EN ISO 12543-3 Pt. 6.5.2
14	G-value in %	73	69
15	Shading coefficient	0.92	0.86

Table 2. Technical specification in the following classes of Bohflam products: EI90, E120

1	fire resistance classification	EI90	EI120
2	nominal thickness	33mm	47mm
3	minimum production size	200 x 200mm	200 x 200mm
4	maximum production size with nominal thickness	2200 x 3000mm (bigger sizes upon request)	2200 x 3000mm (bigger sizes upon request)
5	maximum tested size	information upon request	information upon request
6	thickness tolerance	+3 / -2mm	+5 / -3mm
7	external size tolerance	+2 / -2mm	+3 / -3mm
8	weight for minimum thickness	68kg/m²	98kg/m²
9	temperature range	+45 / -10°C	+45 / -10°C
10	light transmission	82%	76%
11	sound reduction	Rw 43dB	Rw 46dB
12	U-value	5,0W/m²K	5,0W/m²K
13	UV stable	EN ISO 12543-3 Pt. 6.5.2	EN ISO 12543-3 Pt. 6.5.2
14	G-value in %	63	57
15	Shading coefficient	0.79	0.71

Bohflam products covered by this EPD are multilayer glass in which the panes of toughened float glass are connected by intermediate layers made of silica gel with the properties of expanding under the influence of high temperature. During a fire (at a temperature of 120 ° C), these layers expand, creating a hard, opaque coating that provides temporary protection against fire. Float glass used is a clear, flat soda lime silicate glass with parallel, fire-polished surface. Toughened glass consists of a pane that has been specially heat-treated to give the glass increased impact resistance. If the glass breaks under exposure to a high load, it disintegrates into very small fragments without forming sharp edges.

Technical data for Bohflam products are available at manufacturer web-site.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The EPD relates to the product group “flat glass” and applies to: 1 m² area of glass product in the following classes: EI30, EI60, EI90, E120. Each Bohflam average unit/product is declared as follows: directly used material flows are determined using average area (1 m²) or produced masses (kg) and assigned to the declared unit. All other inputs and outputs in the manufacture were scaled to the declared unit as a whole, where no direct assignment to the average size is possible. The reference production period is year 2020. The results of environmental assessment per class product are provided in Tables;

Class no.	Data in
EI30	see Table 6
EI60	see Table 7
EI90	see Table 8
EI120	See Table 9

The results are also presented in the Table 10 in relation to the 1 kg of the product. In order to determine the environmental impact of specific products EI30, EI60, EI90 and EI120 with a given glass thickness (15mm-55mm), the values given in the table 10 for 1 kg of the glass pane should be multiplied by the conversion factors included in the table 5.

Goal

The goal of the LCA is to demonstrate the environmental impacts of Bohflam products produced in Poland. In accordance with EN 15804, the environmental impacts covered by this Environmental Product Declaration are presented for the entire product life cycle in the form of basic information in Tables 5-9.

System boundary

The life cycle analysis of the declared product covers “Product Stage” A1-A4 modules, “End of Life stage” C1-C4 modules and loads&gains beyond system in D module (Cradle to Gate with options) in accordance with EN 15804 and ITB PCR A. The specific data originate from the year 2020. The production-specific data of flat glass manufacture are taken form specific related glass manufacturers. Due to the wide range of possible applications and designs, the use stage is not taken into account in the calculation

Allocation

The alocation rules used for this EPD are based on general ITB PCR A. Production of Bohfalm products is the line process located in Ciele plant (Poland). Allocation was done on product mass basis. The impacts from raw materials extraction and processing are allocated in A1 module of the EPD (including input materials, and energy consumption, transportation, emissions and wastes resulting from the production of glass). All company data collected, i.e. all commodities/input and raw materials used, the thermal energy, the electricity consumption and all results of the available emission measurements from the plants were taken into consideration. Minimum 99% of impacts from line production were inventoried and allocated to Bohfalm production. Municipal waste, emissions and waste and energy supply was inventoried for whole production process. Energy supply (gas and electricity) was inventoried for whole factory and in a adequate mass based way was allocated to the products assessed. Emissions in the factory are assessed using national KOBiZE

emission factors for energy carriers. Data gaps were either filled with comparable data or conservative assumptions, or the data were cut off in compliance with the 1 % rule.

System limits

99.9% of input materials and 100% energy consumption (electricity, gas,) was inventoried in factory and 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 and electric power consumption, direct production waste, and available emission measurements. Tires consumption for transport was not taken into account. Ancillary items, precomponents with a percentage share of less than 0.1% were not included in the calculations. It is assumed that the total sum of omitted processes does not exceed 1% of all impact categories. In accordance with EN 15804 machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees. Packaging is included.

A1 and A2 Modules: Raw materials supply and transport

Process starts with sourced raw materials. Raw material supply includes raw material extraction and pre-treatment processes. The raw materials (glass) are introduced as a mixture into the furnace where they are melted at a temperature of approx. 1,550 °C, generally using gas as an energy resource. The main components of float glass are the naturall raw materials sand (silicon carbonate, 58%), soda (sodium carbonate, 18%), dolomite (15%), lime (calcium carbonate, 5%) and sulphate (1%). The glass is shaped by distributing the mass of liquid glass over a bath of molten tin. The glass sheet is then cooled evenly and cut to size. Coated glass is float glass that has been coated with a metal-oxide-based coating using various processes (sputtering, evaporation, pyrolytic processes). In the manufacture of tempered ESG, float glass is heated to its transition temperature (min.640 °C) and then rapidly cooled. The glass used in the manufactory plant is produced mainly by the recognised two manufctures in Poland. Transport is relevant for delivery of raw materials and other auxiliary materials to the plant and the transport of materials within the plant. The transport distances of the input-products were taken into consideration as a function of 100% of the mass of the products. Data on transport of the different input products to the manufacturing plants were inventoried in detail and modelled by assessor. For calculation purposes European fuel averages are applied in module A2.

A3: Production

Manufacturing starts with a input products delivered to factory including: glass float, gel silica, KOH, glass covers, glass PVB, Tiokol, TPS, distance frames, buthyl, technical gases, packaging. The production process consists processes: cutting, CNC, hating, folding fire glass (plotter), pouring gel into panes, heating, packaging. The process uses electricity and gas to produce heat. All production waste generated during production and manufacture is internally recycled. Packaging materials were accounted.

A4: Transport to construction site

Transport of final product to construction site is taken as the weight average values for transport to customers. The following transport scenario to the place of use was assumed based on the manufacturer's declaration: large vehicle, 75% capacity over an average distance of 800 km. For calculation purposes European fuel averages are applied in module A4.

End of life scenarios (C and D modules)

The end-of-life scenario for all products has been generalized. Bohflam glass products are not specifically designed for reuse, although reuse is still possible if sorted into its original pure components, can be reintroduced into the manufacturing process. Approximately 70% of the glass share and 100% of the other materials are disposed of at a construction waste landfill. According to scenario 30% of glass products are collected, shipped to central collection points and recycled, for example for the production of container glass, insulating glass wool, sandpaper or glass bricks or flat glass. It is assumed that at the end of life the transport distance from the product deconstruction place to waste processing (C2) is 50 km on > 16 t loaded lorry with 75% capacity utilization and fuel consumption of 35 l per 100 km. The reuse, recovery and recycling potential

for a new product system is considered beyond the system boundaries (module D) based on national practice. The recycling of the glasses provides benefits to D module.

Table 3. End of life scenarios for Bohflam products

Products	Material recovery	Recycling	Landfilling
Bohflam glass	100%	30%	70%

The waste generated during the production of 1 m² of Bohflam is evaluated and shown separately for each of the three main fractions: hazardous wastes, ladnfill waste, materials for recycyling. Since waste handling is modelled within the system boundaries, the amounts shown refer to the deposited wastes. A portion of the waste indicated is generated during the manufacture of the input-products.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2020 – 31.12.2020 (1 year). The life cycle assessments were done for Poland as reference area.

Data quality - production

The values determined to calculate A3 originate from verified Progress LCI inventory data. A1 values were prepared considering specific and generic EPDs for the European made glass products. The background data for the secondary inputs come from the Ecoinvent v.3.7 and 3.8 data base.

Assumptions and estimates

All production processes (A3) inputs and outputs were assigned to different types of products with mass based allocation approach.

Calculation rules

LCA was done in accordance with ITB PCR a document. Characterization factors are CML ver. 4.2 based. ITB-LCA algorithms were used for impact calculations. A1 was calculated based on data from the database and specific EPD for steel, A3 and A2 are calculated based on the LCI questionnaire provided by the manufacturer. Emission of greenhouse gases was calculated using the IPCC 2013 GWP method with a 100 year horizon. Emission of acidifying substances, Emission of substances to water contributing to oxygen depletion, Emission of gases that contribute to the creation of ground-level ozone, Abiotic depletion, and ozone depletion emissions where all calculated with the CML-IA baseline method

Data bases

The background data for the processes come from the following databases: Ecoinvent v.3.7 and 3.8 (KOH, glass cover, TPS, metal frames, buthyl, gases, packaging), specific EPD for a 2 float glass producers, national, energy KOBiZE (Polish electricity mix and combustion factors for fuels). Specific (LCI) data quality analysis was a part of the audit/verification. The time related quality of the data used is valid (5 years).

Additional information

No substances included in the Candidate List of Substances of Very High Concern for authorization under the REACH regulations are present in BOHFALM products, either above the threshold for registration with the European Chemicals Agency or above 0.1 %

The electricity mix represents the average Polish specific electricity supply for final consumers, including electricity own consumption, transmission/distribution losses and electricity imports from neighbouring countries. Reference year is 2020 and carbon impact of polish electricity mix is 0.25 kg CO_2/MJ.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to the unit DU – 1 m² area of Bohflam specific glass product produced by Bohamet S.A. in Poland (Table 5-9). The following life cycle modules are included in the declaration (Table 4).

Table 4. System boundaries (life stage modules included) in a product environmental assessment

Environmental assessment information (MA – Module assessed, MNA – Module not assessed, 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**
MA	**MA**	**MA**	**MA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MA**	**MA**	**MA**	**MA**	**MA**

The results are also presented in the table in relation to the kilogram of the product (Table 10).

In order to determine the environmental impact of specific products EI30, EI60, EI90 and EI120 with a given glass thickness, the values given in the table 10 for 1 kg of the glass pane should be multiplied by the conversion factors included in the table 5.

Table 5. Values of conversion factors from 1 kg to a specific product of a given thickness per 1m^2

	15mm	16mm	25mm	32mm	38mm	47mm	50mm	52mm	55mm
EI30	33	34							
EI60			53						
EI90				69	83				
EI120						102	107	110	114

Table 6. Environmental product characteristic – BOHFLAM EI30 GLASS (34 kg/m²)

Environmental impacts: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2	5.74E+01	1.70E+00	6.42E+01	2.82E+00	6.75E-01	1.77E-01	9.66E-01	3.94E-01	-6.25E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11	1.07E-06	0.00E+00	1.72E-06	0.00E+00	2.00E-07	0.00E+00	7.18E-08	1.30E-08	-3.64E-12
Acidification potential of soil and water	kg SO_2	1.95E+00	1.33E-02	2.43E-01	2.17E-02	5.25E-03	1.36E-03	4.63E-03	5.24E-04	-3.42E-02
Formation potential of tropospheric ozone	kg Ethene	3.25E-01	8.94E-04	3.00E-01	1.46E-03	5.58E-04	9.12E-05	2.54E-04	1.89E-04	-4.72E-03
Eutrophication potential	kg $(PO_4)^{3-}$	1.87E-01	2.35E-03	7.29E-03	3.84E-03	1.22E-03	2.40E-04	8.78E-04	3.50E-04	-4.39E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	9.57E-02	0.00E+00	7.60E-01	0.00E+00	7.64E-03	0.00E+00	6.26E-07	5.25E-04	-1.35E-06
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	9.65E+02	2.26E+01	7.71E+02	3.86E+01	1.70E+01	2.41E+00	5.90E+00	4.62E+00	-8.48E+01
Environmental aspects: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.51E+01	2.36E-01	4.50E+01	3.86E-01	9.35E-02	2.41E-02	4.01E+00	8.30E-02	-6.09E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	9.01E+02	2.48E+01	9.60E+02	4.05E+01	1.71E+01	2.53E+00	1.64E+01	5.90E+00	-9.13E+01
Use of secondary material	kg	1.76E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	4.12E-01	1.24E+00	0.00E+00	2.02E+00	0.00E+00	1.27E-01	0.00E+00	7.13E-03	-3.91E-01
Use of non-renewable secondary fuels	MJ	4.84E-01	0.00E+00	3.20E-04	0.00E+00	0.00E+00	0.00E+00	1.50E-02	8.53E-02	-4.60E+00
Net use of fresh water	m^3	7.40E-01	2.53E-04	2.86E-02	4.13E-04	5.78E-03	2.58E-05	5.13E-03	8.98E-04	-1.32E-02
Other environmental information describing waste categories: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	4.20E-03	9.10E-04	7.55E-01	1.48E-03	7.20E-06	9.28E-05	2.95E-06	8.21E-07	-9.54E-08
Non-hazardous waste disposed	kg	5.73E+01	1.08E+00	6.85E+00	1.76E+00	3.57E-02	1.10E-01	1.45E-02	6.80E+00	-8.39E-01
Radioactive waste disposed	kg	6.87E-04	0.00E+00	0.00E+00	0.00E+00	1.12E-04	0.00E+00	4.05E-05	7.30E-06	0.00E+00
Components for re-use	kg	0.00E+00	0.00E+00	6.80E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	3.62E-02	0.00E+00	2.72E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recover	kg	0.00E+00	0.00E+00	3.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 7. Environmental product characteristic – BOHFLAM EI60 GLASS (52 kg/m²)

Environmental impacts: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2	8.77E+01	2.60E+00	9.83E+01	4.32E+00	1.03E+00	2.70E-01	1.48E+00	6.03E-01	-9.57E+00
Depletion potential of the stratospheric ozone layer	kg CFC 11	1.64E-06	0.00E+00	2.63E-06	0.00E+00	3.06E-07	0.00E+00	1.10E-07	1.98E-08	-5.57E-12
Acidification potential of soil and water	kg SO_2	2.99E+00	2.03E-02	3.72E-01	3.32E-02	8.02E-03	2.07E-03	7.09E-03	8.02E-04	-5.22E-02
Formation potential of tropospheric ozone	kg Ethene	4.98E-01	1.37E-03	4.59E-01	2.23E-03	8.53E-04	1.40E-04	3.89E-04	2.89E-04	-7.21E-03
Eutrophication potential	kg $(PO_4)^{3-}$	2.86E-01	3.60E-03	1.11E-02	5.87E-03	1.86E-03	3.67E-04	1.34E-03	5.35E-04	-6.72E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	1.46E-01	0.00E+00	1.16E+00	0.00E+00	1.17E-02	0.00E+00	9.57E-07	8.03E-04	-2.07E-06
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	1.48E+03	3.46E+01	1.18E+03	5.90E+01	2.59E+01	3.69E+00	9.03E+00	7.06E+00	-1.30E+02
Environmental aspects: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	5.37E+01	3.61E-01	6.88E+01	5.90E-01	1.43E-01	3.69E-02	6.13E+00	1.27E-01	-9.32E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.38E+03	3.79E+01	1.47E+03	6.19E+01	2.62E+01	3.87E+00	2.51E+01	9.03E+00	-1.40E+02
Use of secondary material	kg	2.70E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	6.30E-01	1.90E+00	0.00E+00	3.10E+00	0.00E+00	1.94E-01	0.00E+00	1.09E-02	-5.98E-01
Use of non-renewable secondary fuels	MJ	7.40E-01	0.00E+00	4.89E-04	0.00E+00	0.00E+00	0.00E+00	2.30E-02	1.30E-01	-7.04E+00
Net use of fresh water	m^3	1.13E+00	3.87E-04	4.38E-02	6.31E-04	8.84E-03	3.95E-05	7.85E-03	1.37E-03	-2.01E-02
Other environmental information describing waste categories: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	6.43E-03	1.39E-03	1.15E+00	2.27E-03	1.10E-05	1.42E-04	4.51E-06	1.26E-06	-1.46E-07
Non-hazardous waste disposed	kg	8.76E+01	1.65E+00	1.05E+01	2.70E+00	5.46E-02	1.68E-01	2.22E-02	1.04E+01	-1.28E+00
Radioactive waste disposed	kg	1.05E-03	0.00E+00	0.00E+00	0.00E+00	1.71E-04	0.00E+00	6.20E-05	1.12E-05	0.00E+00
Components for re-use	kg	0.00E+00	0.00E+00	1.04E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	5.54E-02	0.00E+00	4.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recover	kg	0.00E+00	0.00E+00	5.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 8. Environmental product characteristic – BOHFLAM EI90 GLASS (68 kg/m²)

Environmental impacts: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2	1.15E+02	3.40E+00	1.28E+02	5.65E+00	1.35E+00	3.53E-01	1.93E+00	7.88E-01	-1.25E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	2.15E-06	0.00E+00	3.44E-06	0.00E+00	4.00E-07	0.00E+00	1.44E-07	2.59E-08	-7.28E-12
Acidification potential of soil and water	kg SO_2	3.91E+00	2.66E-02	4.87E-01	4.34E-02	1.05E-02	2.71E-03	9.27E-03	1.05E-03	-6.83E-02
Formation potential of tropospheric ozone	kg Ethene	6.51E-01	1.79E-03	6.00E-01	2.92E-03	1.12E-03	1.82E-04	5.08E-04	3.78E-04	-9.43E-03
Eutrophication potential	kg $(PO_4)^{3-}$	3.74E-01	4.70E-03	1.46E-02	7.68E-03	2.43E-03	4.80E-04	1.76E-03	7.00E-04	-8.79E-03
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	1.91E-01	0.00E+00	1.52E+00	0.00E+00	1.53E-02	0.00E+00	1.25E-06	1.05E-03	-2.70E-06
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	1.93E+03	4.53E+01	1.54E+03	7.71E+01	3.39E+01	4.82E+00	1.18E+01	9.24E+00	-1.70E+02
Environmental aspects: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	7.02E+01	4.73E-01	9.00E+01	7.71E-01	1.87E-01	4.82E-02	8.02E+00	1.66E-01	-1.22E+01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.80E+03	4.96E+01	1.92E+03	8.10E+01	3.43E+01	5.06E+00	3.28E+01	1.18E+01	-1.83E+02
Use of secondary material	kg	3.53E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	8.24E-01	2.48E+00	0.00E+00	4.05E+00	0.00E+00	2.53E-01	0.00E+00	1.43E-02	-7.83E-01
Use of non-renewable secondary fuels	MJ	9.68E-01	0.00E+00	6.40E-04	0.00E+00	0.00E+00	0.00E+00	3.00E-02	1.71E-01	-9.21E+00
Net use of fresh water	m^3	1.48E+00	5.06E-04	5.72E-02	8.26E-04	1.16E-02	5.16E-05	1.03E-02	1.80E-03	-2.63E-02
Other environmental information describing waste categories: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	8.40E-03	1.82E-03	1.51E+00	2.97E-03	1.44E-05	1.86E-04	5.90E-06	1.64E-06	-1.91E-07
Non-hazardous waste disposed	kg	1.15E+02	2.16E+00	1.37E+01	3.52E+00	7.14E-02	2.20E-01	2.90E-02	1.36E+01	-1.68E+00
Radioactive waste disposed	kg	1.37E-03	0.00E+00	0.00E+00	0.00E+00	2.24E-04	0.00E+00	8.11E-05	1.46E-05	0.00E+00
Components for re-use	kg	0.00E+00	0.00E+00	1.36E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	7.25E-02	0.00E+00	5.44E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recover	kg	0.00E+00	0.00E+00	6.80E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 9. Environmental product characteristic – BOHFLAM EI120 GLASS (98kg/m²)

Environmental impacts: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2	1.65E+02	4.90E+00	1.85E+02	8.14E+00	1.95E+00	5.09E-01	2.79E+00	1.14E+00	-1.80E+01
Depletion potential of the stratospheric ozone layer	kg CFC 11	3.10E-06	0.00E+00	4.95E-06	0.00E+00	5.77E-07	0.00E+00	2.07E-07	3.73E-08	-1.05E-11
Acidification potential of soil and water	kg SO_2	5.63E+00	3.83E-02	7.01E-01	6.25E-02	1.51E-02	3.91E-03	1.34E-02	1.51E-03	-9.85E-02
Formation potential of tropospheric ozone	kg Ethene	9.38E-01	2.58E-03	8.65E-01	4.21E-03	1.61E-03	2.63E-04	7.33E-04	5.45E-04	-1.36E-02
Eutrophication potential	kg $(PO_4)^{3-}$	5.39E-01	6.78E-03	2.10E-02	1.11E-02	3.51E-03	6.91E-04	2.53E-03	1.01E-03	-1.27E-02
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2.76E-01	0.00E+00	2.19E+00	0.00E+00	2.20E-02	0.00E+00	1.80E-06	1.51E-03	-3.90E-06
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.78E+03	6.53E+01	2.22E+03	1.11E+02	4.89E+01	6.95E+00	1.70E+01	1.33E+01	-2.45E+02
Environmental aspects: (DU) 1m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.01E+02	6.81E-01	1.30E+02	1.11E+00	2.69E-01	6.95E-02	1.16E+01	2.39E-01	-1.76E+01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.60E+03	7.15E+01	2.77E+03	1.17E+02	4.94E+01	7.30E+00	4.72E+01	1.70E+01	-2.63E+02
Use of secondary material	kg	5.09E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	1.19E+00	3.58E+00	0.00E+00	5.84E+00	0.00E+00	3.65E-01	0.00E+00	2.06E-02	-1.13E+00
Use of non-renewable secondary fuels	MJ	1.39E+00	0.00E+00	9.22E-04	0.00E+00	0.00E+00	0.00E+00	4.33E-02	2.46E-01	-1.33E+01
Net use of fresh water	m^3	2.13E+00	7.29E-04	8.25E-02	1.19E-03	1.67E-02	7.44E-05	1.48E-02	2.59E-03	-3.79E-02
Other environmental information describing waste categories: (DU) 1 m²										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.21E-02	2.62E-03	2.18E+00	4.28E-03	2.07E-05	2.67E-04	8.50E-06	2.37E-06	-2.75E-07
Non-hazardous waste disposed	kg	1.65E+02	3.11E+00	1.97E+01	5.08E+00	1.03E-01	3.17E-01	4.18E-02	1.96E+01	-2.42E+00
Radioactive waste disposed	kg	1.98E-03	0.00E+00	0.00E+00	0.00E+00	3.23E-04	0.00E+00	1.17E-04	2.10E-05	0.00E+00
Components for re-use	kg	0.00E+00	0.00E+00	1.96E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	1.04E-01	0.00E+00	7.84E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recover	kg	0.00E+00	0.00E+00	9.80E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 10. Environmental product characteristic – BOHFLAM products averaged (1 kg)

Environmental impacts: (DU) 1 kg										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2	1.69E+00	5.00E-02	1.89E+00	8.31E-02	1.99E-02	5.19E-03	2.84E-02	1.16E-02	-1.84E-01
Depletion potential of the stratospheric ozone layer	kg CFC 11	3.16E-08	0.00E+00	5.06E-08	0.00E+00	5.89E-09	0.00E+00	2.11E-09	3.81E-10	-1.07E-13
Acidification potential of soil and water	kg SO_2	5.75E-02	3.91E-04	7.16E-03	6.38E-04	1.54E-04	3.99E-05	1.36E-04	1.54E-05	-1.00E-03
Formation potential of tropospheric ozone	kg Ethene	9.57E-03	2.63E-05	8.83E-03	4.29E-05	1.64E-05	2.68E-06	7.48E-06	5.57E-06	-1.39E-04
Eutrophication potential	kg $(PO_4)^{3-}$	5.50E-03	6.92E-05	2.14E-04	1.13E-04	3.58E-05	7.06E-06	2.58E-05	1.03E-05	-1.29E-04
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	2.81E-03	0.00E+00	2.24E-02	0.00E+00	2.25E-04	0.00E+00	1.84E-08	1.54E-05	-3.98E-08
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.84E+01	6.66E-01	2.27E+01	1.13E+00	4.99E-01	7.09E-02	1.74E-01	1.36E-01	-2.50E+00
Environmental aspects: (DU) 1kg										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.03E+00	6.95E-03	1.32E+00	1.13E-02	2.75E-03	7.09E-04	1.18E-01	2.44E-03	-1.79E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.65E+01	7.30E-01	2.82E+01	1.19E+00	5.04E-01	7.44E-02	4.82E-01	1.74E-01	-2.68E+00
Use of secondary material	kg	5.19E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	1.21E-02	3.65E-02	0.00E+00	5.96E-02	0.00E+00	3.72E-03	0.00E+00	2.10E-04	-1.15E-02
Use of non-renewable secondary fuels	MJ	1.42E-02	0.00E+00	9.41E-06	0.00E+00	0.00E+00	0.00E+00	4.42E-04	2.51E-03	-1.35E-01
Net use of fresh water	m^3	2.18E-02	7.44E-06	8.41E-04	1.21E-05	1.70E-04	7.59E-07	1.51E-04	2.64E-05	-3.87E-04
Other environmental information describing waste categories: (DU) 1 kg										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.24E-04	2.68E-05	2.22E-02	4.37E-05	2.12E-07	2.73E-06	8.68E-08	2.41E-08	-2.81E-09
Non-hazardous waste disposed	kg	1.68E+00	3.18E-02	2.02E-01	5.18E-02	1.05E-03	3.24E-03	4.27E-04	2.00E-01	-2.47E-02
Radioactive waste disposed	kg	2.02E-05	0.00E+00	0.00E+00	0.00E+00	3.30E-06	0.00E+00	1.19E-06	2.15E-07	0.00E+00
Components for re-use	kg	0.00E+00	0.00E+00	2.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	1.07E-03	0.00E+00	8.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recover	kg	0.00E+00	0.00E+00	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RESULTS INTERPRETATION

The environmental impact of product is mainly dependent on the energy-intensive production of glass used (almost 70% of impact of all production input products) on which the Bohamet S.A. has a limited influence. Production consumes a relatively significant amount of electricity, where its share is 1.85 kgCO_2 / 1 kg of the Bohflam product. The global warming potential expressed in eq. carbon dioxide ranges from 123-355 kg of CO_2/1m^2 of Bohflam specific products (product stage: modules A1-A3). Abiotic depletion potential (ADP-fossil fuels) for fossil resources (at a product stage) is in the range of 1.7-5.0 GJ/1 m^2 of products with a mass 34-98 kg/m^2.

VERIFICATION

The process of verification of this EPD was in accordance with ISO 14025. 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. D.Sc. Eng. Michał Piasecki. m.piasecki@itb.pl Verification of LCA: M.Sc. Eng. Dominik Bekierski d.bekierski@itb.pl

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Normative references

- EN 15804:2012 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- TB PCR A General Product Category Rules for Construction Products
- PN-EN 572-1 Szkło w budownictwie -- Podstawowe wyroby ze szkła sodowo-wapniowo-krzemianowego -- Część 1: Definicje oraz ogólne właściwości fizyczne i mechaniczne
- PN-EN ISO 12543-4:2011 Szkło w budownictwie -- Szkło warstwowe i bezpieczne szkło warstwowe -- Część 4: Metody badań odporności
- 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

KIEROWNIK
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CERTIFICATE № 269/2021
of TYPE III ENVIRONMENTAL DECLARATION

Products:

Insulating glass panes for fire protection applications

Manufacturer:

BOHAMET S.A.

ul. Toruńska 2, Ciele, 86-005 Białe Błota, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

PN-EN 15804+A1

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 10th November 2021 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, November 2021