EPD 2024





Enviromental Product Declaration

Aluminum profiles

for windows, doors and façade systems

In accordance with the standards EN ISO 14025:2006, EN 15804:2012 + A2:2019/AC:2021 and PCR 2019:14 construction products version 1.3.4

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THERMOPLASTIKI

This EPD should provide current information and may be updated if conditions change. Therefore, the stated validity is subject to its continued registration and publication on ww.environdec.com. This EPD covers multiple products (Appendix), based on worst-case results.

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General Information

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UN CPC code: 41532 Bars, rods and profiles, of aluminium				
PCR review was conducted by: The Technical Committee of the International EPD® System Chair of the PCR review: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.				
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Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD process certification ☒ EPD verification by individual Third-party verifier: Dr. Dimitrios Velissariou				
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1. Declaration

The EPD owner holds the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but registered in different EPD programs, or not compliant with EN 15804:2012+A2:2019/AC:2021, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances, and use (e.g., identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804:2012+A2:2019/AC:2021 and ISO 14025:2006. This EPD is specific, indicating the company's provision of specific data for multiple products (see Appendix) from one production site.

2. THERMOPLASTIKI

Manufacturer

THERMOPLASTIKI is located in Kavala at Polistilo 640 03 and specializes in manufacturing aluminum profiles for window frames, door frames, and facade systems at its facility in Kavala. The company adheres to ISO 45001:2018, ISO 14001:2015, and ISO 9001:2015 standards, certified by DQS since 2021-12-09. These aluminum products are used for windows frames, doors frames, and façade systems which can enhance energy efficiency and indoor comfort and contribute to the environmental performance of buildings. THERMOPLASTIKI provides construction solutions across various sectors including residential, commercial, industrial, and retail, ensuring optimal performance in diverse settings.

Sustainability strategy

THERMOPLASTIKI's dedication to environmantal practices by its certification according to ISO 14001:2015 standards (certified by DQS from 2021-12-09). This commitment is apparent in the manufacture of premium aluminum profiles, meeting standards outlined in ELOT EN ISO 140-3, ENV 1627, EN 12207, EN 12208, EN 12210, EN 13115, EN 12400, EN 13049, EN 10077, and EN 13501-1, which govern the assessment of aluminum profile conformity, aligning with Regulation (EU) No. 305/2011. These aluminum products, crucial for window frames, door frames, and facade systems can enhance energy efficiency, indoor comfort, and environmental sustainability. The latter is integral to THERMOPLASTIKI's manufacturing. Moreover, the company has devised an Environmental Product Declaration (EPD), enabling continuous monitoring of environmental performance, streamlining progress tracking, and identifying avenues for improvement.

Product description

Name of the product or product family

This Environmental Product Declaration (EPD®) aligns with PCR 2019:14 for "Construction Products" established by the International EPD® System and outlines the attributes of a representative unit of multiple products (See Appendix): 1 kg of aluminum profiles for window frames, door frames, and facade systems. These profiles represent average-sized single sheet aluminum profiles designed for double glazing, with considerations for production volumes, where double glass accounts for 95% and triple glass for 5%. These aluminum products encompass applications such as sliding, folding, tilt and turn, and lift and slide. These aluminum products are manufactured at THERMOPLASTIKI's facility in Kavala, Greece.

Description of the product and its use

The extensive range of aluminum frames offered by THERMOPLASTIKI provides versatile solutions tailored to individual needs. These aluminum profiles, available under the trade names SCHÜCO, ALUMIL, and ELVIAL, serve as essential components for manufacturing windows, doors, and facade systems. Within each category, a variety of sub-categories are available to address specific requirements, including Tilt & Turn, Exterior Doors, Lift & Slide, Sliding, Pask, Folding/Sliding, Rotating, and Mechanisms. This diverse range caters to a wide spectrum of architectural and functional needs, ensuring efficiency and flexibility in construction projects.

One notable example of THERMOPLASTIKI's commercial success in the aluminum frames category is the SCHÜCO product, AWS 65. This thermally insulating window system boasts a total frame width of 107mm and features a robust aluminum construction renowned for its high resistance to wind, air permeability, and water tightness. The widened thermal insulation zone, with specially designed thermal break chambers, offers exceptional energy-saving performance. With the possibility of double or triple glazing (up to 55 mm) and the application of a concealed Schüco mechanism, this system is known for its simplicity and smart design.

Technical characteristics of the SCHÜCO AWS 65 include a frame depth of 65 mm, frame width of 75 mm, maximum glazing thickness ranging from 5-45mm for the frame and 15-55 mm for the leaf, leaf depth of 75 mm, and leaf width of 78mm. These features make it suitable for various settings such as offices, retail spaces, industrial buildings, residences, and commercial complexes.

2.1 Specifications

The aluminum profiles designed for window frames, door frames, and facade systems are customized to meet a broad range of applications. For detailed information, additional specifications are available on the website https://www.thermoplastiki.gr/en/frames/aluminum/[1].

Additionally, the dimensional characteristics and composition of an average-sized single sheet aluminum frame for double glazing (considering production volumes), chosen as a representative unit of multiple products (See Appendix), are provided in Table 1 below.

Table 1. Dimensional characteristics and composition of representative aluminum frame.

Representative Unit: aluminum frame (SCHÜCO, AWS 65)				
Dimensions		**Composition**	**[kg]**	**[%]**
Depth [m]	0.075	**Aluminum**	11.78	67.4
Width [m]	0.795	**Gaskets (EPDM)**	1.3	7.4
		Thermal break (Polyamide)	2	11.4
Height [m]	1.21	**Coating powder (Polyester)**	2.4	13.8

3. Life Cycle Assessment

3.1 Declared unit

The declared unit is defined as 1 kg of single sheet aluminum frame for double glazing, selected as a representative unit of multiple products (See Appendix) considering production volumes. These measurements are taken at the THERMOPLASTIKI's facility in Kavala, Greece.

- 1 kg

5.2 Reference service life

The assessment examines environmental impacts throughout an anticipated average service life of 40 years [2,3].

- 40 years

5.3 Representativity

The gathered data mirrors the study's timeframe, technology focus, and geographical scope, sourced directly from THERMOPLASTIKI ERP software.

5.4 Time-coverage

The specific data pertaining to the year 2023 has been employed for the Life Cycle Assessment (LCA) calculations, considered as a representative year for the analysis.

- 1 January 2023 - 31 December 2023

5.5 Geographical scope

In line with the study objectives, establishing the geographic scope for data collection within unit processes necessitates thorough consideration of THERMOPLASTIKI's industrial facilities, which encompass 47,500m^2 in Polistilo 640 03, Greece. The relevant geographic classifications being considered include Global {GLO}, European {RER}, Greek {GR}, or {IAI Area, EU27 & EFTA} within the Ecoinvent database (v.3.9).

- Global {GLO}, European {RER}, Greek {GR}, or {IAI Area, EU27 & EFTA}

5.6 Database and LCA: software used

The Life Cycle Assessment (LCA) calculations were conducted using SimaPro Developer software version 9.5.0.2, integrated with the Ecoinvent 3.9 database, incorporating allocation and cut-off by classification. The LCA methods applied adhere to the standards outlined in ISO 14025:2006. The reference package used for impact indicator is based on EF 3.1.

- SimaPro Developer software version 9.5.0.2 with Ecoinvent 3.9

5.7 Data quality

The data gathered for components and energy corresponds to the year 2023, encompassing details on raw materials consumption and energy usage. Stringent verification procedures have been employed to validate the credibility and coherence of the collected data, ensuring its adherence to standards of precision, completeness, consistency, reproducibility, representativeness, and data sources.

- Good data quality

5.8 Cut-off rules

Aligned with EN 15804:2012+A2:2019/AC:2021 standards, this study upholds a minimum inclusion threshold of 95% for total inflows per module (A-D), ensuring comprehensive coverage of over 99%. Any incomplete data is supplemented through proxies or extrapolation techniques. Insignificant inflows, irrelevant to the LCA, are outlined in the Environmental Product Declaration (EPD). Cut-off criteria, based on mass and energy thresholds, eliminate flows below 1% cumulative mass or energy.

The following processes have been excluded:

- Cardboards and HDPE for packaging
- Fabrication of machinery involved in the manufacturing process, constructions, or any other durable assets.
- Transfer of employees to the facility.
- Staff transportation within the facility.
- Research and development undertakings, including the production and assembly of laboratory machinery. Emissions over an extended period.
- Long-term emissions

5.9 Allocation

In this Life Cycle Assessment (LCA), efforts were made to minimize allocation use, employing a mass-based physical approach when necessary. Data on the system's composition were directly obtained and analyzed, adhering to modularity and the polluter pays concept. Following EN 15804:2012+A2:2019/AC:2021 and ISO 14044:2006 guidelines, specific allocation procedures were incorporated in both the manufacturing and end-of-life phases. In manufacturing, unavoidable allocations, like selling all aluminum cutting remnants, were addressed using a precise mass-based physical method. Particularly, the aluminum remnants from manufacturing are categorized as waste aluminum for treatment (empty process) due to the cut-off at recycling. The benefits and costs of recycling are attributed to the production of recycled aluminum.

Regarding the end-of-life stage, the study adopts a process where recovered aluminum is designated for recycling. However, it's essential to highlight that this allocation does not fully capture the avoided impacts of virgin materials, reflecting the current and most likely reality of the product and making it representative for this life cycle assessment. This comprehensive approach provides a detailed insight into the environmental implications throughout the product's life cycle.

5.10 Lifecycle and compliance

Aligned with ISO 14025:2006 standards, THERMOPLASTIKI's Environmental Product Declaration (EPD) methodology for aluminum profiles ensures the quantification of environmental information across the product life cycle, facilitating comparisons with similar products. Developed following ISO 14040:2006 and 14044:2006 Life Cycle Assessment (LCA) principles, THERMOPLASTIKI's EPD adheres rigorously to various standards, including:

- General Program Instructions (GPI) for the International EPD® System (Version 4.0, 2021-03-29). [4]
- ISO 14040:2006, 14044:2006, and 14025:2006.[5–7]
- Product Category Rule (PCR 2019:14 v.1.3.4) for "Construction Products" by the International EPD® System.[8]
- EN 15804:2012+A2:2019/AC:2021.[9]

5.11 System boundaries

The determination of the system boundaries for the assessment of THERMOPLASTIKI's aluminum profiles aligns with the specific objectives and parameters outlined in EN 15804:2012+A2:2019/AC:2021 for construction products. Following a "cradle to gate with modules C1–C4 and module D (A1–A3 + C + D)" approach, the chosen method covers the entirety of the product's life cycle, from initial raw material extraction to final manufacturing. Additionally, the end-of-life phase and any external impacts beyond the defined system boundaries are integral components of the assessment.

Careful consideration has been given to establish system boundaries that incorporate essential stages crucial to the product's life cycle, ensuring a comprehensive evaluation of its environmental impact. By encompassing the entire spectrum of activities associated with the production process, this approach enables a thorough understanding of sustainability implications, facilitating informed decisions regarding environmental performance enhancements and overall resource management. The following processes are included within the scope of the product system under examination [8].

Table 2. Description of the system boundary according to the PCR 2019:14 v. 1.3.4 including modules declared, geographical scope, share of specific data (in GWP-GHG results) and variation in GWP-GHG results between products and sites.

	Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Resource recovery stage**
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy	Operational water use	De-construction	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	GR	GR	GR										GR	GR	GR	GR	GR
Share of specific data	>90%					-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	<10%					-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	0%					-	-	-	-	-	-	-	-	-	-	-	-

Exclusions from the system boundary:

- Environmental impacts from infrastructure and construction work not linked to making the product.
- Effects on the environment caused by workers commuting to and from work.
- Activities done by others, like installing, building, and using the product.
- Input and output data falling outside the designated cut-off criteria established for the LCA study.

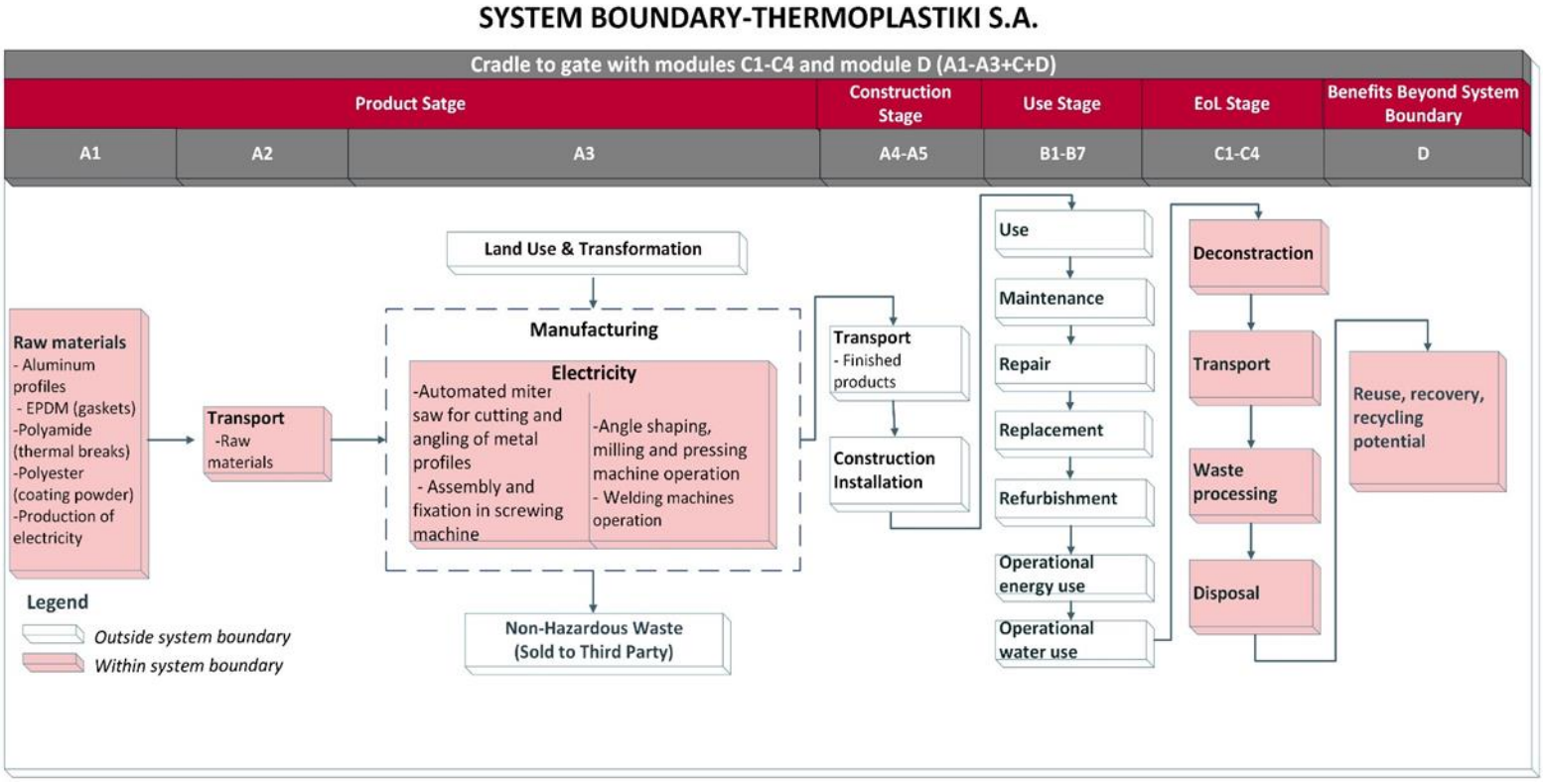


Figure 1. System boundary of the life cycle assessment

4. Life Cycle stages

Product Stage A1 - A3

A1- Extraction and production of raw materials.

The data on raw material usage primarily came from THERMOPLASTIKI for the reference year of 2023. The main materials used in producing aluminum for window frames, door frames, and façade systems are aluminum profiles, EPDM gaskets, polyamide thermal breaks, and polyester coating powder.

A2- Transport of raw materials

The raw materials are procured from various manufacturers based in Greece, and Germany. The main supplier for the majority of aluminum profiles is situated in Bielefeld, Germany, while the remaining aluminum profiles, gaskets, thermal breaks, and coating powder are obtained primarily from cities in northern Greece.

To determine transportation distances, THERMOPLASTIKI initially provided the data, which was then cross-referenced and refined using Google Maps. This process factored in the locations of both the suppliers and THERMOPLASTIKI facilities. Weighted average transportation distances were subsequently calculated to reflect the varying significance of distance based on the quantities of raw materials involved.

A3- Manufacturing

Electricity mix

The energy requirements for the manufacturing process in stage A3 are primarily met through external electricity sources without a designated preference for a particular energy mix. There is no on-site production of electrical energy, such as photovoltaic systems. Therefore, the country-specific mix for medium voltage electricity from the Ecoinvent database (v.3.9) has been utilized for modeling the electricity consumption in this stage.

The climate impact for the electricity consumed in stage A3 is 1.43 kg CO2 eq., calculated using the GWP-GHG indicator from the DAPEEP report (residual electricity mix as 533.23 g CO2 eq./kWh). The data used is from the "2022 Energy Mix" (**ΕΝΕΡΓΕΙΑΚΟ ΜΕΙΓΜΑ 2022**) report by the "Renewable Energy Sources Operator and Guarantees of Origin" (**ΔΙΑΧΕΙΡΙΣΤΗΣ ΑΠΕ ΚΑΙ ΕΓΓΥΗΣΕΩΝ ΠΡΟΕΛΕΥΣΗΣ**, DAPEEP).[10]

Water

Water is viewed as a closed system, meaning there are minimal inflows or outflows from the process being studied. This simplifies the assessment, allowing focus on other important factors while recognizing the inherent conservation and recycling mechanisms involved in water management within the analyzed process.

Production waste/ by-products

Emissions are systematically tracked in compliance with the terms stipulated in the operational license and are documented on an annual basis through the Annual Waste Producer Report (AWPR) for the year 2023. Residual aluminum cuttings and scrap (EWC 17 04 02) are routinely sent back to the primary suppliers after each raw material delivery and subsequently transported to their production facilities for recycling. However, it's crucial to recognize that this practice does not fully correspond to the benefits derived from utilizing recycled materials instead of virgin resources.

End of life stage, C1 - C4

This phase consists of the modules related to the end of useful life, C1 to C4, detailed below:

- C1 Deconstruction, demolition

Machinery operations related to de-installation are assumed to be zero, indicating manual execution.

- C2 Transport

This process involves the transportation of construction waste from the construction site to the waste treatment plant using a municipal waste collection service, facilitated by a 21-metric-ton lorry. The distance covered for this operation is specified as 30 kilometers.

- C3 Waste treatment

After use, aluminum profiles undergo pre-processing, with 90% of the waste aluminum is recovered and processed for melting.

- C4 Waste disposal

The remaining 10% fraction of aluminum is projected to be handled as municipal solid waste scrap. Additionally, the residual portion (0.33 kg) of the aluminum products consists of a waste plastic mixture, which is disposed of as follows: 2% through open burning, 3% via unsanitary landfilling, 95% in sanitary landfills, and 1% through municipal incineration.

Reuse/recovery/recycling potential, D

In the context of end-of-life scenario D, the 90% of the waste aluminum is recovered and subsequently fully recycled into post-consumer aluminum scrap.

5. Environmental information

Core environmental impact indicators for 1 kg of aluminum profiles for window frames, door frames and façade systems in 2023: Module-wise results in compliance with EN 15804:2012+A2:2019/AC:2021 standards

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO2 eq	1.41E+01	0.00E+00	4.15E-02	1.77E-01	5.20E-02	-2.28E-02
GWP-fossil	kg CO2 eq	1.39E+01	0.00E+00	4.15E-02	1.75E-01	5.18E-02	-2.27E-02
GWP-biogenic	kg CO2 eq	5.99E-02	0.00E+00	7.63E-06	2.25E-03	1.84E-04	-3.33E-05
GWP-luluc	kg CO2 eq	1.78E-01	0.00E+00	5.25E-06	1.75E-04	3.67E-06	-6.74E-05
ODP	kg CFC11 eq	3.11E-07	0.00E+00	6.51E-10	1.44E-09	1.31E-10	-3.80E-10
AP	mol H+ eq	9.45E-02	0.00E+00	2.27E-04	7.47E-04	7.35E-05	-1.58E-04
EP-freshwater	kg P eq	8.43E-03	0.00E+00	7.75E-07	4.29E-05	7.32E-07	-2.25E-06
EP-marine	kg N eq	1.43E-02	0.00E+00	9.87E-05	1.42E-04	7.11E-04	-5.62E-05
EP-terrestrial	mol N eq	1.29E-01	0.00E+00	1.07E-03	1.55E-03	3.33E-04	-6.02E-04
POCP	kg NMVOC eq	4.95E-02	0.00E+00	4.18E-04	4.96E-04	1.22E-04	-1.89E-04
ADP minerals & metals	kg Sb eq	2.44E-05	0.00E+00	2.67E-08	3.70E-06	1.47E-08	-6.46E-08
ADP-fossil	MJ	1.87E+02	0.00E+00	5.39E-01	1.21E+00	1.12E-01	-3.14E-01
WDP (AWARE)	m^3 depriv.	4.53E+00	0.00E+00	1.01E-03	1.69E-02	3.74E-03	-1.72E-03

Additional environmental impact indicators for 1 kg of aluminum profiles for window frames, door frames and façade systems production in 2023: Module-specific outcomes in accordance with EN 15804:2012+A2:2019/AC:2021.

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidence	9.28E-07	0.00E+00	5.42E-09	1.28E-08	1.33E-08	-2.24E-09
IRP	kBq U235 eq.	1.34E+00	0.00E+00	1.78E-04	5.92E-03	3.25E-04	-3.93E-04
ETP-fw	CTUe	5.72E+01	0.00E+00	2.63E-01	8.92E-01	8.94E-01	-2.16E-01
HTP-c	CTUh	2.62E-08	0.00E+00	6.11E-12	1.11E-10	1.85E-10	-1.32E-11
HTP-nc	CTUh	2.96E-07	0.00E+00	1.06E-10	4.45E-09	6.25E-10	-2.34E-10
SQP	Pt	1.87E+01	0.00E+00	5.99E-02	1.20E+00	2.32E-01	-2.29E-01

Resource use indicators for 1 kg of aluminum profiles for window frames, door frames and façade systems production in 2023. Module-wise results in compliance with EN 15804:2012+A2:2019/AC:2021 standards.

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	1.26E+00	0.00E+00	5.34E-04	6.11E-02	1.48E-03	-1.99E-03
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.26E+00	0.00E+00	5.34E-04	6.11E-02	1.48E-03	-1.99E-03
PENRE	MJ	1.87E+02	0.00E+00	5.39E-01	1.21E+00	1.12E-01	-3.14E-01
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	1.87E+02	0.00E+00	5.39E-01	1.21E+00	1.12E-01	-3.14E-01
SM	kg	3.50E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	2.95E-01	0.00E+00	3.66E-05	6.39E-04	1.21E-04	-7.40E-05

Waste categories indicators for 1 kg of aluminum profiles for window frames, door frames and façade systems production in 2023: Module-wise results in compliance with EN 15804:2012+A2:2019/AC:2021 standards.

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	6.66E-03	0.00E+00	5.55E-06	5.70E-02	2.56E-03	-7.84E-06
NHWD	kg	3.26E+00	0.00E+00	2.72E-03	4.87E-02	3.82E-01	-1.71E-02
RWD	kg	3.43E-04	0.00E+00	3.94E-08	1.47E-06	7.52E-08	-9.50E-08

Output flows for 1 kg of aluminum profiles for window frames, door frames and façade systems production in 2023: Module-wise results in compliance with EN 15804:2012+A2:2019/AC:2021 standards.

Impact category	Unit	A1-A3	C1	C2	C3	C4	D
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.03E-01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Climate impact for 1 kg of aluminum profiles for window frames, door frames and façade systems production in 2023: Module-wise results in compliance with EN 15804:2012+A2:2019/AC:2021 standards.

Impact indicator	Unit	A1-A3	C1	C2	C3	C4	D
GWP-GHG	kg CO2 eq	1.40E+01	0.00E+00	4.13E-02	1.76E-01	5.03E-02	-2.26E-02

GWP-GHG: The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Disclaimer: The results of modules A1-A3 (or A1-A5 for services) should not be used isolated from the end-of-life (EoL) scenario (modules C1-C4) included in this EPD. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

References

(1) Thermoplastiki S.A. *Schuco, AWS 65*. Θερμοπλαστική | Βιομηχανία Κατασκευής Συνθετικών Κουφωμάτων (uPVC) και Κουφωμάτων Αλουμινίου. https://www.thermoplastiki.gr/product/schuco-aws-65/ (accessed 2024-04-29).

(2) Maia, M.; Morais, R.; Silva, A. Application of the Factor Method to the Service Life Prediction of Window Frames. *Eng. Fail. Anal.* **2020**, *109*, 104245. https://doi.org/10.1016/j.engfailanal.2019.104245.

(3) Asif, M.; Davidson, A.; Muneer, T.; MImechE, Ce. Life Cycle of Window Materials - A Comparative Assessment. **2002**.

(4) The International EPD® System. General Programme Instructions for the International EPD® System (Version 4.0, 2021-03-29).

(5) ISO 14025:2006, Environmental Labels and Declarations –Type III Environmental Declarations – Principles and Procedures, 2010.

(6) ISO 14040, Environmental Management — Life Cycle Assessment — Principles and Framework, 2006.

(7) ISO 14044:2006, Environmental Management — Life Cycle Assessment — Principles and Framework, 2006.

(8) The International EPD® System. Product Category Rules for Construction Products, PCR 2019:14, v.1.3.4 (2025-06-20).

(9) EN 15804:2012+A2:2019/AC:2021 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products.

(10) ΔΙΑΧΕΙΡΙΣΤΗΣ ΑΠΕ ΚΑΙ ΕΓΓΥΗΣΕΩΝ ΠΡΟΕΛΕΥΣΗΣ. *ΕΝΕΡΓΕΙΑΚΟ ΜΕΙΓΜΑ 2022*. https://www.dapeep.gr/dimosieuseis/eguiseis-proeleusis-energeiako/.

Appendix

Product list I

Schüco

Tilt & Turn:

- AWS 65

Technical characteristics
Frame profile depth: 65 mm
Frame face width: 75 mm
Max glass thickness: 5-45 casement 15-55 mm
Sheet profile depth: 75 mm
Sheet face width: 78mm

- AWS 70.BS.HI

Technical characteristics
Frame profile depth: 70 mm
Frame face width: 66.5 mm
Max glass thickness: 17-41 mm
Sheet profile depth: 80 mm
Sheet face width: 50 mm

- AWS 75.SI

Technical characteristics
Frame profile depth: 75 mm
Frame face width: 59 mm
Glass thickness: 18-52 mm
Sheet profile depth: 85 mm
Sheet face width: 78 mm

- AWS 90.SI

Technical characteristics
Frame profile depth: 90 mm
Frame face width: 56 mm
Glass thickness: 28-63 mm
Sheet profile depth: 100 mm
Sheet face width: 83 mm

Folding/Sliding

- ASS 70 FD

Technical characteristics
Frame profile depth: 70 mm
Frame face width: 60 mm
Max glass thickness: 6-45 mm
Sheet profile depth: 70 mm
Sheet face width: 54 mm

Sliding:

- ASE 67 PD

Technical characteristics
Frame profile depth: 177 & 267 mm
Frame face width: 0 mm
max glass thickness: 36-49 mm
Sheet profile depth: 67 mm
Sheet face width: 32.2 mm

- ASS 39 PD.NI

Technical characteristics
Frame profile depth: 107-160 mm
Frame face width (visible): 80 mm
Max glass thickness: 32 mm
Sheet profile depth: 39 mm
Sheet face width: 37.5 mm

- ASS 50

Technical characteristics
Frame profile depth: 120 mm
Frame face width: 38 mm
Glass thickness: 8-32 mm
Sheet profile depth: 50 mm
Sheet face width: 84 mm

PASK:

- AWS 65 PASK

Technical characteristics
Frame profile depth: 65 mm
Frame face width: 69 mm
Maximum glass thickness: 4-45mm casement 11-55mm sheet mm
Sheet profile depth: 75 mm
Sheet face width: 78 mm

Mechanisms

- Simply Smart
- Tip Tronic

Lift & Slide

- ASE 60

Technical characteristics
Frame profile depth: 140 mm
Frame face width: 48 mm
Maximum glass thickness: 38 mm
Sheet profile depth: 60 mm
Sheet face width: 92 mm

- ASE 80.HI

Technical characteristics
Frame profile depth: 180 mm
Frame face width: 48 mm
Maximum glass thickness: 60 mm
Sheet profile depth: 80 mm
Sheet face width: 92 mm

- ASS 50

Technical characteristics
Frame profile depth: 120 mm
Frame face width: 38 mm
Maximum glass thickness: 8-32 mm
Frame face width: 38 mm
Maximum glass thickness: 8-32 mm
Sheet profile depth: 50 mm
Sheet face width: 84mm at 150kg – 96mm at 300kg

- ASS 70 HI

Technical characteristics
Frame profile depth: 160 mm
Frame face width: 50 mm
Maximum glass thickness: 12-52 mm
Sheet profile depth: 70 mm
Sheet face width: 98 mm

Product list II

Schüco

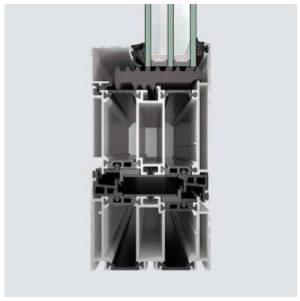
Exterior door

- ADS 65 HD

Technical characteristics
Frame profile depth: 65 mm
Frame face width: 69 mm
Maximum glass thickness: 24-55 mm
Sheet profile depth: 65 mm
Sheet face width: 95 mm



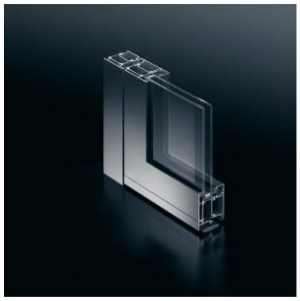
ADS 75 SimplySmart



ADS 90 SimplySmart

- ADS 75 SIMPLY SMART

Technical characteristics
Frame profile depth: 75 mm
Frame face width: 76 mm
Maximum glass thickness: 28 mm – 63 mm
Sheet profile depth: 75 mm
Sheet face width: 117 mm



ADS 65 HD



Door System

- ADS 90 SIMPLY SMART

Technical characteristics
Frame profile depth: 90 mm
Frame face width: 76 mm
Maximum glass thickness: 28mm – 63 mm
Sheet profile depth: 90 mm
Sheet face width: 117 mm

- DOOR SYSTEM

Rotating

- AWS 65

Technical characteristics
Frame profile depth: 65 mm
Maximum glass thickness: 24-55 mm
Sheet profile depth: 75 mm
Total sheet frame face width: 166mm
Perimeter



AWS 65

- AWS 75 SI

Technical characteristics
Frame profile depth: 75 mm
Maximum glass thickness: sheet 18-61 mm
Sheet profile depth: 85 mm
Total sheet frame face width: 186mm
Perimeter

Product list III

Alumil

Tilt & Turn:

- S67

Technical characteristics
Frame profile depth: 67 mm
Frame face width: 67 mm
Maximum glass thickness: From 23 to 45 mm
Sheet profile depth: 75 mm
Sheet face width: 73 mm

- S77

Technical characteristics
Frame profile depth: 77 mm
Frame face width: 61 mm
Maximum glass thickness: From 23 to 72 mm
Sheet profile depth: 85 mm
Sheet face width: 73 mm

- S77 PHOS

Technical characteristics
Frame profile depth: 77 mm
Frame face width: 67 mm
Maximum glass thickness: Double Glazing 30 mm ή Triple Glazing 45 mm
Sheet profile depth: 85 mm
Sheet face width: 53,4 mm

Exterior Doors

- SD77 (ENTRANCE)

Technical characteristics
Frame profile depth: 77 mm
Frame face width: 71mm - threshold 22 mm
Maximum glass thickness: From 23 mm to 59 mmSheet profile depth: 77 mm
Sheet face width: 109

Lift & Slide:

- S560

Technical characteristics
Frame profile depth: 136 mm
Maximum glass thickness: 24 mm up to 43 mm
Sheet profile depth: 56 mm
Sheet face width: 96.5 mm

- S700

Technical characteristics
Frame profile depth: Double guide rail 168.5 mm
Frame face width: 50 mm
Maximum glass thickness: 22 mm έως 50 mm
Sheet profile depth: 70 mm
Sheet face width: 95.5

Sliding

- M630 PHOS

Technical characteristics
Frame profile depth: Double guide rail 155 mm – Triple guide rail 232 mm
Frame face width: Bottom visible profile: 62 mm
Maximum glass thickness: 32 mm
Sheet profile depth: 63 mm
Sheet face width: 44,2 mm at the hooks

- S650 PHOS

Technical characteristics
Frame profile depth: Double guide rail 164 mm Triple guide rail 250 mm
Frame face width: Zero visible aluminium face width – 0 mm
Maximum glass thickness: 46 mm
Sheet profile depth: 61,9 mm
Sheet face width: 25 mm at the hooks

ELVIAL

Tilt & Turn:

- W59.SI2

Technical characteristics
Frame profile depth: 58,6 mm
Frame face width: 55 mm
Maximum glass thickness: 34 mm
Sheet profile depth: 67,2 mm
Sheet face width: 75 mm

Exterior Doors

- XCLUSIVE 88 i2 (ENTRANCE DOOR)

Technical characteristics
Frame profile depth: 77 mm
Frame face width: 68,3 mm
Maximum glass thickness: 15-52 mm casement/ sheet 24-61 mm
Sheet profile depth: 77 mm
Sheet face width: 96.7 mm

Lift & Slide

- S46.SI2 (6700 i2)

Technical characteristics
Frame profile depth: 113,1 mm
Frame face width: 47 mm
Maximum glass thickness: 24 mm
Sheet profile depth: 46 mm
Sheet face width: 85,5 mm

Core environmental impact indicators

Table A1. Core environmental impact indicators

Impact category	Indicator	Abbreviation	Unit (expressed per functional/declared unit)
Climate change – total	Global Warming Potential total	GWP-total	kg CO2 eq.
Climate change - fossil	Global Warming Potential fossil fuels	GWP-fossil	kg CO2 eq.
Climate change - biogenic	Global Warming Potential biogenic	GWP-biogenic	kg CO2 eq.
Climate change - land use and	Global Warming Potential land use and land use change	GWP-luluc	kg CO2 eq.
Ozone Depletion	Depletion potential of the stratospheric ozone layer	ODP	kg CFC 11 eq.
Acidification	Acidification potential, Accumulated Exceedance	AP	mol H+ eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment	EP-freshwater	kg P eq.
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching	EP-marine	kg N eq.

	marine end compartment		
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance	EP-terrestrial	mol N eq.
Photochemical ozone formation	Formation potential of tropospheric ozone	POCP	kg NMVOC eq.
Depletion of abiotic resources - minerals and metals	Abiotic depletion potential for non-fossil resources	ADP minerals & metals	kg Sb eq.
Depletion of abiotic resources - fossil fuels	Abiotic depletion for fossil resources potential	ADP-fossil	MJ, net calorific value
Water deprivation potential	Water (user) deprivation potential, deprivation-weighted water consumption	WDP	m3 world eq. deprived

The total global warming potential (GWP-total) is the sum of GWP-fossil, GWP-biogenic, and GWP-luluc. Notably, the omission of GWP-luluc as a separate component is acceptable if its contribution amounts to less than 5% of GWP-total across the designated modules, excluding module D. The abiotic depletion potential (ADP) is disclosed through two distinct indicators, namely ADP-minerals & metals and ADP-fossil. ADP-minerals & metals includes all non-renewable, abiotic material resources, except fossil resources, while ADP-fossil encompasses all fossil resources, including uranium. The ADP-minerals & metals model adopts the ultimate reserve approach.

Additional Environmental Impact Indicators

Table A2 provides details on environmental impact, expressed through impact category indicators of Life Cycle Impact Assessment (LCIA) utilizing characterization factors. These supplementary environmental impact indicators must be computed and incorporated into the project report for each declared module and may also be included in the Environmental Product Declaration (EPD). The inclusion of Table A2 in the EPD is necessary for the stated additional environmental indicators. In cases where additional indicators are not declared, their status should be

acknowledged in the EPD, for instance, by marking them as "Not Declared". For more environmental impact indicators, please consult Table A2.

Table A2. Additional Environmental Impact indicators, in accordance with EN 15804:2012+A2:2019/AC:2021.

Indicator	**Abbreviation**	**Unit** **(expressed per functional/declared unit)**
Particulate Matter emissions	PM	Disease incidence
Ionizing radiation - human health	IRP	kBq U235 eq.
Eco-toxicity - freshwater	ETP-fw	CTUe
Human toxicity - cancer effects	HTP-c	CTUh
Human toxicity – non-cancer effects	HTP-nc	CTUh
Land use related impacts/soil quality	SQP	Dimensionless

Indicators Describing Resource Use

Table A3, introduces indicators delineating resource utilization, to be incorporated into every declared module within the EPD. For resources use environmental impact indicators, refer to Table A3.

Table A3. Environmental indicators of resources use

Indicator	**Abbreviation**	**Unit** **(expressed per functional/declared unit)**
Use of renewable primary energy	PERE	MJ
Use of renewable primary energy resources as raw materials	PERM	MJ
Total use of renewable primary energy resources	PERT	MJ
Use of non-renewable primary energy	PENRE	MJ
Use of non-renewable primary energy resources as raw materials	PENRM	MJ
Total use of non-renewable primary energy resources	PENRT	MJ
Use of secondary material	SM	kg
Use of renewable secondary fuels	RSF	MJ
Use of non-renewable secondary fuels	NRSF	MJ
Use of net fresh water	FW	m3

Note that for identifying the portion of renewable/non-renewable primary energy utilized as an energy carrier rather than as raw materials, we rely on the indicator "use of renewable/non-renewable primary energy excluding renewable/non-renewable primary energy resources used as raw materials." This indicator is determined by calculating the difference between the total input of primary energy and the input of energy resources used as raw materials.

Waste Categories

Table A4 below, highlights indicators detailing diverse waste categories obtained from the life cycle inventory. It's crucial to incorporate these indicators into every declared module within the EPD. The criteria defining hazardous waste are outlined in relevant existing legislation, such as the European Waste Framework Directive.

Table A4. Waste categories indicators

Indicator	**Abbreviation**	**Unit** **(expressed per functional/declared unit)**
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg

Output flows

Table A5 showcases indicators that depict output flows derived from the life cycle inventory. It is essential to integrate these indicators into every declared module within the EPD.

Table A5. Output flows indicators

Indicator	**Abbreviation**	**Unit** **(expressed per functional/declared unit)**
Components for reuse	CRU	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported electrical energy	EEE	MJ
Exported thermal energy	EET	MJ