B-EPD ENVIRONMENTAL PRODUCT DECLARATION

REYNAERS ALUMINIUM
Window Masterline 8 standard

1 m2 of window consisting of a window frame and glass of a standard window size of 1,23m x 1,48m over a lifetime of 60 years

Issued 01.03.2021
Valid until 01.03.2026

Third party verified
Conform to EN 15804+A2, prEN17213:2018, NBN/DTD B08-001 and ISO14025

Modules declared					
A123	A4	A5	B2 B4 B6	C	D
•	•	•	•	•	•

[B-EPD n° 21.0058.02.00.00 – EN]

REYNAERS aluminium
TOGETHER FOR BETTER

OWNER OF THIS ENVIRONMENTAL PRODUCT DECLARATION
Reynaers Aluminium

EPD PROGRAM OPERATOR
Federal Public Service of Health, Food Chain Safety and Environment
www.b-epd.be

The intended use of this EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings. This EPD is only valid when registered on www.b-epd.be. The FPS Public Health cannot be held responsible for the information provided by the owner of the EPD.

PRODUCT DESCRIPTION

PRODUCT NAME

Reynaers Masterline 8, thermally broken window system

PRODUCT DESCRIPTION AND INTENDED USE

MasterLine 8 system offers a wide design range regarding thermal insulation and air- and water tightness. This new generation of innovative window solutions mirrors the current architectural trend towards maximising daylight while offering ultimate insulation levels. MasterLine 8 features 3 different levels of insulation (standard, HI and HI+) for high insulated, low energy and passive houses. These different levels are due to small differences in the internal structure of the frame. In addition, HI and HI+ both contain an extra isolating foam. In this EPD the standard version is used. A window with dimensions of 1,23 m x 1,48 m (1,82 m^2) has a transparent (glass) surface of 1,30 m^2. Or, the 'glass to frame'-ratio of the Masterline 8 is 2,50. Double glazing is used in the product.

The Masterline 8 window is used as an element of the building envelop. The window system is typically an opening in the wall of the building fitted with glass in a frame to admit light or air and allow people to see outside. The Masterline 8 window can be used in new-built and renovation projects of low, mid-rise and high-rise buildings.

Reynaers Masterline 8 window is manufactured by a single manufacturer in a single production site for the main part of the production process. However, some small steps are performed at one of approximately 200 different local fabricators. This list is not specified for reasons of confidentiality. One representative fabricator ('Bouwbedrijf Beneens') is selected, and a variability study is performed in the background report that illustrates that the impact of the fabricator is small. As a result, the EPD is valid for all fabricators.

REFERENCE FLOW / DECLARED UNIT

This Environmental Product Declaration (EPD) describes the environmental impacts of 1 m^2 of window consisting of a window frame and glass of a standard window size of 1,23 m x 1,48 m over a lifetime of 60 years.

Packaging is included.

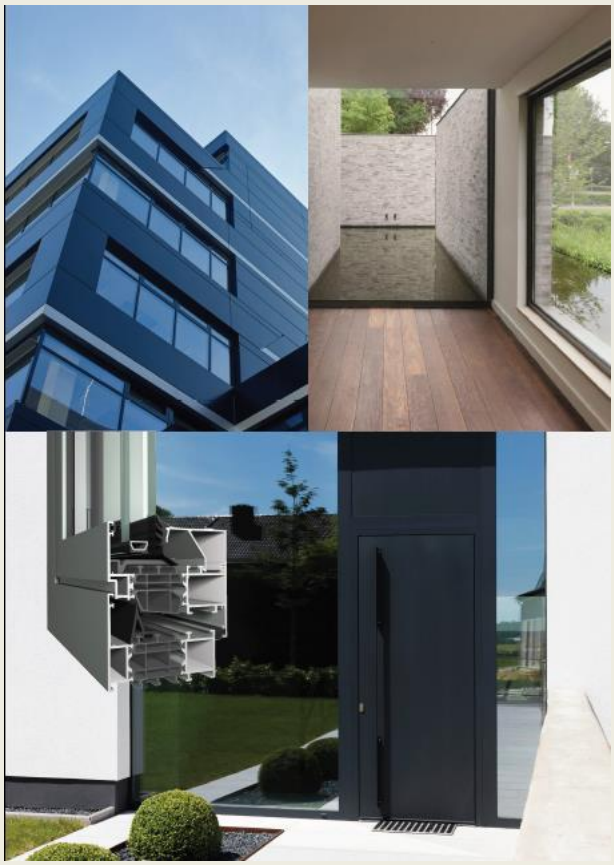
The weight per reference flow is 32,259 kg.

INSTALLATION

The installation of the window is included int his EPD.

Materials for fixation and installation are included. This EPD includes the impacts of all processes, fixating materials, jointing material or treatments necessary for installing/mounting the product according to following scenario: mechanically fixated with screws, insulated and sealed with silicone.

IMAGES OF THE PRODUCT AND ITS INSTALLATION



COMPOSITION AND CONTENT

Components	Composition / content / ingredients	Quantity
Product	- *Aluminium profile* - *Thermal break* - *Glass (double glazing)* - *Fittings* - *Gaskets* - *Consumables*	*25,5 w%* *6,3 w%* *59,1 w%* *5,8 w%* *3,0 w%* *<1 w%*
Fixation materials	- *Steel fixing lugs* - *Steel nails* - *Nylon nailplus*	*9 pieces* *18 pieces* *18 pieces*
Jointing materials	- *PE foam tape* - *PU foam or rockwool* - *Silicone*	*3 m* *412 ml* *0,082 kg (for 3 m)*
Treatments	- *Silicone spray (lubrication)*	*0,001 kg*
Packaging	*No packaging is needed*	/

The product does not contain materials listed in the “Candidate list of Substances of Very High Concern for authorization”.

REFERENCE SERVICE LIFE

The reference service life is estimated at 60 years.

The RSL is based on analysis performed on aluminium frames from building applications of the 1950's-1960's. The results show that the frames have not been significantly affected after 50-60 years (Stacey, 2014).

The conditions under which this RSL is valid are as following: The reference service life is determined for windows in a standard outdoor environment with medium frequency maintenance i.e. cleaning once per year with water and detergent. Glass replacement is considered after 30 years.

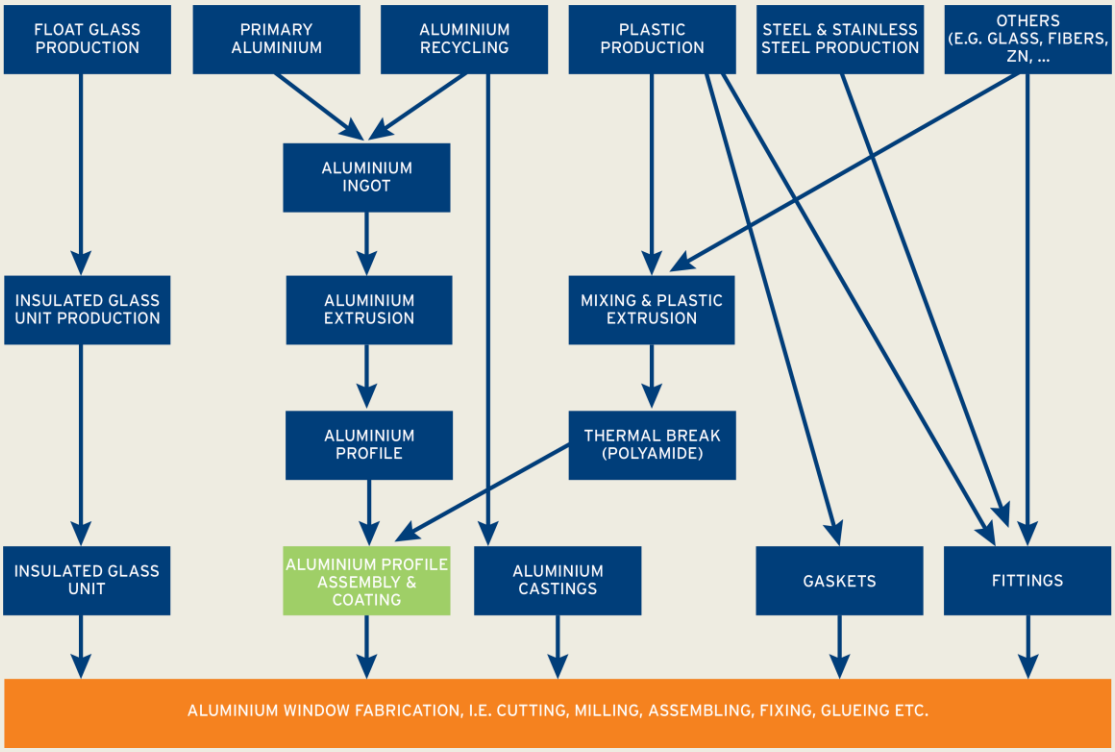
DESCRIPTION OF GEOGRAPHICAL REPRESENTATIVITY

The EPD (A1-D) is representative for the Belgian market. The composed datasets for this life cycle assessment are representative and relevant for aluminium windows produced by Reynaers Aluminium and a representative local fabricator. The data describing the direct inputs and outputs of the foreground processes are representative for Reynaers Aluminium production in Belgium, Duffel.

DESCRIPTION OF THE PRODUCTION PROCESS AND TECHNOLOGY

Window fabrication consists mainly of the following operations:

- Aluminium extruded profiles which are powder coated and thermally broken;
- Frame production by assembling the various profiles via corner connections and fixing via gluing and crimping. Connectors are composed of die cast aluminium;
- Positioning and fixing of the gaskets;
- Integration of the fittings;
- Fixing of the glazing unit via the glazing bead.



Blue = delivered resources
Green = at Reynaers
Orange = at fabricator

TECHNICAL DATA / PHYSICAL CHARACTERISTICS

Technical property	Standard	Value	Unit	Comment
U_w value (thermal transmission coefficient of the whole window)	EN ISO 10077-1	1.5	W/m2K	/
U_f value (thermal transmission coefficient of the profile)	EN ISO 10077-2	2	W/m2K	/
Air tightness	EN 1026; EN 12207	Class 4	/	/
Water tightness	EN 1027; EN 12208	Class 9A	/	/
Wind load resistance	EN 12211; EN 12210	Class C4	/	/

LCA STUDY

DATE OF LCA STUDY
October 2020

SOFTWARE
For the calculation of the LCA results, the software program SimaPro 9.0.0.3 (PRé Consultants, 2019) has been used.

INFORMATION ON ALLOCATION
At Reynaers Aluminium, different types of aluminium applications which are used for the construction of windows, doors, curtain walls and sliding doors, are produced. For the use of energy and the use of surface area only facility level data were available. Energy consumed and surface area used during the manufacturing stage have been allocated to the analyzed product based on the weight of the product (physical relationship).

INFORMATION ON CUT OFF
The following processes are considered below cut-off: benefits and loads of recycling, incineration and reuse of packaging waste in module D; packaging of ancillary materials used during installation; energy use during installation; losses during transport; environmental impacts caused by the personnel of the production plants are not included in the LCA, e.g. waste from the cafeteria and sanitary installations, accidental pollution caused by human mistakes, or environmental effects caused by commuter traffic. Heating or cooling of the plants in order to ensure a comfortable indoor climate for the personnel for example is also neglected. The total of neglected input flows is less than 5% of energy usage and mass as prescribed by EN15804+A2

INFORMATION ON EXCLUDED PROCESSES
Only the processes considered below cut-off are excluded from the study. No additional processes are excluded.

INFORMATION ON BIOGENIC CARBON MODELLING
The product and the packaging of the product does not contain biogenic carbon.

For EN 15804+A2 include following table:

	Biogenic carbon content (kg C / FU)
Biogenic carbon content in product (at the gate)	0
Biogenic carbon content in accompanying packaging (at the gate)	0

INFORMATION ON CARBON OFFSETTING
Carbon offsetting is not allowed in the EN 15804 and hence not taken into account in the calculations.

ADDITIONAL OR DEVIATING CHARACTERISATION FACTORS
The characterization factors from EC-JRC were applied. No additional or deviating characterisation factors were used.

DESCRIPTION OF THE VARIABILITY
Reynaers Masterline 8 window is manufactured by a single manufacturer in a single production site for the main part of the production process. However, some small steps are performed at one of approximately 200 different local fabricators. The impact related to infrastructure, energy use and production waste can vary between the fabricators. One representative fabricator (‘Bouwbedrijf Beneens’) is selected, and a variability study is performed in the background report. The results illustrate that the impact of the fabricator is small. As a result, the EPD is valid for all fabricators. The list of fabricators is not specified for reasons of confidentiality. The variability within the product group has been investigated using the guidelines of the B-PCR (NBN/DTD B 08-001:2017).

DATA

SPECIFICITY

The data used for the LCA are representative for the production of a Reynaers Masterline 8 window, which is manufactured by a single manufacturer in a single production site for the main part of the production process. However, some small steps are performed at one of approximately 200 different local fabricators. One representative fabricator ('Bouwbedrijf Beneens') is selected, and a variability study is performed in the background report. The results illustrate that the EPD is valid for all fabricators.

PERIOD OF DATA COLLECTION

Manufacturer specific data have been collected for the year 2018.

INFORMATION ON DATA COLLECTION

Company specific data for the product stage have been collected by Reynaers Aluminium and were provided to VITO through an online data collection questionnaire. The LCI data for the product stage have been checked by the EPD verifier (Vinçotte) during a factory visit.
VITO uses publicly available generic data for all background processes such as the production of electricity, transportation by means of a specific truck, etc.

DATABASE USED FOR BACKGROUND DATA

The main LCI source used in this study is the Ecoinvent 3.6 database (Wernet et al., 2016). For some processes also the Industry 2.0 database is used.

ENERGY MIX

The Belgian electricity mix (consumption mix + import) has been used to model electricity use in life cycle stages A3, A5, C1 and C4. The used record is the Ecoinvent record 'Electricity, low voltage {BE}| market for | Cut-off, U' (Wernet et al., 2016).

PRODUCTION SITES

{list information the location of the production sites. In case of a collective EPD you list here the names of the market players that can use the collective EPD. }

SYSTEM BOUNDARIES

Product stage			Construction installation stage		Use stage							End of life stage					Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal		Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
☒	☒	☒	☒	☒	**MND**	☒	**MND**	☒	**MND**	☒	**MND**	☒	☒	☒	☒		☒

X = included in the EPD
MND = module not declared

POTENTIAL ENVIRONMENTAL IMPACTS PER REFERENCE FLOW

	Production			Construction process stage		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
GWP total (kg CO2 equiv/FU)	3,24E+02	2,30E+00	2,97E+00	3,63E-01	6,11E+01	MND	4,66E+00	MND	3,78E+01	MND	0,00E+00	MND	0,00E+00	3,31E-01	1,65E-02	6,75E+00	-7,95E+01	4,40E+02
GWP fossil (kg CO2 equiv/FU)	3,23E+02	2,30E+00	3,07E+00	3,62E-01	6,02E+01	MND	2,16E+00	MND	3,76E+01	MND	0,00E+00	MND	0,00E+00	3,31E-01	1,62E-02	6,74E+00	-7,97E+01	4,36E+02
GWP biogenic (kg CO2 equiv/FU)	4,57E-01	1,23E-03	-1,07E-01	1,88E-04	6,35E-01	MND	6,37E-01	MND	1,63E-01	MND	0,00E+00	MND	0,00E+00	1,77E-04	2,03E-04	9,64E-03	4,99E-01	1,80E+00
GWP luluc (kg CO2 equiv/FU)	7,81E-01	8,04E-04	4,87E-03	1,42E-04	1,89E-01	MND	1,87E+00	MND	3,16E-02	MND	0,00E+00	MND	0,00E+00	1,16E-04	3,30E-05	6,23E-04	-3,06E-01	2,88E+00
ODP (kg CFC 11 equiv/FU)	2,01E-05	5,23E-07	2,84E-07	8,12E-08	4,57E-06	MND	6,91E-05	MND	5,84E-06	MND	0,00E+00	MND	0,00E+00	7,52E-08	3,34E-09	2,55E-07	-3,11E-06	1,01E-04
AP (mol H^+ éq./FU)	1,88E+00	9,40E-03	2,11E-02	1,47E-03	2,79E-01	MND	2,04E-02	MND	3,16E-01	MND	0,00E+00	MND	0,00E+00	1,35E-03	5,84E-05	5,43E-03	-4,84E-01	2,54E+00
EP - freshwater (kg (PO4)3- equiv/FU)	1,41E-02	1,81E-05	7,73E-05	3,10E-06	3,33E-03	MND	9,60E-03	MND	1,04E-03	MND	0,00E+00	MND	0,00E+00	2,60E-06	3,94E-07	2,40E-05	-2,32E-03	2,82E-02
EP - marine (kg N equiv/FU)	3,51E-01	2,79E-03	3,15E-03	4,27E-04	5,53E-02	MND	1,67E-02	MND	5,51E-02	MND	0,00E+00	MND	0,00E+00	4,01E-04	1,71E-05	1,39E-03	-7,68E-02	4,86E-01
EP - terrestrial (kg (PO4)3- equiv/FU)	3,34E+00	3,09E-02	7,23E-02	4,72E-03	5,79E-01	MND	6,24E-02	MND	6,48E-01	MND	0,00E+00	MND	0,00E+00	4,44E-03	1,97E-04	1,53E-02	-8,47E-01	4,76E+00
POCP (kg NMVOC equiv/FU)	1,49E+00	9,45E-03	1,03E-02	1,45E-03	2,61E-01	MND	1,19E-02	MND	1,69E-01	MND	0,00E+00	MND	0,00E+00	1,36E-03	5,34E-05	4,26E-03	-2,49E-01	1,96E+00

ADP Elements (kg Sb equiv/FU)	2,69E-03	4,48E-06	4,01E-05	8,25E-07	2,06E-04	MND	9,36E-06	MND	2,80E-04	MND	0,00E+00	MND	0,00E+00	6,44E-07	3,95E-08	1,86E-06	8,30E-05	3,23E-03
ADP fossil fuels (MJ/FU)	3,97E+03	3,47E+01	4,58E+01	5,43E+00	6,45E+02	MND	2,36E+01	MND	4,89E+02	MND	0,00E+00	MND	0,00E+00	4,99E+00	5,80E-01	1,27E+01	-7,70E+02	5,24E+03
WDP (m^3 water eq deprived /FU)	1,06E+02	9,66E-02	1,07E+00	1,61E-02	2,46E+01	MND	6,96E+00	MND	1,20E+01	MND	0,00E+00	MND	0,00E+00	1,39E-02	5,33E-03	1,27E+01	-8,32E+00	1,64E+02

GWP total = total Global Warming Potential (Climate Change); GWP-luluc = Global Warming Potential (Climate Change) land use and land use change; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels; WDP = water use (Water (user) deprivation potential, deprivation-weighted water consumption)

RESOURCE USE

	Production			Construction process		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
PERE (MJ/FU, net calorific value)	4,04E+02	4,79E-01	1,35E+01	8,33E-02	4,37E+01	MND	1,80E+01	MND	3,00E+01	MND	0,00E+00	MND	0,00E+00	6,89E-02	5,95E-02	1,12E+00	-9,56E+01	5,12E+02
PERM (MJ/FU, net calorific value)	6,81E+00	0,00E+00	-1,71E+00	0,00E+00	1,28E-01	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,23E+00
PERT (MJ/FU, net calorific value)	4,11E+02	4,79E-01	1,18E+01	8,33E-02	4,39E+01	MND	1,80E+01	MND	3,00E+01	MND	0,00E+00	MND	0,00E+00	6,89E-02	5,95E-02	1,12E+00	-9,56E+01	5,17E+02

PENRE (MJ/FU, net calorific value)	4,95E+03	3,49E+01	5,72E+01	5,49E+00	8,49E+02	MND	2,88E+01	MND	5,52E+02	MND	0,00E+00	MND	0,00E+00	5,02E+00	6,11E-01	1,48E+01	-1,05E+03	6,50E+03
PENRM (MJ/FU, net calorific value)	1,15E+01	0,00E+00	-6,14E+00	0,00E+00	6,53E-01	MND	0,00E+00	MND	9,21E-01	MND	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	-8,17E-01	0,00E+00	6,08E+00
PENRT (MJ/FU, net calorific value)	4,97E+03	3,49E+01	5,11E+01	5,49E+00	8,50E+02	MND	2,88E+01	MND	5,53E+02	MND	0,00E+00	MND	0,00E+00	5,02E+00	6,11E-01	1,40E+01	-1,05E+03	6,52E+03
SM (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,01E-01	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,24E+01	1,01E-01
RSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW (m^3 water eq/FU)	3,44E+00	3,44E-03	3,10E-02	5,81E-04	6,61E-01	MND	2,13E-01	MND	3,22E-01	MND	0,00E+00	MND	0,00E+00	4,94E-04	1,65E-04	2,97E-01	-3,43E-01	4,97E+00

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 material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

WASTE CATEGORIES & OUTPUT FLOWS

	Production			Construction process stage		Use stage							End-of-life stage					
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
Hazardous waste disposed (kg/FU)	2,31E-01	9,09E-05	3,05E-04	1,44E-05	6,36E-02	MND	1,40E-03	MND	2,42E-03	MND	0,00E+00	MND	0,00E+00	1,31E-05	5,28E-07	1,82E-05	4,85E-02	2,99E-01
Non-hazardous waste disposed (kg/FU)	5,71E+01	1,66E+00	2,35E+00	2,44E-01	1,45E+01	MND	1,06E+00	MND	2,64E+02	MND	0,00E+00	MND	0,00E+00	2,39E-01	1,12E-03	1,59E+01	-1,38E+01	3,57E+02
Radioactive waste disposed (kg/FU)	1,00E-02	2,37E-04	3,03E-04	3,68E-05	1,39E-03	MND	6,57E-05	MND	2,18E-03	MND	0,00E+00	MND	0,00E+00	3,40E-05	5,49E-06	7,15E-05	-1,37E-03	1,43E-02
Components for re-use (kg/FU)	0,00E+00	0,00E+00	4,91E-02	0,00E+00	1,23E-03	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,03E-02
Materials for recycling (kg/FU)	0,00E+00	0,00E+00	9,78E-01	0,00E+00	5,45E-01	MND	0,00E+00	MND	5,72E+00	MND	0,00E+00	MND	0,00E+00	0,00E+00	1,51E+01	0,00E+00	0,00E+00	2,23E+01
Materials for energy recovery (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy (MJ/FU)	0,00E+00	0,00E+00	2,74E+00	0,00E+00	5,80E-01	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	MND	0,00E+00	0,00E+00	0,00E+00	2,04E+01	0,00E+00	2,38E+01

IMPACT CATEGORIES ADDITIONAL TO EN 15804

		Production			Construction process		Use stage							End-of-life stage					
		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling	Total excl module D
	*PM (disease incidence)*	1,78E-05	1,60E-07	2,33E-07	2,38E-08	4,23E-06	MND	2,72E-07	MND	3,33E-06	MND	0,00E+00	MND	0,00E+00	2,30E-08	7,78E-10	4,63E-08	-6,12E-06	2,62E-05
	*IRHH (kg U235 eq/FU)*	1,15E+01	1,52E-01	3,35E-01	2,38E-02	1,45E+00	MND	6,91E-02	MND	1,80E+00	MND	0,00E+00	MND	0,00E+00	2,18E-02	6,33E-03	6,02E-02	-1,26E+00	1,54E+01
	*ETF (CTUe/FU)*	9,93E+03	2,78E+01	7,05E+01	4,48E+00	2,01E+03	MND	3,56E+02	MND	2,63E+03	MND	0,00E+00	MND	0,00E+00	3,99E+00	2,75E-01	3,70E+02	-1,61E+03	1,54E+04
	*HTCE (CTUh/FU)*	3,40E-07	7,81E-10	3,95E-09	1,33E-10	2,51E-07	MND	4,07E-09	MND	2,91E-08	MND	0,00E+00	MND	0,00E+00	1,12E-10	9,75E-12	1,25E-09	-1,07E-07	6,30E-07
	*HTnCE (CTUh/FU)*	6,20E-06	3,03E-08	6,04E-08	4,82E-09	1,76E-06	MND	9,15E-08	MND	6,22E-07	MND	0,00E+00	MND	0,00E+00	4,35E-09	1,91E-10	1,03E-07	-1,51E-06	8,87E-06
	*Land Use Related impacts (dimensionless)*	8,72E+02	2,39E+01	1,58E+02	3,57E+00	1,77E+02	MND	1,16E+02	MND	2,77E+02	MND	0,00E+00	MND	0,00E+00	3,44E+00	3,74E-01	1,01E+01	-1,35E+02	1,64E+03

HTCE = Human Toxicity – cancer effects; HTnCE = Human Toxicity – non cancer effects; ETF = Ecotoxicity – freshwater; (potential comparative toxic unit)
PM = Particulate Matter (Potential incidence of disease due to PM emissions);
IRHH = Ionizing Radiation – human health effects (Potential Human exposure efficiency relative to U235);

	*Global Warming Potential*	*The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.* *It is split up in 4:* - *Global Warming Potential total (GWP-total) which is the sum of GWP-fossil, GWP-biogenic and GWP-luluc* - *Global Warming Potential fossil fuels (GWP-fossil) : The global warming potential related to greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc).* - *Global Warming Potential biogenic (GWP-biogenic) : The global warming potential related to carbon emissions to air (CO2, CO and CH4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.[1]* - *Global Warming Potential land use and land use change (GWP-luluc): The global warming potential related to carbon uptakes and emissions (CO2, CO and CH4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).*
	*Ozone Depletion*	*Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbonsor halons), Which break down when they reach the stratosphere and then catalytically destroy ozone molecules.*
	*Acidification potential*	*Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.*
	*Eutrophication potential*	*The potential to cause over-fertilization of water and soil, which can result in increased growth of biomass and following adverse effects.* *It is split up in 3:* - *Eutrophication potential – freshwater: The potential to cause over-fertilization of freshwater, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication potential – marine: The potential to cause over-fertilization of marine water, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication potential – terrestrial: The potential to cause over-fertilization of soil, which can result in increased growth of biomass and following adverse effects.*
	*Photochemical ozone creation*	*Chemical reactions brought about by the light energy of the sun creating photochemical smog. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.*
	*Abiotic depletion potential for non-fossil ressources*	*Consumption of non-renewable resources, thereby lowering their availability for future generations. Expressed in comparison to Antimonium (Sb).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Abiotic depletion potential for fossil ressources*	*Measure for the depletion of fossil fuels such as oil, natural gas, and coal. The stock of the fossil fuels is formed by the total amount of fossil fuels, expressed in Megajoules (MJ).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Ecotoxicity for aquatic fresh water*	*The impacts of chemical substances on ecosystems (freshwater).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Human toxicity (carcinogenic effects)*	*The impacts of chemical substances on human health via three parts of the environment: air, soil and water.*

[1] Carbon exchanges from native forests shall be modelled under GWP - luluc (including connected soil emissions, derived products or residues), while their CO2 uptake is excluded.

		The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.
	*Human toxicity (non-carcinogenic effects)*	*The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Particulate matter*	*Accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors (NOx, SOx, NH3)*
	*Resource depletion (water)*	*Accounts for water use related to local scarcity of water as freshwater is a scarce resource in some regions, while in others it is not.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Ionizing radiation - human health effects*	*This impact category deals mainly with the eventual impact on human health of low dose ionizing radiation of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*
	*Land use related impacts*	*The indicator is the "soil quality index" which is the result of an aggregation of following four aspects:* *- Biotic production* *- Erosion resistance* *- Mechanical filtration* *- Groundwater* *The aggregation is done based on a JRC model. The four aspects are quantified through the LANCA model for land use.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

DETAILS OF THE UNDERLYING SCENARIOS USED TO CALCULATE THE IMPACTS

A1 – RAW MATERIAL SUPPLY

This module takes into account the extraction and processing of all raw materials, mainly coated aluminium, glass, plastics and rubbers, and energy which occur upstream to the studied manufacturing process.

A2 – TRANSPORT TO THE MANUFACTURER

The raw materials are transported to the manufacturing site.

A3 – MANUFACTURING

This module takes into account the production process: addition of the thermal breaks to the profiles, frame production by assembling the various profiles via corner connections and fixing it via gluing and crimping, positioning and fixing of the gaskets and the integration of the fittings.

A4 – TRANSPORT TO THE BUILDING SITE

Fuel type and consumption of vehicle or vehicle type used for transport	Truck >32 ton 0,256 l diesel / km	Truck 16-32 ton 0,256 l diesel / km	Truck 7.5-16 ton 0,256 l diesel / km
Distance	100 (frame to supplier)	100 (frame: to construction site) 35 (frame: supplier to construction site) 30 (glass: production to construction site)	100 (frame:construction site) 35 (frame: supplier to construction site)
Capacity utilisation (including empty returns)	50%	50%	50%
Bulk density of transported products	Ecoinvent	Ecoinvent	Ecoinvent
Volume capacity utilisation factor	Ecoinvent	Ecoinvent	Ecoinvent

The glass part of the window is directly transported from the external manufacturer of glass to the construction site over a distance of 30 km with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U'). The transportation of the other parts is based on the default scenario's provided by the B-PCR. Aluminium windows are categorized as 'Finishing products: cabinet work' in table 5 of the B-PCR. The following transport steps apply:

- 90% directly to the construction site over 100 km
  - 50% of these 90% is transported with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U')
  - 45% of these 90% is transported with a 7.5-16 ton lorry (ecoinvent record: 'Transport, freight, lorry 7.5-16 metric ton, EURO5 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO5 | Cut-off, U')
  - 5% of these 90% is transported with a 3.5-7.5 ton lorry (ecoinvent record: 'Transport, freight, lorry 3.5-7.5 metric ton, EURO5 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO5 | Cut-off, U')
- 10% is first transported to a supplier over 100 km with a >32 ton lorry (ecoinvent record: 'Transport, freight, lorry >32 metric ton, EURO5 {RER}| transport, freight, lorry >32 metric ton, EURO5 | Cut-off, U')
  - 40% of these 10% is transported over 35 km from supplier to construction site with a 16-32 ton lorry (ecoinvent record: 'Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, U')
  - 50% of these 10% is transported over 35 km from supplier to construction site with a 7.5-16 ton lorry (ecoinvent record: 'Transport, freight, lorry 7.5-16 metric ton, EURO5 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO5 | Cut-off, U')
  - 10% of these 10% is transported over 35 km from supplier to construction site with a 3.5-7.5 ton lorry (ecoinvent record: 'Transport, freight, lorry 3.5-7.5 metric ton, EURO5 {RER}| transport, freight, lorry 3.5-7.5 metric ton, EURO5 | Cut-off, U')

A5 – INSTALLATION IN THE BUILDING

At the construction site, the aluminium profiles are installed in the building and the glazing is fixed inside the frame. Also material losses have been taken into account. A default value of 5% is assumed for the glazing, in line with MMG (Servaes R. et al., 2013). For the profiles 2,5% losses are assumed, as 5% is an unrealistic percentage based on the current installation and transport losses of Reynaers Aluminium.

Parts of the installation	quantity	Description
Processes necessary for the installation of the product	*None*	/
Fixation materials	*9 Steel fixing lugs* *18 Steel nails* *18 Nylon nailplus*	*Window is mechanically fixated in the building envelope*
Jointing materials	*3 m PE foam tape* *412 ml PU foam or Rockwool* *0,082 kg Silicone (for 3 m)*	*Insulation and silicone used to seal openings between window and cavity wall*
Treatments	*0,001 kg Silicone spray*	*Lubricant*
Material losses	*0,953 kg glass* *0,329 kg frame (metal+residuals)*	*Material lost during installation (5% glass, 2,5% frame)*
Packaging	*None*	*Final product is not packed*
Others	9,31E-04 kg VOC emissions	From silicone spray

Ancillary materials for installation (specified by material);	PE foam tape (3 m) Silicone 0,082 kg (3m)	Steel nails (18 pieces) Nylon nailplugs (18 pieces)	Steel fixing lugs (9 pieces)
Water use	Not applicable		
Other resource use	5% glass losses	2,5% metal losses	2,5% residual losses

Quantitative description of energy type (regional mix) and consumption during the installation process	Not applicable		
Waste materials on the building site before waste processing, generated by the product's installation (specified by type)	0,953 kg glass 5% glass waste	0,247 kg metal 2,5% metal waste	0,0823 kg combustible residuals 2,5% residual losses
Output materials (specified by type) as result of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	30% recycled 70% landfilled 0% incinerated	95% recycled 5% landfilled 0% incinerated	0% recycled 5% landfilled 95% incinerated
Direct emissions to ambient air, soil and water	9,31E-04 kg VOC emissions to air from silicone spray		
Distance	Not applicable		

B – USE STAGE (EXCLUDING POTENTIAL SAVINGS)

B1: not declared

B2: In normal use, aluminium building products are not altered or corroded over time. Regular cleaning (once a year with 0,2 liter of water and 0,1 dl of detergent) of the product is taken into account (as defined in the draft PCR for flat glass products prEN 17074) and 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.

B3: not declared

B4: During the product RSL of 60 years, one replacement of the glass is considered. No replacement of the window frame is necessary.

B5: not declared

B6: Since no operational energy use is necessary during the RSL of the product, no environmental impacts occur during this module.

In case of fire, aluminium windows are a non-combustible construction material (European Fire Class A1) in accordance to EN 13501 as well as Directive 96/603/EC and therefore do not make any contribution to fire.

C: END OF LIFE

The vertical draft PCR for windows and doors prEN17213 provides default scenarios for end-of-life processing: 95% of metal waste is recycled and 5% is landfilled, 30% of glass waste is recycled and 70% is landfilled, and 95% of residual waste (mainly plastics) is incinerated and 5% is landfilled. The B-PCR provides default scenarios for transport of waste which are:

- 30 km with a 16-32 ton EURO 5 lorry from demolition site to sorting plant/crusher/collection point;
- 50 km with a 16-32 ton EURO 5 lorry from sorting plant/crusher/collection point to landfill.
- 100 km with a 16-32 ton EURO 5 lorry from sorting facility to incineration plant/energy recovery

Module C2 – Transport to waste processing					
Type of vehicle (truck/boat/etc.)	Fuel consumption (litres/km)	Distance (km)	Capacity utilisation (%)	Density of products (kg/m^3)	Assumptions
Truck 16-32 ton	0,256 l diesel/km	30	50%	ecoinvent scenario	ecoinvent scenario
Truck 16-32 ton	0,256 l diesel/km	50	50%	ecoinvent scenario	ecoinvent scenario
Truck 16-32 ton	0,256 l diesel/km	100	50%	ecoinvent scenario	ecoinvent scenario

End-of-life modules – C3 and C4		
Parameter	Unit	Value
Wastes collected separately	kg	0,000
Wastes collected as mixed construction waste	kg	32,259
Waste for re-use	kg	0,000
Waste for recycling	kg	15,088
Waste for energy recovery	kg	3,168
Waste for final disposal	kg	14,003

D – BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES

In module D, following waste streams are considered after their end-of-waste: the main metal (of which 95% is recycled), glass (of which 30% is recycled) and residual waste (which is 95% incinerated), the replacement of glass (of which 30% is recycled) after 30 years in B4, as well as the 5% glass losses (of which 30% is recycled), 2,5% metal losses (of which 95% is recycled) and 2,5% residual losses (which is 95% incinerated) during A5.

The loads beyond the system boundaries include the treatment of aluminium scrap to prepare it for recycling at the remelter and the sorting of glass to prepare it for remelting. The benefits include the avoided production of virgin material (wrought aluminium, lime and silica sand) and recuperated energy during incineration of combustible residual waste.

Quantitative description of the loads beyond the system boundaries	Treatment of 5,21 kg aluminium scrap to prepare it for recycling at the remelter
	Sorting of 19 kg of glass waste to prepare it for remelting
Quantitative description of the benefits beyond the system boundaries	Avoided production of 4,40 kg primary aluminium
	Avoided production of 7,61 kg of lime
	Avoided production of 11,40 kg of silica sand
	Avoided production of 14,7 MJ of heat using natural gas
	Avoided production of 7,35 MJ of Belgian electricity mix

ADDITIONAL INFORMATION ON RELEASE OF DANGEROUS SUBSTANCES TO INDOOR AIR, SOIL AND WATER DURING THE USE STAGE

INDOOR AIR

No emissions to indoor air are expected (CEN TC 16561).

SOIL AND WATER

No emissions to soil and water are expected (CEN TC 351).

DEMONSTRATION OF VERIFICATION

EN 15804+A1 serves as the core PCR
Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010 Internal ☐ External ☒
Third party verifier: Evert Vermaut (Vincotte) Jan Olieslagerslaan 35 1800 Vilvoorde, Belgium evermaut@vincotte.be

APPLICATION UNIT

The Reynaers Masterline 8 window is used as an element of the building envelop. The window system is typically an opening in the wall of the building fitted with glass in a frame to admit light or air and allow people to see outside. The ratio to the declared unit of 1 m^2 is 1.

ADDITIONAL INFORMATION ON REVERSIBILITY

A qualitative assessment of the reversibility is given (based on BAMB – buildings as material banks.)

Reversibility	*Reversible fixing with anchors and screws*
Simplicity of disassembly	*Simple – Use of dismantling tools required*
Speed of disassembly	*Speedy disassembly*
Ease of handling (size and weight)	*Depending on weight, dimensions and location* - *can be handled manually, but size and/or weight may require more than one worker* - *handling requires mechnical devices (eg vacuum glass handling equipment)*
Robustness of material (material resistance to disassembly)	*Disassembly is possible but should be done carefully in order not to generate any damage (mainly to the coating)*

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General information

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EPD program Program operator Publisher of this EPD	**B-EPD** **FOD Volksgezondheid** Victor Hortaplein 40 bus 10 1060 Brussel België www.environmentalproductdeclarations.eu
Contact programma operator	epd@environment.belgium.be
Based on following PCR documents	EN 15804+A2:2019 NBN/DTD B 08-001 and its complement Insert others
PCR review conducted by	Federal Public Service of Health and Environment & PCR Review committee
Author(s) of the LCA and EPD	Lisa Damen (VITO), Arthur De Jaegher (VITO) epd@vito.be / arthur.dejaegher@vito.be
Identification of the project report	Life cycle assessment of Reynaers Aluminium window Masterline 8 standard (VITO, 2020)
Verification	External independent verification of the declaration and data according to EN ISO 14025 and relevant PCR documents
Name of the third party verifier Date of verification	Evert Vermaut (Vinçotte) 18.12.2020
www.b-epd.be	**www.environmentalproductdeclarations.eu**

Comparing EPDs is not possible unless they are conform to the same PCR and taking into account the building context.
The program operator cannot be held responsible for the information supplied by the owner of the EPD nor LCA practitioner.

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