Environmental Product Declaration(EPD)

Declaration code: EPD-LPG-GB-28.0

Glasfabrik Lamberts GmbH & Co. KG

Cast Glass

Patterned, wired, solar and U-profiled glasses

Basis:

DIN EN ISO 14025
EN 15804

Company EPD
Environmental
Product **D**eclaration

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Declaration holder	Glasfabrik LambertsGmbH & Co. KG Egerstraße 197 95632 Wunsiedel Holenbrunn		
Declaration code	EPD-LPG-GB-28.0		
Designation of declared product	Cast glass: Flat patterned glass, wired glass and solar glass as well as LINIT channel glass (U-profiled glass)		
Scope	Architecture and facade construction		
Basis	This EPD was prepared on the basis of EN ISO 14025:2011 and EN 15804:2012+A1:2013. In addition, the "Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations) applies. The Declaration is based on the PCR Document "Flat Glass in Building“ (PCR-FG-1.2:2016).		
Validity	Publication date: 26.09.2017	Last revision: 24.06.2019	Next revision: 26.09.2022
	This verified Company Environmental Product Declaration applies solely to the specified products and is valid for a period of 5 years from the date of publication in accordance with DIN EN 15804.		
LCA basis	The LCA was prepared in accordance with DIN EN ISO 14040 and DIN EN ISO 14044. The base data include both the data collected at the production site of Glasfabrik Lamberts GmbH & Co. KG and the generic data derived from the GaBi 6 ts data base. LCA calculations were carried out for the considererd "cradle to gate“ life cycle with options(cradle to gate with options) including all upstream processes (e.g. raw material extraction, etc.).		
Notes	The "Conditions and Guidance on the Use of ift Test Documents“ apply. The declaration holder assumes full liability for the underlying data, certificates and verifications.		

Prof. Ulrich Sieberath Director of Institute	Patrick Wortner, MBA and Eng., Dipl.-Ing. (FH) Independent external verifier

1 General product information

Product definition

The EPD relates to the product group glass and applies to:

1 m² and mm of cast glass
from the company Glasfabrik Lamberts GmbH & Co. KG

Glass density: 2,500 kg/m³.

The average unit is declared as follows:
Directly used material flows are determined using average sizes and and assigned to the declared unit. All other inputs and outputs in the manufacture were scaled to the declared unit in their entirety since no direct assignment to the average size is possible. The reference period is the year 2016.

Product description

The manufacture of all glass made by Lamberts is based on the rolled glass process in accordance with EN 572.

All glass units feature at least one, sometimes two patterned glass surface(s).
Patterned glass and LINIT channel glass are available as standard green and low iron glass melts; solar glass only as low iron glass melt and wired glass only as standard green glass melt.

Lamberts LINIT channel glass
The U-profile glass channels are installed in facades as single, double or multiple glazing units. The glass thickness varies between 5 and 8 mm, the web width between 100 mm and 600 mm and the flange height between 20 and 80 mm. Channels can be up to 7.50 m long.
The glass can be provided with wire inlays, and can be thermally toughened, colour enamelled or even sandblasted in the course of the finishing process. Coated glasses are not considered in this EPD.

Patterned glass
The great variety of surface patterns produces changing aesthetical results / plays of light. Excellent light diffusion and daylighting of the interior, accompanied by privacy protection, has been one of its most significant characteristics known for more than 150 years.
Larger glazing dimensions are produced in glass thicknesses between 3 mm and 12 mm and, depending on pattern and thickness, can also be finished in a number of ways (thermal toughening, enamelling, lamination).

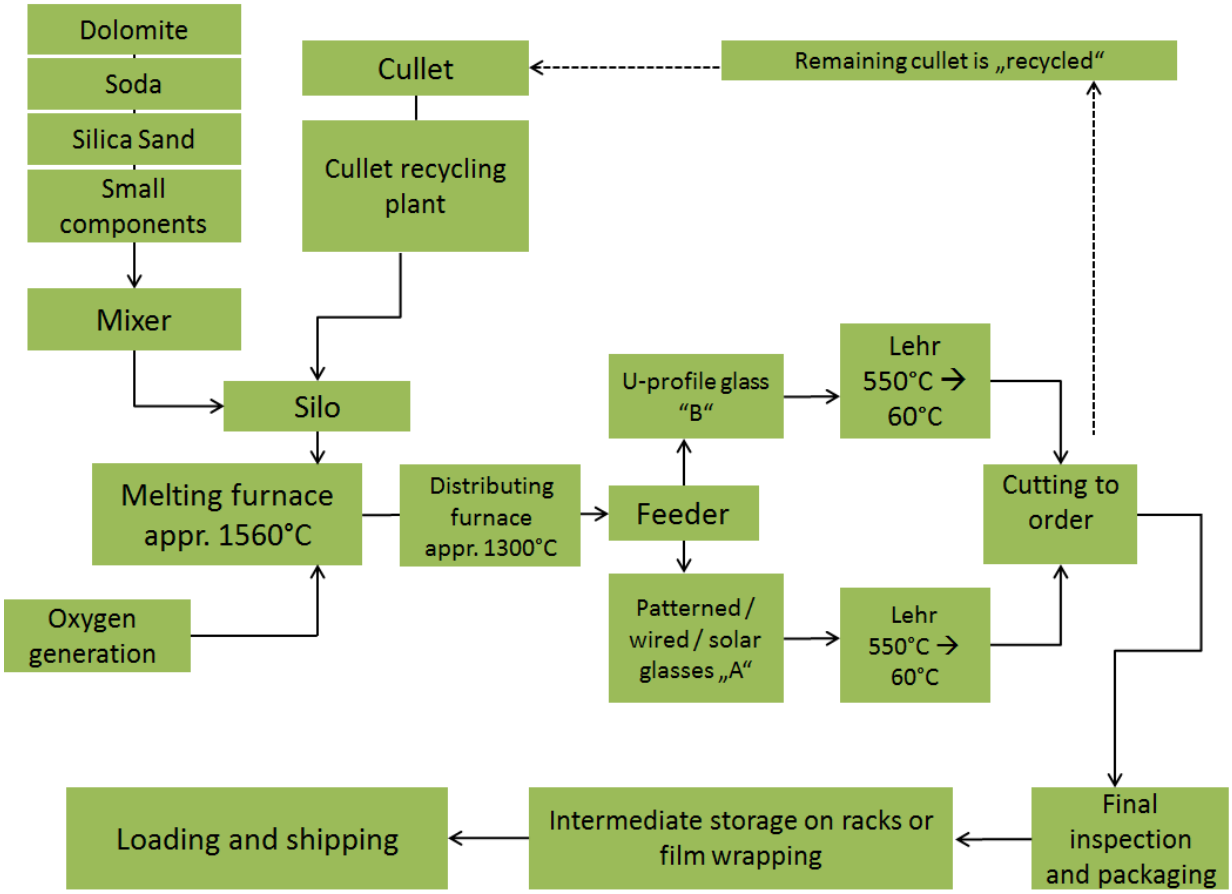
Solar glass
Solar glass is patterned glass for optimising the energy coming into the building, and produced from low-iron melt. They are produced in thicknesses between 2 mm and 6 mm. Most of the glass is further processed into toughened safety glass.

For a detailed product description refer to the manufacturer specifications at www.lamberts.info or the product specifications of the respective offer/quotation.

The products were categorised according to product groups. This was based on a sensitivity analysis of the product portfolio which resulted in the following product groups:

Product group 1 (below also referred to as PG 1)	Linit channel glass with finish Thermally toughened, colour enamelled or sand blasted
Product group 2 (below also referred to as PG 2)	Linit basic U-profile glass
Product group 3 (below also referred to as PG 3)	Patterned, solar and channel glasses

Product manufacture



Application

Lamberts cast glass, be it flat glass or U-profile glass, is used by architects and designers to refurbish a building both by glass surfaces and the lighting effects, and to improve also various technical functions of the facade.
Lamberts architectural design glass is used for interior and exterior building applications.

Lamberts LINIT channel glass is mainly installed in large-scale facades. The range of projects includes production halls and warehouses, office and residential buildings, parking garages and stadiums, theatres and museums.
Lamberts patterned glass is mainly used for interior applications (doors, tables, furniture, luminaires, showers, insulating glass windows, etc.) and in aesthetically sophisticated facades.
Wired glass with or without pattern is used mainly for industrial facades, roofs and interior glass doors.
Solar glass is used mainly for photovoltaic, by the collector industry and for greenhouses.

Management systems (optional)

The following management systems are in place:

- Quality in accordance with ISO 9001
- Energy management ISO 50001
- Environmental management ISO 14001

Additional information

For additional verification of applicability or conformity refer to the CE marking and the documents accompanying the product.

2 Materials used

Primary materials

The primary materials used are listed in the LCA (see Section 7).

Declarable substances

The product contains no substances from the REACH candidate list (declaration dated 05 July 2017).

All relevant safety data sheets are available from Glasfabrik Lamberts GmbH & Co. KG.

3 Construction process stage

Processing recommendations, installation

Observe the instructions for intermediate storage, processing/fabrication, assembly/installation as well as compatibility with other components, provided by the manufacturer.

4 Use stage

Emissions to the environment

No emissions to indoor air, water and soil are known (if applicable, VOC emissions).

Reference service life (RSL)

The reference service life (RSL) can be determined for a "cradle to gate - with options" EPD only if all the modules A1- A3 and B1-B5 are specified;

The reference service life (RSL) of channel glass and flat glass from Glasfabrik Lamberts GmbH & Co KG is not specified because the use stage is not considered.

5 End-of-life stage

Possible end-of-life stages

The cast glass is shipped to central collecting points. There the products are generally shredded and sorted into their original pure components. The end-of-life stage depends on the site where the products are used and is therefore subject to local regulations. Observe the locally applicable regulatory requirements.

This EPD represents the end-of-life modules as 100% versions of each disposal process. This allows to simulate the associated scenario for carrying out the building evaluation.

Disposal routes

This LCA does not include the average disposal routes because the products are used in many different ways.

All calculated life cycle scenarios are detailed in the Annex.

6 Life Cycle Assessment (LCA)

Environmental product declarations are based on life cycle analyses (LCAs) which use material and energy flows for the calculation and subsequent representation of environmental impacts.

Such a Life Cycle Analysis (LCA) was developed for cast glass. The LCA is in conformity with EN 15804 and the requirements set out in the international standards DIN EN ISO 14040, DIN EN ISO 14044, ISO 21930 and EN ISO 14025.

The LCA is representative of the products presented in the Declaration and the specified reference period.

6.1 Definition of goal and scope

Goal

The goal of the LCA is to demonstrate the environmental impacts of cast glass. 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. Apart from these, no other environmental impacts have been specified.

Data quality, data availability and geographical and time-related system boundaries

The specific data originate exclusively from the fiscal year 2016. They were collected at the plant located in Wunsiedel in the context of an on-.site data collection by the ift Rosenheim and originate in parts from company records and partly from values directly obtained by measurement. Validity of the data was checked by the ift Rosenheim.

The generic data originates from the GaBi ts software, "Professional Datenbank und Baustoff Datenbank" (professional database and building materials database). The last update of both databases was

in 2017. Data from before this date originate also from this databases and are not more than 4 years old. No other generic data were used for the calculation.

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

The life cycle was modelled using the sustainability software tool GaBi ts for the development of Life Cycle Assessments.

Scope / system boundaries

The system boundaries refer to the supply of raw materials and purchased parts, manufacture and end-of-life stage of cast glass (cradle to gate with options).
No additional data from pre-suppliers/subcontractors or other sites were taken into consideration.

Cut-off criteria

All company data collected, i.e. all commodities/input and raw materials used, the thermal energy and electricity consumption, were taken into consideration.

The boundaries cover only the product-relevant data. Building sections/parts of facilities that are not relevant to the manufacture of the products, were excluded.

The transport distances of the pre-products were taken into consideration as a function of at least 91% of the mass of cast glass.
The remaining transport distances of the pre-products to the plant were taken into consideration based on a transport mix. This was based on an assumption of the Federal Statistiacal Office.

The criteria for the exclusion of inputs and outputs as set out in EN 15804 are fulfilled. It can be assumed that the total of negligible processes per life cycle stage does not exceed 1 percent of the mass/primary energy. This way the total of negligible processes does not exceed 5 percent of the energy and mass input. The life cycle calculation also includes material and energy flows that account for less than 1 percent.

6.2 Inventory analysis

Goal

All material and energy flows are described below. The processes covered are presented as input and output parameters and refer to the declared/functional units.

Life cycle stages

The Annex shows the entire life cycle of cast glass. Product stage (A1 – A3), end-of-life stage (C3 – C4) and benefits and loads beyond the system boundaries (D) are considered.

Benefits

The below benefits have been defined as per EN 15804:

- Benefits from recycling

Allocation procedures Allocation of co-products

The manufacture of cast glass does not produce any allocations of co-products

Allocations for re-use, recycling and recovery

If cast glass is reused / recycled during the product stage (rejects), the elements are shredded, as necessary, and then sorted into their original pure components. The system boundaries for the manufacture of of cast glass were set following their disposal, with termination of their waste characteristics.

Allocations beyond life cycle boundaries

Use of recycled materials in the manufacturing process was based on the current market-specific situation. In parallel to this, a recycling potential was taken inco consideration that reflects the economic value of the product after recycling (recyclate). The system boundary set for the recycled material refers to collection.

Secondary material

The use of secondary material in Module A3 by the company Glasfabrik Lamberts GmbH & Co. KG by was considered. Secondary material is used.

Inputs

The LCA includes the following production-relevant inputs:

Energy
The electricity mix is based on “Strommix Wasserkraft - Deutschland” (German hydropower mix).
Gas is based on “Erdgas Deutschland” (German natural gas).

A portion of the process heat is used for space heating at the production site. This can however not be quantified, hence a “worst case” figure was taken into account for the product.

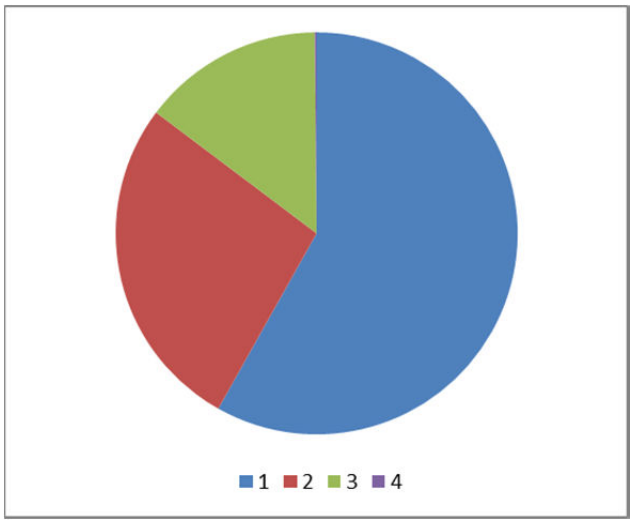
Water
The water consumed by the individual process steps for the manufacture of cast glass is as follows.

- 6.3 l per m² and mm for PG1
- 6.3 l per m² and mm for PG2
- 4.3 l per m² and mm for PG3

The consumption of fresh water specified in Section 6.3 originates (among others) from the upstream processes of the pre-products.

Raw material/pre-products
The chart below shows the share of raw materials/pre-products in %.

No.	Material	Mass in %
1	Batch	58%
2	Factory cullet	27%
4	Flat glass recyclate	15%
5	others	<1%



Ancillary materials and consumables
Yearly average ancillary materials and consumables required for the manufacture of 1 m² and mm of cast glass:

- 2.2 kg per m² and mm for PG1
- 2.1 kg per m² and mm for PG2
- 1.5 kg per m² and mm for PG3

Outputs

The LCA includes the following production-relevant outputs per m² of cast glass:

Waste
Secondary raw materials were included in the benefits.
See Section 6.3 - Impact assessment

Waste water
The manufacture of cast glass does not produce any waste water.

6.3 Impact assessment

Goal

The impact assessment covers inputs and outputs. The impact categories applied are named below:

Impact categories

The models for impact assessment were applied as described in EN 15804-A1.
The impact categories presented in the EPD are as follows:

- Depletion of abiotic resources (fossil fuels);
- Depletion of abiotic ressources (elements);
- Acidification of soil and water;
- Ozone depletion;
- Global warming;
- Eutrophication;
- Photochemical ozone creation.

Waste

The waste generated during the manufacture of 1 m² and mm of cast glass is evaluated and shown separately for each of the three main fractions, namely trade wastes, special wastes and radioactive wastes. 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 pre-products.

Results per m^2 and mm of cast glass (Part 1)		**PG 1**		**PG 2**		**PG 3**			**PG 1 + 2**		**PG 3**	
Environmental impacts	**Unit**	**A1 – A3**	**C4**	**A1 – A3**	**C4**	**A1 – A3**	**C4**		**C3**	**D**	**C3**	**D**
Global warming potential (GWP)	kg CO_2 equiv.	1.81	0.28	1.61	0.28	1.23	0.19		0.01	-1.51	0.01	-1.04
Depletion potential of stratospheric layer (ODP)	kg R11 equiv.	9.65E-08	1.00E-11	6.04E-11	1.00E-11	5.50E-10	6.88E-12		3.91E-13	-1.03E-11	4.56E-13	-7.10E-12
Acidification potential of soil and water (AP)	kg SO_2 equiv.	0.01	9.89E-04	0.01	9.89E-04	4.70E-03	6.79E-04		2.52E-05	-0.01	2.94E-05	-5.60E-03
Eutrophication potential (EP)	kg PO_4^{3-} equiv.	1.07E-03	1.05E-04	9.96E-04	1.05E-04	7.08E-04	7.24E-05		2.28E-06	-1.04E-03	2.66E-06	-7.11E-04
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 equiv.	6.47E-04	6.83E-05	5.20E-04	6.83E-05	4.02E-04	4.69E-05		1.61E-06	1.08E-03	1.87E-06	7.45E-04
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb equiv.	2.14E-05	1.11E-07	1.99E-05	1.11E-07	1.37E-05	7.60E-08		3.52E-09	-3.21E-06	4.11E-09	-2.20E-06
Abiotic depletion potential - fossil fuels (ADP - fossil resources)	MJ	52.95	3.16	51.25	3.16	36.40	2.17		0.09	-20.11	0.11	-13.81
Use of resources	**Unit**											
Use of renewable primary energy - excluding renewable primary energy resources used as raw materials	MJ	39.23	1.43	7.20	1.43	5.04	0.98		0.05	-1.47	0.06	-1.01
Use of renewable primary energy resources used as raw materials (material use)	MJ	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	39.23	1.43	7.20	1.43	5.04	0.98		0.05	-1.47	0.06	-1.01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials.	MJ	55.29	4.74	53.57	4.74	38.01	3.25		0.17	-21.72	0.19	-14.92
Use of non-renewable primary energy resources used as raw materials (material use)	MJ	0.02	-0.02	0.02	-0.02	0.01	-0.01		-0.02	0.00	-0.01	0.00
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy + material use)	MJ	55.31	4.72	53.59	4.72	38.02	3.24		0.15	-21.72	0.18	-14.92
Use of secondary materials	kg	0.81	0.00	0.81	0.00	0.56	0.00		0.00	0.00	0.00	0.00

C4 = 100% scenario (disposal site)
C3+D = 100% scenario (recycling and benefit)

Results per m2 and mm of cast glass (Part 2)		PG 1		PG 2		PG 3			PG 1 + 2		PG 3	
Use of resources	**Unit**	**A1 – A3**	**C4**	**A1 – A3**	**C4**	**A1 – A3**	**C4**		**C3**	**D**	**C3**	**D**
Use of renewable secondary fuels	MJ	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Use of non-renewable secondary fuels	MJ	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Use of net fresh water	m^3	0.05	2.06E-03	0.02	2.06E-03	0.01	1.42E-03		7.50E-05	-3.22E-03	8.76E-05	-2.21E-03
Waste categories	**Unit**											
Hazardous waste disposed	kg	1.34E-07	1.40E-08	1.10E-07	1.40E-08	5.91E-08	9.64E-09		6.26E-11	-1.87E-08	7.30E-11	-1.28E-08
Non-hazardous waste disposed (municipal waste)	kg	0.16	3.65	0.15	3.65	0.11	2.51		1.02E-04	-0.20	1.19E-04	-0.14
Radioactive waste	kg	9.36E-04	6.23E-04	9.29E-04	6.23E-04	6.45E-04	4.28E-04		2.40E-05	-6.42E-04	2.80E-05	-4.41E-04
Output material flows	**Unit**											
Components for re-use	kg	0.00	0.00	0.00	0.00	0.00	0.00		0.00	-	0.00	-
Materials for recycling	kg	1.77E-06	0.00	1.77E-06	0.00	1.48E-02	0.00		2.83	-	1.94	-
Materials for energy recovery	kg	0.00	0.00	0.00	0.00	0.00	0.00		0.00	-	0.00	-
Exported energy (electricity)	MJ	0.00	0.00	0.00	0.00	0.00	0.00		0.00	-	0.00	-
Exported energy (thermal energy)	MJ	0.00	0.00	0.00	0.00	0.00	0.00		0.00	-	0.00	-

Calculation of channel glass was based on the declared product P23/60/7. The environmental impacts of differing channel glass can be calculated using the formula on the right and the factors given below:

P xx/xx/x = x(P 23/60/7) * factor xx

Profile	Dimensions [mm]	kg/m²	Factor		Profile	Dimensions [mm]	kg/m²	Factor
P 15	150/41/6	21.3	**0.84**		P 15/60/7	150/60/7	29.3	**1.15**
P 23	232/41/6	19.4	**0.76**		P 18/60/7	180/60/7	27.2	**1.07**
P 26	262/41/6	18.7	**0.74**		P 23/60/7	232/60/7	25.4	**1.00**
P 33	331/41/6	17.8	**0.70**		P 26/60/7	262/60/7	24	**0.94**
P 50	498/41/6	16.9	**0.67**		P 33/60/7	331/60/7	23	**0.91**
					P 40/60/7	400/60/7	21.8	**0.86**

6.4 Interpretation, LCA presentation and critical review

Evaluation

For calculation, the scenarios of the research project "EPDs für transparente Bauelemente“ (EPDs for transparent building components) were used [3]. For scenarios C3, C4 and D, 100% scenarios were selected. For landfilling only C4 was selected, for recycling C3 the combination with D. A combination with adjustment of the percentages is possible. This allows to adjust the LCA to the building and the respective situation.

The values obtained from the LCA calculation are suitable for the certification of buildings, as necessary.

Report

The LCA underlying this EPD was developed according to the requirements set out in DIN EN ISO 14040 and DIN EN ISO 14044 as well as EN 15804 and EN ISO 14025. It is not addressed to third parties for confidentiality reasons. It is deposited with the ift Rosenheim. The results and conclusions reported to the target group are complete, correct, without bias and transparent. The results of the study are not designed to be used for comparative statements intended for publication.

Critical review

The critical review of the LCA took place in the course of verification of the EPD and was carried out by Patrick Wortner, MBA and Eng., Dipl.-Ing. (FH), an external verifier.

7 General information regarding the EPD

Comparability

This EPD was prepared in accordance with EN 15804 and is therefore only comparable to those EPDs that also comply with the requirements set out in EN 15804.
Any comparison must refer to the building context and the same boundary conditions of the various life cycle stages.
For comparing EPDs of construction products, the rules set out in EN 15804 (Clause 5.3) apply.

Communication

The communications format of this EPD meets the requirements of EN 15942:2011 and is therefore the basis for B2B communication. Only the nomenclature has been changed according to EN 15804.

Verification

Verification of the Environmental Product Declaration is documented in accordance with the ift "Richtlinie zur Erstellung von Typ III Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations) in accordance with the requirements set out in EN ISO 14025.

This Declaration is based on the PCR Document "Flachglas im Bauwesen“ (Flat Glass in Building) PCR-FG-1.2 : 2016“.

The European standard EN 15804 serves as the core PCR[a)]
Independent verification of the declaration and statement according to EN ISO 14025:2010 ☐ internal ☒ external
Independent third party verifier: [b)] Patrick Wortner
[a)] Product category rules [b)] Optional for business-to-business communication, Mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Revisions of this document

No.	Date	Note:	reviser	Verifier
1	26.09.2017	External verification and approval	Stich	Wortner
2	26.10.2017	Adaption of product groups	Stich	Wortner
3	24.06.2019	Review	Zwick	Wortner

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Beuth Verlag GmbH, Berlin

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[25] Arbeitsschutzgesetz – ArbSchG (Safety at Work - Law)
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[26] Bundesimmissionsschutzgesetz – BImSchG (Federal Immission Law)
Gesetz zum Schutz vor schädlichen Umwelteinwirkungen durch Luftverunreinigungen, Geräusche, Erschütterungen und ähnlichen Vorgängen (Law on harmful environmental impacts by air contamination, noise, vibrations and similar processes), 26 September 2002 (BGBl. I p. 3830)

[27] Chemikaliengesetz – ChemG (Chemicals Act)
Gesetz zum Schutz vor gefährlichen Stoffen (Law on protection against hazardous substances
Unterteilt sich in Chemikaliengesetzt und eine Reihe von Verordnungen; hier relevant
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[28] Chemikalien-Verbotsverordnung – ChemVerbotsV (Chemicals Prohibition Regulation)
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8 Annex

Description of life cycle scenarios for cast glass

Product stage			Con-struction stage		Use stage							End-of-life stage				Benefits and loads be-yond the system boundaries
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacture	Transport	Construction/Installation	Use	Inspection, maintenance, clean-ing	Repair	Exchange / Replacement	Improvement / Modernisation	Operational energy use	Operational water use	Deconstruction	Transport	Waste management	Disposal	Re-use Recovery Recycling potential
✓	✓	✓	—	—	—	—	—	—	—	—	—	—	—	✓	✓	✓

No data could be provided by the manufacturer for calculating the scenarios of the additional modules A4 - A5, B1 - B7 und C1 - C2, therefore they were not taken into consideration by the LCA.
It is possible to represent the scenarios of the end-of-life-stage as described in the reseach project "EPDs für transparente Bauelemente“ (EPS for transparent building components) [31].

Note:The standard scenarios selected are presented in bold type. They were also used for calculating the indicators in the summary table.

✓ Included in the LCA
— Not included in the LCA

A5 Construction/Installation – not considered, informative module

No.	Scenario	Description
A5	Disposal packaging	Output substances following waste treatment on site.

Environmental impacts occur in the selected scenario, resulting from the use of packaging material.

The amounts used for product packaging calculated in A1-A3, are as follows:

	Mass in kg		
Material	**PG1**	**PG2**	**PG3**
Plastics	1,64E-04	1,65E-04	1,14E-04

C3 Waste management

No.	Scenario	Description
C3	Disposal	For this EPD 100% scenarios were calculated. C3+D = 100% scenario (recycling and benefit)

The below table presents the disposal processes and their percentage by mass/weight. The calculation is based on the above mentioned shares in percent related to the declared unit of the product system.

C3 Disposal			
	Unit	**C3.1**	**C3.2**
Recovery system, for re-use	%	0	0
Recovery system, for recycling	%	0	100
Recovery system, for energy recovery	%	0	0
Disposal	%	100	0

C4 Disposal

No.	Senario	Description
C4	Disposal	For this EPD 100% scenarios were calculated. C4 = 100% scenario (disposal site)

D Benefits and loads beyond the system boundaries

No.	Scenario	Description
D	Recycling potential	For this EPD 100% scenarios were calculated. D from C3

Imprint

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Notes
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