

Iplus | Planibel low-e

the range of AGC glasses with thermal insulation

for structures:

4 | - 6 | - 8 | - 10 | - 12 |

Declaration Holder **AGC Glass Europe**

Date of issue 2015



1. Summary

Declaration Holder

AGC Glass Europe
Avenue Jean Monnet, 4
B- 1348 Louvain-la-Neuve

www.agc-glass.eu
www.yourglass.com
environment@eu.agc.com

Declaration number

PBLE2013-1NV

This Declaration is based on the PCR document:

EN 15804:2012+A1:2013: Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

Validity date

This EPD applies to the above-mentioned construction product and is valid until replaced by a new version (evaluation typically 5 years from the date of issue).

Date of issue

2014

Construction product

Iplus and planibel low-e (soft coated).

Declared Product / Declared Unit

The declared unit is 1 m² of flat glass (4, 6, 8, 10 or 12 mm), covered with a low emissivity coating applied by magnetron coating (4|, 6|, 8|, 10|, 12|).

Scope of validity:

The Life Cycle Assessment was carried out according to ISO 14040 and ISO 14044. The Environmental Product Declaration was prepared according to EN 15804 and ISO 14025.

Verification

CEN standard EN 15804 serves as core PCR.

Third party independent verification of the declaration, according to EN ISO 14025:2010.

Internal

External

Third party verifier:

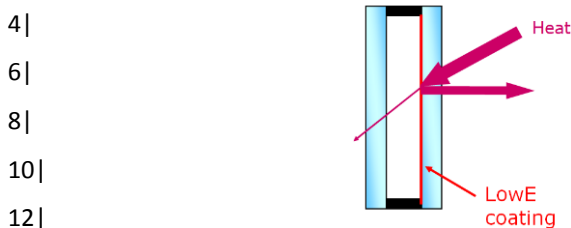
Charlotte Petiot

2. Product

2.1 Product description

The product considered for the assessment is flat glass covered with a low emissivity layer (low-e). Iplus and Planibel low-e is the AGC brand name for magnetron coated glass, highly prized for their thermal performance.

Reference structures considered in this EPD:



with the digit referring to the glass thickness (in millimetre) and the “|” to the presence of a coating.

This glass range is treated with a thin transparent coating. This coating reflects heat back into the building, thereby reducing the heat loss through the window. It also reduces the heat transfer from the inner space to the cooler outer space, thus further lowering the amount of heat that escapes from a window. These properties reduce the amount of energy to heat the building. In addition, the coating allows large amounts of free solar energy to enter the building, thereby heating it passively.

2.2 Application & delivery status

Glazing products are tailor made products, delivered in a wide variety of dimensions, applicable in all kinds of configurations.

2.3 Technical Data

Technical data for Planibel Low-E (4 mm):

- Thermal transmission (EN 673):
 $U_g = 3,6-3,7 \text{ W}/(\text{m}^2 \cdot \text{K})$
- Light transmission (EN 410): $T_v = \text{max } 82 \%$
- Light reflection (EN 410): $\rho_v = 10 \%$
- Solar factor (EN 410): 73-75 %

Further data on: www.yourglass.com

2.4 Relevant product standard

The product coated glass complies with EN 1096-4:2004.

Thermally toughened soda lime silicate safety glass complies with EN 12150-2:2004 and heat soak thermally toughened soda lime silicate safety glass with standard EN 14179-2:2005.

2.5 Base materials / Ancillary materials

The production of thermal insulating glass is in accordant with EN 572-1 for building products that defines the magnitude of the proportions by mass of the principal constituents of float glass.

Basic raw materials used in flat glass production:

- glass forming materials: silica sand (57%) and external glass cullet (8%);
- intermediate and modifying materials such as sodium carbonate (17%), dolomite (14%), limestone (3%), feldspar & blast furnace slag (2%), sodium sulphate (1%);
- colouring and coating agents such as iron oxide and other metallic compounds (<1%).

Composition of the declared unit (% of total mass):
>99% glass

No substances of the “Candidate List of Substances of Very High Concern for Authorisation (or SVHC)”, exceeding the concentration in article threshold, in the declared unit.

2.6 Manufacturing & Processing

The basic principle of the float glass process is to mix the raw materials, melt them in the furnace and pour the molten glass onto a bath of molten tin. The combustion in the furnace uses air and natural gas / fuel oil. The glass solidifies as it floats on the thin bath. After the tin bath, the glass ribbon passes on to an annealing zone where it cools down gradually while being carried on rollers. At the end of this zone the glass is cut into sheets.

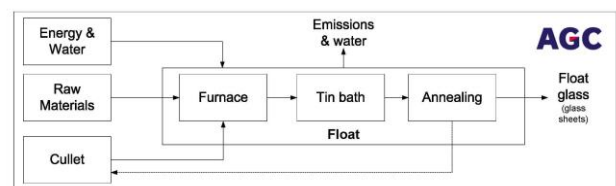


Figure 1 – Flat glass manufacturing

The low emissivity coating is applied with the magnetron

sputtering vacuum deposition. The glass is washed, inspected before it enters the coating zone (vacuum) via the buffer.

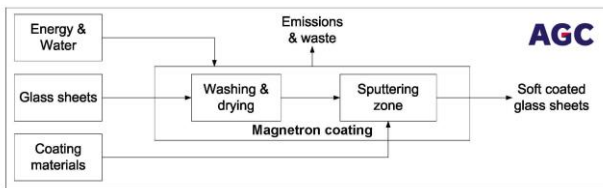


Figure 2 – Process flow magnetron sputtering vacuum deposition

Input data were gathered from fifteen European based AGC float lines, two European based AGC magnetron coaters and the European AGC R&D centre.

All manufacturing and processing sites operate under a certified quality and environmental management system.

2.7 Environmental and health during manufacturing

AGC plant managements are committed to the group environmental and safety policy. At group or division level specific programmes are defined to act as guidelines for the country organisations and plants. Key performance indicators (KPI's) have been selected, are reported and are reviewed on a regular basis.

All glass manufacturing plants obtained ISO, 9001, ISO 14001 and OHSAS 18001 certification, as did the main processing plants.

2.8 Product processing / Installation

Not relevant. The construction process stage is not in the system boundary.

2.9 Packaging

Flat glass and soft coated glass are warehoused and transported in vertical position: by inloader trucks (dedicated trailer stillage combinations). Wood, cardboard and metal ropes are used for fixation, plastic film can be used for additional protection.

2.10 Condition of use

Not relevant. The use stage is not in the system boundary.

2.11 Environment and health during use

Intended usage of soft coated glass does not entail

adverse environmental or health effects. No dangerous substances are released during the use of the product (see also point 7). On the contrary, the use of Planibel Low-E in residential and in commercial buildings leads to energy savings and thus makes it possible to avoid CO₂-emissions (see chapter 8).

2.12 Reference service life

The reference service life (RSL) is set at 30 years.

The RSL does not reflect the actual life time which typically is set by the lifetime and refurbishment of a building. The RSL is not referring to the warranty either.

2.13 Extraordinary effects (Fire, water, Mechanical destruction)

Not relevant.

2.14 Re-use phase

Glass is recyclable. Glass cullet from manufacturing and processing is commonly reintroduced in the glass manufacturing process. It decreases the required energy input for the furnaces. Cullet represents on average 30% of flat glass mass manufactured by AGC, at average 4% coming from outside the glass manufacturing plant (pre-consumer cullet - reference year 2009).

Nowadays about 5% of end-of-life glazing from buildings is dismantled, collected separately and recycled for glass manufacturing (post-consumer cullet); about 95% ends up in demolition waste. Nevertheless, and because the lack of accurate data, we assume a conservative approach and consider that 100% is treated as demolition waste.

2.15 End-of-Life

The following waste codes (EU-codes according to Decision 2000/532/EC and Annex III to Directive 2008/98/EC) can apply:

- 10 11 12 – waste glass from manufacture of glass and glass products (pre-consumer glass cullet);
- 17 02 02 – glass from construction and demolition waste (end-of-life glass).

3. Life Cycle Assessment (LCA): Calculation rules

3.1 Calculation rules

This EPD reports the results of the LCA in which the environmental impacts generated by material and energy flows involved in the manufacturing of float glass and the magnetron coating process are modelled and calculated. The LCA was performed in accordance with the product category rules set out in the European standard EN 15804+A1 and the LCA principles and requirements set out of ISO 14040 and ISO 14044.

3.1 Declared unit

The declared unit is 1 m² of flat glass (4, 6, 8, 10 or 12 mm), covered with a low emissivity coating applied by magnetron coating (4|, 6|, 8|, 10|, 12|).

3.2 System boundary

This is a cradle-to-gate EPD, which covers a system boundary including raw materials & energy supply, manufacturing & processing of flat glass to Low-E coated glass, with associated transport (A1-A3). The installation and use stage is due to the diversity of application and construction not included in the calculation.

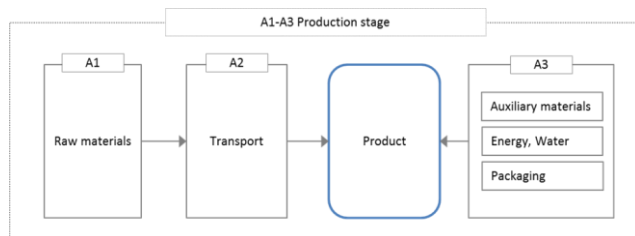


Figure 3 – System boundary “cradle-to-gate”

3.3 Data quality & Background data

Primary data on input/output and transport were collected from European based AGC production plants: 10 float sites (15 float lines and the AGC R&D centre. Other relevant data were obtained from manufacturer’s information (e.g., product composition).

The production volumes of these sites were used to determine average values (weighed averages).

Background data were used from the GaBi 6 database (2013). European data sets were used for raw materials, auxiliary materials, energy, water and transport. Data choices focussed on including the best fitting alternatives for all processes in the LCA-model.

The life cycle inventory (LCI) results were modelled and calculated using the GaBi software tool and a life cycle

impact assessment (LCIA) was performed.

3.4 Period under review

The period under review is one year. Data from 2013 were utilized for this study.

3.5 Estimates and assumptions

Road transports were considered to return empty, transport per ship with a load. Operational data on transport distances were completed with estimates for local supplies (eg. packaging). An average distance of 100 km was considered for these local supplies, all by road transport.

3.6 Cut-off criteria

The production of the required machinery and equipment have not been considered.

Operational data (raw materials, energy, auxiliary and operating materials, waste, emissions to air and water) were utilised in the calculation. Also known material and energy flows of less than 1% were accounted.

It can be assumed that the total of negligible processes does not exceed 5%.

3.7 Allocation

There is no allocation of co-products for the manufacturing and processing under consideration in this EPD.

3.8 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all data sets to be compared were created according to EN15804:2012+A1:2013 and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. Life Cycle Assessment (LCA) - Inventory & Interpretation

4.1 Description of the system boundary

The product stage is covered by this EPD (see point 3.2):

- Raw materials supply (A1);
- Transport (A2);
- Manufacturing & processing (A3).

Below a selection of indicators is presented for the declared unit, being 1 m² of flat glass (4, 6, 8, 10 or 12

mm), covered with a low emissivity coating applied by magnetron coating (4|, 6|, 8|, 10|, 12|).

These indicators describe different types of environmental impact (eg. global warming), input needs of resources (eg. fresh water, energy) and output flows (eg. waste) for the declared unit for a selected number of compositions with the same technical properties (U_g, Tv, ρ_v, solar factor)

4.2 Environmental impact indicators

The CML 2001 life cycle impact assessment method was used. The impact indicators are presented below.

Parameter		Unit	A1-3				
			4	6	8	10	12
Global warming potential (100 years)	GWP	[kg CO ₂ -eq.]	14,6	21,3	28	34,6	41,3
Ozone depletion potential – stratospheric ozone layer	ODP	[kg CFC11-eq.]	1,36E-8	2,01E-8	2,65E-8	3,3E-8	3,95E-8
Acidification potential	AP	[kg SO ₂ -eq.]	0,093	0,138	0,183	0,228	0,273
Eutrophication potential	EP	[kg PO ₄ ³⁻ -eq.]	0,012	0,017	0,023	0,029	0,035
Photochemical ozone creation potential	POCP	[kg Ethene eq.]	5,69E-3	8,45E-3	1,12E-2	1,4E-2	1,67E-2
Abiotic depletion potential for non-fossil resources	ADPE	[kg Sb eq.]	4,65E-5	6,96E-5	9,27E-5	1,16E-4	1,39E-4
Abiotic depletion potential for fossil resources	ADPFE	[MJ]	174	256	337	418	500

The environmental impacts of Planibel Low-E are primarily determined by the manufacturing of the flat glass, the basic material of this magnetron coated glass. It contributes for about:

- 91 % (4mm) to 97 % (12mm) of the global warming potential (GWP) and is mainly due to carbon dioxide emissions;
- 96 % to 98,5 % to the ozone depletion potential (ODP), predominantly due to CFC (chlorofluorocarbons) involved in upstream processes for some raw and packaging materials (eg. dolomite, wood treatment, steel)
- 96 % to 98 % to the acidification potential (AP), mainly arising from sulphur dioxide and nitrogen oxides emissions from the manufacturing of the flat glass with the associated energy provision. Long distance transport (ship) contributes to a lesser extent;
- 92 % to 99 % to the eutrophication potential (EP), where nitrogen oxides emitted are the main contributor. Emissions to water contribute to a lesser extent;
- 96 % to 98 % to the photochemical ozone

creation potential (POCP), predominantly as a result of sulphur dioxide and nitrogen oxides emitted.;

- 98 % to 99 % to the abiotic depletion potential of non-renewable material resources (ADPE), mainly arising from upstream sodium chloride (rock salt) which is required to produce sodium carbonate (a raw material for flat glass);
- 93 % to 97 % to the abiotic depletion potential for fossil resources (ADPFE), predominantly due to fossil fuels used in the glass manufacturing process and fossil fuels and uranium for electricity provision.

The coating process contributes to a lesser extent. Its contribution decreases with the thickness of the glass sheet. The electricity provision for the coating process, the upstream processes of materials involved in this processing step having the second largest influence on the main impact indicators.

Estimate for other glass thicknesses:

All indicators are dominated by the manufacturing of the glass sheets. On the basis of the results conservative estimates of environmental indicators, resources uses

and waste quantities can be made:

- For combining glass sheets of various thicknesses: summing the result for a particular indicator for the glass sheets used
- For other glass thicknesses: by using the delta indicator of the presented structures.

4.3 Resource uses

Parameter		Unit	A1-3				
			4	6	8	10	12
Primary energy resources, total renewable	PERT	[MJ]	9	12,5	16,1	19,6	23,2
Primary energy resources, total non-renewable	PENRT	[MJ]	174,4	255,7	337,1	418,5	499,8
Fresh water use	FW	[m³]	7,9	10,5	13,2	15,9	18,6

The primary energy use related to the production of soft coated glass sheets (183,4 MJ) is dominated by the production of the flat glass sheets (92 % for 4mm thickness to 97% for 12mm). Heavy fuel and natural gas are significant energy sources (non renewables) in the manufacturing process.

Used non-renewable material resources are mainly sodium chloride (rock salt – about 77 %) required for the production of sodium carbonate and to a lesser extent to sodium sulphate (about 10%), both related to flat glass

manufacturing. Upstream processes of auxiliary materials involving mining ores, such as steel for metal straps for packaging, contribute as well. Mining ores and energy resources (eg. coal for electricity production) also result in waste rock.

The fresh water demand is for about 68% due to upstream processes of electricity and raw materials for flat glass production (eg. sodium carbonate). The upstream processes of the magnetron coating having the second largest impact on this indicator (about 32%).

4.4 Waste categories

Parameter		Unit	A1-3				
			4	6	8	10	12
Hazardous waste disposed	HWD	[kg]	0,0022	0,0033	0,0044	0,0055	0,0066
Non-hazardous waste disposed	NHWD	[kg]	0,036	0,053	0,070	0,088	0,105
Radioactive waste disposed	RWD	[kg]	0,0053	0,0070	0,0088	0,0106	0,0124

The non-hazardous waste is mainly due the processes upstream for packaging material. The hazardous waste is predominantly due to the same upstream processes.

Radioactive waste is generated exclusively linked to electricity supply (nuclear power stations).

5. Requisite evidence

Volatile organic compounds (VOC)

Not relevant.

6. Additional information

6.1 Energy savings by the use of Planibel Low-E

Low-E glass helps to keep the heat inside or outside, reducing the need for heating or cooling. Both heating and cooling consume energy (and thus lead to CO₂-emissions), so reducing these needs makes it possible to avoid CO₂-emissions.

Did you know?

The manufacturing of 1m² of AGC double glazing with an inner sheet of Planibel Low-E (soft coated) leads to the emission of 36,5 kg of CO₂. On the other hand, 47 to 196 kg of CO₂ per year (at average 121 kg) are saved by replacing 1m² of single glazing with AGC double glazing (U_g = 1,1 W/(m².K)). The savings are the highest in cold regions.

The CO₂ emitted during production is thus offset after only a few months of use (at average <4,5 months):

- Moscow (East): <2,5 months;
- Helsinki (North): <3,5 months;
- Praha (Central) and Sofia (South central): 3,5 months;
- Frankfurt (Central continental): <4 months;
- Brussels (Central maritime): <4,5 months;
- Roma (South): <9,5 months.

Further information on CO₂-savings and sustainable buildings can be consulted in the AGC Environmental Report: www.agc-glass.eu

7. References

EN 15804

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

ISO 14025

Environmental labels and declarations — Type III environmental declarations

NF P01-10

Qualité environnementale des produits de construction — Déclaration environnementale et sanitaire des produits de construction.

PCR 2011, Part A

Institut Bauen und Umwelt e.V., Königswinter (pub.): Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report. July 2011

www.bau-umwelt.de

PCR Guidance Text for Building-Related Products and Services, Part B

Requirements on the EPD for Plate glass for construction

EeB Guide

EeB Guide — Part A (October 2012): Operational guidance for the preparation of LCA studies for energy-efficient buildings and building products.

GaBi 6

GaBi version 6 database 2012 (release 2013) — PE International