REYNAERS ALUMINIUM NV/SA

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ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025 and EN 15804

Product	Eco System® 50 Window
	
Declaration holder	
Publisher and programme holder	European Aluminium EUROPEAN ALUMINIUM
Declaration number	EPD EUROPEAN ALUMINIUM 2017 – REYNAERS 10
Issue date	1 Dec 2017
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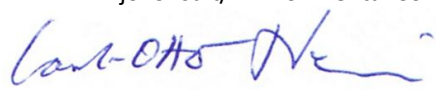
Weblink	www.reynaers.com

1. General information

Owner of the declaration	Reynaers Aluminium Oude Liersebaan 266 B- 2570 Duffel, Belgium
Programme holder	European Aluminium AISBL (previously European Aluminium Association AISBL) Avenue de Broqueville, 12 B - 1150 Brussels Belgium  Dr Gerd Götz, Director General
PCR used for the verification	EAA Product Category Rules (PCR) for Aluminium Building Products – version of 30 January 2013
Verification	EN15804 serves as core PCR completed by EAA PCR Verification of the EPD by an independent third party in accordance with ISO 14025 [ ] Internally [X] Externally
Verifier	Carl-Otto Nevén NEVÉN Miljökonsult/Environmental Cons.  Carl-Otto Neven
Declaration number	EPD EUROPEAN ALUMINIUM 2017 – REYNAERS 10
Declared Unit	1 m^2 of Eco System® 50 window
Product group covered and applicability	This EPD covers single vent powder-coated Eco System® 50 for aluminium windows. These EPD results have been calculated from a modelling tool developed by thinkstep via an i-report in GaBi 6. Among the Eco System® 50 window series, four representative products have been identified and corresponding EPD results have been calculated based on specific bill of materials. These 4 products represent the products sold on the market. The results generated by this EPD-data software can be considered as a good proxy to model the windows designed by Reynaers and fabricated by their European distributors.
Liability	The owner of the declaration is liable for the underlying manufacturing information and evidence; European Aluminium, i.e. the programme holder, is not be liable in this respect.

2. Product

2.1. Product description and application

This Environmental Product Declaration (EPD) is for business to business communication. This EPD refers to the "single vent Eco System® 50 Window" product family which is a well-insulated system for windows and doors, that combines aesthetic design and energy efficiency with a moderate price.

EPD results have been calculated for 4 one-vent representative windows which are reported in Table 1.

Table 1. List of representative products for the Eco System® 50 windows (single vent)

Size (W x H)	Glazing Unit	Function	Fittings	No of rep products	Surface area (m^2)
1.23m x 1.48m	Double (D)	Operable – tilt & turn (O) or non-operable (N)	Siegenia (Si) or Sobinco (So)	3	1.82
1.48m x 2.18m	Double (D)	Non-operable (N)	/	1	3.23

For the standard size 1.23m x 1.48m, calculations have been done for Double-glazed (D) windows which are Operable (O) or Non-operable (N). For operable windows, calculations have been done with two different fittings: Siegenia (Si) or Sobinco (So). Hence, 3 representative products have been calculated for the standard size which corresponds to a surface area of 1.82 m^2.

For the large sized windows, i.e. 1.48m x 2.18m, calculations have been done for a double-glazed window which is non-operable. Hence, only one representative products has been calculated for the large window size which corresponds to a surface area of 3.23 m^2.

2.2. Technical data

The most relevant technical data are reported in Table 2.

Table 2. Most relevant technical data

Category	Description & value	Standards
Thermal Insulation	Uf-value down to 1,6 W/m^2K depending on the frame/vent combination and the glass thickness.	EN ISO 10077-1; EN ISO 10077-2
Acoustic performance	Sound reduction Index (Rw) from 35 up to 39 depending on glazing	EN ISO 140-3; EN ISO 717-1
Air tightness	Class 4	EN 1026; EN 12207
Water tightness	Class E	EN 1027; EN 12208
Wind load resistance	Class C4	EN 12211; EN 12210
Burglar resistance	WK 2	EN 1630; EN 1627
Fire resistance	EW30 EI 30 or EI 45 or EI 60	NEN 6069 EN 13501-2; EN 1364-1; EN 1634-1

For the most up-to-date values of the technical data, please refer to the product specifications available on the Reynaers website (see the specifications of ES 50 window products in the section www.reynaers.com/consumers/our-products).

2.3. Relevant Standards for market Applications

Most relevant standards for applications of aluminium window or door products in buildings are EN 14351-1 (performances) & EN 12519 (terminology).

2.4. Delivery status and packaging

The windows are supplied with appropriate protection and transport equipment, e.g. racks. Occasionally, the aluminium profiles can be protected with a thin adhesive plastic film. This packing is not considered in this EPD study.

2.5. Window fabrication (foreground processes)

The window and door fabrication consists mainly in the following operations:

1. Aluminium profile preparation mainly via sawing, milling and gluing. Those aluminium profiles are powder coated and thermally broken profiles.
2. Frame production by assembling the various profiles via corner connections and fixing via gluing and/or crimping. Connectors are composed of aluminium die cast.
3. Positioning and fixing the various gaskets.
4. The fittings integration (if relevant)
5. The fixing of the glazing unit via the glazing bead.

The contribution of the fabrication process to the overall production impact of the window or door is below the cut-off rule of 5%. Hence, no specific LCA modelling has been done on that process step, except a scrap rate of 3% for the aluminium profile which has been considered.

2.6. Main background processes

The main production processes are reported in Figure 1.

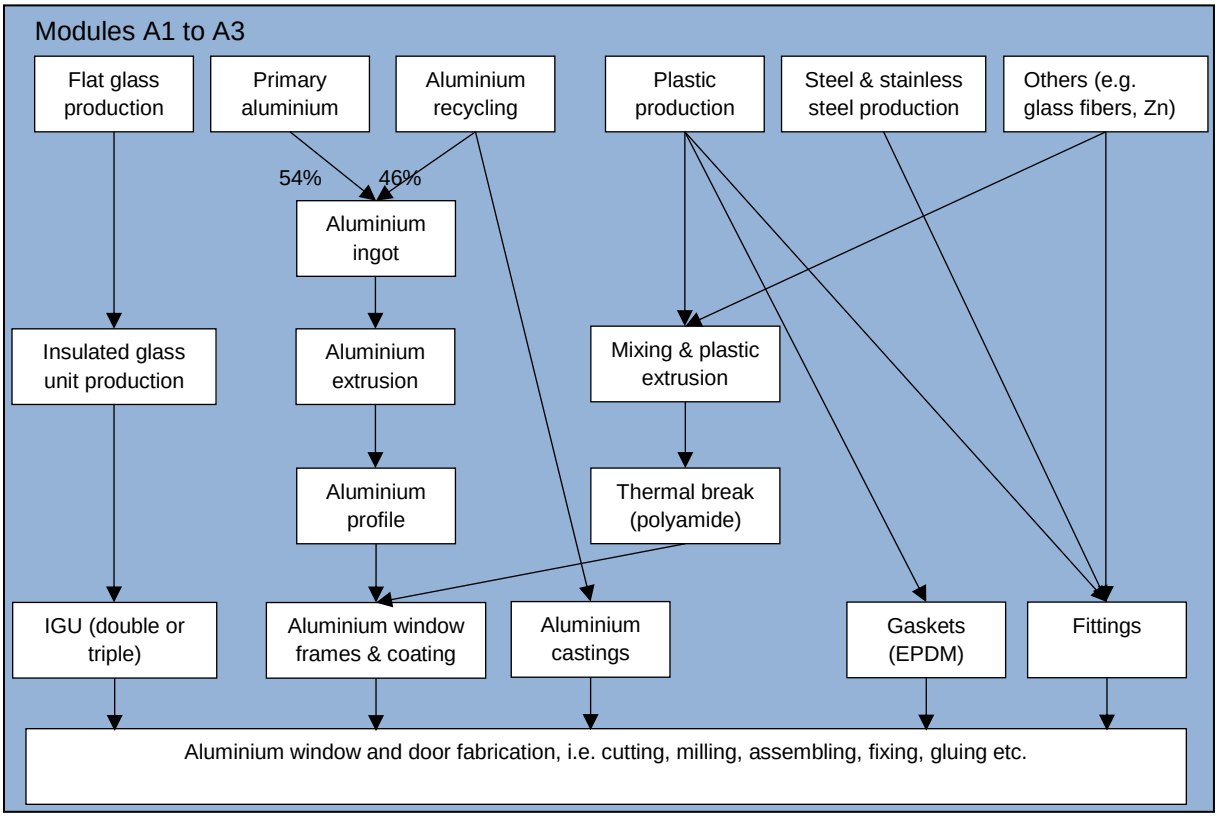


Figure 1. Main production processes and components of aluminium doors and windows

The aluminium profile production has been modelled using European Aluminium LCI datasets (year 2010) for the primary aluminium production, extrusion, recycling and remelting as described in the Environmental profile report developed by European Aluminium. The aluminium ingot (i.e. the billet) production has assumed that aluminium originated for 54% from primary aluminium and 46% from recycling which corresponds to the average recycling input rate of aluminium produced in Europe.

For the other components and materials production, e.g. thermal break, gaskets, glass unit or fittings, datasets from the GaBi database have been used (version GaBi 6, SP27, 2015). The powder coating of aluminium profile has been modelled using GaBi datasets as well.

2.7. Health and safety aspects during production and installation

There are no critical health and safety aspects during the production of aluminium windows. Cr-free pre-treatments are used for the pre-treatment of aluminium profile prior the VOC-free powder coating process.

There are no relevant aspects of occupational health and safety during the further processing and installation of Reynaers windows or doors. Under normal installation, no measurable environmental impacts can be associated with the use of Reynaers aluminium windows or doors. The appropriate safety measures need to be taken at the building site, especially if installation takes place on a high-rise building.

2.8. Further processing, use and reference service life

Eco System® 50 Windows are customised building products which are ready to be installed on the building site. This EPD does not cover the downstream process to install the product at the building site.

During use, the indoor air quality, i.e. VOC emission, is not affected by aluminium windows / VOC from aluminium windows/.

Since the use phase is not modelled, no specific information can be given about the Reference Service Life. In normal use, aluminium building products are not altered or corroded over time. A regular cleaning (e.g. once a year) of the product suffices to secure a long service life. However, the use of highly alkaline (pH >10) or highly acidic (pH < 4) cleaning solutions should be avoided.

In practice, a service life of 50 years can be assumed in normal use for such application /DURABILITY/ with the exception of the IGU (Insulated Glass Unit) which needs to be replaced usually after 30 years due to a slow degradation of its performance.

In case of fire, aluminium is a non-combustible construction material (European Fire Class A1) in accordance with Directive 96/603/EC, and does therefore not make any contribution to fire.

2.9. End of life stage

At the end-of-life stage, aluminium windows should be specifically dismantled and collected in order to be treated since they include several materials which can be efficiently recycled or can be used for energy recovery.

In particular, the aluminium profiles are systematically dismantled and sent for recycling. This high collection rate has been confirmed by a study done by Delft University showing that large aluminium pieces like aluminium profiles are systematically collected thanks to their intrinsic economic value /EAA DELFT/. Hence, a collection rate of 99% was used for the profiles.

Gaskets, thermal breaks and hardware are collected together with the aluminium profiles and are then treated through shredding and sorting with the aluminium profile.

The glazing unit, however, is not systematically collected at the building renovation or demolition site. Indeed, the glazing unit is still often broken on site and is then sent to landfilling. In some European countries, the glazing unit is specifically collected and sent to recycling, e.g. in the Netherlands. Hence, two extreme end of life scenarios have been used for flat glass: 99% recycling or 100% landfilling. Table 3 reports the main parameters of the End of life scenario for the various materials and components of the window.

Table 3. Parameters of the end of life scenarios for the main materials and components

Component/material	Collection rate	Typical treatment	Overall recycling rate
Aluminium frame	99%	Shredding, sorting & recycling	92%
Thermal break (e.g. PA)	99%	Shredding, sorting & incineration	/
Gaskets (e.g. EPDM)	99%	Shredding, sorting & incineration	/
Fittings (metal-based)	99%	Shredding, sorting & recycling	90%
Glass – scenario 1	99%	Shredding, sorting & recycling	90%
Glass – Scenario 2	0%	100% landfilling	

In the case of scenario 1, only a small fraction of the window (1%) is then considered as landfilled in the LCA model. From collected aluminium scrap (99%) up to the recycled aluminium ingot (92%), it is assumed as a conservative estimate that 7% of the aluminium metal is lost. Hence, the overall recycling rate of aluminium has been fixed to 92%.

The waste code for aluminium in accordance with the European Waste Catalogue (EWC) is 17 04 02. Figure 2 reports the main processes and parameters used for the end of life stage modelling.

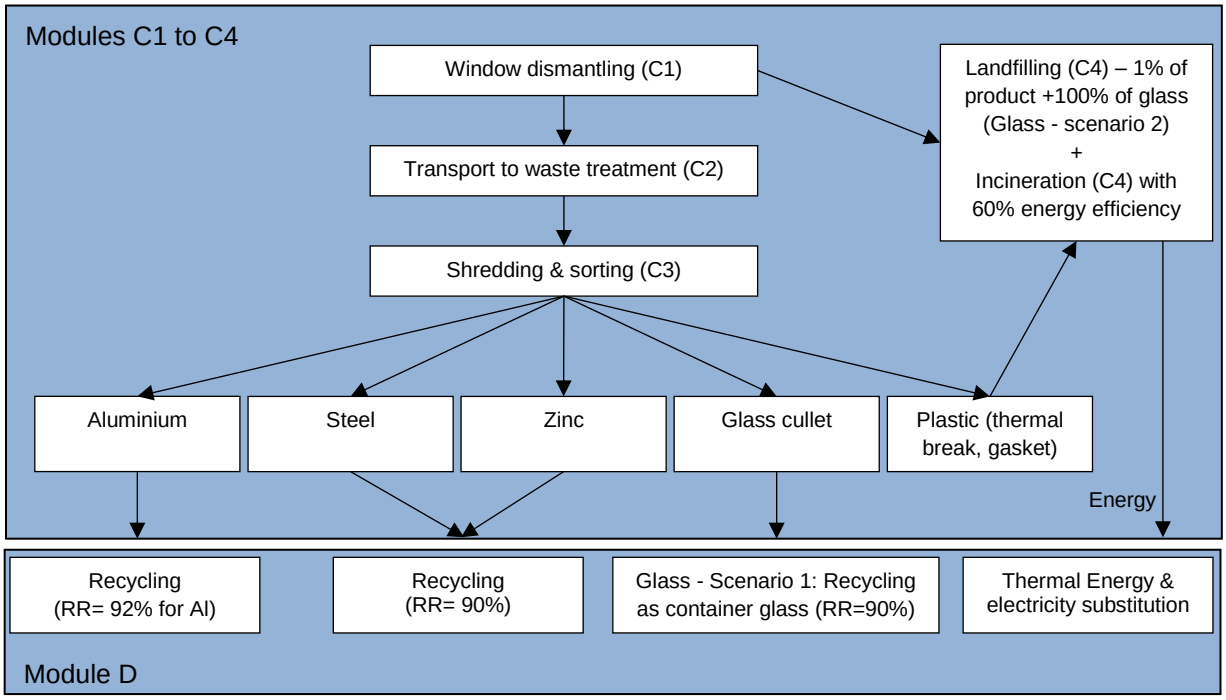


Figure 2. main processes and parameters for the end of life stage modelling

3. LCA: Calculation rules

3.1. Product size, Bill of Materials and declared unit

EPD calculations have been done for the two window sizes described under point 2.1. The Bill of Materials of the 4 corresponding representative products are reported in Table 4. The declared unit corresponds to 1 m^2 of window.

The EPD results are reported for each representative product in the 4 annexes of this EPD.

Table 4. Bill of Materials (kg) of the declared unit for the 4 representative products

Product number	1	2	3	4
Reference	SDOSo	SDOSi	SDN	LDN
Glass	22,20	22,20	25,50	26,40
Aluminium frame	6,64	7,38	3,68	2,79
Thermal break (PA)	1,09	0,99	0,50	0,38
Gasket	0,60	0,60	0,26	0,20
Fitting and others	1,31	1,10	0,16	0,10
Total	31,85	32,26	30,11	29,88

L = large size / S = standard size, D = Double glazing / T=Triple glazing, O= Operable / N=Non-operable, So = Sobinco fittings / Si= Siegenia fittings

3.2. System boundaries

Type of EPD: Cradle to gate – with options

The production stage (modules A1-A3) includes processes that provide materials and energy input for the system, manufacturing and transport processes up to the factory gate, as well as waste processing.

For the end of life, a collection rate of 99% is assumed and directed to recycling (module D). The 1% lost product is modelled through landfilling (module C4). Considering the few losses along the recycling chain, it is assumed that 92% of the Al material is effectively recycled as new ingot. Hence, an end of life recycling rate of 92% is used within module D to reflect the benefits of recycling through the substitution principle.

According to the PCR document, modules C1, C2 and C3 shall be addressed in the EPD. Since aluminium products covered in these EPDs are intermediate building products for which it is difficult to define deconstruction and transport scenarios, it has been decided not to cover these three modules. For building products made of aluminium, the contribution of these modules is below the 5% cut-off rule and their omission can be considered as reasonable.

3.3. Estimates and assumptions

It has been assumed that the aluminium profiles were composed of a mix of 54% primary aluminium and 46% recycled aluminium. Such mix represents the typical sourcing of aluminium in Europe, all markets included. Alloying elements were not considered and a pure aluminium profile has been assumed as a proxy. Alloy used by Reynaers is composed of at least 98% of Aluminium. Hence, such assumption appears adequate.

3.4. Cut-off criteria

No specific data were collected and used to model the fabrication stage, which has a limited impact on the full life cycle profile of windows, doors or curtain walls. The impacts of fabrication operations are below the cut-off rules of 5%. Nevertheless, a scrap rate of 3% at the fabrication stage has been used in the LCA model.

All other known operating data was taken into consideration in the analysis, except for modules C1, C2 and C3 which were not calculated. Based on the long experience of data collection within the European Aluminium Industry, it can be estimated that the ignored processes or flows contribute to less than 5% to the impact categories under review.

3.5. Background data

GaBi 6 2014- the software system for comprehensive analysis developed by thinkstep (previously PE International) – was used for modelling the life cycle for the production of the aluminium windows. Generic GaBi 6 data sets have been used for energy, transport and consumables. For the aluminium primary production, recycling and sheet production, the datasets described in the environmental profile report of European Aluminium have been used /EAA EPR/.

3.6. Foreground data and EPD-data tool

The modelling efforts were focussed on the identification of representative products and the proper calculation and consideration of the BoM of the representative products within the LCA model.

No specific process data have been collected considering that their impact on the whole product life cycle is limited. In most cases, the window fabrication is not performed by Reynaers but by their distributors disseminated in Europe which sell and install Reynaers window systems on the European market. Hence, collecting data on this process step is also very challenging. In any case, energy and consumables used at the fabrication stage are below the cut-off rule of 5% and were not considered. A scrap rate of 3% at fabrication stage was anyway considered in the model.

3.7. Data quality

The data quality can be considered as good. The LCA models have been checked and most relevant flows are considered. Technological, geographical and temporal representativeness is appropriate. The use of collective data can be considered as a reasonable proxy for the Reynaers aluminium windows, doors and curtains walls.

3.8. Allocation

Any aluminium scrap produced along the fabrication chain is sent back to recycling. This recycling loop has been modelled in the GaBi model so that the aluminium window is the only product exiting the gate. Hence, the production process does not deliver any co-products.

At the end-of-life stage, the aluminium window is sent to an EoL treatment which is modelled according to the scenario reported in section 2.9. The environmental burdens and benefits of recycling and energy recovery are calculated in module D accordingly.

3.9. Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data to be compared has been drawn up in accordance with EN 15804 and the building context or product-specific characteristics are taken into consideration.

4. LCA scenarios and additional technical information

Modules A4, A5 and B1-B7 are not taken into consideration in this Declaration. The modules C1-C3 are not calculated. In module A1, a recycled metal content of 46% is assumed for the aluminium profiles. . Hence, end of life credits are calculated in Module D based on a net aluminium recycling of 92% at end of life minus 46% at production stage, i.e. a quantity representing 46% of the aluminium content of the window. It is assumed that the inherent properties are conserved through recycling, i.e. quality factor is kept to one.
Module C1 to C3 shall be calculated in "Cradle to Grave" EPD or for integration in Building assessment.

Table 5: Modules addressed in the EPD study (X: module declared, Y: module required by PCR but not calculated, MND: module not declared)

Production			Installation		Use stage							End-of-Life				Next product system
Raw material supply (extraction, processing, recycled material)	Transport to manufacturer	Manufacturing	Transport to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to EoL	Waste processing for reuse, recovery or recycling	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	Y	Y	Y	X	X

5. LCA results

The LCA results are reported in the 10 annexes.

List of abbreviations: GWP: Global warming potential; ODP: Ozone layer depletion potential; AP: Acidification potential of land and water; EP: Eutrophication potential; POCP: Photochemical oxidation potential; ADPE: Abiotic depletion potential (elements); ADPF: Abiotic depletion potential (fossil fuels); PERE: Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM: Use of renewable primary energy resources used as raw materials; PERT: Total use of renewable primary energy resources; PENRE: Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM: Use of non-renewable primary energy resources used as raw materials; PENRT: Total use of non-renewable primary energy resources; SM: Use of secondary materials; RSF: Use of renewable secondary fuels; NRSF: Use of non- renewable secondary fuels; FW: Use of net fresh water; HWD: Hazardous waste disposed; NHWD: Non-hazardous waste disposed; RWD: Radioactive waste disposed; CRU: Components for re-use; MFR: Materials for recycling; MER: Materials for energy recovery; EEE: Exported electrical energy; EET: Exported thermal energy.

6. LCA interpretation

- Aluminium window production – Modules A1 to A3.

The majority of the environmental impacts comes from the aluminium profile and to a lesser extent from the glazing unit. Hence, most indicators are influenced by the mass of aluminium in the declared unit: The higher the aluminium mass, the higher the indicator. Hence, the GWP indicator evolves from 56 [kg CO_2-eq] for the LDN window up to 86 [kg CO_2-eq] for the SDOSi window. The LDN window presents the lightest BoM, i.e. 29.84 kg, with a mass of aluminium profile of 2.7 kg and the SDOSi window presents the heaviest BoM, i.e. 32.26 kg, with a mass of the Al profile reaching 6.67 kg. This explains why the GWP is increased by 50% while the mass of BoM is increased by less than 10%.

Within the aluminium production processes, the primary aluminium production is dominant, especially the alumina production and the electrolysis. The recycled ingot production which presents a much lower impact than the primary ingot production is used in Module A1-A3 for the fraction of aluminium coming from recycling (46%). The extrusion process which converts ingot, i.e. billets, into profile is much less significant. The LCA modelling and the impact of the primary aluminium production is detailed in the environmental profile report /EAA EPR/.

The impact of the other components, e.g. thermal break, gaskets and fittings, is less significant due to their low contribution to the BoM.

- End of life stage: modules C4 and module D

Parameters reported in Table 3 were used to model the end of life stage.

Module C4: In the case of the glass recycling scenario, the contribution of module C4 (disposal) is very limited compared to modules A1-A3 and module D. However, in case of the glass landfilling scenario, the mass of non-hazardous waste disposed becomes significant, i.e. corresponding at least to the mass of the glazing unit.

Module D: The environmental benefits come not only from the recycling of aluminium and metal fittings but also from glass recycling in case of scenario 1. About 30% to 50% of GWP savings are obtained in Module D compared to the value calculated for module A1-A3. The energy indicators follow the same trends. Additional benefits are also resulting from the energy recovery from the incineration of the gaskets and the thermal break.

These calculations show the relevance to consider Module D in the full assessment of windows in the building context.

7. References

CEN/TR 15941	Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data; CEN/TR 15941:2010
DIRECTIVE 96/603/EC	COMMISSION DECISION of 4 October 1996 establishing the list of products belonging to Classes A ' No contribution to fire '
DURABILITY	Aluminium and Durability - Towards Sustainable Cities, edited by Michael Stacey, Published by Cwningen Press, November 2014 ISBN 978-0-9930162-0-2 (available at http://www.world-aluminium.org/publications/)
EAA DELFT	COLLECTION OF ALUMINIUM FROM BUILDINGS IN EUROPE - A Study by Delft University of Technology – 2004, available at http://european-aluminium.eu/media/1628/collection-of-aluminium-from-buildings-in-europe.pdf
EAA EPR	Environmental Profile Report for the European Aluminium Industry - April 2013- Data for the year 2010, available at http://european-aluminium.eu/media/1329/environmental-profile-report-for-the-european-aluminium-industry.pdf
EAA PCR	Product Category Rules (PCR) for Aluminium Building Products – version of 30 Jan 2013, available at http://european-aluminium.eu/resource-hub/epd-programme-according-to-en15804/
EN 1026	Windows and doors. Air permeability. Test method
EN 1027	Windows and doors. Watertightness. Test method
EN 12207	Windows and doors. Air permeability. Classification
EN 12208	Windows and doors. Watertightness. Classification
EN 12210	Windows and doors. Resistance to wind load. Classification
EN 12211	Windows and doors. Resistance to wind load. Test method
EN 12519	Windows and pedestrian doors — Terminology
EN 12519	Windows and pedestrian doors — Terminology
EN 14351-1	Windows and doors - Product standard, performance characteristics - Part 1: Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics
EN 15804	Sustainability of construction works –Environmental Product Declarations – Core rules for the product category of construction products
EN 1627	Pedestrian doorsets, windows, curtain walling, grilles and shutters. Burglar resistance. Requirements and classification
EN 1630	Pedestrian doorsets, windows, curtain walling, grilles and shutters - Burglar resistance - Test method for the determination of resistance to manual burglary attempts
EN 573-3	Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition and form of products
EN ISO 10077-1	Thermal performance of windows, doors and shutters -- Calculation of thermal transmittance -- Part 1: General
EN ISO 10077-2	Thermal performance of windows, doors and shutters -- Calculation of thermal transmittance -- Part 2: Numerical method for frames
EN ISO 14025	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
EN ISO 140-3	Acoustics -- Measurement of sound insulation in buildings and of building elements -- Part 3: Laboratory measurements of airborne sound insulation of building elements
EN ISO 14040	Environmental management - Life cycle assessment - Principles and framework
EN ISO 14044	Environmental management - Life cycle assessment - Requirements and guidelines
EN ISO 717-1	Acoustics -- Rating of sound insulation in buildings and of building elements -- Part 1: Airborne sound insulation
GABI 6	GaBi 6.3 dataset documentation for the software-system and databases, LBP, University of Stuttgart and PE INTERNATIONAL AG, Leinfelden-Echterdingen, 2013 (http://documentation.gabi-software.com/)
NEN 6069	Beproeving en klassering van de brandwerendheid van bouwdelen en bouwproducten (fire resistance testing and classification of building elements and products)
RECYCLING IN EN15804	TACKLING RECYCLING ASPECTS IN EN15804 – paper presented at the « LCA & Construction » conference in Nantes 10-12 July 2012
VOC from Al windows	Evaluation of Volatile Organic Compounds and aldehydes emitted by a “thermolacquered aluminium window posed (White QUALICOAT)" according to ISO 16000, Bureau Veritas Laboratoires, Report N°1200410-1 (E12-002890)

Annex 1: Eco System® 50 window –type SDOSo
i.e. Standard size, Double glazing, Operable, Sobinco fittings

Reference	1
Width of the window [m]	1,23
Height of the window [m]	1,48
Fraction of transparent area (%)	74%
Glazing Unit	Double glazing (2 X 6 mm of glass)
Function	Operable – Tilt and Turn
Fittings	Sobinco

Bill of Materials of the declared unit in kg	
Glass	22,20
Aluminium frame	6,64
Thermal break (PA)	1,09
Gasket	0,60
Fitting and others	1,31
Total	**31,85**

EPD results

Per m^2 of window							
ENVIRONMENTAL IMPACTS				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
GWP	Global warming potential	[kg CO2-eq.]	84,36	3,7518	-40,108	3,9738	-28,046
ODP	Ozone layer depletion potential	[kg CFC11-eq.]	1,69E-06	1,34E-11	-1,2E-06	1,71E-11	-1,2E-06
AP	Acidification potential of land and water	[kg SO2-eq.]	0,33818	0,002568	-0,18056	0,003944	-0,1147
EP	Eutrophication potential	[kg PO43--eq.]	0,036926	0,000627	-0,01554	0,000829	-0,00658
POCP	Photochemical oxidation potential	[kg ethene-eq.]	0,01702	0,000161	-0,00521	0,000295	-0,00707
ADPE	Abiotic depletion potential (elements)	[kg Sb-eq.]	0,003915	9,32E-08	-0,00406	1,72E-07	-0,00329
ADPF	Abiotic depletion potential (fossil fuels)	[MJ]	1050,8	1,406	-426,24	4,3142	-304,88
RESOURCE USE				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	180,56	-	-	-	-
PERM	Use of renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-
PERT	Total use of renewable primary energy resources	[MJ]	180,56	0,11914	-122,1	0,40996	-119,14
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	1213,6	-	-	-	-
PENRM	Use of non-renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-
PENRT	Total use of non-renewable primary energy resources	[MJ]	1213,6	1,5614	-526,14	4,588	-401,08
SM	Use of secondary materials	[kg]	3,3374	0	0	0	0
RSF	Use of renewable secondary fuels	[MJ]	0	0	0	0	0
NRSF	Use of non- renewable secondary fuels	[MJ]	0	0	0	0	0
FW	Use of net fresh water	[m3]	0,57498	0,00925	-0,28786	0,009842	-0,25826
END OF LIFE STAGE (ouput materials from Module C1)				Glass recycling		Glass landfilling	
Material collected separately		kg		**31,68**		**9,48**	
for recycling (e.g. metals & glass)		kg		29,94		7,74	
for energy recovery (e.g. gaskets & thermal break)		kg		1,74		1,74	
Material for landfilling		kg		**0,17**		**22,37**	
OUTPUT FLOWS AND WASTE				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
HWD	Hazardous waste disposed	[kg]	0,012654	4,21E-07	-0,00858	1,38E-06	-0,00636
NHWD	Non-hazardous waste disposed	[kg]	10,582	0,20424	-6,364	16,65	-5,9126
RWD	Radioactive waste disposed	[kg]	0,06734	6,22E-05	-0,04107	0,000109	-0,03966
CRU	Components for re-use	[kg]	0	0	-	0	-
MFR	Materials for recycling	[kg]	0	0	23,606	0	7,1928
MER	Materials for energy recovery	[kg]	0	0	-	0	-
EEE	Exported electrical energy	[MJ]	0	5,846	-	5,846	-
EET	Exported thermal energy	[MJ]	0	13,542	-	13,542	-

Annex 2: Eco System® 50 window –type SDOSi
i.e. Standard size, Double glazing, Operable, Siegenia fittings

Reference	2
Width of the window [m]	1,23
Height of the window [m]	1,48
Fraction of transparent area (%)	74%
Glazing Unit	Double glazing (2 X 6 mm of glass)
Function	Operable – Tilt and Turn
Fittings	Siegenia

Bill of Materials of the declared unit in kg	
Glass	22,20
Aluminium frame	7,38
Thermal break (PA)	0,99
Gasket	0,60
Fitting and others	1,10
Total	32,26

EPD results

Per m^2 of window							
ENVIRONMENTAL IMPACTS				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
GWP	Global warming potential	[kg CO2-eq.]	85,84	3,6408	-40,33	3,8628	-28,268
ODP	Ozone layer depletion potential	[kg CFC11-eq.]	1,78E-06	1,28E-11	-1,3E-06	1,64E-11	-1,3E-06
AP	Acidification potential of land and water	[kg SO2-eq.]	0,34484	0,002412	-0,1813	0,003789	-0,11618
EP	Eutrophication potential	[kg PO43--eq.]	0,037222	0,000582	-0,01554	0,000784	-0,00662
POCP	Photochemical oxidation potential	[kg ethene-eq.]	0,017168	0,000151	-0,00527	0,000284	-0,00713
ADPE	Abiotic depletion potential (elements)	[kg Sb-eq.]	0,002679	8,36E-08	-0,00286	1,63E-07	-0,00209
ADPF	Abiotic depletion potential (fossil fuels)	[MJ]	1065,6	1,3098	-426,98	4,218	-305,62
RESOURCE USE				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	185	-	-	-	-
PERM	Use of renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-
PERT	Total use of renewable primary energy resources	[MJ]	185	0,111	-122,84	0,40256	-119,88
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	1228,4	-	-	-	-
PENRM	Use of non-renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-
PENRT	Total use of non-renewable primary energy resources	[MJ]	1228,4	1,4578	-526,88	4,4844	-401,82
SM	Use of secondary materials	[kg]	3,9146	0	0	0	0
RSF	Use of renewable secondary fuels	[MJ]	0	0	0	0	0
NRSF	Use of non- renewable secondary fuels	[MJ]	0	0	0	0	0
FW	Use of net fresh water	[m3]	0,56832	0,008954	-0,2849	0,009546	-0,25456
END OF LIFE STAGE (ouput materials from Module C1)				Glass recycling		Glass landfilling	
Material collected separately			kg	**32,16**		**9,96**	
for recycling (e.g. metals & glass)			kg	30,41		8,21	
for energy recovery (e.g. gaskets & thermal break)			kg	1,75		1,75	
Material for landfilling			kg	**0,10**		**22,30**	
OUTPUT FLOWS AND WASTE				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
HWD	Hazardous waste disposed	[kg]	0,009916	3,91E-07	-0,00627	1,35E-06	-0,00406
NHWD	Non-hazardous waste disposed	[kg]	11,026	0,1813	-6,6526	16,65	-6,2012
RWD	Radioactive waste disposed	[kg]	0,069042	5,85E-05	-0,04092	0,000105	-0,03944
CRU	Components for re-use	[kg]	0	0	-	0	-
MFR	Materials for recycling	[kg]	0	0	24,05	0	7,622
MER	Materials for energy recovery	[kg]	0	0	-	0	-
EEE	Exported electrical energy	[MJ]	0	5,7498	-	5,7498	-
EET	Exported thermal energy	[MJ]	0	13,32	-	13,32	-

Annex 3: Eco System® 50 window –type SDN
i.e. Standard size, Double glazing, Non- operable

Reference	3
Width of the window [m]	1,23
Height of the window [m]	1,48
Fraction of transparent area (%)	85%
Glazing Unit	Double glazing (2 X 6 mm of glass)
Function	Non- operable
Fittings	/

Bill of Materials of the declared unit in kg	
Glass	25,50
Aluminium frame	3,68
Thermal break (PA)	0,50
Gasket	0,26
Fitting and others	0,16
Total	30,11

EPD results

Per m^2 of window							
ENVIRONMENTAL IMPACTS				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
GWP	Global warming potential	[kg CO2-eq.]	61,54	1,785	-29,665	2,0825	-13,685
ODP	Ozone layer depletion potential	[kg CFC11-eq.]	9,44E-07	6,26E-12	-7E-07	1,11E-11	-7E-07
AP	Acidification potential of land and water	[kg SO2-eq.]	0,2703	0,001207	-0,14025	0,003026	-0,05389
EP	Eutrophication potential	[kg PO43--eq.]	0,034	0,000294	-0,01496	0,000556	-0,00313
POCP	Photochemical oxidation potential	[kg ethene-eq.]	0,00867	7,59E-05	-0,00091	0,000252	-0,00337
ADPE	Abiotic depletion potential (elements)	[kg Sb-eq.]	0,00043	4,59E-08	-0,00125	1,5E-07	-0,00023
ADPF	Abiotic depletion potential (fossil fuels)	[MJ]	747,15	0,66385	-306,85	4,505	-147,05
RESOURCE USE				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	102,85	-	-	-	-
PERM	Use of renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-
PERT	Total use of renewable primary energy resources	[MJ]	102,85	0,056865	-63,495	0,44115	-60,18
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	841,5	-	-	-	-
PENRM	Use of non-renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-
PENRT	Total use of non-renewable primary energy resources	[MJ]	841,5	0,7378	-359,55	4,7345	-194,65
SM	Use of secondary materials	[kg]	1,683	0	0	0	0
RSF	Use of renewable secondary fuels	[MJ]	0	0	0	0	0
NRSF	Use of non- renewable secondary fuels	[MJ]	0	0	0	0	0
FW	Use of net fresh water	[m3]	0,32385	0,004429	-0,1615	0,005168	-0,1224
END OF LIFE STAGE (ouput materials from Module C1)				Glass recycling		Glass landfilling	
Material collected separately			kg	**30,07**		**4,57**	
for recycling (e.g. metals & glass)			kg	29,20		3,70	
for energy recovery (e.g. gaskets & thermal break)			kg	0,86		0,86	
Material for landfilling			kg	**0,05**		**25,55**	
OUTPUT FLOWS AND WASTE				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
HWD	Hazardous waste disposed	[kg]	0,002576	2,01E-07	-0,00335	1,47E-06	-0,00044
NHWD	Non-hazardous waste disposed	[kg]	6,732	0,09605	-3,519	21,76	-2,924
RWD	Radioactive waste disposed	[kg]	0,03842	2,94E-05	-0,02151	9,01E-05	-0,01964
CRU	Components for re-use	[kg]	0	0	-	0	-
MFR	Materials for recycling	[kg]	0	0	25,075	0	3,3915
MER	Materials for energy recovery	[kg]	0	0	-	0	-
EEE	Exported electrical energy	[MJ]	0	2,8475	-	2,8475	-
EET	Exported thermal energy	[MJ]	0	6,6045	-	6,6045	-

Annex 4: Eco System® 50 window –type LDN
i.e. Large size, Double glazing, Non-operable

Reference	4
Width of the window [m]	1.48
Height of the window [m]	2.18
Fraction of transparent area (%)	88%
Glazing Unit	Double glazing (2 X 6 mm of glass)
Function	Non- operable
Fittings	/

Bill of Materials of the declared unit in kg	
Glass	26,40
Aluminium frame	2,79
Thermal break (PA)	0,38
Gasket	0,20
Fitting and others	0,10
Total	29,88

EPD results

Per m^2 of window							
ENVIRONMENTAL IMPACTS				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
GWP	Global warming potential	[kg CO2-eq.]	56,408	1,3552	-27,544	1,672	-10,472
ODP	Ozone layer depletion potential	[kg CFC11-eq.]	7,22E-07	4,75E-12	-5,3E-07	9,94E-12	-5,3E-07
AP	Acidification potential of land and water	[kg SO2-eq.]	0,25696	0,000906	-0,13376	0,002851	-0,0411
EP	Eutrophication potential	[kg PO43--eq.]	0,033704	0,000223	-0,01505	0,000502	-0,00238
POCP	Photochemical oxidation potential	[kg ethene-eq.]	0,006732	5,75E-05	6,54E-05	0,000246	-0,00257
ADPE	Abiotic depletion potential (elements)	[kg Sb-eq.]	0,000326	3,36E-08	-0,00122	1,45E-07	-0,00013
ADPF	Abiotic depletion potential (fossil fuels)	[MJ]	680,24	0,49896	-283,36	4,6112	-111,76
RESOURCE USE				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	83,688	-	-	-	-
PERM	Use of renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-
PERT	Total use of renewable primary energy resources	[MJ]	83,688	0,042592	-49,456	0,45408	-45,936
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	756,8	-	-	-	-
PENRM	Use of non-renewable primary energy resources used as raw materials	[MJ]	0	-	-	-	-
PENRT	Total use of non-renewable primary energy resources	[MJ]	756,8	0,5544	-324,72	4,8312	-147,84
SM	Use of secondary materials	[kg]	1,2584	0	0	0	0
RSF	Use of renewable secondary fuels	[MJ]	0	0	0	0	0
NRSF	Use of non- renewable secondary fuels	[MJ]	0	0	0	0	0
FW	Use of net fresh water	[m3]	0,26928	0,003344	-0,13552	0,004136	-0,09328
END OF LIFE STAGE (ouput materials from Module C1)				Glass recycling		Glass landfilling	
Material collected separately			kg	**29,84**		**3,44**	
for recycling (e.g. metals & glass)			kg	29,19		2,79	
for energy recovery (e.g. gaskets & thermal break)			kg	0,65		0,65	
Material for landfilling			kg	**0,03**		**26,43**	
OUTPUT FLOWS AND WASTE				Glass recycling		Glass landfilling	
Parameter		Unit	A1-3	C4	D	C4	D
HWD	Hazardous waste disposed	[kg]	0,001892	1,5E-07	-0,00337	1,5E-06	-0,00025
NHWD	Non-hazardous waste disposed	[kg]	5,764	0,070576	-2,8776	23,32	-2,2352
RWD	Radioactive waste disposed	[kg]	0,031416	2,21E-05	-0,01698	8,76E-05	-0,01496
CRU	Components for re-use	[kg]	0	0	-	0	-
MFR	Materials for recycling	[kg]	0	0	25,784	0	2,552
MER	Materials for energy recovery	[kg]	0	0	-	0	-
EEE	Exported electrical energy	[MJ]	0	2,1384	-	2,1384	-
EET	Exported thermal energy	[MJ]	0	4,972	-	4,972	-