AGC GLASS EUROPE

ENVIRONMENTAL AND HEALTH PRODUCT DECLARATION

Mirox MNGE 6 mm

Mirror on a 6 mm thick glass

In accordance with ISO 14025:2006, EN 15804+A1:2014 and its French national complement NF EN15804/CN:2016

October 2021

1. Warning

Information from this declaration is provided under AGC Glass Europe responsibility according to the standards EN 15804+A1:2014 and the French national complement NF EN15804/CN:2016.

Any total or partial use of the information provided in this document shall at least be accompanied by an explicit reference to this EPD as well as its issuer. The latter can provide the original document upon request.

EN 15804+A1 from CEN has been used as Product Category Rules (PCR).

2. Reading guide

Environmental impacts results, resource use indicators as well as waste and output flows are presented in scientific writing with three significant digits.

All positive values (> 0) reflect environmental impacts and negative values (< 0) refer to environmental benefits. This approach applies to all modules, including module D. Where module D has a result higher than zero, it is an additional impact.

3. Comparability of EPD for construction products

Environmental product declarations may not be comparable if they do not comply with EN15804+A1.

Chapter *5.3 Comparability of EPD construction products* from EN15804+A1 norm defines the required conditions under which the construction products can be compared, on the basis of the information provided by the EPD:

A comparison of the environmental performance of construction products, based on their EPDs, shall be based on the use of the products and their impacts on the building, and shall account for the entire life cycle of the product (i.e. include all information modules).

4. General information

Name and address of the manufacturer	AGC Glass Europe Avenue Jean Monnet 4 B-1348 Louvain-la-Neuve sustainability@eu.agc.com
Production sites	This EPD is representative of Mirox MNGE range sold by AGC Glass Europe in France. AGC Glass Europe operates 5 production sites in Europe providing mirrors to French and European market. Results from this EPD reflects data collected from all these sites, representing 100% of the production.
Reference year	Foreground data collected from AGC sites is representative of the 2019 calendar year.
Type of EPD	☐ Cradle to factory gate ☐ Cradle to grave ☒ Cradle to grave + module D
	☐ Collective ☒ Individual, covering AGC Glass Europe range of products
Verifier name	Cécile Beaudard (Solinnen)
Program operator	**FDES INIES** www.inies.fr Address : Association HQE, 4 avenue du Recteur Poincaré – 75016 Paris – France
Publication date	October 2021
Expiration date	October 2026

<table>
<tr>
<td>Commercial references covered by the EPD</td>
<td>Reference product is a Mirox MNGE 6 mm, a mirror made of a soda-lime glass sheet of 6 mm, a silver layer and two protecting paint layers.

It is a real product representative of a main market share of Mirox MNGE range of products.

This EPD also covers the Mirox 4Green range of product as well as mirrors equipped with a safety backing film SAFE+.

Table 1: Mirrors products covered by this EPD
<table><tr><th>Product</th><th>6 mm</th></tr><tr><td>Mirox MNGE</td><td>X</td></tr><tr><td>Mirox MNGE SAFE+</td><td>X</td></tr><tr><td>Mirox 4Green</td><td>X</td></tr><tr><td>Mirox 4Green SAFE+</td><td>X</td></tr></table>
Legend
X Other references covered by this EPD
X Reference product of this EPD</td>
</tr>
<tr>
<td>Target audience</td>
<td>This EPD is primarily intended for business-to-business communication, although they might be consulted by end consumers as well (business-to-consumer).</td>
</tr>
</table>

5. Functional unit and product description

5.1. Description of the functional unit

The functional unit is to ensure the function of 1m² of mirror used in construction or as furniture over a 30 years reference service life.

The associated reference flow is a Mirox MNGE of 15 kg (see Table 2).

Note 1: The reference service life of the product is set to 30 years. This period does not reflect real product lifetime, which is generally defined by building refurbishment. It does not refer to product guarantee neither. This period reflects a standard duration of use considered in glazing EPDs.

5.2. Product description

The reference product is a Mirox MNGE 6 mm, which is made of a soda-lime float glass of 6 mm, a silver layer and two protecting paint layers.

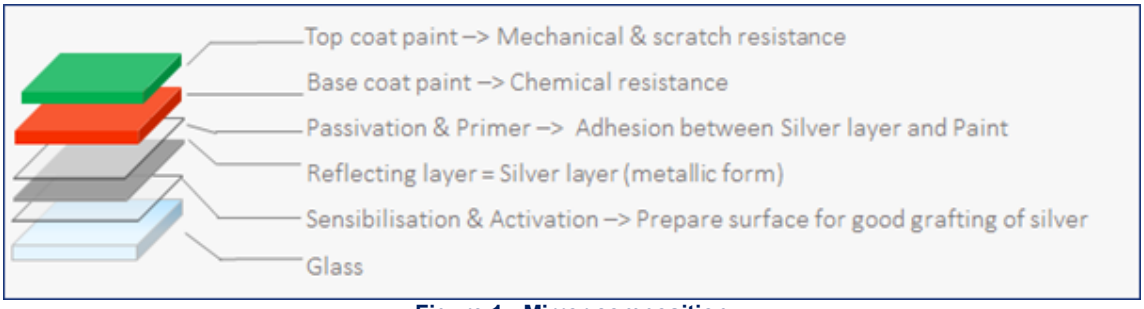


Figure 1 : Mirror composition

More information available on https://agc-yourglass.com/

5.3. Description of the product usage

Mirox MNGE range is intended for interior use only in a wide range of application, as a construction element or as for decorative purposes: wall cladding, furniture, door component.

5.4. Main performance of the functional unit

Mirrors are decorative products for which there is no standardised measure of the performance.

5.5. Other technical features not included in the functional unit

Not applicable.

5.6. Description of the product main components and/or material

Mirox MNGE 4 mm, which is made of a soda-lime float glass of 6 mm, a silver layer and two protecting paint layers.

Table 2 : Mirox MNGE 6 mm composition

Product composition	Mirox MNGE 6 mm
Float glass (soda-lime)	
Mass (kg)	15 kg
Mass (% final product)	> 98%
Silver layer	
Silver mass	< 1 g
Palladium, tin, silane mass	< 1 g
Mass (% final product)	< 0.1%
Protective paint layers	
Base coat	≈ 55 g
Top coat	≈ 65 g
Paint mass (% final product)	< 2%
Packaging	
Wooden box	137 g/m²
Steel – nails form wooden box	4 g/m²
Cardboard	0.13 g/m²
Interleaving powder	0.15 g/m²
Reusable steel stillage (depreciation)	30 g/m²

5.7. Substances from REACH candidate list

Mirox MNGE and Mirox 4Green product range covered by this EPD do not contain any substance from REACH candidate list according to REACH regulation (more than 0.1%).

5.8. Reference service life description

The reference service life (RSL) of mirrors is 30 years.

Table 3 : Reference conditions of product use justifying RSL

Parameter	Value
Reference service life	30 years
Declared product properties (when leaving the production site) and finishing	These properties are defined in the standard EN 1036-1 and 1036-2 - *Glass in building – Mirrors from silver-coated float glass for internal use.*
Theoretical application parameters (if imposed by the producer), including references to the appropriate use practices	These information are detailed in the standard NF DTU 39:2006 *Building works – Glazing and Mirror Glass Works*, which defines the specifications for the implementation of glazing and installation of glazing products (new construction, renovation, refurbishment, maintenance) performed on site in all types of buildings.
Alleged quality of the construction work, when the installation is made in accordance with the manufacturer's instructions	
Exterior environment (for exterior applications), e.g. weather resistance, pollutants, UV and wind exposure, building orientation, shade, temperature	
Interior environment (for interior applications), e.g. temperature, humidity, chemicals exposure	
Use conditions, e.g. usage frequency, mechanical exposure	
Maintenance, e.g. required frequency, type and quality and replacement of replaceable components	

5.9. Biogenic carbon content (C stock)

Mirror products covered by this EPD do not contain biogenic carbon. The biogenic carbon stock is thus 0 kg C/FU.

6. Life cycle stages

This EPD is a cradle to grave study, with module D (benefits beyond the system boundaries).
Life cycle stages regarding product installation (A5) and product use (B1-B7) are modelled based on Glass in building product category rules EN 17074:2019.

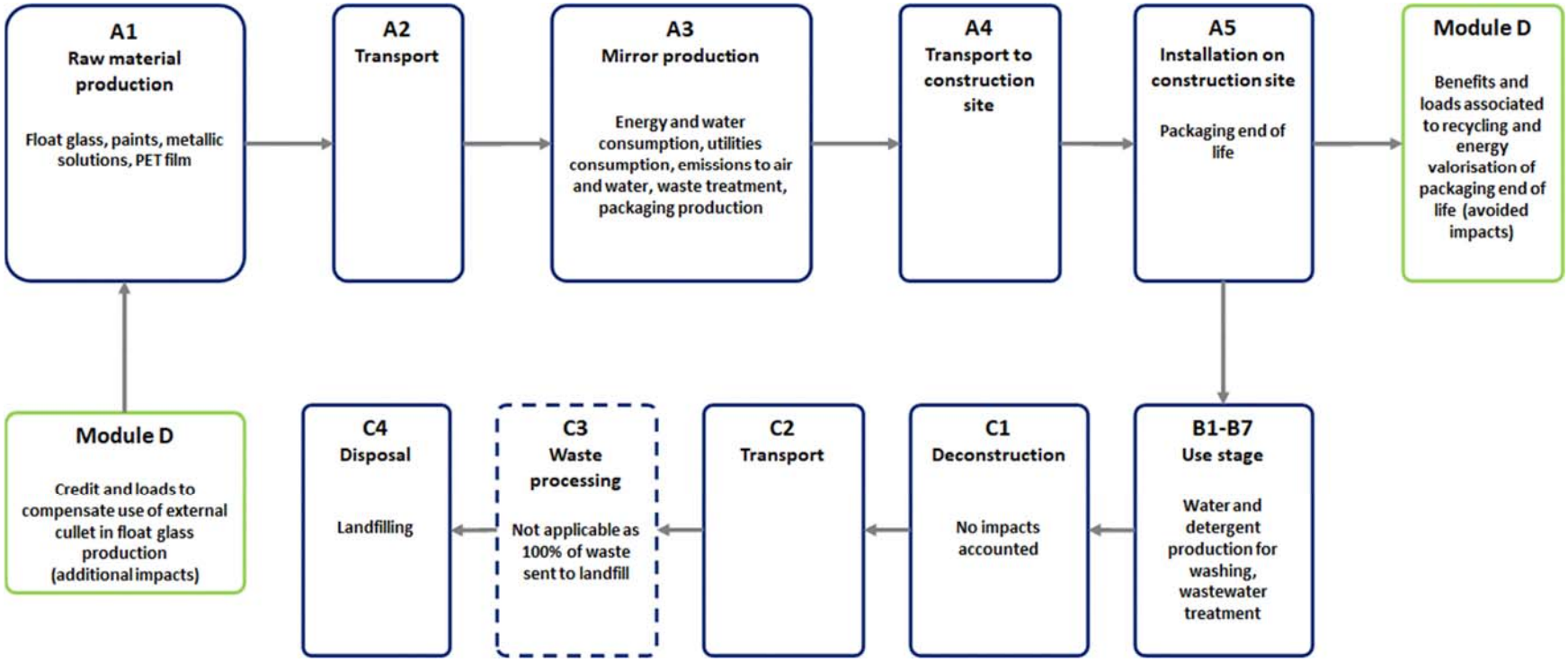


Figure 2 : Life cycle overview

6.1. Production stage, module A1-A3

Module A1-A3 covers the following processes.

1. **Raw material production**

Raw material production includes float glass production, from batch material extraction (sand, dolomite, soda ash, limestone…) to impacts from glass melting and forming such as energy supply, direct emissions from glass production.
This stage also covers production of paints.

2. **Raw material transport to production site**

All transports of raw materials are accounted. The upstream ones, between quarries and float plants, as well as the ones between float and paint producers and mirror production sites.

3. **Production process**

Mirror production process includes the following steps:

- Float glass polishing and washing
- Silver layer deposition and drying
- Base coat deposition and drying
- Top coat deposition and drying
- Mirror washing
- Laying of the safety backing film (in case of SAFE+ products)

Figure 3 : Mirror processing stage

Allocations

A1: Float glass production impacts are allocated based on mass. Impacts per m² are then derived based on float glass thickness and glass density.

A3: Consumptions and emissions from mirror processing have been allocated based on total mirror area production.

These allocations comply with the flat glass product category rule EN 17074:2019.

All inputs and outputs have been taken into account. No available data has been voluntary excluded for this evaluation.

6.2. Construction stage, module A4-A5

1. Transport to the construction site

Transport to construction site considers the weighted average distance between AGC Glass Europe plants producing mirrors and Paris. Mirrors are transported by road in “inloader” diesel truck of 24.7 tonnes net load. Inloader trucks are dedicated to glass products transportation.
This transportation scenario is representative of a construction site located in France.

Table 4 : Transport to construction site

Parameter	Value	Unit
Vehicle description	24.7	Tonne | Diesel truck - EURO 5 – cargo, 40 t gross payload
Distance to construction site	764	km
Utilisation rate (including empty return)	75	%
Bulk density of transported products	2500	kg/m³
Volume capacity utilisation factor	1	

2. Installation in the building

This step only accounts for the packaging end of life:

- Transport of used packaging to sorting centre
- Recycling process (sorting, washing, shredding) in case of recycled wastes
- Incineration for the waste fraction following this treatment
- Landfilling for the waste fraction following this treatment

Following EN 17074:2019, no ancillary materials or energy consumption is considered for the glass to be installed.

This transportation scenario is representative of a construction site located in France.

6.3. Use stage, module B1-B7

1. Description

The only module from the use stage considered is B2 “maintenance”. This stage corresponds to glass cleaning with water and detergent.

Repair (B3), replacement (B4) and refurbishment (B5) are not considered. Under normal conditions of use, mirrors do not need any of these operations.

Finally, mirrors do not emit any substances neither to the air nor to water during its use (B1).

2. Maintenance parameters

Following EN 17074:2019, the average annual water consumption is 0.2 litres per square meter of glass (i.e. 6 litres/m² over the whole life cycle) and an annual detergent consumption of 10 g/m² (300 g/m² over the whole life cycle). Most of this water (75%) is considered as discharged to sewer grid and further treated in a wastewater treatment plant. The remaining 25% is considered as evaporated. Together with evaporated water, 25% of the volatile organic compounds (alcohol) from the glass cleaner is also considered as evaporated.

Table 5 : Glass maintenance

Parameter (whole life cycle)	Value	Unit
Maintenance process	Cleaning as described in EN 17074:2019	
Water consumption for maintenance	0.006	m³/RSL
Glass cleaner consumption for maintenance	6	kg/RSL
Detergent consumption	0.0045	m³/RSL
Energy consumption for maintenance	0	kWh

This maintenance scenario is representative of a building located in France.

6.4. End of life stage, module C1-C4

End of life includes the following steps:

- C1: deconstruction;
- C2: transport to waste treatment site;
- C3: waste treatment;
- C4: landfilling of demolition wastes.

End of life scenario is based on a worst-case scenario, considering that 100% of the mirrors are sent to landfill for inert material in the end of life.

Table 6 : End of life scenarios

Parameter	Value	Unit
Share of mirrors collected as mixed wastes	100	%
Share of mirrors sent to landfill	100	%
Transport to landfill (truck)	50	km

All glass wastes are transported by diesel truck with a net payload of 22 tonnes.

No mechanical operation is considered as regards dismantling and demolition (module C1).

This end-of-life scenario is a representative of a deconstruction site located in France

6.5. Benefits and loads beyond system boundaries, module D

Benefits and loads beyond system boundaries refer to the following parameters.

1. **Additional loads due to external cullet use in module A1**

In this EPD, benefits from recycling are already accounted at production stage in module A1 through primary data. Indeed, external cullet used for float glass production limits the environmental impacts from module A1. Hence, module D only acts as a load beyond system boundaries, balancing the environmental benefits included in module A1.
If looking at the benefits from recycling formula, module D is here referring to a negative net output flow, referring to the cullet use during float glass production. Module D is thus an additional impact corresponding to the net consumption of cullet, which is not compensated during other life cycle stages.
When using the module D formula, this additional impact is calculated as

Module D additional load = MS (IV-IS)

This additional impact is calculated as:

- The additional production of batch raw materials (silica sand, soda ash, dolomite etc.).
- The energy overconsumption due to non-use of cullet. Indeed, virgin raw material requires 25% more energy than cullet to be melted.
- Increase of CO_2 emission from decarbonisation due to the substitution of cullet by carbonated raw materials (soda ash, limestone, dolomite)

NF EN15804/CN:2016 details the calculation rule of material recovery.

$$BenefNetRecycl = MSval\ (IVval - ISval) - MS\ (IV - IS)$$

With:

Symbol	Description	Value
MS_{val}	Mass of secondary material actually recovered from the mass of collected stock	0 kg/kg float glass
IV_{val}	Inventory of production of the material substituted by the recovered secondary material in the downstream system using the material	Not assessed (worst case scenario for the end of life)
IS_{val}	Inventory of production of secondary material ready for use in the downstream system from the stock	Not assessed (worst case scenario for the end of life)
MS	Mass of secondary material introduced into the product object of assessment during its manufacture	0.854 kg/kg float glass
IV	Inventory of production of the blank material used to produce the product object of assessment in the absence of material recovery of the material	See details below
IS	Inventory of production of the secondary material ready for use to produce the product objects of assessment	

IV – IS normally refers to the inventory of production of the virgin raw materials minus the production of the secondary raw material. In case of flat glass, the point of substitution, i.e. when recycled material and virgin ones have similar properties, is achieved, when the glass has been (re)melted. Indeed, next to the avoided raw material production, the use of cullet also has an influence on the melting process (lower energy consumption and no decarbonisation), as described in annex D from EN 17074:2019.

2. Benefits and loads from recycling and thermal valorisation of packaging from module A5

Benefits and loads from packaging waste generated in module A5 are considered in the module D. These are:

- Wooden packaging
- Steel from nails (wooden packaging)
- Steel from metallic stillages (depreciation)
- Cardboard separating two piles of mirrors on a stillage

Wood recycling

Wood is considered as partly recycled in wood chips for further material valorisation in particle boards and chipboard. Recycling step consists is modelled as an electricity consumption for shredding.

Avoided production is modelled as a production of similar amount of wood from forests.

Steel recycling

Contribution of steel to module D is modelled up to the substitution point, i.e. up to steel ingot production. The LCA model includes both a production of secondary steel ingots (loads) and the avoided production of a similar amount of primary steel ingot on the other side (benefits).

Cardboard recycling

Contribution of cardboard to module D is modelled up to the substitution point, i.e. up to base paper production. The LCA model includes both a production of base paper from recycled fibres (testliner) and the avoided production of a similar amount of base paper from virgin fibres.

3. Benefits and loads from energy valorisation

A part of the wooden and cardboard packaging is sent to energy valorisation or to landfill equipped with a biogas recovery and valorisation. The benefits associated to the avoided energy production is modelled by considering:

- The French electricity mix
- Heat produced from a natural gas boiler

The modelling of the benefits and loads beyond the system boundaries is representative of the French situation.

Note 1:
Other materials sent to recycling or to energy valorisation are coming from module A1-A3, for which EN 15804+A1 excludes their benefits and loads calculation from module D.

Note 2:
Environmental impacts reported in module D as a positive value (> 0) are additional environmental impacts to be added to the cradle to grave results. Conversely, negative values (< 0) are environmental benefits reducing the cradle to grave impacts.

7. Information regarding life cycle assessment calculation

Table 7 : Information regarding life cycle assessment calculation

PCR used	ISO 14025:2006 (published in July 2006) NF EN 15804+A1:2014 (published in April 2014) NF EN 15804/CN:2016 (published in June 2016) EN 17074:2019 (published in October 2019)
System boundaries	Cradle to grave, including module D
Allocations	A1: mass based A3: area based

Primary data representativeness	*Geographical representativeness* 4 sites of AGC Glass Europe producing the Mirox MNGE and Mirox 4Green range, representing 100% of the production. One additional site considered for the sensitivity analysis to ensure 100% of the production of all mirrors range covered by this EPD. Distribution in France. *Time representativeness* Primary data collected refer the whole 2019 calendar year. *Technological representativeness* Primary data collected from all the AGC Glass Europe.
Background data representativeness	GaBi version 10.5.0.78 and the associated database 2021.2 have been used for the modelling and the calculation of this EPD. GaBi software has also been used for the modelling and computation of LCIA results. All background data have been created or updated during the last 10 years.
Cut-off criteria	All product components and packaging have been considered in the study. In case of insufficient input data, proxy have been used to estimate environmental impacts.
Energy model	Electrical mix used for mirror production reflects the weighted average mix based on national mix of countries where AGC Glass Europe operates mirror production plants. This mix is adjusted to each specific case for the validity range assessment. Only renewable electricity produced and consumed on-site has been accounted as green electricity. All electricity from the grid has been modelled as national mix, even when AGC is covering part of it with guaranties of origin. Natural gas mix used for mirror production reflects the weighted average mix based on national mix of natural gas supply of countries where AGC Glass Europe operates mirror production plants.
Other assumptions	Whenever data was not available for one of the sites producing mirrors, the weighted average value of the other responding sites has been considered. Base coat and top coat paints have been modelled based on the safety datasheets (SDS) of AGC Glass Europe suppliers.
Variability	Results variability for the products covered by this EPD is lower than 40% for the reference indicators from NF EN 15804/CN:2016: - Global Warming Potential - Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - Non-hazardous wastes disposed Results variability has also been assessed for other environmental indicators from EN 15804+A1 and is also lower than 40% for all of them.

8. Life cycle assessment results

Table 8 : Environmental impacts

Environmental impacts	Production stage	Construction stage			Use stage							End of life stage					Total life cycle	Benefits and loads beyond system boundaries
	Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	Total B1-B7	C1 Deconstruction	C2 Transport	C3 Waste processing	C4 Disposal	Total C1-C4		
Global warming Potential kg CO_2 eq/FU	1.89E+01	6.31E-01	1.51E-01	7.82E-01	0	1.10E-01	0	0	0	0	0	1.10E-01	0	3.44E-02	0	2.24E-01	2.59E-01	2.01E+01	8.94E-01
Ozone layer depletion potential kg CFC 11 eq/FU	2.63E-08	1.10E-16	2.61E-10	2.61E-10	0	6.77E-10	0	0	0	0	0	6.77E-10	0	6.06E-18	0	1.21E-15	1.21E-15	2.72E-08	1.12E-09
Acidification kg SO_2 eq/FU	8.70E-02	1.33E-03	5.91E-05	1.39E-03	0	1.98E-04	0	0	0	0	0	1.98E-04	0	1.98E-04	0	1.31E-03	1.51E-03	9.01E-02	1.51E-03
Eutrophication kg $(PO_4)^{3-}$ eq/FU	1.17E-02	3.18E-04	1.32E-05	3.31E-04	0	6.14E-05	0	0	0	0	0	6.14E-05	0	4.98E-05	0	1.72E-04	2.22E-04	1.23E-02	2.86E-04
Photochemical oxidant creation potential Ethene eq/FU	5.42E-03	1.42E-04	8.38E-06	1.51E-04	0	2.88E-03	0	0	0	0	0	2.88E-03	0	1.58E-05	0	1.01E-04	1.17E-04	8.56E-03	9.48E-05
Abiotic resource depletion - Elements kg Sb eq/FU	1.21E-03	4.88E-08	3.67E-09	5.24E-08	0	4.58E-07	0	0	0	0	0	4.58E-07	0	2.70E-09	0	2.15E-08	2.42E-08	1.21E-03	-6.53E-08
Abiotic resource depletion - Fossil MJ/FU	2.53E+02	8.52E+00	1.88E-01	8.71E+00	0	3.30E+00	0	0	0	0	0	3.30E+00	0	4.71E-01	0	3.06E+00	3.53E+00	2.68E+02	7.01E+00
Water pollution m^3/UF	5.47E+00	1.40E-01	4.61E-03	1.45E-01	0	4.27E-02	0	0	0	0	0	4.27E-02	0	7.73E-03	0	5.78E-02	6.55E-02	5.73E+00	3.96E-01
Air pollution m^3/UF	1.20E+03	2.69E+01	5.13E+00	3.20E+01	0	1.47E+02	0	0	0	0	0	1.47E+02	0	2.07E+00	0	2.56E+01	2.76E+01	1.41E+03	3.29E+01

Table 9 : Resource use

Resource use	Production stage	Construction stage			Use stage							End of life stage					Total life cycle	Benefits and loads beyond system boundaries
	Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	Total B1-B7	C1 Deconstruction	C2 Transport	C3 Waste processing	C4 Disposal	Total C1-C4		
Renewable primary energy as energy carrier *(MJ/FU)*	1.38E+01	4.78E-01	7.60E-02	5.54E-01	0	1.13E-01	0	0	0	0	0	1.13E-01	0	2.64E-02	0	4.16E-01	4.42E-01	1.49E+01	-8.71E-01
Renewable primary energy resources used as raw materials *(MJ/FU)*	2.32E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.32E+00	0
Total use of renewable primary energy resources *(MJ/FU)*	1.61E+01	4.78E-01	7.60E-02	5.54E-01	0	1.13E-01	0	0	0	0	0	1.13E-01	0	2.64E-02	0	4.16E-01	4.42E-01	1.72E+01	-8.71E-01
Non-renewable primary energy resources as energy carrier *(MJ/FU)*	2.79E+02	8.58E+00	2.50E-01	8.83E+00	0	3.42E+00	0	0	0	0	0	3.42E+00	0	4.74E-01	0	3.15E+00	3.63E+00	2.94E+02	7.98E+00
Non-renewable primary energy resources used as raw materials *(MJ/FU)*	1.38E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.38E+00	0
Total use of non-renewable primary energy resources *(MJ/FU)*	2.80E+02	8.58E+00	2.50E-01	8.83E+00	0	3.42E+00	0	0	0	0	0	3.42E+00	0	4.74E-01	0	3.15E+00	3.63E+00	2.96E+02	7.98E+00
Use of secondary material *(kg/FU)*	1.34E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.34E+00	0
Use of renewable secondary fuels *(MJ/FU)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels *(MJ/FU)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of net fresh water *(m^3/FU)*	3.84E-02	5.47E-04	3.80E-04	9.28E-04	0	2.68E-03	0	0	0	0	0	2.68E-03	0	3.03E-05	0	7.44E-04	7.74E-04	4.28E-02	-1.94E-03

Table 10 : Waste categories

Waste categories	Production stage	Construction stage			Use stage								End of life stage					Total life cycle	Benefits and loads beyond system boundaries
	Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	Total B1-B7	C1 Deconstruction	C2 Transport	C3 Waste processing	C4 Disposal	Total C1-C4		
Hazardous waste disposal *(kg/FU)*	1.68E-07	4.32E-10	4.73E-11	4.80E-10	0	2.93E-10	0	0	0	0	0	2.93E-10	0	2.39E-11	0	3.45E-10	3.69E-10	1.69E-07	1.69E-09
Non-hazardous waste disposal *(kg/FU)*	5.65E-01	1.27E-03	6.67E-03	7.94E-03	0	5.55E-03	0	0	0	0	0	5.55E-03	0	7.05E-05	0	1.52E+01	1.52E+01	1.57E+01	3.70E-02
Radioactive waste disposal *(kg/FU)*	5.30E-03	1.04E-05	2.34E-05	3.38E-05	0	9.83E-06	0	0	0	0	0	9.83E-06	0	5.74E-07	0	3.32E-05	3.38E-05	5.38E-03	-1.01E-04

Table 11 : Output flows

Output flows	Production stage	Construction stage			Use stage								End of life stage					Total life cycle	Benefits and loads beyond system boundaries
	Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	Total B1-B7	C1 Deconstruction	C2 Transport	C3 Waste processing	C4 Disposal	Total C1-C4		
Components for reuse *(kg/FU)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling *(kg/FU)*	4.94E-01	0	1.12E-01	1.12E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	6.06E-01	0
Materials for energy recovery (*kg/FU*)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported electrical energy *(MJ/FU)*	3.87E-03	0	1.85E-01	1.85E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	1.89E-01	0
Exported thermal energy *(MJ/FU)*	8.81E-03	0	3.23E-01	3.23E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	3.32E-01	0
Exported energy – process gas *(MJ/FU)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

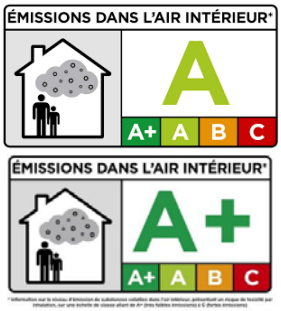
9. Additional information

9.1. Release of hazardous substances into indoor air, soil and water during the use stage

9.1.1. Indoor air

- **VOC and formaldehyde emissions**

VOC and formaldehyde emission testing have been carried out according to EN 7375:2005 and EN ISO 16000-9:2009. Based on these testing and considering their associated exposition scenario, mirrors from the Mirox MNGE and Mirox 4Green range have been classified A for the standard product and A+ in case of mirrors equipped with a safety film.



- Mirox MNGE
- Mirox 4Green

- Mirox MNGE SAFE+
- Mirox 4Green SAFE+

The VOC declaration of these products is publicly available on pour website **https://agc-yourglass.com**

- **Reaction to fungal and bacterial growth**

Not tested. Glass is a mineral inert material. It is not by itself a medium for micro-organisms growth.

- **Natural radioactive emissions from construction products**

Not tested.

- **Emission of particulates and fibres emissions**

Not tested.

9.1.2. Water and soil

Not tested. The product is not in contact with water intended for human consumption.

9.2. Product contribution to indoor wellbeing

9.2.1. Product characteristics regarding hygrothermal comfort

Not applicable, mirrors have no influence on the hygrothermal comfort of a building.

9.2.2. Product characteristics regarding acoustics

Not applicable, mirrors have no influence on the acoustics of a building.

9.2.3. Product characteristics regarding visual comfort

Thanks to their light reflection properties, mirrors enhanced the internal volume perception of residential and professional space, especially rooms where one aims to compensate a lack of light by providing a perspective effect.

9.2.4. Product characteristics as regarding odours

Not tested. Glass is a mineral inert material, not able to release any odour during its use.

10. Extrapolation rules

Mirox MNGE and Mirox 4Green of other thicknesses than the one from the reference product can be assessed by using extrapolation rules. These rules are applicable for any product from Mirox MNGE and Mirox 4Green range.

The intended use of these extrapolation rules is to allow industrial customers using Mirox MGNE and Mirox 4Green in their products to assess the environmental impacts of a specific product bought.

The upper and lower range are described below.

Table 12 : Extrapolation rules min and max products

Product composition	Mirox MNGE 3 mm	Mirox MGNE 8 mm SAFE+
Float glass		
Thickness	3 mm	8 mm
Mass (kg)	7.5 kg	20 kg
SAFE+ film		
PET film	-	69 g
Silver layer		
Silver	< 1 g	
Palladium, tin, silane	< 1 g	
Paint		
Base coat	≈ 55 g	
Top coat	≈ 65 g	
Packaging		
Wood (« end-caps »)	137 g/m²	
Steel - nails (« end-caps »)	4 g/m²	
Cardboard	0.13 g/m²	
Interleaving powder	0.15 g/m²	
Reusable steel stillage (depreciation)	30 g/m²	

Environmental impacts depend on the combination of three parameters:

- A fix impact
- An impact proportional to the float thickness
- An impact linked to an eventual safety film

They can be computed according to the following formula.

$$Env = I_{mirror\ fix} + (FT * I_{1mm\ float}) + (SF * I_{SAFE+\ film})$$

Fix impacts from mirror production — *Impact proportional to float thickness* — *Impacts of a safety film*

With:

$I_{mirror\ fix}$	Fix impacts from mirror production
FT	Float thickness (in mm)
$I_{1mm\ float}$	Impacts per mm of float glass
SF	Boolean linked to a safety film (1 if safety film, 0 otherwise)
$I_{SAFE+\ film}$	Impacts associated to safety film

Note that only modules to which acid-etched glass contributes are presented. All other modules are considered as null (B1, B3, B4, B5, B6, B7, C1).

Table 13 : Extrapolation values – Environmental impacts 1

Environmental impacts		Production stage	Construction stage			Use stage		End of life			Total life cycle	Benefits and loads beyond system boundaries
		Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B2 Maintenance	Total B1-B7	C2 Transport	C4 Élimination	Total C1-C4		
GWP – kg CO_2 eq./FU	I mirror fix	1.48E+00	1.30E-03	1.51E-01	1.53E-01	1.10E-01	1.10E-01	3.13E-04	9.23E-03	9.54E-03	1.76E+00	-5.91E-03
	I 1mm float	2.91E+00	1.05E-01	0	1.05E-01	0	0	5.68E-03	3.59E-02	4.15E-02	3.05E+00	1.50E-01
	I SAFE+ film	4.88E-01	0	0	0	0	0	1.57E-04	4.62E-03	4.78E-03	4.93E-01	0
ODP – kg CFC11 eq./FU	I mirror fix	1.17E-08	2.26E-19	2.61E-10	2.61E-10	6.77E-10	6.77E-10	5.51E-20	3.17E-17	3.18E-17	1.26E-08	-3.86E-16
	I 1mm float	2.43E-09	1.82E-17	0	1.82E-17	0	0	1.00E-18	1.96E-16	1.97E-16	2.43E-09	1.86E-10
	I SAFE+ film	7.82E-15	0	0	0	0	0	2.76E-20	1.59E-17	1.59E-17	7.83E-15	0
AP – kg SO_2 eq./FU	I mirror fix	1.42E-02	2.75E-06	5.91E-05	6.19E-05	1.98E-04	1.98E-04	1.80E-06	2.40E-05	2.58E-05	1.45E-02	-1.36E-04
	I 1mm float	1.21E-02	2.22E-04	0	2.22E-04	0	0	3.27E-05	2.14E-04	2.47E-04	1.26E-02	2.74E-04
	I SAFE+ film	7.68E-04	0	0	0	0	0	9.01E-07	1.20E-05	1.29E-05	7.81E-04	0
EP – kg PO_4 eq./FU	I mirror fix	7.74E-04	6.56E-07	1.32E-05	1.38E-05	6.14E-05	6.14E-05	4.53E-07	2.63E-05	2.67E-05	8.76E-04	-1.74E-05
	I 1mm float	1.82E-03	5.29E-05	0	5.29E-05	0	0	8.23E-06	2.43E-05	3.25E-05	1.90E-03	5.05E-05
	I SAFE+ film	9.47E-05	0	0	0	0	0	2.27E-07	1.32E-05	1.34E-05	1.08E-04	0
POCP – kg C_4H_4 eq./FU	I mirror fix	7.81E-04	2.93E-07	8.38E-06	8.67E-06	2.88E-03	2.88E-03	1.44E-07	2.18E-06	2.33E-06	3.67E-03	-3.20E-05
	I 1mm float	7.73E-04	2.36E-05	0	2.36E-05	0	0	2.61E-06	1.64E-05	1.91E-05	8.15E-04	2.11E-05
	I SAFE+ film	1.09E-04	0	0	0	0	0	7.20E-08	1.09E-06	1.17E-06	1.10E-04	0
ADPE – kg Sb eq./FU	I mirror fix	1.20E-03	1.01E-10	3.74E-09	3.84E-09	4.59E-07	4.59E-07	2.47E-11	6.89E-10	7.14E-10	1.20E-03	-1.48E-07
	I 1mm float	2.04E-06	8.16E-09	0	8.16E-09	0	0	4.48E-10	3.60E-09	4.05E-09	2.06E-06	1.55E-08
	I SAFE+ film	1.02E-07	0	0	0	0	0	1.24E-11	3.45E-10	3.58E-10	1.03E-07	0
ADPF – MJ/FU	I mirror fix	2.72E+01	1.76E-02	1.88E-01	2.05E-01	3.30E+00	3.30E+00	4.29E-03	1.39E-01	1.44E-01	3.08E+01	-1.11E+00
	I 1mm float	3.76E+01	1.42E+00	0	1.42E+00	0	0	7.78E-02	4.87E-01	5.65E-01	3.95E+01	1.35E+00
	I SAFE+ film	1.02E+01	0	0	0	0	0	2.15E-03	6.98E-02	7.19E-02	1.03E+01	0

Table 14 : Extrapolation values – Environmental impacts 2

Environmental impacts		Production stage	Construction stage			Use stage		End of life			Total life cycle	Benefits and loads beyond system boundaries
		Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B2 Maintenance	Total B1-B7	C2 Transport	C4 Élimination	Total C1-C4		
Air pollution – m³/FU	I mirror fix	1.54E+02	5.55E-02	5.13E+00	5.19E+00	1.47E+02	1.47E+02	1.88E-02	7.98E-01	8.17E-01	3.07E+02	-1.35E+01
	I 1mm float	1.75E+02	4.47E+00	0	4.47E+00	0	0	3.42E-01	4.13E+00	4.47E+00	1.84E+02	7.73E+00
	I SAFE+ film	3.16E+01	0	0	0	0	0	9.44E-03	4.00E-01	4.09E-01	3.20E+01	0
Water pollution – m³/FU	I mirror fix	3.24E-01	2.89E-04	4.61E-03	4.90E-03	4.27E-02	4.27E-02	7.03E-05	2.25E-02	2.26E-02	3.94E-01	-5.19E-03
	I 1mm float	8.58E-01	2.33E-02	0	2.33E-02	0	0	1.28E-03	5.87E-03	7.15E-03	8.89E-01	6.69E-02
	I SAFE+ film	1.03E-01	0	0	0	0	0	3.52E-05	1.13E-02	1.13E-02	1.14E-01	0

Table 15 : Extrapolation values – Resource consumption 1

Resource consumption		Production stage	Construction stage			Use stage		End of life			Total life cycle	Benefits and loads beyond system boundaries
		Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B2 Maintenance	Total B1-B7	C2 Transport	C4 Élimination	Total C1-C4		
PERE – MJ/FU	I mirror fix	4.16E+00	9.86E-04	7.60E-02	7.69E-02	1.13E-01	1.13E-01	2.40E-04	1.04E-02	1.07E-02	4.36E+00	-1.07E+00
	I 1mm float	1.60E+00	7.95E-02	0.00E+00	7.95E-02	0	0	4.37E-03	6.75E-02	7.19E-02	1.75E+00	3.40E-02
	I SAFE+ film	1.89E+00	0	0	0	0	0	1.20E-04	5.23E-03	5.35E-03	1.89E+00	0
PERM – MJ/FU	I mirror fix	2.32E+00	0	0	0	0	0	0	0	0	2.32E+00	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
PERT – MJ/FU	I mirror fix	6.48E+00	9.86E-04	7.60E-02	7.69E-02	1.13E-01	1.13E-01	2.40E-04	1.04E-02	1.07E-02	6.68E+00	-1.07E+00
	I 1mm float	1.60E+00	7.95E-02	0	7.95E-02	0	0	4.37E-03	6.75E-02	7.19E-02	1.75E+00	3.40E-02
	I SAFE+ film	1.89E+00	0	0	0	0	0	1.20E-04	5.23E-03	5.35E-03	1.89E+00	0

Table 16 : Extrapolation values – Resource consumption 2

Resource consumption		Production stage	Construction stage			Use stage		End of life			Total life cycle	Benefits and loads beyond system boundaries
		Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B2 Maintenance	Total B1-B7	C2 Transport	C4 Élimination	Total C1-C4		
PENRE – MJ/FU	I mirror fix	2.87E+01	1.77E-02	2.50E-01	2.67E-01	3.42E+00	3.42E+00	4.31E-03	1.44E-01	1.48E-01	3.25E+01	-1.46E+00
	I 1mm float	4.16E+01	1.43E+00	0	1.43E+00	0	0	7.83E-02	5.02E-01	5.80E-01	4.37E+01	1.57E+00
	I SAFE+ film	1.01E+01	2.84E-14	0	2.84E-14	0	0	2.16E-03	7.21E-02	7.43E-02	1.02E+01	3.02E-14
PENRM – MJ/FU	I mirror fix	1.38E+00	0	0	0	0	0	0	0	0	1.38E+00	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	1.53E+00	0	0	0	0	0	0	0	0	1.53E+00	0
PENRT – MJ/FU	I mirror fix	3.01E+01	1.77E-02	2.50E-01	2.67E-01	3.42E+00	3.42E+00	4.31E-03	1.44E-01	1.48E-01	3.39E+01	-1.46E+00
	I 1mm float	4.16E+01	1.43E+00	0	1.43E+00	0	0	7.83E-02	5.02E-01	5.80E-01	4.37E+01	1.57E+00
	I SAFE+ film	1.16E+01	2.84E-14	0	2.84E-14	0	0	2.16E-03	7.21E-02	7.43E-02	1.17E+01	3.02E-14
SM – kg/FU	I mirror fix	6.76E-05	0	0	0	0	0	0	0	0	6.76E-05	0
	I 1mm float	2.24E-01	0	0	0	0	0	0	0	0	2.24E-01	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
RSF – MJ/FU	I mirror fix	0	0	0	0	0	0	0	0	0	0	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
NRSF – MJ/FU	I mirror fix	0	0	0	0	0	0	0	0	0	0	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
FW – m³/FU	I mirror fix	7.98E-03	1.13E-06	3.80E-04	3.81E-04	2.68E-03	2.68E-03	2.75E-07	1.33E-06	1.60E-06	1.10E-02	-3.82E-03
	I 1mm float	5.07E-03	9.11E-05	0	9.11E-05	0	0	5.00E-06	1.24E-04	1.29E-04	5.29E-03	3.13E-04
	I SAFE+ film	2.78E-03	-2.10E-17	0	-2.10E-17	0	0	1.38E-07	6.65E-07	8.03E-07	2.78E-03	3.99E-17

Table 17 : Extrapolation values – Waste categories

Waste categories		Production stage	Construction stage			Use stage		End of life			Total life cycle	Benefits and loads beyond system boundaries
		Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B2 Maintenance	Total B1-B7	C2 Transport	C4 Élimination	Total C1-C4		
HWD - kg/FU	I mirror fix	1.22E-07	8.92E-13	4.73E-11	4.82E-11	2.93E-10	2.93E-10	2.17E-13	2.59E-11	2.61E-11	1.22E-07	-2.55E-11
	I 1mm float	7.65E-09	7.19E-11	0.00E+00	7.19E-11	0	0	3.95E-12	5.33E-11	5.72E-11	7.78E-09	2.86E-10
	I SAFE+ film	2.17E-09	0	0	0	0	0	1.09E-13	1.30E-11	1.31E-11	2.18E-09	0
NHWD - kg/FU	I mirror fix	1.92E-01	2.63E-06	6.67E-03	6.67E-03	5.55E-03	5.55E-03	6.41E-07	1.37E-01	1.37E-01	3.41E-01	6.82E-03
	I 1mm float	6.22E-02	2.12E-04	0	2.12E-04	0	0	1.16E-05	2.50E+00	2.50E+00	2.56E+00	5.02E-03
	I SAFE+ film	7.90E-03	0	0	0	0	0	3.21E-07	6.87E-02	6.87E-02	7.66E-02	0
RWD - kg/FU	I mirror fix	1.03E-03	2.14E-08	2.34E-05	2.35E-05	9.83E-06	9.83E-06	5.22E-09	1.67E-06	1.68E-06	1.06E-03	-1.36E-04
	I 1mm float	7.13E-04	1.73E-06	0	1.73E-06	0	0	9.47E-08	5.26E-06	5.35E-06	7.20E-04	5.80E-06
	I SAFE+ film	5.44E-04	0	0	0	0	0	2.61E-09	8.37E-07	8.40E-07	5.45E-04	0

Table 18 : Extrapolation values – Output flows

Output flows		Production stage	Construction stage			Use stage		End of life			Total life cycle	Benefits and loads beyond system boundaries
		Total A1-A3	A4 Transport	A5 Installation	Total A4-A5	B2 Maintenance	Total B1-B7	C2 Transport	C4 Élimination	Total C1-C4		
CFR - kg/FU	I mirror fix	0	0	0	0	0	0	0	0	0	0	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
MFR kg/FU	I mirror fix	8.70E-03	0	1.12E-01	1.12E-01	0	0	0	0	0	1.20E-01	0
	I 1mm float	8.09E-02	0	0	0	0	0	0	0	0	8.09E-02	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
MFE - kg/FU	I mirror fix	0	0	0	0	0	0	0	0	0	0	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
EEE – MJ/FU	I mirror fix	3.87E-03	0	1.85E-01	1.85E-01	0	0	0	0	0	1.89E-01	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
EET – MJ/FU	I mirror fix	8.81E-03	0	3.23E-01	3.23E-01	0	0	0	0	0	3.32E-01	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0
EEPG – MJ/FU	I mirror fix	0	0	0	0	0	0	0	0	0	0	0
	I 1mm float	0	0	0	0	0	0	0	0	0	0	0
	I SAFE+ film	0	0	0	0	0	0	0	0	0	0	0

More information available on https://agc-yourglass.com/

And in the « Sustainability » section of our environmental website https://www.agc-glass.eu/en/sustainability