CREATING BRIGHT FUTURES

Environmental Product Declaration

C67K - C77K Turn & tilt windows

BASED ON
PCR 2019:14 v.1.11 and
C-PCR-007 (EN 17213:2020)
v.2020-04-09

PROGRAMME
The International EPD System
www.environdec.com

In accordance with
ISO 14025 and
EN 15804-2012+A2:2019

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EPD®

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

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Programme Information

EPD REFERENCES

EPD OWNER: AluK Italy Via Monte Amiata 3A 37057 S.Giovanni Lupatoto, Verona Italia

PROGRAM OPERATOR: EPD INTERNATIONAL AB, box 21060, Se-100 31 Stockholm, Sweden; info@environdec.com

INDEPENDENT VERIFICATION

The declaration has been developed referring to the International EPD® System, following the General Programme Instructions v.3.01. Further information and the document itself are available at: www.environdec.com. EPD document valid within the following geographical area: Europe according to sales market conditions

ISO standard ISO 21930, CEN standard EN 15804 and EN 17213 served as core PCR
PCR 2019:14 version 1.11 "Construction Products"
c-PCR-007 windows and doors (EN 17213) 2020-04-09
PCR 2019:14 review was conducted by: The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepciòn, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.

Independent verification of the declaration and data, according to EN ISO 14025:2018

☐ EPD process certification (Internal) ☑ EPD verification (External)

Third party verifier: Ugo Pretato, Studio Fieschi & Soci S.r.l. - Recognized Individual Verifier

Approved by: The Technical Committee of the International EPD® System

Procedure for follow-up during EPD validity involves third party verifier: ☐ YES ☑ NO

Environmental declarations published within the same product category, but from different programmes may not be comparable. In particular, EPDs of construction products may not be comparable if they do not comply with EN 15804. EPD owner has the sole ownership, liability and responsibility of the EPD.

CONTACTS

For additional information relative to the activities of AluK Italy or in regards to this environmental declaration, please contact: pietro.cacciatori@aluk.com

Technical support to AluK Italy was provided by Life Cycle Engineering, Italy (info@studiolce.it, www.lcengineering.eu).

Leading The Way in **Aluminium Constructions**

The Company **in Italy**

150+
collaborators

27.200 m²
covered of which 940 m² for the Design Studio of Verona and Milan

50.000+
windows produced per year

41.2 M€
turnover

3.630+
Tons of aluminum distributed per year

ALUK®

AluK is a **global leader** in the engineering, distribution and design of **aluminium windows, doors, and facade solutions**.

Founded over **70 years ago**, AluK has become a major player in the aluminium construction systems sector, and **currently runs operations in 10 countries**. We have served over **2,600 clients** in more than 50 countries across the globe, and have joined forces with over **800 collaborators**.

Although we have a global reach, we retain the “home-grown” local touch and proudly remain a family-owned and family-run business. We are driven by the spirit of entrepreneurship, with solid European roots. Our head office is based in **Luxembourg**.

Our goal is to achieve **sustainable growth** through ongoing product innovation, technical expertise, and expansion into new markets.

We carry out **extensive research** into each of our markets and develop aluminium construction systems which are tailor-made specifically for its requirements. At the same time, we not only meet, but exceed, the required demands and regulations.

This focused, customised approach ensures a stronger and more successful relationship with our clients. Our expert services and tailor-made approach enables us to optimally support the needs of each individual market.

C67K - C77K
Turn and tilt window

› C67K

› C77K

THE PRODUCT

The products included in this EPD are **aluminium windows assembled from extruded coated aluminium profiles** with thermal break manufactured by AluK.

The series has been designed to allow the construction of high quality windows with important weights and dimensions with a particular attention to the air permeability, watertightness, thermal, acoustic and burglary resistant performances. The thermal strips and the gaskets have been designed and studied with particular attention to innovative materials in order to raise the thermal performances at the maximum level.

C67K The outer frame has a depth equal to 67 mm whereas the movable sash has a depth of 77 mm, making the system suitable for housing of high thermo-acoustic insulation and safety glasses, with thickness equal to 24-52 mm for the outer frame and 24-62 mm for the sash.

C77K The outer frame has a depth equal to 77 mm whereas the movable sash has a depth of 87 mm, making the system suitable for housing of high thermo-acoustic insulation and safety glasses, with thickness up to 62 mm for the outer frame and 72 mm for the sash.

The windows are used as enclosures for openings in building facades, although they can also be installed indoors.

TECHNICAL DESCRIPTION

The range of the outer frames and the adjusting blocks allows to fit the seires in a wide range of wall connections.

MAIN POSSIBLE FEATURES

- Frontal hinges for Turn&Tilt.
- Concealed hinges with 110° openings.
- Concealed hinges with 180° openings.
- "TBT" mechanism.
- Quick installation of telescopic rods and closing devices.
- Quick installation of polyamide rods for single sash and double sash openings
- New range of handles and built-in mechanism.
- Anti-burglary devices.

Not all the features are related to this study.

The central gasket can be offered in two variants: a single expanded gasket or a combination between a "standard" EPDM gasket and an additional expanded gasket. Both solutions allow to get the same Uf values of the sections. A single gasket is used for the external glazing and for the overlapping sections of the sashes.

		C67K	C77K
Frame thickness (mm)		67	77
Thermal break (mm)		24	24
IGU		triple glazing	triple glazing
Thermal transmittance, frame (W/m²K)	EN 10077-2	1,53	1,38
Air permeability	EN 12207	4	4
Watertightness	EN 12208	E1500	E1500
Resistance to wind load	EN 12210	C5	C5

› STUDIED PRODUCTS DECLARED UNIT AND CONVERSION FACTORS

MODEL	UNIT	C67K	C77K
Type	-	Turn & tilt	Turn & tilt
Measures	m	1,23X1,48	1,23X1,48
Declared unit	m^2	1	1
Conversion factor to 1 window	m^2	1,82	1,82
Conversion factor to 1 kg	m^2/kg	0,0289	0,0283
Transparent area	%	72,2	72,2

The technical data of the declared products as well as their composition are shown in the following tables. None of the declared window systems contain substances included in the list of Substances of Very High Concern with a concentration of more than 0.1% by weight. The product contains no biogenic carbon, post-consumer and renewable matter.

› CONTENT DECLARATION

1 m²	UNIT	C67K	C77K
Aluminium 6060 profiles	kg	**6,8**	**6,9**
PA 6.6 + GF	kg	**1,2**	**1,6**
Coating powder	kg	**0,4**	**0,5**
IGU	kg	**23,2**	**23,2**
Flat glass	kg	22,0	22,0
Sealant	kg	0,7	0,7
Gas	kg	0,08	0,08
PVB	kg	0,3	0,3
Gasket and fittings	kg	**3,0**	**3,2**
Zinc alloy	kg	0,6	0,6
EPDM	kg	1,0	1,1
Aluminium	kg	0,6	0,6
Stainless steel	kg	0,005	0,05
Steel	kg	0,5	0,5
PA 6	kg	0,09	0,1
POM	kg	0,003	0,003
PP	kg	0,02	0
PE	kg	0,21	0,21
Total	kg	**34,6**	**35,3**
Packaging: Kraft paper	kg	**0,0051**	**0,0051**

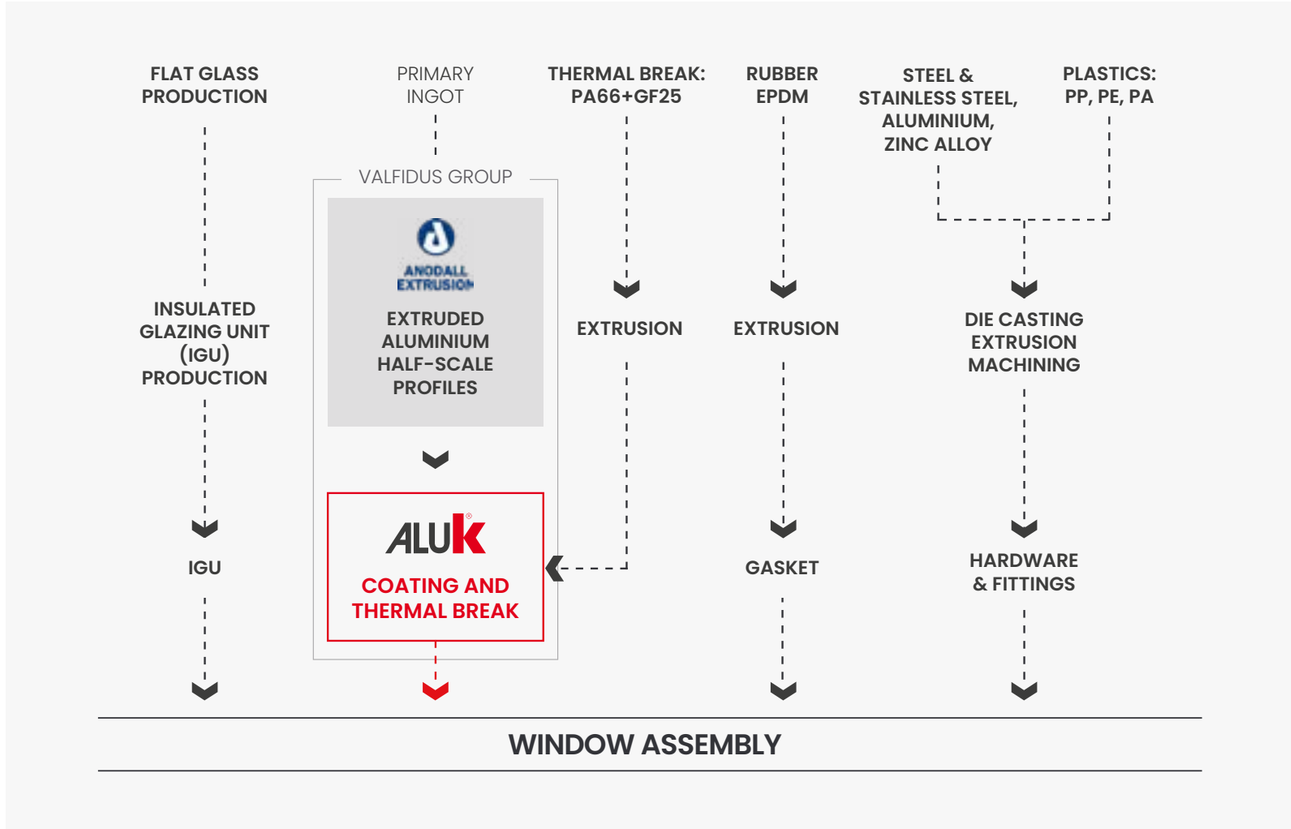
PACKAGING

Coated profile are generally sent directly to final assembler and basically are separated from each other by little cardboard or wood pieces. These packaging materials are not included in the scope of this EPD as under 1% cut-off.

RECYCLING AND DISPOSAL

In module D are reported only the net benefits of recycling.
In this EPD, all the components EoL scenarios have been setup according to default values specified in EN 17213.

Production process



SECTIONS The extruded aluminium sections are made from homogenised billets, EN AW-6060 alloy, with limited composition tolerances, suitable for anodising or painting. All extruded aluminium sections are supplied at physical state T6 (EN 12020-2).

THERMAL BREAK The thermal break is obtained by inserting some special reinforced polyamide bars, mechanically hooked to aluminium knurled extruded sections.

GASKETS Both static and dynamic gaskets are realized EPDM (ethylene-propylene elastomer).

ACCESSORIES Accessories of the highest quality are expressly designed by AluK itself to grant the utmost reliability and safety.

GLAZING The system permits applications of glazing or panes with thickness from 24 to 72 mm on single, double or triple insulated glazing units. Glass panes are blocked using aluminium stop-glazing and inner and outer EPDM gaskets.

Scope and type of EPD

	PRODUCTION STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				RESOURCE RECOVERY
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	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
	✓	✓	✓	✓	ND	ND	ND	ND	ND	ND	ND	ND	✓	✓	✓	✓	✓
Geography	GLO	GLO	IT	IT	-	-	-	-	-	-	-	-	IT	IT	IT	IT	EU
Specific Data Used	>90%	>90%	>90%	>90%	-	-	-	-	-	-	-	-	-	-	-	-	-

✓ = Module assessed; **ND** = Module not declared; EU = European Union; IT = Italy ; GLO = World

THE APPROACH USED IN THIS EPD IS “CRADLE-TO-GATE WITH OPTIONS”

TYPE OF EPD

Product specific EPD

PLANT LOCATION

AluK Italy Via Monte Amiata 3A 37057 S.Giovanni Lupatoto, Verona Italia

SOFTWARE

SimaPro ver. 9.5 (www.pre.nl)

DATABASE

Ecoinvent 3.9.1

REFERENCE YEAR

The reference year used for primary data collection and processing is 2021-2022 fiscal year

FUNCTIONAL UNIT

The declaration refers to the declared unit of 1 m^2 of aluminium window

Environmental results

C67K

ENVIRONMENTAL IMPACTS		UPSTREAM + CORE	DOWNSTREAM					
		A1-3	A4	C1	C2	C3	C4	D
GWP, t	kg CO_2 eq	**1,77E+02**	8,09E-01	0,00E+00	1,08E+00	2,96E-02	4,47E-02	-2,38E+01
GWP, f	kg CO_2 eq	**1,75E+02**	8,09E-01	0,00E+00	1,08E+00	2,94E-02	4,47E-02	-2,37E+01
GWP, b	kg CO_2 eq	**6,97E-01**	5,92E-05	0,00E+00	7,89E-05	1,20E-04	1,35E-05	-7,04E-02
GWP, luluc	kg CO_2 eq	**9,45E-01**	1,56E-05	0,00E+00	2,08E-05	7,25E-05	2,78E-06	-2,42E-02
GWP, GHG[1]	kg CO_2 eq	**1,24E+02**	7,85E-01	0,00E+00	1,05E+00	2,88E-02	4,34E-02	-2,21E+01
ODP	kg CFC-11 eq	**5,33E-06**	1,72E-08	0,00E+00	2,29E-08	2,65E-10	6,93E-10	-1,13E-06
AP	mol H+ eq	**9,44E-01**	3,44E-03	0,00E+00	4,59E-03	1,40E-04	4,10E-04	-1,49E-01
EPf	kg P eq	**4,32E-03**	6,24E-07	0,00E+00	8,32E-07	1,86E-06	5,19E-08	-7,22E-04
EPm	kg N eq	**1,59E-01**	1,53E-03	0,00E+00	2,04E-03	2,47E-05	1,92E-04	-2,37E-02
EPt	mol N eq	**1,78E+00**	1,65E-02	0,00E+00	2,20E-02	2,74E-04	2,09E-03	-2,72E-01
POCP	kg NMVOC eq	**5,27E-01**	5,31E-03	0,00E+00	7,08E-03	8,36E-05	6,16E-04	-8,54E-02
ADPe*	kg Sb eq	**6,39E-04**	2,73E-08	0,00E+00	3,64E-08	1,10E-09	1,82E-09	-1,88E-05
ADPf*	MJ	**2,85E+03**	1,04E+01	0,00E+00	1,38E+01	5,81E-01	5,65E-01	-4,26E+02
WDP*	m^3 depriv.	**1,57E+02**	9,72E-03	0,00E+00	1,30E-02	5,70E-03	7,43E-04	-5,22E+01

C77K

ENVIRONMENTAL IMPACTS		UPSTREAM + CORE	DOWNSTREAM					
		A1-3	A4	C1	C2	C3	C4	D
GWP, t	kg CO_2 eq	**1,84E+02**	8,24E-01	0,00E+00	1,10E+00	3,01E-02	4,48E-02	-2,42E+01
GWP, f	kg CO_2 eq	**1,82E+02**	8,24E-01	0,00E+00	1,10E+00	2,99E-02	4,47E-02	-2,41E+01
GWP, b	kg CO_2 eq	**7,03E-01**	6,03E-05	0,00E+00	8,05E-05	1,21E-04	1,35E-05	-7,06E-02
GWP, luluc	kg CO_2 eq	**1,01E+00**	1,59E-05	0,00E+00	2,12E-05	7,38E-05	2,78E-06	-2,46E-02
GWP, GHG[1]	kg CO_2 eq	**1,30E+02**	8,01E-01	0,00E+00	1,07E+00	2,93E-02	4,35E-02	-2,25E+01
ODP	kg CFC-11 eq	**5,54E-06**	1,75E-08	0,00E+00	2,34E-08	2,68E-10	6,94E-10	-1,16E-06
AP	mol H+ eq	**9,76E-01**	3,51E-03	0,00E+00	4,68E-03	1,43E-04	4,10E-04	-1,51E-01
EPf	kg P eq	**4,48E-03**	6,36E-07	0,00E+00	8,49E-07	1,88E-06	5,20E-08	-7,33E-04
EPm	kg N eq	**1,65E-01**	1,56E-03	0,00E+00	2,08E-03	2,51E-05	1,92E-04	-2,40E-02
EPt	mol N eq	**1,84E+00**	1,68E-02	0,00E+00	2,24E-02	2,80E-04	2,09E-03	-2,75E-01
POCP	kg NMVOC eq	**5,47E-01**	5,41E-03	0,00E+00	7,22E-03	8,52E-05	6,17E-04	-8,67E-02
ADPe*	kg Sb eq	**6,82E-04**	2,78E-08	0,00E+00	3,72E-08	1,12E-09	1,82E-09	-1,88E-05
ADPf*	MJ	**2,98E+03**	1,06E+01	0,00E+00	1,41E+01	5,90E-01	5,66E-01	-4,37E+02
WDP*	m^3 depriv.	**1,62E+02**	9,91E-03	0,00E+00	1,32E-02	5,79E-03	7,45E-04	-5,35E+01

Additional environmental impact indicators are computed in the LCA report but not reported in the EPD.
*The results of this enviromental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.
[1] Methane characterization factors for this indicator is based on PCR 2019:14 v1.11

- **GWP - total** Global Warming Potential Total
- **GWP - fossil** Global Warming Potential Fossil fuels
- **GWP - biogenic** Global Warming Potential Biogenic
- **GWP - luluc** Global Warming Potential Land use and lnd use change
- **GWP - GHG**[1] Global Warming Potential Irreversible
- **ODP** Ozone Depletion Potential
- **AP** Acidification Potential
- **EP - freshwater** Eutrophication Potential Aquatic freshwawter
- **EP - marine** Eutrophication Potential Aquatic marine
- **EP - terrestrials** Eutrophication Potential Terrestrial
- **POCP** Photochemical Ozone Creation Potential
- **ADP - minerals&metals** Abiotic Depletion Potential - Non fossil resources (elements)
- **ADP - fossil** Abiotic Depletion Potential - Fossil resources
- **WDP** Water Deprivation Potential

Environmental results

C67K

RESOURCE USE		UPSTREAM + CORE	DOWNSTREAM					
		A1-3	A4	C1	C2	C3	C4	D
PERE	MJ	**3,36E+02**	2,78E-02	0,00E+00	3,70E-02	7,63E-02	1,55E-02	-3,29E+01
PERM	MJ	**0,00E+00**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	**3,36E+02**	2,78E-02	0,00E+00	3,70E-02	7,63E-02	1,55E-02	-3,29E+01
PENRE	MJ	**2,73E+03**	1,07E+01	0,00E+00	1,42E+01	5,88E-01	5,81E-01	-4,29E+02
PENRM	MJ	**1,41E+02**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	**2,87E+03**	1,07E+01	0,00E+00	1,42E+01	5,88E-01	5,81E-01	-4,29E+02
SM	kg	**0,00E+00**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,60E-01
RSF	MJ	**3,93E-11**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NSRF	MJ	**4,61E-10**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	**7,69E+00**	4,42E-04	0,00E+00	5,89E-04	3,09E-04	3,26E-05	-1,39E+00

C77K

RESOURCE USE		UPSTREAM + CORE	DOWNSTREAM					
		A1-3	A4	C1	C2	C3	C4	D
PERE	MJ	**3,46E+02**	2,83E-02	0,00E+00	3,78E-02	7,73E-02	1,56E-02	-3,35E+01
PERM	MJ	**0,00E+00**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	**3,46E+02**	2,83E-02	0,00E+00	3,78E-02	7,73E-02	1,56E-02	-3,35E+01
PENRE	MJ	**2,83E+03**	1,09E+01	0,00E+00	1,45E+01	5,97E-01	5,82E-01	-4,40E+02
PENRM	MJ	**1,63E+02**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	**3,00E+03**	1,09E+01	0,00E+00	1,45E+01	5,97E-01	5,82E-01	-4,40E+02
SM	kg	**0,00E+00**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,86E-01
RSF	MJ	**3,93E-11**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NSRF	MJ	**4,61E-10**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	**7,92E+00**	4,50E-04	0,00E+00	6,01E-04	3,13E-04	3,26E-05	-1,43E+00

- **PERE** Primary Renewable energy (carrier)
- **PERM** Primary Renewable energy (feedstock)
- **PERT** Primary Renewable energy (total)
- **PENRE** Primary Non-renewable energy (carrier)
- **PENRM** Primary Non-renewable energy (feedstock)
- **PENRT** Primary Non-renewable energy (total)
- **SM** Use of secondary materials
- **RSF** Use of renewable secondary fuels
- **NSRF** Use of non-renewable secondary fuels
- **FW** Use of Net Fresh Water

Environmental results

C67K

WASTE PRODUCTION		UPSTREAM + CORE	DOWNSTREAM					
		A1-3	A4	C1	C2	C3	C4	D
HWD*	kg	**7,06E-03**	6,98E-05	0,00E+00	9,30E-05	6,66E-07	3,82E-06	1,97E-01
NHWD*	kg	**2,07E+01**	5,15E-04	0,00E+00	6,87E-04	1,03E-03	1,68E+01	-2,88E+00
RWD*	kg	**3,79E-03**	9,06E-07	0,00E+00	1,21E-06	2,24E-06	4,45E-08	-4,36E-04

C77K

WASTE PRODUCTION		UPSTREAM + CORE	DOWNSTREAM					
		A1-3	A4	C1	C2	C3	C4	D
HWD*	kg	**7,54E-03**	7,11E-05	0,00E+00	9,49E-05	6,77E-07	3,83E-06	2,03E-01
NHWD*	kg	**2,17E+01**	5,25E-04	0,00E+00	7,01E-04	1,05E-03	1,68E+01	-2,93E+00
RWD*	kg	**4,23E-03**	9,24E-07	0,00E+00	1,23E-06	2,26E-06	4,46E-08	-4,43E-04

C67K

OUTPUT FLOWS		UPSTREAM + CORE	DOWNSTREAM					
		A1-3	A4	C1	C2	C3	C4	D
CRU	kg	**2,71E+00**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	**2,25E+00**	0,00E+00	0,00E+00	0,00E+00	1,46E+01	0,00E+00	2,22E-02
MER	kg	**0,00E+00**	0,00E+00	0,00E+00	0,00E+00	3,12E+00	0,00E+00	0,00E+00
EE	MJ	**0,00E+00**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

C77K

OUTPUT FLOWS		UPSTREAM + CORE	DOWNSTREAM					
		A1-3	A4	C1	C2	C3	C4	D
CRU	kg	**2,81E+00**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	**2,33E+00**	0,00E+00	0,00E+00	0,00E+00	1,49E+01	0,00E+00	2,28E-02
MER	kg	**0,00E+00**	0,00E+00	0,00E+00	0,00E+00	3,28E+00	0,00E+00	0,00E+00
EE	MJ	**0,00E+00**	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

*The results of this enviromental impact indicator are based on EDIP 2003 method.

- **HWD** Hazardous Waste Disposed
- **NHWD** Non-Hazardous Waste Disposed
- **RWD** Radioactive Waste Disposed

- **CRU** Components For Re-Use
- **MFR** Material For Recycling
- **MER** Materials For Energy Recovery
- **EE** Exported Energy

LCA Methodology

Calculation rules

UPSTREAM

A1
Raw material supply

CORE

A2
Transport

A3
Manufacturing

DOWNSTREAM

A4
Transport

C1
De-construction

C2
Transport

C3
Waste processing

C4
Disposal

D
Reuse-Recovery-Recycling potential

This EPD provides information on the production stage of the aluminium profiles (raw material supply, transport to plants and manufacturing), IGU, fittings and gaskets and their end-of-life.

Recycling potential of aluminium and others materials with burdens saving due to use in a second product systems is also reported.

The information is presented in a modular way separated in the following stages.

The environmental burden of the product was calculated based on EN 15804:2012+A2:2019, PCR 2019:14 v1.11 , c-PCR-007 and EN 17213. **This declaration is a cradle to gate with options EPD type**, based on the application of Life Cycle Assessment (LCA) methodology. In the whole LCA model, infrastructures and production equipments are not taken into account. Allocations are done on mass basis.

The coating of profiles at factory level is modelled using AluK Italy plant-specific data for fiscal year 2021-2022.

Custom LCA questionnaires were used to gather in-depth information on all aspects of the production system (e.g., content and specifications of raw materials, pretreatment, process efficiencies, air and water emissions, waste management) in order to provide a complete picture of the system's environmental load from raw material procurement (A1) to Transport (A2), Manufacturing (A3). Given that there is virtually no maintenance, use phase (B1:B7) was not considered according to EN:15804 and PCR 2019:14 v1.11, while transport to final destination (A4) and end of life (C1-C2-C3-C4-D) were considered.

Therefore, in nominal installation and operating conditions, no emissions to air nor to water shall occur.

According to ISO 14040 and 14044, allocation is avoided whenever possible by subdividing the system into subsystems. When allocation cannot be avoided, physical properties are used to guide flow analysis. Following a sensitivity analysis among economic and mass allocation, the variation between the results was found to be minimal and given the high uncertainty related to the market prices, mass allocation has been performed in Anodall extrusion process. Which means that extruded aluminium profiles and by-products for remelting have the same environmental impacts.

Data quality has been assessed and validated during the data collection process.

According to EN:15804 the cut-off criterion applied for mass and energy flows is 1%.

The energy sources behind the electricity grid used in manufacturing is the italian residual mix 0,457 kg CO2 eq./kWh (AIB report May 2022) to which LCE adds emissions related to network losses and transformation.

Calculation rules

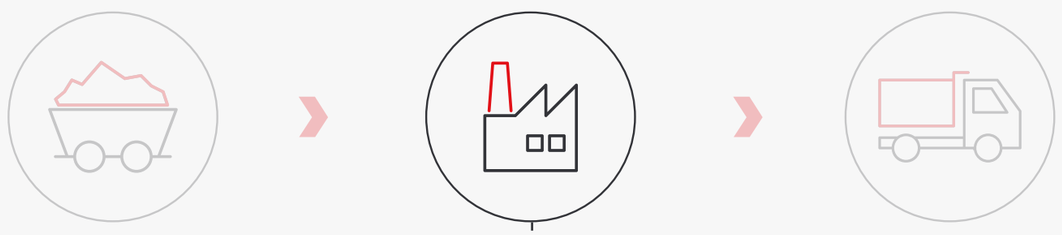
A1 RAW MATERIAL SUPPLY

- Production and mining of raw materials
- Extruded aluminium profile
- Generation of electricity from national energy mix
- Production of process fuel

A1–3 - CRADLE TO GATE

The aggregation of the modules A1, A2 and A3 is allowed by EN 15804.
This rule is applied in this EPD and denoted by A1-3.
This module represents the manufacture of aluminium profiles (including extraction and processing of raw materials and the transport to production sites), the production of the rest of the components of the windows (IGU, fittings and gaskets), the transport of these components and the windows assembley.
Final profile sizing for installation is not taken into account due to high variability related to the cutting process itself.

Calculation rules



A2 TRANSPORTATION

- Raw materials transportation from production or collection facilities to production plant
- Internal transportation

A3 MANUFACTURING

- Production phases as listed above
- Utilities and ancillaries
- Auxiliary raw materials
- Waste generation and treatment

Calculation rules

A4 TRANSPORT – DISTRIBUTION

- Transport to the costumers, a distance of 150 km has been assumed as standard scenario

A4 MODULE PARAMETERS

- Transport by road* Lorry, 16-32 t max payload
- Diesel consumption (l/km) 0.265
- Distance (km) 150
- Volume capacity utilization 100%
- Mass capacity utilization 60%

**Technology mix, Euro 3, 4, 5, 6 from ACI dataset 2021*

C1 DE-CONSTRUCTION DEMOLITION

- The contribution of dismantling operations for windows are considered negligible on impact categories.

C2 TRANSPORT TO WASTE PROCESSING

- A distance of 200 km has been assumed for the transport to sorting dealers (same module parameters as A4)

C3 WASTE PROCESSING

- A specific waste processing scenario has been set up in order to take into account different energy consumptions related to metal, glass and plastic scrap facilities.

C4 DISPOSAL

- Waste to disposal and recovery rates for all components are based on EN 17213 default scenarios.

D REUSE - RECOVERY - RECYCLING POTENTIAL

- For aluminium windows, module D report the environmental burden of recycled aluminium,metals and glass scrap generated sent to recycling plus the amount of energy recovery related to plastic energy valorization. the avoided aluminium production is referred to an average aluminium ingot with 85% recycled content.

C4 and D MODULES PARAMETERS

- Recovery rate for metals (recycling) 95%
- Recovery rate for glass (recycling)30%
- Recovery rate for plastics (energy valorization) 95%
- Metals and plastics to landfill 5%
- Glass to landfill 70%
- Efficiency for materials recycling 90%
- Efficiency for energy valorization 60%

Additional information

The systems provide a contribution to the sustainable building design from an energy standpoint and environmental resources involved in the process of realization.

Particular attention, given the tightness of the system, will be put to the thermo-hygrometric control of the indoor climate, especially the air changes, to avoid humidity increases that could generate reductions of occupants comfort and condensations or mold on the internal surfaces.

The final product will have to respect the provisions of EU Construction Products Regulation (no 305/2011), with CE-marking apposed, as attestation of conformity according to the relevant clauses of EN 14351-1 "Windows and doors - Product Standard, performance characteristics..

References

- EN 15804:2012+A2:2019
- ISO 14044:2021
- ISO 14040:2021
- Life Cycle Assessment (LCA) applied to turn and tight triple glazing with thermal break window products for EPD® purposes - final report
- General Programme Instructions, v3.01
- PCR 2019:14 - Construction products - v 1.11
- c-PCR-007 Windows and doors (EN 17213) 2020-04-09
- EN 17213:2020

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