AGC GLASS EUROPE

ENVIRONMENTAL AND HEALTH PRODUCT DECLARATION

Triple glazing units

(Thermobel TG, iplus TGU, ipasol TGU)

Reference structure 4|-14-4-14-|4

Mounting accessories excluded

In accordance with ISO 14025:2010, EN 15804+A1:2014 and its French national complement NF EN15804/CN:2016

June 2019

1. Warning

Information from this declaration are 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 results higher than zero, it is an additional impact to be added to the rest of the life cycle.

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 Contact: sustainability@eu.agc.com
Production sites	This EPD is representative of triple glazing units sold by AGC Glass Europe / AGC Interpane in France. AGC Glass Europe operates 32 production sites in Europe providing triple glazing units to French and European market. Results from this EPD reflect data collected from all these sites, representing 100% of the production.
System boundaries	☐ Cradle to factory gate ☐ Cradle to grave ☒ Cradle to grave + module D
Type of EPD	☐ Collective ☒ Individual, covering AGC Glass Europe and AGC Interpane range of products The EPD user is invited to check at *Validity range* part if its IGU structure is well covered by this EPD.
Verifier name	Cécile Beaudard (Solinnen)
Program operator	**FDES INIES** Website: www.inies.fr Address : Association HQE, 4 avenue du Recteur Poincaré – 75016 Paris - FRANCE
Publication date	June 2019
Expiration date	June 2024
Target audience	This EPD is primarily intended for business-to-business communication, although it might be consulted by consumers as well (business-to-consumer).

Commercial reference

Reference product is a triple glazing unit from Thermobel TG range with a 4|-14-4-14-|4 structure.
It is a real product representing a major market share, especially for residential market.
The IGU range of products covered by this EPD is:
For AGC Glass Europe brands:

- Thermobel TG Top
- Thermobel TG Advanced
- Thermobel TG Energy^{N}
- Thermobel TG LS
- Thermobel Stopray
- Thermobel ipasol

For AGC Interpane brands:

- iplus TGU
- iplus 3
- iplus 3LS TGU
- ipasol TGU

The typical name of a triple glazing from AGC Glass Europe is built as:

AGC Thermobel TG + coating name

Note that AGC Interpane commercialises its products under different brand names. AGC Interpane naming is built as:

AGC Interpane + coating name + "3" or "TGU"

Next to the commercial name, the structure of the IGU is also provided to specify the exact product. Table below provides typical brand names and the associated glazing description.

Brand name	Description
AGC Thermobel TG Top 4|-14-4-14-|4 AGC Interpane iplus 3 4|-14-4-14-|4	Triple glazing unit with two soft coated glass iplus 1.1
AGC Thermobel TG ipasol 4|-14-4-14-|4 AGC Interpane ipasol TGU 4|-14-4-14-|4	Triple glazing unit with one ipasol and one iplus 1.0 soft coated glass

Validity range

This EPD covers all AGC Glass Europe and AGC Interpane sites producing IGUs. Calculations are based on primary data collected throughout the 32 sites from AGC Glass Europe and AGC Interpane producing IGUs in Europe. Weighted average have been considered, based on production quantities (in m² of IGUs) from each site.

Next to the 4|-14-4-14-|4 reference structure from this EPD, other triple glazing structures are covered by this EPD through validity range. These are structures for which the variability of the reference environmental indicators from NF EN 15804/CN:2016 is lower than +/- 40%. These ones are detailed in the following tables. Triple glazing structures that are not listed in the table are not covered by this EPD.

Low-e TGU			
No thermal toughening	4-**x**-4-**x**-4	5-**x**-4-**x**-4	6-**x**-4-**x**-4
	4-**x**-4-**x**-5	5-**x**-4-**x**-5	6-**x**-4-**x**-5
	4-**x**-4-**x**-6	5-**x**-4-**x**-6	6-**x**-4-**x**-6
Thermally toughened glass	4T-**x**-4T-**x**-4T	5T-**x**-4T-**x**-4T	6T-**x**-4T-**x**-4T
	4T-**x**-4T-**x**-5T	5T-**x**-4T-**x**-5T	6T-**x**-4T-**x**-5T
	4T-**x**-4T-**x**-6T	5T-**x**-4T-**x**-6T	6T-**x**-4T-**x**-6T

*With **x** the spacer width from 10 to 18 mm*

Solar control TGU			
No thermal toughening	4-**x**-4-**x**-4	5-**x**-4-**x**-4	6-**x**-4-**x**-4
	4-**x**-4-**x**-5	5-**x**-4-**x**-5	6-**x**-4-**x**-5
	4-**x**-4-**x**-6	5-**x**-4-**x**-6	6-**x**-4-**x**-6
Thermally toughened glass	4T-**x**-4T-**x**-4T	5T-**x**-4T-**x**-4T	6T-**x**-4T-**x**-4T
	4T-**x**-4T-**x**-5T	5T-**x**-4T-**x**-5T	6T-**x**-4T-**x**-5T
	4T-**x**-4T-**x**-6T	5T-**x**-4T-**x**-6T	

*With **x** the spacer width from 10 to 18 mm*

Legend

- IGU structures covered by this EPD
- Representative product of this EPD
- IGU structures not covered by this EPD

5. Functional unit and product description

5.1. Description of the functional unit

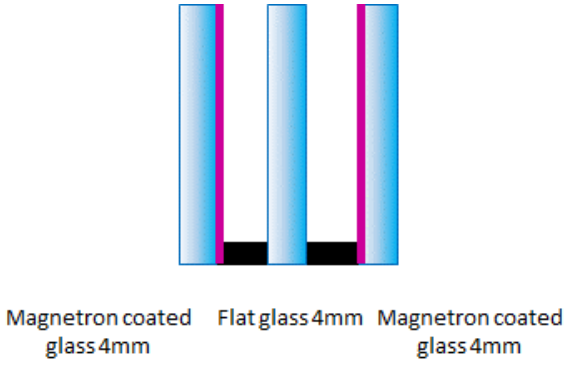
The declaration refers to a functional unit of 1 m² of insulated glazing unit with a thermal insulation of $U_g \leq 1.1$ W/(m².K) for a reference service life (RSL) of 30 years.
The associated reference flow is a triple glazing made of:

- Three flat glass panes of 4 mm, for a total mass of 30 kg
- Two spacers, desiccant, sealants and insulating gas (cumulative mass of ≈ 1.3 kg)

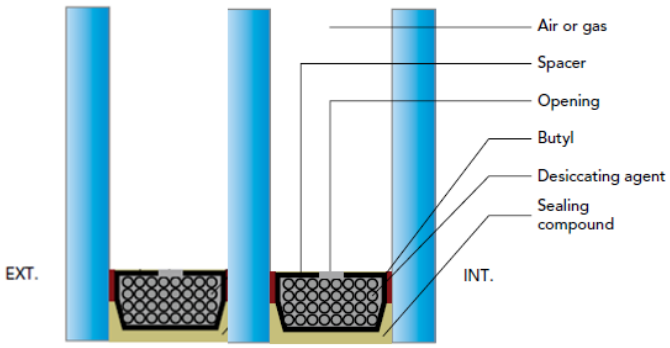
Note: The reference service life of the product is set to 30 years. This period does not reflect real product lifetime, which is generally defined by building refurbishment. It does not refer to product guarantee neither. This period reflects a standard duration of use considered in glazing EPDs.

5.2. Product description

The reference product is triple glazing with eventual solar control properties. The reference structure is a 4|-14-4-14-|4 TGU, made of three 4mm flat glass panes, two of which being magnetron coated. These coated panes give the specific thermal properties to the TGU (thermal insulation, light transmission, solar factor). The glass panes are separated by cavities containing an insulating gas (argon 90%) and assembled with a spacer, desiccant and sealants.



4|-14-4-14-|4 triple glazing structure



Triple glazing components

This product conform to EN 1279-5:2018 " Glass in building – Insulating glass units. Product standard".

All products from Thermobel range are CE marked in accordance with EN 1279-5:2018.

More information available on www.yourglass.com.

5.3. Description of the product usage

Low-e/solar control IGUs are meant to be used as glazing facades in construction projects. It can also be used in a wide range of other construction applications. In that case, glass can be delivered with technical properties fitting with specific use requirements.

Table 1 : Product characteristics

Properties	Symbol	Low-e TGU	Solar control TGU
Thermal transmission (according to EN 673)	U_g (W/m².K)	0.5 to 0.7	0.6
Light Transmission (EN 410)	Tv (%)	65 to 77	22 to 66
Light Reflection (EN 410)	ρv (%)	16 to 21	15 to 62
Solar factor (EN 410)	g (%)	43 to 55	15 to 39
Direct airborne sound insulation (EN 12578)	Rw (C;Ctr) (dB)	33 (-2;-6)	33 (-2;-6)
Resistance to fire (EN13501-2)		NPD	NPD
Reaction to fire (EN 13501-1)		NPD	NPD
Bullet resistance (EN 1063)		NPD	NPD
Burglar resistance (EN 356)		NPD	NPD
Pendulum body impact resistance (EN 12600)		NPD	NPD

Thermobel TG products covered by this EPD have no specific properties as regards resistance to falls, burglary, fire, fire arms or explosion. No performance is declared for these aspects. Products with such properties belong to Thermobel TG Stratobel/Stratophone or Thermobel TG Security ranges, not covered by this EPD.
More information available on www.yourglass.com.

5.4. Other technical features not included in the functional unit

Not applicable.

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

Thermobel IGUs covered by this EPD are made of three soda-lime flat glass panes, two of which being magnetron coated. These panes are separated by cavities filled with an insulating gas (argon) and assembled by a spacer, desiccant and sealants.

The reference product is a triple glazing unit with a 4|-14-4-14-|4 structure. It is a real product, representing an important market share, especially for residential market. Its composition is detailed in the following table.

Table 2 : 4|-14-4-14-|4 IGU components

Product composition	4|-14-4-14-|4 IGU
Flat glass	
Number of glass panes	3 panes
Glass (mass)	30 kg
Magnetron coating (mass)	0.002 kg
Mass (% final product)	96%
Cavity	
Argon (volume)	27 litres
Argon (mass)	48 g
Spacer (material)	Stainless steel, Aluminium, polyamide/steel
Spacer (mass)	≈ 300 to 500 g (depending on material)*
Desiccant (material)	Zeolite
Desiccant (mass)	≈ 140 g
Inner sealant (material)	Polyisobutylene
Inner sealant (mass)	≈ 60 g
Outer sealant (material)	Polysulfide, Silicone, Polyurethane
Outer sealant (mass)	≈ 600 g
Mass (% final product)	4%
Packaging	
Cork spacer	10.1 g/m²
Cardboard	2.6 g/m²
LDPE film	11.6 g/m²
Polystyrene blocks	0.4 g/m²
Metallic stillage (depreciation)	40 g/m²

** For a glazing 1m square in shape*

5.6. Substances from REACH candidate list

AGC Thermobel TG products covered by this EPD do not contain any substance from REACH candidate list according to REACH regulation (more than 0.1%)

5.7. Reference service life description

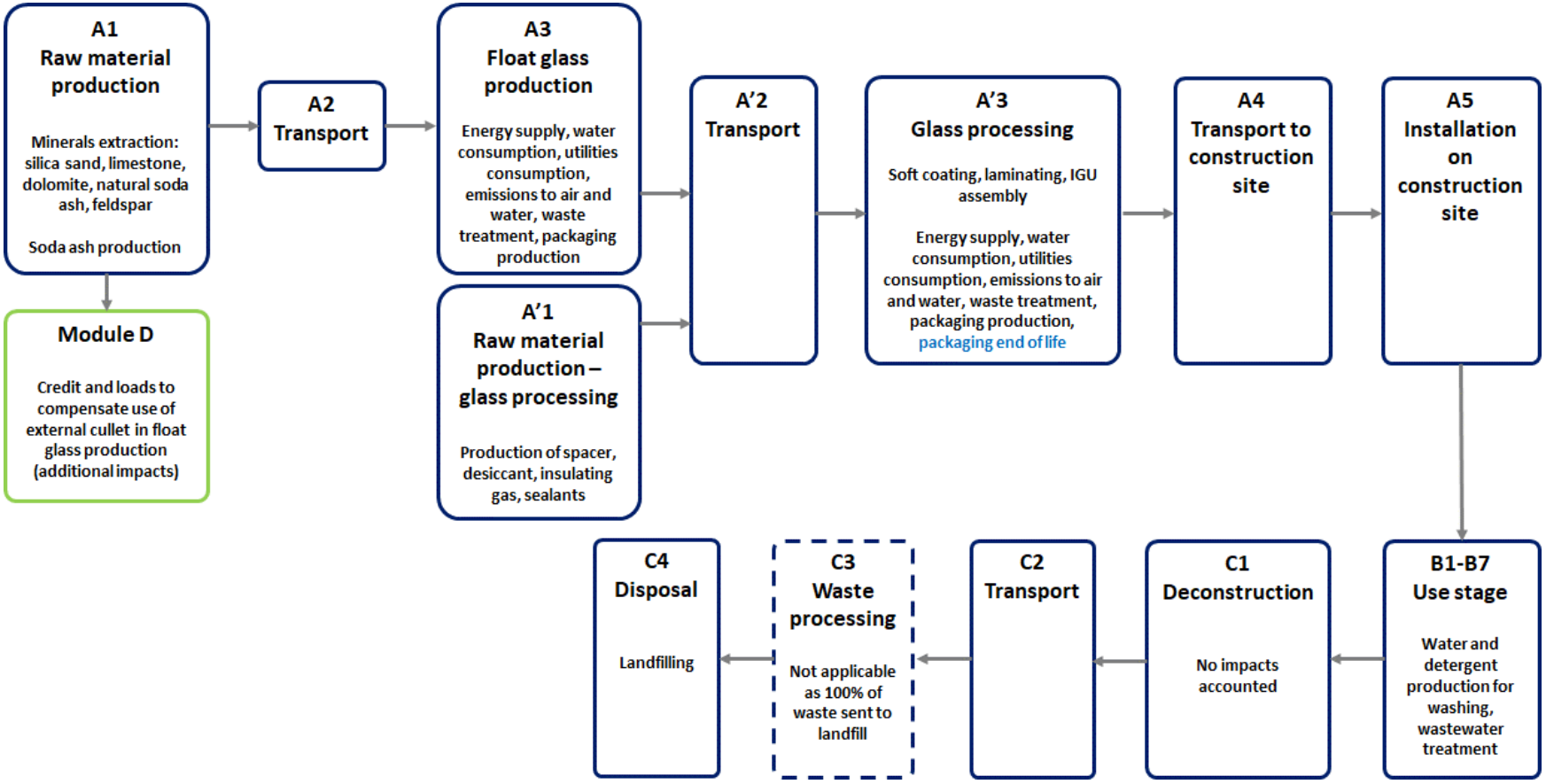
The reference service life (RSL) of low-e magnetron-coated glass is 30 years.

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 laminated glass definition standard EN 1279-5:2018 *Glass in building – Insulating glass units. Product standard*
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	

6. Life cycle stages

This EPD is a cradle to grave study including module D.
Life cycle stages regarding product installation (A5) and product use (B1-B7) are modelled based on Glass in building product category rules prEN 17074:2017.



6.1. Production stage, module A1-A3

Module A1-A3 covers the production and transport of raw materials used for triple glazing units production. It also covers consumptions and emissions from processing sites such as energy and water consumption, water effluents, wastes treatment.
IGU processing involves the following steps:

- Float glass loading
- Glass cutting to specific dimensions
- Float washing in order to prevent any impurity and to remove interleavant powder used for float transport
- Assembling (first spacer) and inner sealant deposition
- Placing of the second float glass pane
- Assembling (second spacer) and inner sealant deposition
- Placing of the third float glass pane
- Outer sealant deposition

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. This allocation comply with the flat glass product category rule prEN 17074:2017.

A3: Consumptions from IGU processing have been allocated based on area for energy as well as IGU type (double or triple glazing) as regards water consumption, and other components (spacer, desiccant, sealants, insulating gas). This latter allocation deviate from prEN 17074:2017 guidance, which only refers to an allocation based on area. This allocation has been preferred as better reflecting physical relationship and real quantities used. A3 sub-module does not generate by-product.

6.2. Construction stage, module A4-A5

Transport to construction sites (module A4) considers an average 1000 km distance between AGC Glass Europe plants producing IGU and construction site.
As regards installation on site (module A5), no ancillary materials is considered for the glass to be installed in accordance with prEN17074:2017.
No breakage during transport and installation has been considered, following prEN 17074:2017.

1. **Transport to the construction site**

Transport to construction site scenario considers a delivery over a long distance in truck loaded at nominal capacity.

Table 4 : Transport to construction site

Parameter	Value	Unit
Vehicle description	5	Tonne | Diesel truck - EURO 5 – cargo
Distance to construction site	1000	km

2. Installation on site

No ancillary materials is considered for the glass to be installed in accordance with prEN17074:2017. Packaging end of life is accounted in module A3 as detailed in prEN17074:2017 product category rule.

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, float glass does not need any of these operations.

Finally, magnetron-coated glass does not emit any substances neither to the air nor to water during its use (B1).

2. Maintenance parameters

Following prEN17074:2017, 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 consumption of detergents of 10 g/m² (300 g/m² over the whole life cycle). The majority 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.

Table 5 : Glass maintenance

Parameter (whole life cycle)	Value	Unit
Water consumption for maintenance	6	litres
Detergent consumption	300	g
Waste water discharge to WWTP	4.5	litres

6.4. End of life stage, module C1-C4

No mechanical operation is considered as regards dismantling and demolition (module C1).
End of life includes:

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

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

Table 6 : End of life scenarios

Parameter	Value	Unit
Waste glass sent to landfill	100	%
Transport to landfill (truck)	50	km
Waste recycled	0	%

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

6.5. Benefits and loads beyond system boundaries, module D

IGU processing generates float glass losses, sub-components losses (spacer) as well as packaging wastes that are sent to recycling. However, these outputs are not accounted within module D, according to EN 15804+A1.
Moreover, end of life scenario considers a 100% landfilling worst case scenario. Hence, there is no output flow considered in module D.
In this EPD, benefits from recycling is 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, 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 prEN 17074:2017.

Note:
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

PCR used	ISO14025:2010 EN 15804+A1:2014 NF EN 15804/CN:2016 prEN17074:2017
System boundaries	Cradle to grave, including module D
Allocations	A1: mass based A3: area based (energy) Area and IGU type (double/triple) for water consumption and effluent and cavity components (spacer, desiccant; sealants, insulating gas).
Primary data representativeness	*Geographical representativeness* 32 European production sites of AGC Glass Europe, representing 100% of the production. Distribution in France. *Time representativeness* Primary data collected refer the whole 2016 calendar year. *Technological representativeness* Primary data collected from all the AGC Glass Europe/AGC Interpane sites.
Background data representativeness	GaBi version 8.7.1.30 and the associated Service Pack 37 database have been used for the modelling and the calculation of this EPD. 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. Cut-off processes for this EPD are transport of packaging waste from the construction site to the waste treatment as well as the sorting/shredding of spacer losses sent to recycling. The cumulative impact of these excluded processes is : - Less than 1% in mass and for primary energy consumption compared to the cradle to grave life cycle (excluding module D) - Less than 5% in mass and 1% for primary energy consumption compared to the affected modules
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

8. Life cycle assessment results

Environmental impacts	Production stage	Construction stage		Use stage							End of life stage				Total life cycle	D Benefits and loads beyond system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction	C2 Transport	C3 Waste processing	C4 Disposal		
Global warming Potential kg CO_2 eq/FU	5.97E+01	5.52E+00	0	0	7.68E-03	0	0	0	0	0	0	1.19E-01	0	5.14E-01	6.59E+01	2.32E+00
Ozone layer depletion potential kg CFC 11 eq/FU	1.28E-05	1.38E-15	0	0	2.69E-09	0	0	0	0	0	0	1.99E-17	0	2.84E-15	1.28E-05	2.85E-09
Acidification kg SO_2 eq/FU	2.36E-01	1.29E-02	0	0	2.16E-04	0	0	0	0	0	0	7.00E-04	0	2.85E-03	2.53E-01	4.35E-03
Eutrophication kg $(PO_4)^{3-}$ eq/FU	3.29E-02	3.07E-03	0	0	1.25E-04	0	0	0	0	0	0	1.76E-04	0	4.36E-04	3.67E-02	7.71E-04
Photochemical oxidant creation potential Ethene eq/FU	1.62E-02	1.25E-03	0	0	9.47E-05	0	0	0	0	0	0	5.68E-05	0	2.26E-04	1.78E-02	3.37E-04
Abiotic resource depletion - Elements kg Sb eq/FU	8.24E-04	4.51E-07	0	0	1.77E-07	0	0	0	0	0	0	8.55E-09	0	4.95E-08	8.24E-04	2.55E-07
Abiotic resource depletion - Fossil MJ/FU	8.11E+02	7.51E+01	0	0	3.96E-01	0	0	0	0	0	0	1.63E+00	0	7.29E+00	8.95E+02	2.36E+01
Abiotic resource depletion – Elements (including NF 15804/CN) kg Sb eq/FU	8.24E-04	4.48E-07	0	0	1.76E-07	0	0	0	0	0	0	8.50E-09	0	4.42E-08	8.24E-04	2.53E-07
Water pollution m^3/FU	2.59E+01	1.88E+00	0	0	1.49E-01	0	0	0	0	0	0	3.91E-02	0	2.02E-01	2.82E+01	1.05E+00
Air pollution m^3/UF	4.10E+03	2.35E+02	0	0	1.62E+01	0	0	0	0	0	0	7.51E+00	0	6.00E+01	4.42E+03	1.27E+02

AGC
Your Dreams, Our Challenge

ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025 and EN 15804+A1

Resource use	Production stage	Construction stage		Use stage							End of life stage				Total life cycle	D Benefits and loads beyond system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction	C2 Transport	C3 Waste processing	C4 Disposal		
Renewable primary energy as energy carrier *(MJ/FU)*	7.24E+01	4.49E+00	0	0	1.33E+00	0	0	0	0	0	0	9.49E-02	0	8.95E-01	7.92E+01	4.70E-01
Renewable primary energy resources used as raw materials *(MJ/FU)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources *(MJ/FU)*	7.24E+01	4.49E+00	0	0	1.33E+00	0	0	0	0	0	0	9.49E-02	0	8.95E-01	7.92E+01	4.70E-01
Non-renewable primary energy resources as energy carrier *(MJ/FU)*	8.67E+02	7.55E+01	0	0	6.58E-01	0	0	0	0	0	0	1.64E+00	0	7.54E+00	9.53E+02	2.41E+01
Non-renewable primary energy resources used as raw materials *(MJ/FU)*	1.70E+01	0	0	0	0	0	0	0	0	0	0	0	0	0	1.70E+01	0
Total use of non-renewable primary energy resources *(MJ/FU)*	8.84E+02	7.55E+01	0	0	6.58E-01	0	0	0	0	0	0	1.64E+00	0	7.54E+00	9.70E+02	2.41E+01
Use of secondary material *(kg/FU)*	3.45E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	3.45E+00	0
Use of renewable secondary fuels *(MJ/FU)*	5.49E-21	0	0	0	0	0	0	0	0	0	0	0	0	0	5.49E-21	4.89E-25
Use of non-renewable secondary fuels *(MJ/FU)*	6.45E-20	0	0	0	0	0	0	0	0	0	0	0	0	0	6.45E-20	5.75E-24
Use of net fresh water *(m^3/FU)*	2.39E-01	7.56E-03	0	0	8.35E-03	0	0	0	0	0	0	1.60E-04	0	1.65E-03	2.57E-01	5.11E-03

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ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025 and EN 15804+A1

Waste categories	Production stage	Construction stage		Use stage							End of life stage				Total life cycle	D Benefits and loads beyond system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction	C2 Transport	C3 Waste processing	C4 Disposal		
Hazardous waste disposal *(kg/FU)*	2.41E-03	4.19E-06	0	0	8.93E-11	0	0	0	0	0	0	9.14E-08	0	1.15E-07	2.42E-03	6.17E-08
Non-hazardous waste disposal *(kg/FU)*	2.05E+00	6.36E-03	0	0	4.29E-03	0	0	0	0	0	0	1.33E-04	0	3.13E+01	3.33E+01	7.50E-02
Radioactive waste disposal *(kg/FU)*	2.64E-02	1.55E-04	0	0	3.14E-06	0	0	0	0	0	0	2.22E-06	0	1.01E-04	2.67E-02	1.03E-04

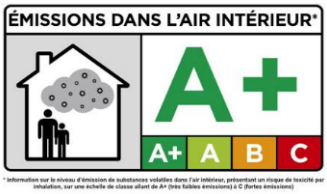
Resource use	Production stage	Construction stage		Use stage							End of life stage				Total life cycle	D Benefits and loads beyond system boundaries
	Total A1-A3 Production	A4 Transport	A5 Installation	B1 Usage	B2 Maintenance	B3 Reparation	B4 Replacement	B5 Refurbishment	B6 Use of energy	B7 Use of water	C1 Deconstruction	C2 Transport	C3 Waste processing	C4 Disposal		
Components for reuse - kg/FU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for recycling - kg/FU	9.77E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	9.77E+00	0
Materials for energy recovery - kg/FU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported electrical energy (MJ/FU)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported thermal energy (MJ/FU)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported energy - Process Gas (MJ/FU)	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 tests have been performed according to EN 7375:2005 et NF EN ISO 16000-9:2009. Based on the results of these tests and considering the exposition factor taken into account, Thermobel IGUs emission level has been rated A+.

- **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

The relevant technical characteristics for a 4|-14-4-14-|4 triple glazing unit are given in the table below.

Properties	Symbol	Low-e TGU	Solar control TGU
Thermal transmission (according to EN 673)	U_g (W/m².K)	0.5 to 0.7	0.6
Light Transmission (EN 410)	Tv (%)	65 to 77	22 to 66
Light Reflection (EN 410)	ρv (%)	16 to 21	15 to 62
Solar factor (EN 410)	g (%)	43 to 55	15 to 39

Source: CE marking

9.2.2. Product characteristics regarding acoustics

A 4|-14-4-14-|4 triple glazing has a direct airborne sound insulation R_w (C; C_{tr}) = 33 (-2 ; -6) dB.
This characteristic can be improved by using asymmetric and thicker glass panes. For example, a 6|-14-4-14-|4 triple glazing has a direct airborne sound insulation R_w (C; C_{tr}) = 36 (-2 ; -6) dB.

Source: CE marking

9.2.3. Product characteristics regarding visual comfort

Being part of the building envelope, glass contributes to visual comfort by providing natural light and reducing artificial lighting needs. The light transmission value of a 4|-14-4-14-|4 triple glazing unit is between 65% and 77%.
In case of a solar control triple glazing unit, this value is between 22% and 66%.

Source: CE marking

9.2.4. Product characteristics regarding odours

AGC Glass Europe IGUs covered by this EPD are tested against NF EN ISO 16000-9 :2009 standard. Glass is a mineral inert material, not able to release any odour during its use.

More information available on www.yourglass.com

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