STOPSOL – SUNERGY – PLANIBEL LOW-E

the range of pyrolytic coated glasses

AGC GLASS EUROPE
AGC INTERPANE

Reference thickness:

4 mm

Other thicknesses:

3 – 12 mm

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DECLARATION HOLDER

AGC GLASS UNLIMITED   AGC INTERPANE

THIS DECLARATION IS BASED ON

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

Fiche de Déclaration Environnementale et Sanitaire no. 01-536:2016.

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

2016

CONSTRUCTION PRODUCT

STOPSOL
SUNERGY
PLANIBEL LOW – E (PLANIBEL A, PLANIBEL G)

DECLARED PRODUCT / DECLARED UNIT

The declared unit is *1 m² of coated glass*.

SCOPE OF VALIDITY:

The Life Cycle Assessment was carried out according to ISO 14040 and ISO 14044. The Environmental Product Declaration is complying to EN 15804+A1 and according to ISO 14025.

This document applies for products supplied from both AGC Glass Europe and AGC Interpane.

VERIFICATION

The original Environmental Product Declaration* has been audited and externally verified according to EN 15804:2012+A1:2013, NF EN 15804/CN and ISO 14025:2010 by an independent third party.

CEN standard EN 15804 serves as the core PCR
Independent verification of the declaration, according to EN ISO 14025:201 ☐ Internal   ☒ External
Third Party Verifier: bio by Deloitte. (Yannick Le Guern)
* PCR : Product category rules

* The original document is available under the French Programme INIES:

iniES
Environmental and health reference data for building

PRODUCT

1.1. Product description

The product considered for the assessment is a glass comprising a sheet of float substrate, one side of which is covered with a thin transparent metal-oxide pyrolytic coating which can also be referred as hard coated glass. STOPSOL, SUNERGY, PLANIBEL LOW-E are the brand names for AGC glass with this highly regarded coating.

These glass sheets have the feature to be installed as single glass, can be laminated and heat treated (eventually enamelled or silkscreened), can be thermally bend while offer the possibility for different aesthetic solutions.

The reference structure considered in this EPD is a 4| mm glass. Other structures are considered and results for 3| and 12| mm are also presented. Different thickness can be calculated as explained in section 3.

1.2. Application & delivery status

Coated glass is delivered in a wide variety of dimensions, applicable in all kinds of configurations.

1.3. Technical Data

Technical data for the reference structure:

Parameter	Symbol Unit	Product range
Thermal transmission (EN 673)	Ug - W/(m².K)	1.0 – 1.5
Light transmission (EN 410)	Tv - %	16 – 75
Light reflection (EN 410)	ρv - %	8 – 37
Solar factor (EN 410)	g - %	16 – 76

* values are calculated assuming coated glass in a double glazing (see pocket values).

Please note that for more detailed information regarding other thicknesses and specific glass characteristics see, please follow our configuration tool at: http://www.yourglass.com.

1.4. Relevant Product Standard

Float glass (soda lime silicate glass) complies with EN 572-9:2004. The range of products with pyrolytic coating conform to:

- EN 1096-1 – Glass in building – Coated glass – Part 1: Definitions and classification;
- EN 1096-2 - Glass in building – Coated glass – Part 2: Requirements and test methods for class A, B and S coatings;
- EN 1096-4 - Glass in building – Coated glass – Part 4: Evaluation of conformity/Product standard;

All products are CE-marked following EN 1096-4. CE-Marking declarations are available from www.yourglass.com/CE.

1.5. Base materials / Ancillary materials

The production of flat glass substrate is also 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 glass production:

- glass forming materials: silica sand and external glass cullet;
- intermediate and modifying materials such as sodium carbonate, dolomite, limestone, feldspar & blast furnace slag, sodium sulphate;
- colouring and coating agents such as iron oxide and other metallic compounds.

Composition of the declared unit (% of total mass):

- > 99,98% glass;
- < 0,02% coating materials;

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.

1.6. 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 gas/fuel oil. The glass solidifies as it floats on the tin bath. In order to coat a glass online by a pyrolytic process, few modifications are needed on the production line of the glass substrate.

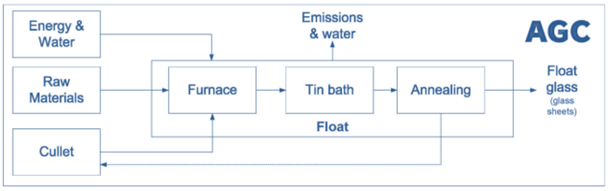

Figure 1. Glass manufacturing scheme.

After the glass leaves the and floats on a bath of molten tin, one or more coating machines, located above the ribbon of glass near the end of the bath, release a mixture of gases. Under high temperatures, the gases react to form a solid substance that is deposited on the surface of the hot glass.

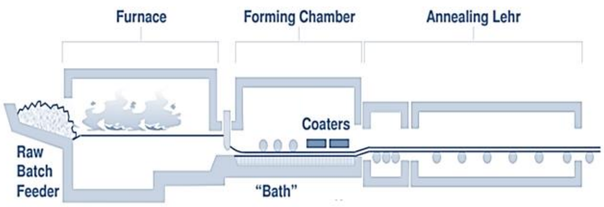

Figure 2. Pyrolytic coating scheme

The resulting coating is hard, uniform, extremely thin—and too tough to easily scratch off. From here, the hot glass moves through 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. The glass cullet is re-introduced in the furnace.

Regarding the data use for the model, it was gathered from a European AGC site and which operates under a certified quality, environmental and safety management system.

1.7. Environmental and health during manufacturing

AGC plant managers 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 flat glass manufacturing plants obtained ISO, 9001, ISO 14001 and OHSAS 18001 certification.

1.8. Product processing / Installation

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

1.9. Packaging

Glass warehoused and transported in vertical position: by in-loader trucks (dedicated trailer stillage combinations). Wood, cardboard and metal ropes are used for fixation. Plastic film can be used for additional protection.

1.10. Condition of use

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

1.11. Environment and health during use

Intended usage of glass does not entail adverse environmental or health effects. On the contrary, the use of flat glass in different setups in residential and in commercial buildings (e.g., double glazing) contributes to energy savings and thus makes it possible to avoid CO2-emissions.

1.12. Reference service life

The reference service life (RSL) for flat glass 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.

1.13. Extraordinary effects (Fire, water, Mechanical destruction).

Not relevant.

1.14. 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. Internal and external cullet represents an average 30% of the flat glass mass manufactured by AGC.

1.15. End-of-Life

According to European data, end-of-life building glass is almost never recycled into new glass products. 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, considering the lack of accurate statistical data, we assume a conservative approach and thus consider that 100% is treated as demolition waste and landfilled.

The following waste codes (EU-codes according to Commission 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);

LIFE CYCLE ASSESSMENT: CALCULATION RULES

2.1. 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 mirrored glass 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.

2.2. Declared unit

The declared unit is 1 m² of clear or tinted float glass.

2.3. System boundary

This document is a cradle-to-gate EPD, which covers a system including raw materials & energy supply, manufacturing of flat 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.

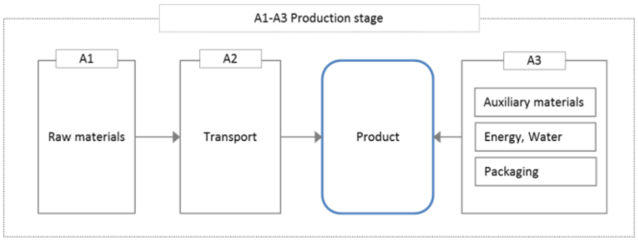

Figure 3 – System boundary "cradle-to-gate".

2.4. Data quality & Background data

Primary data on input/output and transport were collected from European the dedicated production plant. 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.

Background data were used from the GaBi 6.110 database (2015). European data sets were used for raw materials, auxiliary materials, energy, water and transport. Data choices focused 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 ts* software tool and a life cycle impact assessment (LCIA) was performed.

2.5. Period under review

The period under review is one year. Data from 2015 was used for this study.

2.6. 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 (e.g. packaging). An average distance of 100 km was considered for these local supplies, all by road transport. Specific data was used for modelling raw materials transport, depending on supplier's distance.

2.7. 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%.

2.8. Allocation

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

2.9. Comparability

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 and for the same functional unit.

LIFE CYCLE ASSESSMENT (LCA): INVENTORY & INTERPRETATION

3.1. Description of the system boundary

The product stage is covered by this EPD (see point 3.3):

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

Below a selection of indicators is presented for the functional unit, i.e. 1 m² of coated glass..

These indicators describe different types of environmental impact (e.g., global warming), input needs of resources (e.g., fresh water, energy) and output flows (e.g., waste) for a selected number of compositions with similar technical properties (Ug ,Tv, ρv , solar factor).

3.2. Environmental impact indicators

The life cycle impact assessment methods recommend by EN 15804+A1 were used. The impact indicators are presented in Table 1 for the production stage (A1 - A3) for the reference unit, and results are also provided for different thicknesses, including the minimum and maximum values.

Table 1. Environmental impact categories

		4|	3|	12|
GWP	Global warming potential (100 years) [kg CO_2-eq.]	1,15E+01	8,63E+00	3,45E+01
ODP	Ozone depletion [kg CFC11-eq.]	1,33E-08	9,98E-09	3,99E-08
AP	Acidification for soil and water [kg SO_2-eq.]	8,37E-02	6,28E-02	2,51E-01
EP	Eutrophication potential [kg PO_4^{3-}- eq.]	1,11E-02	8,33E-03	3,33E-02
POCP	Formation potential of tropospheric ozone [kg Ethene eq.]	5,12E-03	3,84E-03	1,54E-02
ADPE	Abiotic depletion potential for non-fossil resources [kg Sb eq.]	4,70E-05	3,53E-05	1,41E-04
ADPFE	Abiotic depletion potential for fossil resources [MJ]	1,50E+02	1,13E+02	4,50E+02

The environmental impacts of the declared products are primarily determined by the manufacturing process of the flat glass, and, the upstream energy & raw materials provision. It contributes for about:

- The global warming potential (GWP) is mainly due to carbon dioxide emissions (> 97%). The manufacturing process, the raw materials provision and the energy provision are the main contributors (respectively 64 %, 20 % and 14 %). The coating process is responsible for 5% of the total emission of CO_2-eq. If any thermal toughening is performed, it adds about 1,96 kg CO2 eq. to the GWP (the same for all thicknesses);
- The ozone depletion potential (ODP) is predominantly (about 93%) due to upstream processes for some raw and packaging materials (e.g., dolomite, wood treatment, steel) and to a lesser extent to energy provision (e.g., electricity

production). In terms of manufacturing stage, 18% is due to coating the glass substrate. If toughening is performed, there is an increase of 1,46E-09.

- The acidification potential (AP) mainly arises from sulphur dioxide and nitrogen oxides emissions (together > 95%) and is for about two third related to the onsite manufacturing process. Coating, around 4%. Toughening: + 9,87E-03;
- The glass substrate is responsible for 94% of the manufacturing emission, while the other 6% are related with the coating stage flows. The nitrogen oxides emitted by the manufacturing process (about 86 %) and by upstream processes for energy provision, raw materials provision (e.g., soda) are the main contributors to the eutrophication potential (EP). Toughening: + 5,36E-04;
- - The photochemical ozone creation potential (POCP) is predominantly a result of sulphur dioxide and nitrogen oxides emitted (about 73 %). Manufacturing, as well as upstream energy and raw materials provision are important contributors. Organic emissions to air, related to upstream processes for energy and raw materials provision, are the second important contributor (about 18%). Toughening: +5,75E-04;
- About 78% of the abiotic depletion potential of non-renewable material resources (ADPE) arises from upstream sodium chloride (rock salt) which is required to produce sodium carbonate (a raw material for flat glass). Sodium sulphate provision, used for flue gas treatment, contributes for about 10% to this indicator. Coating steps adds 5,18E-06 while toughening 3,44E-07;
- The abiotic depletion potential for fossil resources (ADPFE) is due to fossil fuels used in the glass manufacturing process (90%), and fossil fuels and uranium for electricity provision. Toughening: +2,19E+01.

The influence of the transport and water provision related to float glass production is for most of these indicators marginal.

Estimate for other structures:

On the basis of the results presented in this EPD, conservative estimates of environmental indicators, resources uses and waste quantities can be made for other applications:

- For glass sheets with a thicknesses other than those mentioned in the tables (e.g., 5 mm, 8 mm, 12 mm, 15 mm, 19 mm) can be roughly calculated: by dividing the impact indicator of the reference structure by its thickness (namely 4) and multiplying it by its proper thickness (e.g., 8). Considering this, each 1 mm of 1 m² of coated glass has a GWP = 2,98 [kg CO_2-eq.];
- Combining glass sheets of various thicknesses: summing the result for a particular impact indicator of the glass sheets used. Considering Table 1, one can calculate the GWP of a toughened 4 mm Planibel, which would result in: 11,9 + 1,96 = 13,39 [kg CO2-eq.].

Please take into account that the above mentioned allows for a rough estimate.

3.3. Resource use

The results for resource use are presented in **Table 2** for the different thickness of flat glass.

Table 2. Resource use

		4 mm	3 mm	12 mm
PERT	Primary energy resources, total renewable [MJ]	1,40E+01	1,05E+01	4,20E+01
PENRT	Primary energy resources, total [MJ]	1,87E+02	1,40E+02	5,61E+02
FW	Fresh water use [m³]	2,40E-02	1,80E-02	7,20E-02

The primary energy use related to the production of flat glass sheets (about 159 MJ) is related to the energy consumption for the production of the flat glass sheets and the energy provision (about 74%). The coating inputs adds additional 9,7% of primary energy. Upstream raw materials provision and associated transport contribute for about 26%. Fossil fuels are significant energy sources (non-renewables) in all processes involved.

Toughened glass implicates additional energy consumption, representing an additional primary energy use of about 35 MJ (for all glass thicknesses mentioned).

Upstream processes of auxiliary materials involving mining ores, such as steel for metal straps for packaging, contribute as well but to a lesser extent. Mining ores and energy resources (e.g., coal for electricity production) also result in waste rock.

The fresh water demand is for about 70% due to upstream processes of electricity and raw materials required for flat glass production (e.g., sodium carbonate, oxygen). Additional 3,77E-03 m³ are added due to the coating step.

3.4. Waste categories

The results for waste flows are presented in **Table 3**.

The non-hazardous waste (including inert waste) is mainly generated by the processes upstream for raw materials, recyclable packaging materials and energy provision.

Table 3. Waste categories				
		4|	3|	12|
HWD	Hazardous waste disposed [kg]	1,59E-04	1,19E-04	4,77E-04
NHWD	Non-hazardous waste disposed [kg]	1,68E-01	1,26E-01	5,04E-01
RWD	Radioactive waste disposed [kg]	3,50E-03	2,63E-03	1,05E-02

The hazardous waste is predominantly due to the upstream processes for packaging material (metal straps). Radioactive waste is generated exclusively linked to electricity supply (nuclear power stations) for the manufacturing and all upstream processes.

REQUISITE EVIDENCE

4.1. Volatile organic compounds (VOC)

In the framework of the REACH Regulation (1907/2006/EC) glass is exempted from registration under Annex V item 11 (Commission Regulation 987/2008/EC of 8 October 2008 amending Regulation 1907/2006/EC). It is assumed that untreated soda-lime-silica glass products are not covered by this VOC criterion since glass is an inert product that does not release organic compounds. For more information on the chemical management of our product range please see our **REACH declaration** available under the tools section at www.yourglass.com.

Our products are also tested according to EN 7375:2004.

ADDITIONAL INFORMATION

5.1. Energy savings by the use of insulating glass

Soft coated 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 CO_2-emissions), so reducing these needs makes it possible to avoid CO_2-emissions.

Did you know?

The manufacturing of 1m² of AGC double glazing leads to the emission of around ± 30 - 40 kg of CO2. On the other hand, 47 to 196 kg of CO_2 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)). Consider that the savings are the highest in cold regions.

The CO_2 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 CO_2-savings and sustainable buildings can be consulted in the AGC Environmental Report available at www.agc-glass.eu.

The added value of AGC products for green buildings:

The new LEED Version 4 for new constructions gives points to C2C products as well as for EPDs. In this new version, Cradle to Cradle Certified™ products contribute up to two points in the “Building product disclosure and optimization - material ingredients” credit. It encourages project teams to choose “healthier products and materials” in order to minimise the use and generation of harmful substances. Hence, by using EPDs and our AGC’s Cradle to Cradle Certified™ products, architects and builders are eligible to earn direct points. As well as being a standardised report, EPDs can also be incorporated into Building Information Models (BIM).

For more information please visit: www.yourglass.com

REFERENCES

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Cradle to Cradle Products Innovation Institute
http://www.c2ccertified.org/

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