

EPD for Mirror / Ultra Mirror

Environmental Product Declaration

in accordance with DIN EN ISO 14025 and EN 15804

**Silver coating for flat glass as addition to the EPD Floatglass,
Laminated Safety and Coated Glass (EPD-GFEV-19.0)**

Company EPD

Guardian Europe S.à r.l.



Declaration Code
EPD-GM-GB-19.1

**Note: This EPD is an addition to the EPD Floatglass, Laminated Safety and
Coated Glass (EPD-GFEV-19.0)**

Environmental Product Declaration in accordance with ISO 14025 and EN 15804

Mirror / Ultra Mirror



Detailed version

Programme operator	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 83026 Rosenheim			
Life Cycle Assessment	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 83026 Rosenheim			
Holder of the declaration	Guardian Europe S.à.r.l. 19, rue du Puits Romain L-8070 Bertrange			 <small>Glass • Automotive • Building Products</small>
Declaration code	EPD-GM-GB-19.1			
Designation of declared product	Silver coating for flat glass			
Scope	Silver coating for flat glass to be used in interior applications for buildings			
Basis	This EPD was prepared on the basis of EN ISO 14025:2011 and EN 15804:2012. In addition to that, the "Guidance on Preparing Type III Environmental Product Declarations" applies. This Declaration is based on the PCR Document "Flachglas im Bauwesen" (Glass in Building) PCR-FG-1.1 : 2013. The EPD is created as addition to the EPD Floatglass, Laminated Safety and Coated Glass (EPD-GFEV-19.0).			
validity	This verified Environmental Product Declaration applies solely to the specified products and is valid for a period of 5 years from the date of issue. The declaration holder assumes full liability for the underlying data, certificates and verifications.			
	Publication date: 25. June 2015	Latest revision: 21. July 2016	Next revision: 25. June 2020	
LCA Basis	The LCA was prepared in accordance with EN ISO 14040 and EN ISO 14044. The base data include both data collected at various companies and generic data from the "GaBi 6" database. LCA calculations were based on the "cradle to gate" life cycle.			
Notes on publication	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		

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Additional holder of declaration	<ul style="list-style-type: none">• Guardian Oroshaza / Hungary• Guardian Dudelange / Luxembourg• Guardian Llodio / Spain
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1 Product definition

Product definition

This EPD applies to the product group Glass and is valid for:

Silver coating for flat glass. The LCA was prepared using the declared unit:
1 m² glass coating

The LCA for the declared unit only includes the surface coating. The environmental effects of the glass can be found in the EPD Floatglass, Laminated Safety and Coated Glass (EPD-GFEV-19.0) and is not included in this EPD.

The declared unit relates to the product stage of 1 m² silver-coating for flat glass.

Product description:

Silver coating for flat glass

Silver coated flat glass is the result of silver and paint or copper sulphate deposition on high quality float glass. This deposition is done on a silver coating process line. After deposition of the silver layer, the paint layer is applied and cured by IR lights in order to protect the mirror from corrosion and mechanical damages

The product is used in the widest range of indoor applications i.e. bathrooms, furniture and solar mirrors. Silver-coated flat glass is applied on large sheets of glass and cut to size for cost effective fabrication.

The EPD is created as addition to the EPD Floatglass, Laminated Safety and Coated Glass (EPD-GFEV-19.0). It can be used as an extension to following products:

- "Flat glass" (FG) refers to both uncoated and coated float glass. Float glass is a clear, flat soda lime silicate glass with parallel, fire-polished surfaces, in some cases bearing metal-oxide-based coatings to modify the radiation (thermal insulation and/or solar control) properties of the glass.

Product standards:

- Mirrors from silver-coated float glass for internal use: EN 1036

For detailed product descriptions and performance specifications please refer to the manufacturer specifications at www.guardianglass.com or product descriptions for the respective product.

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Application

Silver-coated flat glass for applications in buildings -

- UltraMirror I is only used as interior applications in buildings.
- Mirror is used as interior applications in buildings as well as for specific solar mirror applications.

Additional information

For information and content of the EPD Floatglass, Laminated Safety and Coated Glass (EPD-GFEV-19.0) visit www.ift-service.de

2 Materials used

2.1 Primary products

Primary products

The main components of float glass, which consists of the naturally occurring raw materials sand (silicon carbonate, 59%), soda (sodium carbonate, 18%), dolomite (15%), lime (calcium carbonate, 4%), nepheline (3%), and sulphate (1%). The mass of the coating in relation to float glass with 4mm is estimatedly 1%.

For the process of Silver coating primary products as in 7.2 described are used.

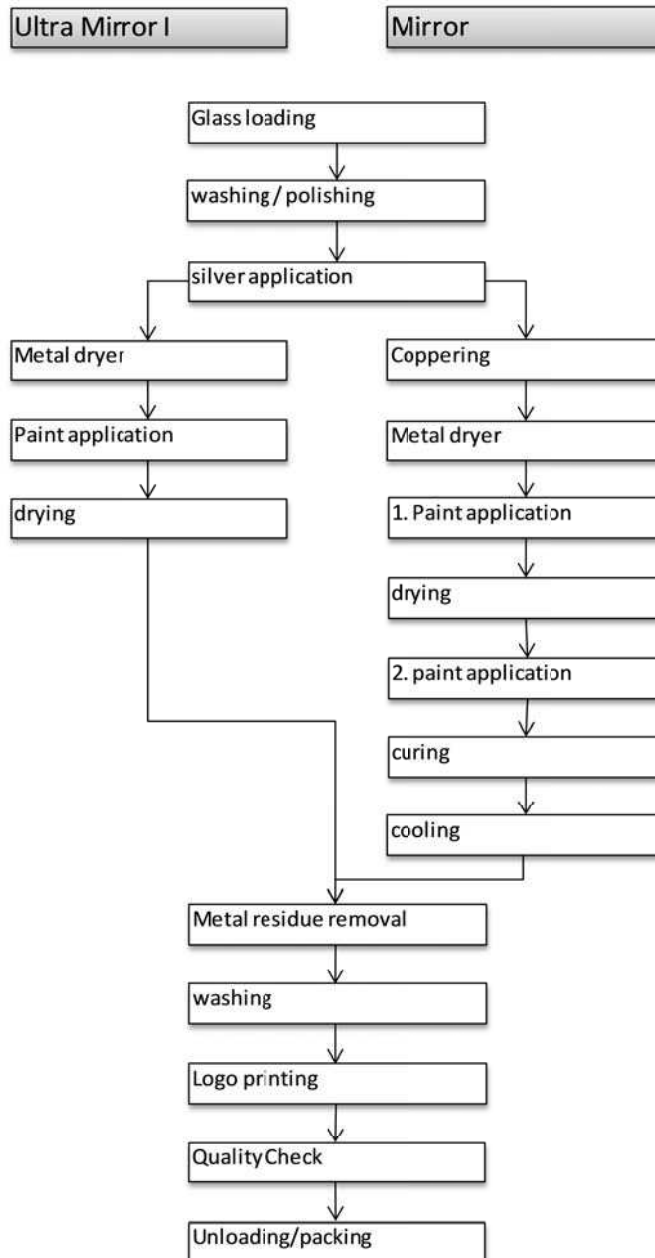
2.2 Declarable substances

Declarable substances

In accordance with the REACH candidate list, no substances of very high concern are contained. (Mirror: Declaration from November 2009 / Ultra Mirror: Declaration from July 2014)

3 Product stage

Product manufacture Wet coating process



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4 Construction stage

Processing recommendations, installation The mirror or UltraMirror I can be cut, grinded, polished or drilled. We recommend immediate cleansing after machining. Processing and installation guidelines must be applied

5 Use stages

Emissions to the environment No emissions to indoor air, water and soil known

B1 - B7 The use stage is not considered in this declaration

6 End-of-life stage (not declared)

Possible end-of-life stages Mirror / Ultra Mirror is not specifically designed for reuse, although reuse is by all means possible.

The End-of-life stage of Mirror / Ultra Mirror can only be considered in combination with Flat glass. The End-of-life stage was not part of the LCA.

All production waste generated during manufacture is internally recycled.

7 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.

As the basis for this, an LCA was prepared for silver coating of flat glass. The LCA was developed in accordance with EN 15804 and the requirements set out by the international standards EN ISO 14040, 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.

7.1 Definition of goal and scope

Goal The goal of the LCA is to demonstrate the environmental impacts of FG and TSG with a mirror application. As set out by EN 15804 the environmental impacts covered by the Environmental Product Declaration for the product stage on a cradle to gate approach. The LCA is calculated for an EPD as addition to the EPD Floatglass, Laminated Safety and Coated Glass (EPD-GFEV-19.0).

Data quality and data availability, also geographical and time-related system boundaries The production-specific data for silver coating of flat glass originate from data collected at the production plant. The average values determined are based on the volumes produced by the plants.

The base data for the coating consist of data collected in 2013 for the

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geographical area of Europe and is corresponding to current production. The quantity data for the raw materials, energy and ancillary materials used are annual averages. Data were additionally collected by the **ift** Rosenheim in 2014 in order to verify representativeness. Therefore data was collected from production sites in Dudelange (LUX), Llodio (ESP) und Oroshaza (HUN).

The life cycle of the coating was modelled using the sustainability software tool "GaBi 6" for the development of Life Cycle Assessments. All relevant background datasets for the production of Mirror / Ultra Mirror are taken from the database of the software tool "GaBi 6".

The databases were last updated in 2015. Data before this date also originate from this database and are not more than 4 years old. No other generic data were used for the calculation.

To cover all European Union members, for all life cycle phases were used preferably generic data records for Europe (e.g. "power mix EU-27"). If no European records were existed, German or global records were used.

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

Scope and system boundaries

The system boundaries refer to all process steps for the manufacturing plants, from the extraction of the raw materials to the dispatch of the product, ready for shipment, from the production gate.

Due to the wide range of possible applications and designs, the use stage and the End-of-life stage are not included in the calculation.

Cut-off criteria

All operating data collected, i.e. all raw materials used by composition, the electrical energy consumed, internal consumption of ancillary materials, all production waste which can be directly attributed to the product, and all available emissions data from the plants, were included in the LCA.

Building sections/parts of facilities that are not relevant to the manufacture of the product were excluded.

The average weighted transport distances of the primary products/pre-products to the various manufacturing plants were not taken into account.

It can be assumed that the total of negligible processes per life cycle stage does not exceed 5 percent. The life cycle calculation also includes material and energy flows that account for less than 1 percent.

7.2 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.

The models of the unit processes used for the LCA have been documented in a transparent manner.

Life cycle stages

Product stage A1, A3.

Benefits

No benefits are taken into account.

Allocation procedures

In the product stage of Mirror / Ultra Mirror no Co-product occurs.

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Allocation of co-products

Allocations for reuse, recovery and recycling There is no allocation for reuse, recovery and recycling declared

Allocations based on life cycle boundaries It is not possible to quantify that a certain amount of secondary material is used in the product stage. Since the End-of-life stage is not taken into account, a credit in D can't be awarded.

Inputs

The LCA includes the following production-relevant inputs:

Energy

The electricity mix is based on "European electricity mix".
 Gas is based on "EU-27: Thermal Energy from natural gas".

Water

For water the following European mix is used:
 "EU-27: Tap water; water purification treatment; production mix, at plnt; from surface water (en)"
 For further information: The consumption of fresh water specified in Section 7.3 originates (among others) from the upstream processes of the primary products/pre-products.

Raw material/primary products/pre-products:

The chart below shows the percentage of raw materials/pre-products used.

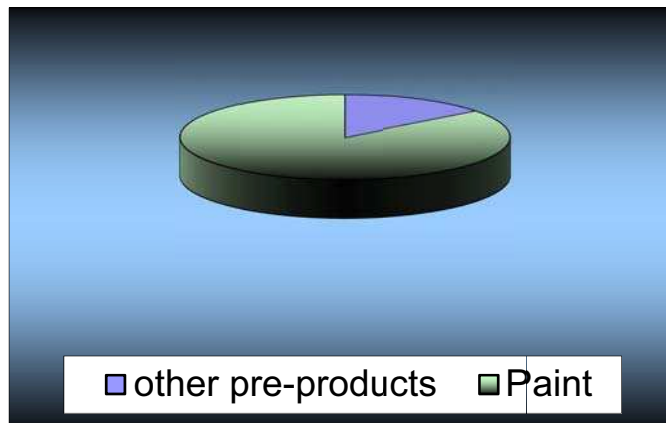


Figure 1: raw materials Mirror / Ultra Mirror

Nr.	Material	Masse in %
1	Other pre-products	14,8
2	Paint	85,2

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Ancillary materials and consumables:

0,223 kg ancillary materials and consumables are required for 1 m² of Mirror / Ultra Mirror. Share in % is given below:

No.	Material	Mass in %
5	Sulphuric Acid	35,3%
1	Xylene	20,7%
6	Sodium Hydroxide solution (caustic soda)	14,8%
8	Ammonium-hydroxide	9,9%
9	others	19,3%

Outputs

The LCA includes the production-relevant outputs for silver coating per 1 m² of Mirror / Ultra Mirror are given below:

Waste

Secondary raw materials were included in the benefits.
See Section 7.3 - Impact assessment

Waste water

0.022 m³ waste water is produced for the manufacture of 1 m² of Mirror / Ultra Mirror

7.3 Impact assesment**Goal**

Impact assessment covers inputs and outputs. The impact categories applied are set out below:

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Impact categories

The characterisation factors of the ELCD (European Reference Life Cycle Database) were used. The characterisation factors for the consumption of abiotic resources were taken from CML (Institute of Environmental Sciences, Faculty of Science, Leiden University, Netherlands).

- Abiotic depletion - fossil resources (ADP - fossil fuels.)
- Abiotic depletion - non-fossil resources (ADP - elements);
- Acidification of soil and water;
- Ozone depletion;
- Global warming;
- Eutrophication;
- Photochemical ozone creation.

Wastes

The waste generated during the production of 1 m² of Mirror / Ultra Mirror 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 primary products/pre-products. Radioactive waste results from the generation of electricity. The wastes presented are generated throughout the entire product life cycle.

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Results per m² silver coating for flat glass		
Environmental impacts	Unit	A1, A3
Global warming potential (GWP 100)	kg CO ₂ equiv.	2,03
Ozone depletion potential (ODP)	kg R11-equiv.	1,25E-08
Acidification potential of soil and water (AP)	kg SO ₂ equiv.	0,01
Eutrophication potential (EP)	kg PO ₄ ³⁻ equiv.	8,65E-04
Photochemical ozone creation potential (POCP)	kg C ₂ H ₄ equiv.	7,73E-04
Abiotic depletion potential - non-fossil resources (ADP - elements)	kg Sb- equiv.	1,53E-04
Abiotic depletion potential - fossil resources (ADP – fossil fuels)	MJ and Hz.	28,17
Use of resources	Unit	
Use of renewable primary energy - excluding renewable primary energy resources used as raw materials	MJ	5,14
Use of renewable primary energy resources used as raw materials (material use)	MJ	0
Total use of renewable primary energy resources (primary energy and renewable primary energy resources used as raw materials) (energy + material use)	MJ	5,14
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials.	MJ	36,14
Use of non-renewable primary energy resources used as raw materials (material use)	MJ	0
Total use of non-renewable primary energy resources (primary energy and non-renewable primary energy resources used as raw materials) (energy + material use)	MJ	36,14
Use of secondary materials	kg	0
Use of renewable secondary fuels	MJ	0
Use of non-renewable secondary fuels	MJ	0
Use of net fresh water	m ³	0,05

Values that cannot be shown or are inexistent or marginal are expressed as [-]. Non-relevant modules are described in the Annex.

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Waste categories	Unit	A1, A3
Hazardous waste disposed	kg	1,17E-05
Non-hazardous waste disposed (municipal waste)	kg	0,10
Radioactive waste	kg	3,14E-03
Output material flows	Unit	A1, A3
Components for re-use	kg	-
Materials for recycling	kg	-
Materials for energy recovery	kg	-
Exported energy	MJ	-

Values that cannot be shown or are inexistent or marginal are expressed as [-]. Non-relevant modules are described in the Annex.

7.4 Interpretation, LCA presentation and critical verification

Interpretation

All relevant and necessary items as per EN ISO 14040 and EN ISO 14044 were included in the LCA. It can therefore be assumed that the LCA is suitable, without restriction, for use in the Environmental Product Declaration for Mirror / Ultra Mirror.

The environmental impacts shown are suitable for the certification of buildings.

Report

The LCA report was prepared in accordance with the requirements of EN ISO 14040, EN ISO 14044, EN 15804 and ISO 14025.

The results of the study are not designed to be used for comparative statements intended for publication.

The results and conclusions reported to the target group are complete, correct, without bias and transparent.

The report is not addressed to third parties due to confidential information contained in the report.

Critical verification

The LCA was critically verified by the independent and external verifier Patrick Wortner, MBA and Eng., Dipl.-Ing. (FH).

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8 General information regarding the EPD

- Comparability** This EPD was prepared in accordance with EN 15804 and is therefore only comparable to those EPDs that that also comply with EN 15804. Any comparison must be based on reference to the building context and the fact that the same boundary conditions were considered in the various life cycle stages. For a comparison of EPDs for construction products the rules as per 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** Guideline "Guidance on Preparing Type III Environmental Product Declarations" in accordance with the requirements set out in ISO 14025.

The European standard EN 15804 serves as the core PCR ^a .
Independent verification of the declaration according to EN ISO 14025:2010 <input type="checkbox"/> internal <input checked="" type="checkbox"/> external
Independent third party verifier Patrick Wortner
^a Product category rules ^b Voluntary for the exchange of information within trade, obligatory for the exchange of information between trade and consumer (see ISO 14025:2010, 9.4)

Revisions of this document

No.	Date	Status note	Creator	Verifier
1	25.06.2015	First internal verification and approval	F. Stich	F. Stöhr
2	21.07.2016	Adaption based on EPD-GFEV-19.0 and external verification	F. Stich	P. Wortner
3				
4				
5				

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notes

This EPD is mainly based on the work and findings of the Institut für Fenstertechnik e.V., Rosenheim (**ift** Rosenheim) and specifically on the **ift**-Guideline NA.01/1 – Guidance on the Preparation of Type III Environmental Product Declarations.

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