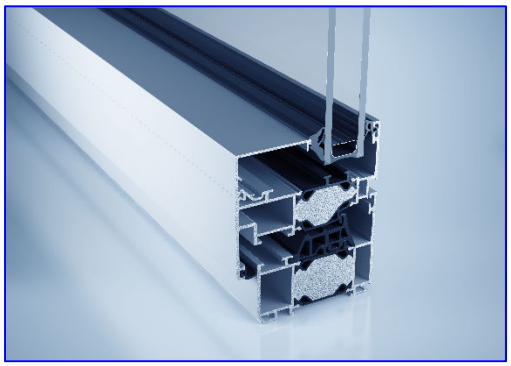
# Environmental Product Declaration

Declaration Code: M-EPD-HAF-GB-38.000

**Note:** This EPD is based on the heroal aluminium windows and lifting-sliding elements model EPD. The EPD becomes valid with transmission to the manufacturer by the **ift**.



**heroal-Johann Henkenjohann GmbH & Co. KG**

# heroal “Windows” and Lifting-Sliding Elements

# W65, W72, W77, S42, S65, S77


**Basis:**

DIN EN ISO 14025
EN15804

Company EPD
**E**nvironmental
**P**roduct **D**eclaration

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# Environmental Product Declaration

Declaration Code: M-EPD-HAF-GB-38.000

| | | | |
|---|---|---|---|
| **Programme operator** | ift Rosenheim GmbH<br>Theodor-Gietl-Straße 7-9<br>D-83026 Rosenheim | | |
| **Practitioner of the LCA** | ift Rosenheim GmbH<br>Theodor-Gietl-Straße 7-9<br>D-83026 Rosenheim | | |
| **Supported by** | heroal-Johann Henkenjohann GmbH & Co. KG<br>Österwieher Straße 8<br>33415 Verl | Note: Declaration holder are listed on page 3. | |
| **Declaration code** | M-EPD-HAF-GB-38.000 | | |
| **Designation of declared product** | heroal aluminium windows and lifting-sliding elements<br>W65, W72, W77, S42, S65, S77 | | |
| **Scope** | Window systems as well as lifting-sliding door systems in aluminium for all building classes | | |
| **Basis** | This EPD was prepared on the basis of EN ISO 14025:2011 and DIN EN 15804:2012+A1:2013. In addition, the "Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations) applies. The Declaration is based on the PCR documents EN 17213 “PCR for windows and doors”, “PCR Part A” PCR-A-0.2:2018 and "Windows, flat roof windows, skylights and continuous roof lights" PCR-FE-2.1:2018.” | | |
| **Validity** | Publication date:<br>15.04.2021 | Last revision:<br>09.06.2021 | Next revision:<br>15.04.2026 |
| | This verified Model Environmental Product Declaration applies solely to the specified products in accordance with the systems from heroal-Johann Henkenjohann GmbH & Co. KG and is valid for a period of five years from the date of publication in accordance with DIN EN 15804. | | |
| **LCA basis** | The LCA was prepared in accordance with DIN EN ISO 14040 and DIN EN ISO 14044. The data are based on both the data compiled from the production site of heroal-Johann Henkenjohann GmbH & Co. KG and the generic data derived from the “GaBi 10” database. LCA calculations were carried out for the included “cradle to gate life cycle with options” (cradle to gate with options) including all upstream chains (e.g. raw material extraction, etc.). | | |
| **Notes** | The “Conditions and Guidance on the Use of ift Test Documents” apply.<br>The declaration holder assumes full liability for the underlying data, certificates and verifications. | | |

| | | |
|---|---|---|
| Christian Kehrer<br>Head of Certification and Surveillance Body | Dr. Torsten Mielecke<br>Chairman of Expert Committee<br>ift-EPD and PCR | Patrick Wortner<br>External verifier |

## Declaration holder

The currently valid EPDs are published according to the following list on www.ift-service.de/epd:

There are currently no valid EPDs available.

# 1 General product information

**Product definition**

The EPD relates to the product group “Windows” and applies to:

**1 m² of aluminium window and lifting-sliding element**

The functional unit is obtained by summing up:

| Product group | Assessed product | Weight per unit area | Installation depth (frame) |
|---|---|---|---|
| F1 | W77 | 44.02 kg/m² | 0.089 m |
| F2 | W72 and W65 | 35.45 kg/m² | 0.084 m |
| F3 | W72 additional systems | 39.00 kg/m² | 0.084 m |
| H1 | Lifting-sliding doors / parallel sliding-tilting (PSK) | 40.00 kg/m² | 0.202 m |
| H2 | Sliding doors | 14.83 kg/m² | 0.202 m |

Table 1: Product groups

The average unit is declared as follows:
Directly used material flows are determined using the average sizes (window: 1.23 m x 1.48 m, lifting-sliding element: 3,00 m x 2,18 m) in accordance with EN 17213 and assigned to the declared unit. All other inputs and outputs in the production were scaled to the declared unit in their entirety since no direct assignment to the average size is possible. The reference period is the year 2019.

The validity of the EPD is restricted to the following models:

| **F1** | **F2** | **F3** | **H1** | **H2** |
|---|---|---|---|---|
| **W77 PH** | **W72** | **W72 PW** | **S77 SL** | **S42** |
| W77 | W65 | W72 CW | W72 PSK | S42 HF |
| W77 HI | | W72 RL/CL | S77 | S65 |
| W77 i | | W72i External | | |
| W77 UD | | W72 HI | | |
| | | W72i Internal | | |
| | | W72 UD | | |

*Bold = reference products

**Product description**

The heroal W65, W72, and W77 aluminium window systems are offered in a wide variety of shapes and are also available as arched, segmented arched and elliptical arched windows. Thanks to the modular design they are compatible with other heroal systems.
heroal is the only company to manufacture the complete thermal-break aluminium/PVC composite profiles in a company works on the basis of third-party monitored production (by ift Rosenheim) in accordance with QM 323. The perfect combination of adhesive cord and knurling applied during the heroal insulating process ensures the above-average rigidity and shear strength of the heroal aluminium composite profiles.

heroal S77 and S77 HI is a modular lifting-sliding door profile system of modern design that meets the strictest technical requirements for new build and building renovation. It also enables multi-track design variations and accessible, barrier-free systems.
heroal S77 SL opens up new large dimensions and guarantees maximum transparency thanks to its unique innovative frame design. This heroal lifting-sliding door generation combines a moving monorail sash with a framed fixed light and offers minimum face widths.
The heroal S42 and S65 aluminium sliding door system is characterised by its particularly easy and efficient manufacture and an innovative sash design. The pre-mounted labyrinth of the sash profiles also provides for very narrow meeting stiles (central joint). This offers an attractive solution for upmarket residential and commercial non-residential construction.

| | Window | |
|---|---|---|
| | Window | Lifting-sliding element |
| **Profile system**<br>System dimensions<br><br>Face widths<br>Frame:<br>Sash:<br>Installation depth:<br>Thickness of glass / infill panel:<br>Max. sash weights:<br>Max. sash height: | <br><br><br>50–250 mm<br>74–254 mm<br>33–67 mm<br>65/72/77 mm<br>6 - 66 mm<br><br>300 kg<br>2,800 mm | <br><br><br>35–52 mm<br>68–104 mm<br>68–104 mm<br>77- 202 mm<br>6 - 52 mm<br><br>400 kg<br>3,000 mm |
| **System supplier** | heroal-Johann Henkenjohann GmbH & Co. KG | |
| **Opening type/direction** | Tilt, turn, tilt/turn, tilt-before-turn, French and fixed light<br>Inward / outward opening | |
| **Frame material** | 3-chamber aluminium/PVC compound | |
| **Construction type** | Single, double sash/casement in punched and unitised construction | |
| **Thermal break** | Insulators: PA66GF25, PPO/PA-GF20 | |
| **Rebate insulation** | Different plastics | |
| **Surface** | A wide range of designs with a large selection of standard RAL and DB colours as well as Eloxal, Les Couleurs® Le Corbusier and heroal Surface Design (SD). | |
| **Infill panel** | Insulating glass units (double and triple, here: 4/12/4/12/4 mm or 6/15/6/25/6 mm) according to EPD “Insulating glass units”. | |
| **Sealing systems** | Extruded EPDM glazing gaskets | |
| **Glazing gasket** | Extruded EPDM glazing gaskets | |
| **Hardware, accessories and seals/gaskets** | Accessories and hardware as well as quantities according to the heroal systems. | |

For reliable planning and easy installation of additional window shading devices, heroal provides ideal combination options from the tried and tested window systems and the high-quality heroal VS Z solar shading devices.

This EPD does not apply to:

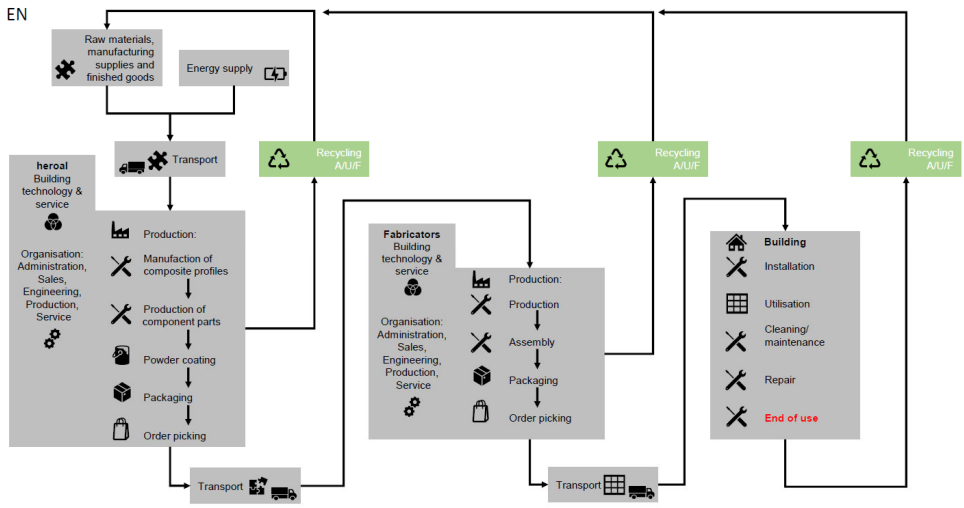
- roof windows because their design differs too much from the declared windows.
- bonded glass construction

Additional components such as external/internal shutters, e.g. roller shutters, solar shading devices, roller shutter boxes, etc. must be considered separately.

Additional information for architects:
Also observe the relevant system descriptions from the manufacturer.

For a detailed product description refer to the manufacturer specifications or the product specifications of the respective offer/quotation.

**Product manufacture**




**Applications**

Aluminium window and lifting-sliding door systems for residential and commercial buildings, office and administrative buildings, industrial buildings, sports and cultural buildings, single-family houses and multiple dwelling units.

**Verifications**

The following verifications are held:

- product qualities according to MINERGIE® (W72, S77 SL)
- product qualities according to MINERGIE-P® (W77)
- passive house component quality (W77 PH)

**Quality assurance**

The following quality assurance system are in place:

- performance characteristics as per EN 14351-1
- quality assurance according to ift QM323 (W72)
- Qualicoat quality seal (powder coating)
- powder coating quality to GSB AL 631-5 (Sea Proof)

**Additional information**

For additional verifications of applicability or conformity, refer to the CE marking and the documents accompanying the product, if applicable.

## 2 Materials used

**Primary materials**

The primary materials used are listed in the LCA (see Section 7).

**Declarable substances**

REACH conformity is queried when transferred to the manufactrer.

All relevant safety data sheets are available from the maunfacturer.

## 3 Construction process stage

**Processing recommendations, installation**

Observe the instructions for assembly/installation, operation, maintenance and disassembly, provided by the manufacturer.

## 4 Use stage

**Emissions to the environment**

No emissions to indoor air, water and soil are known. There may be VOC emissions.

**Reference service life (RSL)**

The RSL information was provided by the manufacturer. The RSL shall refer to the declared technical and functional performance of the product within the building. It shall be established in accordance with specific rules set out in the European product standards and shall also take into account ISO 15686-1, -2, -7 and -8. Where European product standards provide guidance on determining RSL, such guidance shall have priority. If it is not possible to determine the service life as the RSL in accordance with ISO 15686, the BBSR table “Nutzungsdauer von Bauteilen zur Lebenszyklusanalyse nach BNB” (service life of building components for life cycle assessment in accordance with the sustainable construction evaluation system) can be used. For further information and explanations refer to www.nachhaltigesbauen.de.

For this EPD the following applies:
The reference service life (RSL) can be determined for a "cradle to gate with options" EPD only if all of the Modules A1-A3 and B1-B5 are specified;
According to the BBSR table the aluminium windows and lifting-sliding elements manufactured by heroal-Johann Henkenjohann GmbH & Co. KG have a service life of 50 years.

The service life is dependent on the characteristics of the product and in-use conditions. The characteristics described in the EPD are applicable, in particular the characteristics listed below:

- Outdoor environment: Climatic influences may have a negative impact on the service life.
- Indoor environment: No impacts known that have a negative effect on the service life

The service life solely applies to the characteristics specified in this EPD or the corresponding references.
The reference service life (RSL) does not reflect the actual life span, which is usually determined by the service life and the refurbishment of a building. It does not give any information on the useful life, warranty referring to performance characteristics or guarantees.

## 5 End-of-life stage

**Possible end-of-life stages**

The aluminium windows and lifting-sliding elements are shipped to central collection points. There the products are usually shredded and sorted into

their constituents. The end-of-life stage depends on the site where the products are used and is therefore subject to the local regulations. Observe the locally applicable regulatory requirements.

This EPD shows the end-of-life modules based on EN 17213 (aluminium windows/doors – Figure B.1). Specific components of metals and glass are recycled; most plastics are thermally recycled. Residual fractions are sent to landfill.

**Disposal routes**

The LCA includes the average disposal routes.

**All life cycle scenarios are detailed in the Annex.**

# 6 Life Cycle Assessment (LCA)

Environmental product declarations are based on life cycle assessments (LCAs) which use material and energy flows for the calculation and subsequent representation of environmental impacts.

Life cycle assessments have been developed as the basis for aluminium windows and lifting-sliding elements. These LCAs are in conformity with the requirements set out in DIN EN 15804 and the international standards DIN EN ISO 14040, DIN EN ISO 14044, ISO 21930 and EN ISO 14025.

The LCA is representative of the products presented in the Declaration and the specified reference period.

## 6.1 Definition of goal and scope

**Goal**

The goal of the LCA is to demonstrate the environmental impacts of the products. In accordance with DIN EN 15804, the environmental impacts covered by this Environmental Product Declaration are presented for the entire product life cycle in the form of basic information. No other additional environmental impacts are specified.

**Data quality, data availability and geographical and time-related system boundaries**

The specific data originate exclusively from the research project “EPDs for transparent building components“ as well as from data collected by the manufacturer / system supplier “heroal-Johann Henkenjohann GmbH & Co. KG”. The manufacturer-specific data were collected on-site at the plant located in 33415 Verl and originate in parts from company records and partly from values directly obtained by measurement in the 2019 fiscal year. Validity of the data was checked by the ift Rosenheim.

The generic data originate from the “GaBi 10” professional and building materials databases. The last update of both databases was in 2021. Data from before this date originate also from these databases and are not more than 10 years old. No other generic data were used for the calculation.

Data gaps were either filled with comparable data or conservative assumptions, or the data were cut off in compliance with the 1% rule.

The life cycle was modelled using the sustainability software tool “GaBi ts” for the development of life cycle assessments.

**Scope / system boundaries**

The system boundaries refer to the supply of raw materials and purchased parts, manufacture/production, use and end-of-life stage of aluminium windows and lifting-sliding elements.
No additional data from pre-suppliers/subcontractors or other sites were taken into consideration.

**Cut-off criteria**

All company data collected, i.e. all commodities/input and raw materials used, the thermal energy and electricity consumption, were taken into consideration.

The boundaries cover only the product-relevant data. Building sections/parts of facilities that are not relevant to the manufacture of the products, were excluded.

The transport distances of the pre-products used were taken into consideration as a function of 100% of the mass of the products.
The transport mix is composed as follows and originates from the research project "EPDs für transparente Bauelemente" (EPDs for transparent building components):

- truck, 26 – 28 t total weight / 18.4 t payload, Euro 6, freight, 85% capacity used, 100 km;
- truck-trailer, 28 – 34 t total weight / 22 t payload, Euro 6, 50% capacity used, 50 km;
- freight train, electrical and diesel driven; D 60%, E 51% capacity used, 50 km
- seagoing vessel, consumption mix, 50 km.

The criteria for the exclusion of inputs and outputs as set out in DIN EN 15804 are fulfilled. From the data analysis it can be assumed that the total of negligible processes per life cycle stage does not exceed 1% of the mass/primary energy. This way the total of negligible processes does not exceed 5% of the energy and mass input. The life cycle calculation also includes material and energy flows that account for less than 1%.

## 6.2 Inventory analysis

**Goal**

All material and energy flows are described below. The processes covered are presented as input and output parameters and refer to the declared/functional units.

**Life cycle stages**

The Annex shows the entire life cycle of aluminium windows and lifting-sliding elements. The product stage "A1 – A3", construction process stage" A4 – A5", use stage "B2 – B7", end-of-life stage "C1 – C4" and the benefits and loads beyond the system boundaries "D" are considered.

**Benefits**

The below benefits have been defined as per DIN EN 15804:

- benefits from recycling
- benefits (thermal and electrical) from incineration

**Allocation of co-products**

During manufacture the following allocation takes place:
The allocation is based on the running metre of the products (physical property). Extrusion waste is recycled directly.

**Allocations for re-use, recycling and recovery**

If the products are reused/recycled and recovered during the product stage (rejects), the elements are shredded, if necessary and then sorted into their constituents. This is done by various process plants, e.g. magnetic separators.
The system boundaries were set following their disposal, reaching the end-of-waste status.

**Allocations beyond life cycle boundaries**

The use of recycled materials in the manufacturing process was based on the current market-specific situation. In parallel to this, a recycling potential was taken into consideration that reflects the economic value of the product after recycling (recyclate) .
Secondary material designated as inputs to aluminium windows and lifting-sliding elements is calculated as input without loads. For this no benefits are assigned to Module D, but consumption to Modules C3 and C4 (worse case consideration).
The system boundary set for the recycled material refers to collection.

**Secondary material**

The use of secondary material was considered in Module A3. Secondary material is used.

**Inputs**

The LCA includes the following production-relevant inputs per 1 m² of aluminium window and lifting-sliding element:

**Energy**

The input material of natural gas is based on “Thermische Energie für Erdgas Deutschland” (thermal energy for natural gas Germany). Diesel is based on “Diesel Mix Deutschland” (Diesel mix Germany). Distant heating is based on “Fernwärme Deutschland” (distant heating Germany). Manufacture of frame profiles is based on “Strommix heroal” (heroal electricity mix) (see Table 2), manufacture of windows is based on “Strommix Europa-28“ (Europe-28 electricity mix).

| Electricity disclosure of energy supplier | Shares in % |
|---|---|
| Renewable energies | 68 |
| Natural gas | 5 |
| Coal | 22 |
| Other fossil resources | 4 |
| Nuclear energy | 1 |

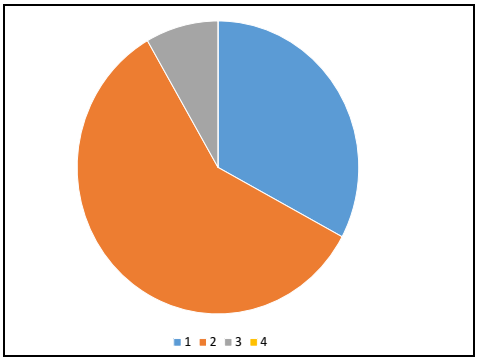
Table 2: “heroal” electricity mix”

A portion of the process heat is used for space heating. This can, however, not be quantified, hence a “worst case” figure was taken into account for the product.

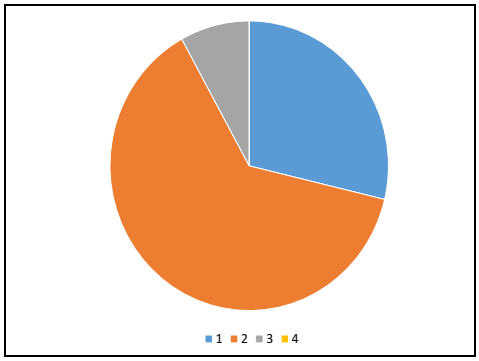
**Water**

The water consumed by the individual process steps for the manufacture amounts to a total of 7.35 l per 1 m² of the window or 6.57 l per 1 m² of lifting-sliding element.
The consumption of fresh water specified in Section 6.3 originates (among others) from the process chain of the pre-products and the process water for cooling.

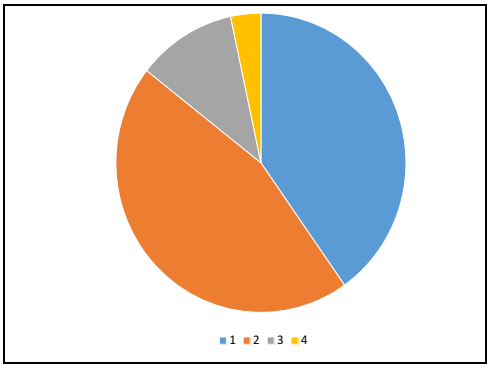
**Raw material / pre-products**
The charts below show the share of raw materials/pre-products in percent.



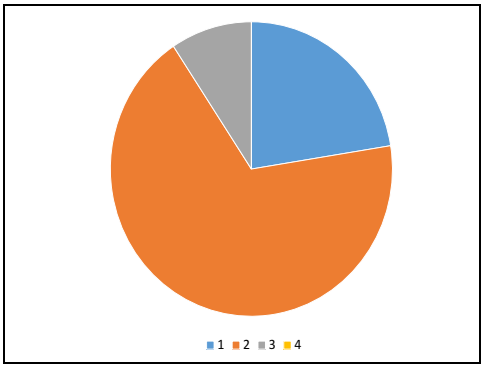
W77 (F1)



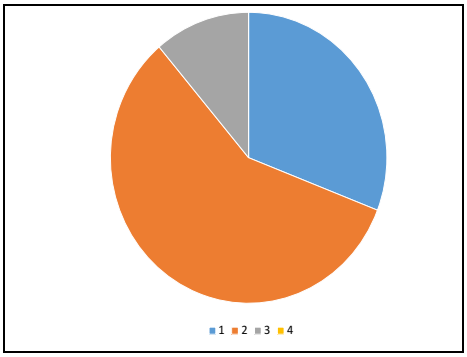
W72 and W65 (F2)



W72 Additional systems (F3)



Lifting-sliding doors / (PSK) parallel slide tilt (H1)



Sliding doors (H2)

Figure 1: Percentage of individual materials per declared unit

| No. | Material | Mass in % | | | | |
|---|---|---|---|---|---|---|
| | | F1 | F2 | F3 | H1 | H2 |
| 1 | Metals | 32.85 | 28.73 | 41.63 | 27.12 | 30.87 |
| 2 | Glass | 58.82 | 63.23 | 46.91 | 64.13 | 57.92 |
| 3 | Plastics | 8.34 | 8.04 | 11.47 | 8.75 | 11.20 |
| 4 | Other | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 3: Percentage of individual materials per declared unit

**Ancillary materials and consumables**
16.23 g of ancillary materials and consumables are used for 1 m² of window and 14.52 g for 1 m² of lifting-sliding element.

**Product packaging**
The amounts used for product packaging are as follows:

| No. | Material | Mass in g | |
|---|---|---|---|
| | | Window | Lifting-sliding element |
| 1 | Wood | 1.20 | 1.08 |
| 2 | Cardboard | 152.90 | 136.80 |
| 3 | PE film | 166.93 | 149.35 |

Table 4: Weight in kg of packaging per declared unit

**Outputs**

The LCA includes the following production-relevant outputs per 1 m² of aluminium window and lifting-sliding element:

**Waste**
Secondary raw materials were included in the benefits.
See Section 6.3 Impact assessment.

**Waste water**
The manufacture of 1 m² of window produces 6.14 l waste water and of 1 m² of lifting-sliding element 5.49 l waste water.

## 6.3 Impact assessment

**Goal**

The impact assessment covers both inputs and outputs. The impact categories applied are stated below:

**Impact categories**

The models for impact assessment were applied as described in DIN EN 15804-A1.
The impact categories presented in the EPD are as follows:

- depletion of abiotic resources (fossil fuels);
- depletion of abiotic resources (mineral substances);
- acidification of soil and water;
- ozone depletion;
- global warming;
- eutrophication;
- photochemical ozone creation.

**Waste**

The waste generated during the production of 1 m² of aluminium window and lifting-sliding element is evaluated and shown separately for the fractions

trade wastes, special wastes and radioactive wastes. Since waste handling is modelled within the system boundaries, the amounts shown refer to the deposited wastes. A portion of the waste indicated is generated during the manufacture of the pre-products.

| Results per 1 m² of W77 aluminium window (F1) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Unit** | **A1-A3** | **A4** | **A5** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **C1** | **C2** | **C3** | **C4** | **D** |
| **Central environmental impacts** | | | | | | | | | | | | | | | | |
| GWP | kg $CO_2$ eq. | 226.00 | 7.42 | 0.74 | - | 49.00 | 52.80 | 0.00 | 176.56 | 0.00 | 0.00 | 0.00 | 1.23 | 11.00 | 0.27 | -89.70 |
| ODP | kg CFC -11 eq. | 5.12E-08 | 1.30E-15 | 1.08E-16 | - | 1.24E-13 | 1.65E-08 | 0.00 | 5.12E-08 | 0.00 | 0.00 | 0.00 | 2.15E-16 | 2.85E-15 | 1.49E-15 | -3.20E-13 |
| AP | kg $SO_2$ eq. | 0.96 | 1.72E-02 | 7.55E-05 | - | 4.88E-02 | 0.41 | 0.00 | 0.68 | 0.00 | 0.00 | 0.00 | 2.38E-03 | 7.71E-04 | 1.64E-03 | -0.38 |
| EP | kg $PO_4^{3-}$ eq. | 8.32E-02 | 4.28E-03 | 1.55E-05 | - | 8.41E-03 | 3.27E-02 | 0.00 | 6.96E-02 | 0.00 | 0.00 | 0.00 | 5.88E-04 | 1.60E-04 | 1.87E-04 | -2.91E-02 |
| POCP | kg ethene eq. | 5.63E-02 | -6.11E-03 | 6.30E-06 | - | 1.30E-02 | 2.33E-02 | 0.00 | 3.74E-02 | 0.00 | 0.00 | 0.00 | -7.73E-04 | 7.81E-05 | 1.25E-04 | -3.12E-03 |
| ADPE | kg Sb eq. | 1.24E-03 | 6.48E-07 | 7.19E-09 | - | 1.69E-05 | 1.14E-03 | 0.00 | 1.21E-03 | 0.00 | 0.00 | 0.00 | 1.08E-07 | 7.86E-08 | 1.00E-07 | -6.06E-05 |
| ADPF | MJ | 3110.00 | 101.00 | 0.12 | - | 1430.00 | 851.00 | 0.00 | 2400.23 | 0.00 | 0.00 | 0.00 | 16.70 | 1.74 | 3.68 | -1080.00 |
| **Use of resources** | | | | | | | | | | | | | | | | |
| PERE | MJ | 1030.00 | 5.65 | 2.49 | - | 25.70 | 80.40 | 0.00 | 662.31 | 0.00 | 0.00 | 0.00 | 0.94 | 0.72 | 0.51 | -422.00 |
| PERM | MJ | 2.47 | 0.00 | -2.47 | - | 0.00 | 0.00 | 0.00 | 4.31E-03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PERT | MJ | 1030.00 | 5.65 | 2.58E-02 | - | 25.70 | 80.40 | 0.00 | 659.84 | 0.00 | 0.00 | 0.00 | 0.94 | 0.72 | 0.51 | -422.00 |
| PENRE | MJ | 3430.00 | 101.00 | 3.56 | - | 1490.00 | 912.00 | 0.00 | 2693.72 | 0.00 | 0.00 | 0.00 | 16.80 | 73.78 | 7.58 | -1240.00 |
| PENRM | MJ | 78.70 | 0.00 | -3.42 | - | 0.00 | 0.00 | 0.00 | 5.27E-02 | 0.00 | 0.00 | 0.00 | 0.00 | -71.46 | -3.76 | 0.00 |
| PENRT | MJ | 3500.00 | 101.00 | 0.13 | - | 1490.00 | 912.00 | 0.00 | 2685.07 | 0.00 | 0.00 | 0.00 | 16.80 | 2.32 | 3.82 | -1240.00 |
| SM | kg | 2.36 | 0.00 | 0.00 | - | 0.00 | 1.14 | 0.00 | 2.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NRSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FW | $m^3$ | 1.92 | 6.47E-03 | 1.76E-03 | - | 0.78 | 0.24 | 0.00 | 1.03 | 0.00 | 0.00 | 0.00 | 1.07E-03 | 2.40E-02 | 9.42E-04 | -1.00 |
| **Waste categories** | | | | | | | | | | | | | | | | |
| HWD | kg | 4.13E-03 | 5.11E-09 | 2.43E-11 | - | 2.05E-07 | 4.12E-03 | 0.00 | 4.13E-03 | 0.00 | 0.00 | 0.00 | 8.47E-10 | 4.98E-10 | 4.06E-10 | -1.47E-07 |
| NHWD | kg | 64.90 | 1.51E-02 | 8.87E-03 | - | 0.50 | 31.20 | 0.00 | 65.27 | 0.00 | 0.00 | 0.00 | 2.50E-03 | 4.40E-02 | 19.00 | -21.30 |
| RWD | kg | 0.16 | 1.23E-04 | 7.14E-06 | - | 4.51E-03 | 2.24E-02 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 2.03E-05 | 2.22E-04 | 4.01E-05 | -6.69E-02 |
| **Output material flows** | | | | | | | | | | | | | | | | |
| CRU | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MFR | kg | 2.90 | 0.00 | 0.00 | - | 0.00 | 29.40 | 0.00 | 24.40 | 0.00 | 0.00 | 0.00 | 0.00 | 21.50 | 0.00 | 0.00 |
| MER | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EEE | MJ | 0.93 | 0.00 | 1.45 | - | 0.00 | 12.60 | 0.00 | 25.68 | 0.00 | 0.00 | 0.00 | 0.00 | 23.30 | 0.00 | 0.00 |
| EET | MJ | 2.05 | 0.00 | 2.58 | - | 0.00 | 22.40 | 0.00 | 46.03 | 0.00 | 0.00 | 0.00 | 0.00 | 41.40 | 0.00 | 0.00 |

**Key:**
**GWP** – global warming potential **ODP** – ozone depletion potential **AP** - acidification potential **EP** - eutrophication potential **POCP** - photochemical ozone formation potential **ADPE** - abiotic depletion potential – non-fossil resources **ADPF** - abiotic depletion potential – fossil resources **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **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 **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for re-use **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy

| Results per 1 m² of W72 / W65 aluminium window (F2) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Unit** | **A1-A3** | **A4** | **A5** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **C1** | **C2** | **C3** | **C4** | **D** |
| **Central environmental impacts** | | | | | | | | | | | | | | | | |
| GWP | kg $CO_2$ eq. | 173.00 | 5.98 | 0.74 | - | 49.00 | 43.00 | 0.00 | 138.93 | 0.00 | 0.00 | 0.00 | 0.94 | 8.53 | 0.23 | -67.10 |
| ODP | kg CFC -11 eq. | 4.91E-08 | 1.05E-15 | 1.08E-16 | - | 1.24E-13 | 1.43E-08 | 0.00 | 4.91E-08 | 0.00 | 0.00 | 0.00 | 1.64E-16 | 2.61E-15 | 1.28E-15 | -2.44E-13 |
| AP | kg $SO_2$ eq. | 0.76 | 1.39E-02 | 7.55E-05 | - | 4.88E-02 | 0.35 | 0.00 | 0.57 | 0.00 | 0.00 | 0.00 | 1.82E-03 | 6.23E-04 | 1.41E-03 | -0.28 |
| EP | kg $PO_4^{3-}$ eq. | 7.06E-02 | 3.45E-03 | 1.55E-05 | - | 8.41E-03 | 2.82E-02 | 0.00 | 6.11E-02 | 0.00 | 0.00 | 0.00 | 4.50E-04 | 1.27E-04 | 1.60E-04 | -2.27E-02 |
| POCP | kg ethene eq. | 4.42E-02 | -4.93E-03 | 6.30E-06 | - | 1.30E-02 | 2.00E-02 | 0.00 | 3.07E-02 | 0.00 | 0.00 | 0.00 | -5.91E-04 | 6.24E-05 | 1.08E-04 | -3.10E-04 |
| ADPE | kg Sb eq. | 1.10E-03 | 5.23E-07 | 7.19E-09 | - | 1.69E-05 | 9.85E-04 | 0.00 | 1.08E-03 | 0.00 | 0.00 | 0.00 | 8.22E-08 | 6.52E-08 | 8.63E-08 | -4.95E-05 |
| ADPF | MJ | 2370.00 | 81.50 | 0.12 | - | 1480.00 | 700.00 | 0.00 | 1889.11 | 0.00 | 0.00 | 0.00 | 12.80 | 1.50 | 3.19 | -803.00 |
| **Use of resources** | | | | | | | | | | | | | | | | |
| PERE | MJ | 729.00 | 4.56 | 2.49 | - | 25.70 | 68.50 | 0.00 | 468.87 | 0.00 | 0.00 | 0.00 | 0.72 | 0.66 | 0.44 | -305.00 |
| PERM | MJ | 2.47 | 0.00 | -2.47 | - | 0.00 | 0.00 | 0.00 | 4.31E-03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PERT | MJ | 731.00 | 4.56 | 2.58E-02 | - | 25.70 | 68.50 | 0.00 | 468.40 | 0.00 | 0.00 | 0.00 | 0.72 | 0.66 | 0.44 | -305.00 |
| PENRE | MJ | 2600.00 | 81.80 | 3.56 | - | 1490.00 | 750.00 | 0.00 | 2082.00 | 0.00 | 0.00 | 0.00 | 12.90 | 57.54 | 6.20 | -928.00 |
| PENRM | MJ | 61.90 | 0.00 | -3.42 | - | 0.00 | 0.00 | 0.00 | 3.20E-02 | 0.00 | 0.00 | 0.00 | 0.00 | -55.52 | -2.92 | 0.00 |
| PENRT | MJ | 2660.00 | 81.80 | 0.13 | - | 1490.00 | 750.00 | 0.00 | 2080.13 | 0.00 | 0.00 | 0.00 | 12.90 | 2.02 | 3.28 | -928.00 |
| SM | kg | 1.81 | 0.00 | 0.00 | - | 0.00 | 0.99 | 0.00 | 1.81 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NRSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FW | $m^3$ | 1.70 | 5.22E-03 | 1.76E-03 | - | 0.78 | 0.21 | 0.00 | 1.07 | 0.00 | 0.00 | 0.00 | 8.20E-04 | 1.87E-02 | 8.09E-04 | -0.72 |
| **Waste categories** | | | | | | | | | | | | | | | | |
| HWD | kg | 3.59E-03 | 4.12E-09 | 2.43E-11 | - | 2.05E-07 | 3.57E-03 | 0.00 | 3.59E-03 | 0.00 | 0.00 | 0.00 | 6.48E-10 | 4.44E-10 | 3.48E-10 | -1.13E-07 |
| NHWD | kg | 50.40 | 1.22E-02 | 8.87E-03 | - | 0.50 | 27.20 | 0.00 | 53.66 | 0.00 | 0.00 | 0.00 | 1.91E-03 | 3.43E-02 | 16.40 | -15.60 |
| RWD | kg | 0.11 | 9.89E-05 | 7.14E-06 | - | 4.51E-03 | 1.95E-02 | 0.00 | 7.41E-02 | 0.00 | 0.00 | 0.00 | 1.56E-05 | 2.05E-04 | 3.44E-05 | -4.92E-02 |
| **Output material flows** | | | | | | | | | | | | | | | | |
| CRU | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MFR | kg | 2.54 | 0.00 | 0.00 | - | 0.00 | 25.60 | 0.00 | 18.94 | 0.00 | 0.00 | 0.00 | 0.00 | 16.40 | 0.00 | 0.00 |
| MER | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EEE | MJ | 0.95 | 0.00 | 1.45 | - | 0.00 | 6.71 | 0.00 | 20.50 | 0.00 | 0.00 | 0.00 | 0.00 | 18.10 | 0.00 | 0.00 |
| EET | MJ | 2.11 | 0.00 | 2.58 | - | 0.00 | 11.90 | 0.00 | 36.89 | 0.00 | 0.00 | 0.00 | 0.00 | 32.20 | 0.00 | 0.00 |

**Key:**
**GWP** – global warming potential **ODP** – ozone depletion potential **AP** - acidification potential **EP** - eutrophication potential **POCP** - photochemical ozone formation potential **ADPE** - abiotic depletion potential – non-fossil resources **ADPF** - abiotic depletion potential – fossil resources **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **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 **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for re-use **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy

| Results per 1 m² of W72 aluminium window additional system (F3) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Unit** | **A1-A3** | **A4** | **A5** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **C1** | **C2** | **C3** | **C4** | **D** |
| **Central environmental impacts** | | | | | | | | | | | | | | | | |
| GWP | kg $CO_2$ eq. | 246.00 | 6.58 | 0.74 | - | 49.00 | 53.70 | 0.00 | 189.46 | 0.00 | 0.00 | 0.00 | 1.24 | 13.40 | 0.20 | -101.00 |
| ODP | kg CFC -11 eq. | 4.66E-08 | 1.15E-15 | 1.08E-16 | - | 1.24E-13 | 1.17E-08 | 0.00 | 4.66E-08 | 0.00 | 0.00 | 0.00 | 2.16E-16 | 3.09E-15 | 1.08E-15 | -3.51E-13 |
| AP | kg $SO_2$ eq. | 0.94 | 1.52E-02 | 7.55E-05 | - | 4.88E-02 | 0.33 | 0.00 | 0.63 | 0.00 | 0.00 | 0.00 | 2.39E-03 | 9.17E-04 | 1.20E-03 | -0.41 |
| EP | kg $PO_4^{3-}$ eq. | 8.75E-02 | 3.80E-03 | 1.55E-05 | - | 8.41E-03 | 2.67E-02 | 0.00 | 7.19E-02 | 0.00 | 0.00 | 0.00 | 5.92E-04 | 1.92E-04 | 1.36E-04 | -2.97E-02 |
| POCP | kg ethene eq. | 5.56E-02 | -5.42E-03 | 6.30E-06 | - | 1.30E-02 | 1.92E-02 | 0.00 | 3.43E-02 | 0.00 | 0.00 | 0.00 | -7.79E-04 | 9.35E-05 | 9.10E-05 | -1.04E-02 |
| ADPE | kg Sb eq. | 9.66E-04 | 5.75E-07 | 7.19E-09 | - | 1.69E-05 | 8.07E-04 | 0.00 | 9.34E-04 | 0.00 | 0.00 | 0.00 | 1.08E-07 | 9.17E-08 | 7.30E-08 | -5.46E-05 |
| ADPF | MJ | 3270.00 | 89.60 | 0.12 | - | 1480.00 | 795.00 | 0.00 | 2486.33 | 0.00 | 0.00 | 0.00 | 16.90 | 2.01 | 2.70 | -1190.00 |
| **Use of resources** | | | | | | | | | | | | | | | | |
| PERE | MJ | 1130.00 | 5.01 | 2.49 | - | 25.70 | 121.00 | 0.00 | 707.59 | 0.00 | 0.00 | 0.00 | 0.94 | 0.77 | 0.37 | -502.00 |
| PERM | MJ | 2.47 | 0.00 | -2.47 | - | 0.00 | 0.00 | 0.00 | 4.31E-03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PERT | MJ | 1130.00 | 5.01 | 2.58E-02 | - | 25.70 | 121.00 | 0.00 | 705.13 | 0.00 | 0.00 | 0.00 | 0.94 | 0.77 | 0.37 | -502.00 |
| PENRE | MJ | 3650.00 | 89.90 | 3.56 | - | 1490.00 | 872.00 | 0.00 | 2774.19 | 0.00 | 0.00 | 0.00 | 16.90 | 58.13 | 5.70 | -1390.00 |
| PENRM | MJ | 61.90 | 0.00 | -3.42 | - | 0.00 | 0.00 | 0.00 | 3.20E-02 | 0.00 | 0.00 | 0.00 | 0.00 | -55.52 | -2.92 | 0.00 |
| PENRT | MJ | 3710.00 | 89.90 | 0.13 | - | 1490.00 | 872.00 | 0.00 | 2772.32 | 0.00 | 0.00 | 0.00 | 16.90 | 2.61 | 2.78 | -1390.00 |
| SM | kg | 2.08 | 0.00 | 0.00 | - | 0.00 | 0.81 | 0.00 | 2.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NRSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FW | $m^3$ | 2.41 | 5.74E-03 | 1.76E-03 | - | 0.78 | 0.30 | 0.00 | 1.39 | 0.00 | 0.00 | 0.00 | 1.08E-03 | 2.92E-02 | 6.85E-04 | -1.18 |
| **Waste categories** | | | | | | | | | | | | | | | | |
| HWD | kg | 2.93E-03 | 4.53E-09 | 2.43E-11 | - | 2.05E-07 | 2.91E-03 | 0.00 | 2.93E-03 | 0.00 | 0.00 | 0.00 | 8.53E-10 | 5.50E-10 | 2.95E-10 | -1.51E-07 |
| NHWD | kg | 60.70 | 1.34E-02 | 8.87E-03 | - | 0.50 | 25.30 | 0.00 | 53.48 | 0.00 | 0.00 | 0.00 | 2.52E-03 | 5.34E-02 | 13.90 | -25.00 |
| RWD | kg | 0.17 | 1.09E-04 | 7.14E-06 | - | 4.51E-03 | 3.05E-02 | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 | 2.05E-05 | 2.39E-04 | 2.92E-05 | -8.04E-02 |
| **Output material flows** | | | | | | | | | | | | | | | | |
| CRU | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MFR | kg | 2.11 | 0.00 | 0.00 | - | 0.00 | 22.20 | 0.00 | 23.01 | 0.00 | 0.00 | 0.00 | 0.00 | 20.90 | 0.00 | 0.00 |
| MER | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EEE | MJ | 0.95 | 0.00 | 1.45 | - | 0.00 | 12.00 | 0.00 | 30.80 | 0.00 | 0.00 | 0.00 | 0.00 | 28.40 | 0.00 | 0.00 |
| EET | MJ | 2.11 | 0.00 | 2.58 | - | 0.00 | 21.30 | 0.00 | 55.19 | 0.00 | 0.00 | 0.00 | 0.00 | 50.50 | 0.00 | 0.00 |

**Key:**
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| Results per 1 m² of aluminium lifting-sliding door / parallel slide and tilt (PSK) (H1) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Unit** | **A1-A3** | **A4** | **A5** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **C1** | **C2** | **C3** | **C4** | **D** |
| **Central environmental impacts** | | | | | | | | | | | | | | | | |
| GWP | kg $CO_2$ eq. | 179.00 | 6.74 | 0.66 | - | 48.20 | 43.90 | 0.00 | 146.72 | 0.00 | 0.00 | 0.00 | 1.05 | 10.50 | 0.27 | -67.30 |
| ODP | kg CFC -11 eq. | 4.76E-08 | 1.18E-15 | 9.71E-17 | - | 1.04E-13 | 1.64E-08 | 0.00 | 4.76E-08 | 0.00 | 0.00 | 0.00 | 1.83E-16 | 2.80E-15 | 1.46E-15 | -2.90E-13 |
| AP | kg $SO_2$ eq. | 0.81 | 1.56E-02 | 6.76E-05 | - | 4.74E-02 | 0.39 | 0.00 | 0.62 | 0.00 | 0.00 | 0.00 | 2.03E-03 | 7.40E-04 | 1.61E-03 | -0.28 |
| EP | kg $PO_4^{3-}$ eq. | 7.34E-02 | 3.89E-03 | 1.39E-05 | - | 7.87E-03 | 3.09E-02 | 0.00 | 6.40E-02 | 0.00 | 0.00 | 0.00 | 5.02E-04 | 1.53E-04 | 1.83E-04 | -2.35E-02 |
| POCP | kg ethene eq. | 4.78E-02 | -5.55E-03 | 5.64E-06 | - | 1.29E-02 | 2.22E-02 | 0.00 | 3.38E-02 | 0.00 | 0.00 | 0.00 | -6.60E-04 | 7.48E-05 | 1.23E-04 | 1.42E-03 |
| ADPE | kg Sb eq. | 1.26E-03 | 5.89E-07 | 6.44E-09 | - | 1.05E-05 | 1.14E-03 | 0.00 | 1.22E-03 | 0.00 | 0.00 | 0.00 | 9.17E-08 | 7.58E-08 | 9.85E-08 | -7.30E-05 |
| ADPF | MJ | 2490.00 | 91.80 | 0.10 | - | 1470.00 | 739.00 | 0.00 | 2007.55 | 0.00 | 0.00 | 0.00 | 14.30 | 1.70 | 3.65 | -812.00 |
| **Use of resources** | | | | | | | | | | | | | | | | |
| PERE | MJ | 744.00 | 5.13 | 2.23 | - | 21.10 | 46.50 | 0.00 | 490.37 | 0.00 | 0.00 | 0.00 | 0.80 | 0.70 | 0.51 | -285.00 |
| PERM | MJ | 2.21 | 0.00 | -2.21 | - | 0.00 | 0.00 | 0.00 | 4.04E-03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PERT | MJ | 746.00 | 5.13 | 2.31E-02 | - | 21.10 | 46.50 | 0.00 | 490.16 | 0.00 | 0.00 | 0.00 | 0.80 | 0.70 | 0.51 | -285.00 |
| PENRE | MJ | 2710.00 | 92.10 | 3.18 | - | 1480.00 | 777.00 | 0.00 | 2203.43 | 0.00 | 0.00 | 0.00 | 14.40 | 70.41 | 7.34 | -930.00 |
| PENRM | MJ | 74.80 | 0.00 | -3.06 | - | 0.00 | 0.00 | 0.00 | 1.82E-03 | 0.00 | 0.00 | 0.00 | 0.00 | -68.15 | -3.59 | 0.00 |
| PENRT | MJ | 2780.00 | 92.10 | 0.12 | - | 1480.00 | 777.00 | 0.00 | 2198.63 | 0.00 | 0.00 | 0.00 | 14.40 | 2.26 | 3.75 | -930.00 |
| SM | kg | 2.03 | 0.00 | 0.00 | - | 0.00 | 1.13 | 0.00 | 2.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NRSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FW | $m^3$ | 1.65 | 5.88E-03 | 1.58E-03 | - | 0.28 | 0.18 | 0.00 | 1.04 | 0.00 | 0.00 | 0.00 | 9.16E-04 | 2.29E-02 | 9.25E-04 | -0.68 |
| **Waste categories** | | | | | | | | | | | | | | | | |
| HWD | kg | 4.74E-03 | 4.64E-09 | 2.18E-11 | - | 2.02E-07 | 4.08E-03 | 0.00 | 4.74E-03 | 0.00 | 0.00 | 0.00 | 7.23E-10 | 4.87E-10 | 3.98E-10 | -1.39E-07 |
| NHWD | kg | 53.70 | 1.37E-02 | 7.95E-03 | - | 0.45 | 29.50 | 0.00 | 59.67 | 0.00 | 0.00 | 0.00 | 2.13E-03 | 4.20E-02 | 18.70 | -14.50 |
| RWD | kg | 0.11 | 1.11E-04 | 6.40E-06 | - | 3.31E-03 | 1.47E-02 | 0.00 | 7.31E-02 | 0.00 | 0.00 | 0.00 | 1.74E-05 | 2.19E-04 | 3.94E-05 | -4.61E-02 |
| **Output material flows** | | | | | | | | | | | | | | | | |
| CRU | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MFR | kg | 2.85 | 0.00 | 0.00 | - | 0.00 | 29.40 | 0.00 | 20.85 | 0.00 | 0.00 | 0.00 | 0.00 | 18.00 | 0.00 | 0.00 |
| MER | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EEE | MJ | 0.85 | 0.00 | 1.29 | - | 0.00 | 7.72 | 0.00 | 24.34 | 0.00 | 0.00 | 0.00 | 0.00 | 22.20 | 0.00 | 0.00 |
| EET | MJ | 1.88 | 0.00 | 2.31 | - | 0.00 | 13.70 | 0.00 | 43.69 | 0.00 | 0.00 | 0.00 | 0.00 | 39.50 | 0.00 | 0.00 |

**Key:**
**GWP** – global warming potential **ODP** – ozone depletion potential **AP** - acidification potential **EP** - eutrophication potential **POCP** - photochemical ozone formation potential **ADPE** - abiotic depletion potential – non-fossil resources **ADPF** - abiotic depletion potential – fossil resources **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **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 **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for re-use **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy

| Results per 1 m² of aluminium lifting-sliding door (H2) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Unit** | **A1-A3** | **A4** | **A5** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **C1** | **C2** | **C3** | **C4** | **D** |
| **Central environmental impacts** | | | | | | | | | | | | | | | | |
| GWP | kg $CO_2$ eq. | 78.90 | 2.53 | 0.66 | - | 48.20 | 15.30 | 0.00 | 65.50 | 0.00 | 0.00 | 0.00 | 0.42 | 5.00 | 9.07E-02 | -27.60 |
| ODP | kg CFC -11 eq. | 3.52E-08 | 4.42E-16 | 9.71E-17 | - | 1.04E-13 | 4.15E-09 | 0.00 | 3.52E-08 | 0.00 | 0.00 | 0.00 | 7.32E-17 | 2.26E-15 | 4.96E-16 | -1.19E-13 |
| AP | kg $SO_2$ eq. | 0.32 | 5.86E-03 | 6.76E-05 | - | 4.74E-02 | 0.13 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 | 8.09E-04 | 4.08E-04 | 5.46E-04 | -0.11 |
| EP | kg $PO_4^{3-}$ eq. | 3.11E-02 | 1.46E-03 | 1.39E-05 | - | 7.87E-03 | 1.04E-02 | 0.00 | 2.71E-02 | 0.00 | 0.00 | 0.00 | 2.00E-04 | 7.92E-05 | 6.21E-05 | -9.03E-03 |
| POCP | kg ethene eq. | 1.93E-02 | -2.08E-03 | 5.64E-06 | - | 1.29E-02 | 7.37E-03 | 0.00 | 1.33E-02 | 0.00 | 0.00 | 0.00 | -2.63E-04 | 3.96E-05 | 4.16E-05 | -5.81E-04 |
| ADPE | kg Sb eq. | 3.66E-04 | 2.21E-07 | 6.44E-09 | - | 1.05E-05 | 3.09E-04 | 0.00 | 3.54E-04 | 0.00 | 0.00 | 0.00 | 3.66E-08 | 4.57E-08 | 3.34E-08 | -2.34E-05 |
| ADPF | MJ | 1080.00 | 34.50 | 0.10 | - | 1470.00 | 255.00 | 0.00 | 867.68 | 0.00 | 0.00 | 0.00 | 5.71 | 1.13 | 1.24 | -331.00 |
| **Use of resources** | | | | | | | | | | | | | | | | |
| PERE | MJ | 346.00 | 1.93 | 2.23 | - | 21.10 | 17.00 | 0.00 | 236.22 | 0.00 | 0.00 | 0.00 | 0.32 | 0.57 | 0.17 | -123.00 |
| PERM | MJ | 2.21 | 0.00 | -2.21 | - | 0.00 | 0.00 | 0.00 | 4.04E-03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PERT | MJ | 348.00 | 1.93 | 2.31E-02 | - | 21.10 | 17.00 | 0.00 | 236.02 | 0.00 | 0.00 | 0.00 | 0.32 | 0.57 | 0.17 | -123.00 |
| PENRE | MJ | 1170.00 | 34.60 | 3.18 | - | 1480.00 | 269.00 | 0.00 | 950.44 | 0.00 | 0.00 | 0.00 | 5.73 | 33.95 | 2.97 | -381.00 |
| PENRM | MJ | 37.10 | 0.00 | -3.06 | - | 0.00 | 0.00 | 0.00 | -2.98E-02 | 0.00 | 0.00 | 0.00 | 0.00 | -32.36 | -1.70 | 0.00 |
| PENRT | MJ | 1210.00 | 34.60 | 0.12 | - | 1480.00 | 269.00 | 0.00 | 953.31 | 0.00 | 0.00 | 0.00 | 5.73 | 1.59 | 1.27 | -381.00 |
| SM | kg | 0.82 | 0.00 | 0.00 | - | 0.00 | 0.38 | 0.00 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| RSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NRSF | MJ | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FW | $m^3$ | 0.78 | 2.21E-03 | 1.58E-03 | - | 0.28 | 6.13E-02 | 0.00 | 0.51 | 0.00 | 0.00 | 0.00 | 3.65E-04 | 1.11E-02 | 3.13E-04 | -0.29 |
| **Waste categories** | | | | | | | | | | | | | | | | |
| HWD | kg | 1.27E-03 | 1.74E-09 | 2.18E-11 | - | 2.02E-07 | 1.26E-03 | 0.00 | 1.27E-03 | 0.00 | 0.00 | 0.00 | 2.88E-10 | 3.67E-10 | 1.35E-10 | -5.43E-08 |
| NHWD | kg | 20.70 | 5.14E-03 | 7.95E-03 | - | 0.45 | 9.87 | 0.00 | 21.55 | 0.00 | 0.00 | 0.00 | 8.50E-04 | 2.03E-02 | 6.33 | -6.09 |
| RWD | kg | 4.90E-02 | 4.18E-05 | 6.40E-06 | - | 3.31E-03 | 5.35E-03 | 0.00 | 3.18E-02 | 0.00 | 0.00 | 0.00 | 6.93E-06 | 1.81E-04 | 1.33E-05 | -1.99E-02 |
| **Output material flows** | | | | | | | | | | | | | | | | |
| CRU | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MFR | kg | 1.08 | 0.00 | 0.00 | - | 0.00 | 9.82 | 0.00 | 8.01 | 0.00 | 0.00 | 0.00 | 0.00 | 6.93 | 0.00 | 0.00 |
| MER | kg | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EEE | MJ | 0.85 | 0.00 | 1.29 | - | 0.00 | 3.35 | 0.00 | 12.64 | 0.00 | 0.00 | 0.00 | 0.00 | 10.50 | 0.00 | 0.00 |
| EET | MJ | 1.86 | 0.00 | 2.31 | - | 0.00 | 5.96 | 0.00 | 22.97 | 0.00 | 0.00 | 0.00 | 0.00 | 18.80 | 0.00 | 0.00 |

**Key:**
**GWP** – global warming potential **ODP** – ozone depletion potential **AP** - acidification potential **EP** - eutrophication potential **POCP** - photochemical ozone formation potential **ADPE** - abiotic depletion potential – non-fossil resources **ADPF** - abiotic depletion potential – fossil resources **PERE** - Use of renewable primary energy **PERM** - use of renewable primary energy resources **PERT** - total use of renewable primary energy resources **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources **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 **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for re-use **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy

## 6.4 Interpretation, LCA presentation and critical review

**Evaluation**

The environmental impacts of

- W77 windows
- W72 / W 65 windows
- W72 additional systems
- lifting-sliding doors / parallel slide and tilt (PSK)
- sliding doors

differ considerably from each other. The differences result mainly from the amount of pre-products and raw materials used. This was to be expected in particular due to the use of anodised aluminium profiles and glass units.

The environmental impacts of the manufacture result mainly from the use of aluminium / its upstream chains and the anodisation of the profiles. For all windows and lifting-sliding elements, the use of insulating strips and their upstream chains presents an additional factor that must be taken into account. The environmental impacts result furthermore mainly from the use of the glass units and their upstream chains.

The cleaning operations using glass cleaners containing ethanol and isopropanol over the 50-year use stage also play a notable role in environmental impacts. Additional central values during the use stage originate from the repair of wearing parts (in particular glass) as well as the one-off replacement in the context of building renovation during a 50-year time period.

For scenario C4 only marginal consumptions arising from the physical pre-treatment and management of the disposal site are expected. Allocation to individual products is almost impossible for site disposal.
In terms of product recycling, for aluminium between 8% and 13% of the environmental impacts arising during the life cycle can be assigned as benefits to scenario D, depending on the product group.

The charts below show the allocation of the main environmental impacts.

**The values obtained from the LCA calculation are suitable for the certification of buildings.**

## Charts

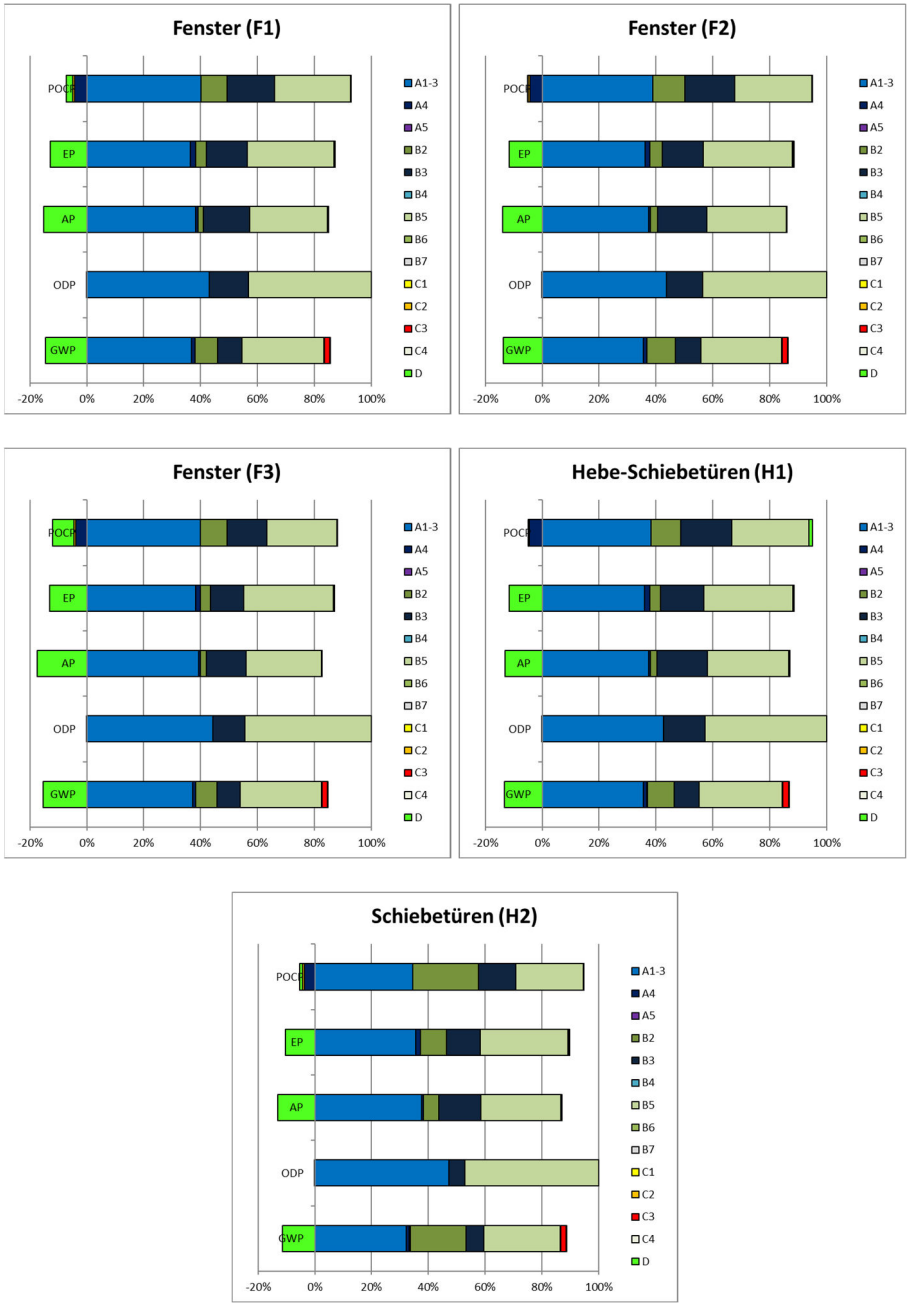


Figure 2: Percentage of the modules in selected environmental impact categories

**Report**

The LCA report underlying this EPD was developed according to the requirements of DIN EN ISO 14040 and DIN EN ISO 14044 as well as DIN EN 15804 and DIN EN ISO 14025. It is not addressed to third parties for reasons of confidentiality. It is deposited with the ift Rosenheim. The results and conclusions reported to the target group are complete, correct, without bias and transparent. The results of the study are not designed to be used for comparative statements intended for publication.

**Critical review**

The critical review of the LCA and of the report took place in the course of verification of the EPD and was carried out by Patrick Wortner, MBA and Eng., Dipl.-Ing. (FH), an external verifier.

## 7 General information regarding the EPD

**Comparability**

This EPD was prepared in accordance with DIN EN 15804 and is therefore only comparable to those EPDs that also comply with the requirements set out in DIN EN 15804.
Any comparison must refer to the building context and the same boundary conditions of the various life cycle stages.
For comparing EPDs of construction products, the rules set out in DIN EN 15804 (Clause 5.3) apply.

The detailed individual results of the products were summarised on the basis of conservative assumptions and differ from the average results. Identification of the product groups and the resulting variations are documented in the background report.

**Communication**

The communications format of this EPD meets the requirements of EN 15942:2012 and is therefore the basis for B2B communication. Only the nomenclature has been changed according to DIN EN 15804.

**Verification**

Verification of the Environmental Product Declaration is documented in accordance with the ift "Richtlinie zur Erstellung von Typ III Umweltproduktdeklarationen" (Guidance on preparing Type III Environmental Product Declarations) in accordance with the requirements set out in DIN EN ISO 14025.

The Declaration is based on the PCR documents EN 17213 “PCR for windows and doors”, “PCR Part A” PCR-A-0.2:2018 and "Windows, flat roof windows, skylights and continuous roof lights" PCR-FE-2.1:2018.”

| |
|---|
| The European standard EN 15804 serves as the core PCR [a)] |
| Independent verification of the Declaration and statement according to EN ISO 14025:2010<br>☐ internal ☒ external |
| Independent third-party verifier: [b)]<br>Patrick Wortner |
| [a)] Product category rules<br>[b)] Optional for business-to-business communication<br>Mandatory for business-to-consumer communication<br>(see EN ISO 14025:2010, 9.4) |

**Revisions of this document**

| No. | Date | Note: | Practitioner of the LCA | Verifier |
|---|---|---|---|---|
| 1 | 14.04.2021 | External Verification | Zwick | Wortner |
| 2 | | | | |
| 3 | | | | |

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# 9 Annex

**Description of life cycle scenarios for aluminium windows and lifting-sliding elements**

| Product stage | | | Con-struction stage | | Use stage | | | | | | | End-of-life stage | | | | Benefits and loads from beyond the system boundaries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| Raw material supply | Transport | Manufacture | Transport | Construction/Installation | Use | Inspection, maintenance, clean-ing | Repair | Exchange / Replacement | Improvement / Modernisation | Operational energy use | Operational water use | Deconstruction | Transport | Waste management | Disposal | Re-use Recovery Recycling potential |
| ✓ | ✓ | ✓ | ✓ | ✓ | — | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Calculation of the scenarios was based on a building service life of 50 years (in accordance with RSL of Section 4 Use stage).

The scenarios were based on information provided by the manufacturer. The scenarios were furthermore based on the research project “EPDs for transparent building components“ (1).

Note: The standard scenarios selected are presented in bold type. They were also used for calculating the indicators in the summary table.

✓ Included in the LCA
— Not included in the LCA

| A4 Transport to the construction site | | |
|---|---|---|
| **No.** | **Scenario** | **Description** |
| A4.1 | Small series - direct marketing | 7.5 t truck (Euro 0-6 mix), 2.7 t payload, 20% capacity used, approx. 50 km to site and empty return trip. |
| **A4.2** | **Small series via local manufacturers** | **7.5 t truck (Euro 0-6 mix), 2.7 t payload, full capacity, approx. 50 km to site and empty return trip as well as 7.5 t truck (Euro 0-6 mix), 2.7 t payload, 20% load, approx. 50 km to site and empty return trip** |
| A4.3 | Small series via distributors | 34 - 40 t truck (Euro 0-6 mix), 27 t payload, full capacity, approx. 150 km to site and empty return trip as well as 7.5 t truck (Euro 0-6 mix), 2.7 t payload, 20% capacity used, approx. 50 km to site and empty return trip |
| A4.4 | Large-scale project | 34 - 40 t truck (Euro 0-6 mix), 27 t payload, full capacity, approx. 150 km to site and empty return trip. |

Weight: F1: 44.34 kg/m², F2: 35.78 kg/m², F3: 39.32 kg/m², H1: 40.28 kg/m², H2: 15.12 kg/m²

The scenarios were calculated per kg and can be scaled to the product group using the above masses. The values in the summary table are already based on m² .

| A4 Transport to the construction site per 1 kg | Unit | A4.1 | A4.2 | A4.3 | A4.4 |
|---|---|---|---|---|---|
| **Central environmental impacts** | | | | | |
| GWP | kg $CO_2$ eq. | 0.14 | **0.17** | 0.16 | 2.04E-02 |
| ODP | kg CFC -11 eq. | 2.42E-17 | **2.92E-17** | 2.77E-17 | 3.54E-18 |
| AP | kg $SO_2$ eq. | 3.21E-04 | **3.88E-04** | 3.50E-04 | 2.84E-05 |
| EP | kg $PO_4^{3-}$ eq. | 8.00E-05 | **9.66E-05** | 8.69E-05 | 6.95E-06 |
| POCP | kg ethene eq. | -1.14E-04 | **-1.38E-04** | -1.21E-04 | -7.29E-06 |
| ADPE | kg Sb eq. | 1.21E-08 | **1.46E-08** | 1.39E-08 | 1.77E-09 |
| ADPF | MJ | 1.88 | **2.28** | 2.16 | 0.28 |
| **Use of resources** | | | | | |
| PERE | MJ | 0.11 | **0.13** | 0.12 | 1.54E-02 |
| PERM | MJ | 0.00 | **0.00** | 0.00 | 0.00 |
| PERT | MJ | 0.11 | **0.13** | 0.12 | 1.54E-02 |
| PENRE | MJ | 1.89 | **2.29** | 2.17 | 0.28 |
| PENRM | MJ | 0.00 | **0.00** | 0.00 | 0.00 |
| PENRT | MJ | 1.89 | **2.29** | 2.17 | 0.28 |
| SM | kg | 0.00 | **0.00** | 0.00 | 0.00 |
| RSF | MJ | 0.00 | **0.00** | 0.00 | 0.00 |
| NRSF | MJ | 0.00 | **0.00** | 0.00 | 0.00 |
| FW | $m^3$ | 1.21E-04 | **1.46E-04** | 1.38E-04 | 1.77E-05 |
| **Waste categories** | | | | | |
| HWD | kg | 9.53E-11 | **1.15E-07** | 1.01E-07 | 1.40E-08 |
| NHWD | kg | 2.81E-04 | **3.40E-04** | 3.32E-04 | 4.11E-05 |
| RWD | kg | 2.29E-06 | **2.77E-06** | 2.62E-06 | 3.35E-07 |
| **Output material flows** | | | | | |
| CRU | kg | 0.00 | **0.00** | 0.00 | 0.00 |
| MFR | kg | 0.00 | **0.00** | 0.00 | 0.00 |
| MER | kg | 0.00 | **0.00** | 0.00 | 0.00 |
| EEE | MJ | 0.00 | **0.00** | 0.00 | 0.00 |
| EET | MJ | 0.00 | **0.00** | 0.00 | 0.00 |

**A5 Construction/Installation**

| No. | Scenario | Description |
|---|---|---|
| **A5.1** | **Manual** | **The elements are installed without mechanical handling.<br>0.0 kWh/m² electricity consumed** |
| A5.2 | Small lifting trolley / lifting platform | A small lifting device or fork-lift truck is required for the installation of the elements.<br>1.0 kWh/m² electricity consumed by lifting platform (1) |
| A5.3 | Crane | A (construction) crane is required for the installation of the elements.<br>1.5 kWh/m² electricity consumed by crane (1) |

In case of deviating consumption during installation/assembly of the products which forms part of the site management, they are covered at the building level.

Ancillary materials, consumables, use of water, material losses and waste as well as transport distances during installation are negligible.

It is assumed that the packaging material in the Module construction / installation is sent to waste handling. Waste is only thermally recycled in line with the conservative approach. Transport to the recycling plants is not taken into account.
Benefits from A5 are specified in Module D. Benefits from waste incineration: electricity replaces electricity mix (EU 28); thermal energy replaces thermal energy from natural gas (EU 28).

| **A5 Construction / Installation per 1 m²** | **Unit** | **A5.1** | A5.2 | A5.3 |
|---|---|---|---|---|
| **Central environmental impacts** | | | | |
| GWP | kg $CO_2$ eq. | **0.00** | 0.39 | 0.59 |
| ODP | kg R11 eq. | **0.00** | 1.27E-14 | 1.90E-14 |
| AP | kg $SO_2$ eq. | **0.00** | 7.72E-04 | 1.16E-03 |
| EP | kg $PO_4^{3-}$ eq. | **0.00** | 9.09E-05 | 1.36E-04 |
| POCP | kg $C_2H_4$ eq. | **0.00** | 5.60E-05 | 8.40E-05 |
| ADPE | kg Sb eq. | **0.00** | 1.32E-07 | 1.99E-07 |
| ADPF | MJ | **0.00** | 4.42 | 6.63 |
| Use of resources | | | | |
| PERE | MJ | **0.00** | 3.26 | 4.89 |
| PERM | MJ | **0.00** | 0.00 | 0.00 |
| PERT | MJ | **0.00** | 3.26 | 4.89 |
| PENRE | MJ | **0.00** | 7.07 | 10.60 |
| PENRM | MJ | **0.00** | 0.00 | 0.00 |
| PENRT | MJ | **0.00** | 7.07 | 10.60 |
| SM | kg | **0.00** | 0.00 | 0.00 |
| RSF | MJ | **0.00** | 0.00 | 0.00 |
| NRSF | MJ | **0.00** | 0.00 | 0.00 |
| FW | $m^3$ | **0.00** | 3.17E-03 | 4.76E-03 |
| Waste categories | | | | |
| HWD | kg | **0.00** | 1.87E-09 | 2.80E-09 |
| NHWD | kg | **0.00** | 5.02E-03 | 7.52E-03 |
| RWD | kg | **0.00** | 1.05E-03 | 1.58E-03 |
| **Output material flows** | | | | |
| CRU | kg | **0.00** | 0.00 | 0.00 |
| MFR | kg | **0.00** | 0.00 | 0.00 |
| MER | kg | **0.00** | 0.00 | 0.00 |

| | | | | |
|---|---|---|---|---|
| EEE | MJ | **0.00** | 0.00 | 0.00 |
| EET | MJ | **0.00** | 0.00 | 0.00 |

**B1 Use (not included)**
Refer to Section 5 Use stage - Emissions to the environment. Emissions cannot be quantified.

**B2 Inspection, maintenance, cleaning**

**B2.1 Cleaning**

| No. | Scenario | Description |
|---|---|---|
| **B2.1.1** | **Rarely, manual** | **Less than 2.5 m height or industrial climber, manually using suitable cleaning agents, annually 2.5 l consumed per 1 m² and cleaning (125 l / 50 yr)** (1) |
| B2.1.2 | Rarely, using machines | More than 2.5 m with elevating platform, crane systems, maintenance platform, etc., annually 10 l water consumed per 1 m² and cleaning (500 l / 50 yr) and 2.5 kWh / 50 yr (1) |
| B2.1.3 | Frequently, manual | Less than 2.5 m height or industrial climber, manually using suitable cleaning agents, quarterly 2.5 l consumed per 1 m² and cleaning (500 l / 50 yr) (1) |
| B2.1.4 | Frequently, using machines | More than 2.5 m with elevating platform, crane systems, maintenance platform, etc., quarterly 10 l water consumed per 1 m² and cleaning (2,000 l / 50 yr) and 2.5 kWh / 50 yr (1) |

Ancillary materials, consumables, use of energy and water, material losses and waste as well as transport distances during cleaning are negligible.

| B2.1 Cleaning per 1 m² | Unit | B2.1.1 | B2.1.2 | B2.1.3 | B2.1.4 |
|---|---|---|---|---|---|
| **Central environmental impacts** | | | | | |
| GWP | kg $CO_2$ eq. | **48.10** | 1.74 | 193.00 | 4.02 |
| ODP | kg CFC -11 eq. | **1.07E-13** | 5.18E-14 | 4.30E-13 | 1.12E-13 |
| AP | kg $SO_2$ eq. | **4.72E-02** | 3.36E-03 | 0.19 | 7.67E-03 |
| EP | kg $PO_4^{3-}$ eq. | **7.96E-03** | 7.57E-04 | 3.18E-02 | 2.35E-03 |
| POCP | kg ethene eq. | **1.28E-02** | 2.60E-04 | 5.14E-02 | 6.20E-04 |
| ADPE | kg Sb eq. | **1.21E-05** | 6.67E-06 | 4.82E-05 | 2.57E-05 |
| ADPF | MJ | **1,460.00** | 20.50 | 5850.00 | 48.90 |
| **Use of resources** | | | | | |
| PERE | MJ | **22.00** | 12.80 | 88.20 | 26.60 |
| PERM | MJ | **0.00** | 0.00 | 0.00 | 0.00 |
| PERT | MJ | **22.00** | 12.80 | 88.20 | 26.60 |
| PENRE | MJ | **1,470.00** | 30.20 | 5890.00 | 67.70 |
| PENRM | MJ | **0.00** | 0.00 | 0.00 | 0.00 |
| PENRT | MJ | **1,470.00** | 30.20 | 5890.00 | 67.70 |
| SM | kg | **0.00** | 0.00 | 0.00 | 0.00 |
| RSF | MJ | **0.00** | 0.00 | 0.00 | 0.00 |
| NRSF | MJ | **0.00** | 0.00 | 0.00 | 0.00 |
| FW | $m^3$ | **0.40** | 0.51 | 1.61 | 2.02 |
| **Waste categories** | | | | | |
| HWD | kg | **2.02E-07** | 7.75E-09 | 8.09E-76 | 1.70E-08 |
| NHWD | kg | **0.46** | 6.39E-02 | 1.83 | 0.22 |
| RWD | kg | **3.58E-03** | 3.84E-03 | 1.43E-02 | 7.75E-03 |

| Output material flows | | | | | |
|---|---|---|---|---|---|
| CRU | kg | **0.00** | 0.00 | 0.00 | 0.00 |
| MFR | kg | **0.00** | 0.00 | 0.00 | 0.00 |
| MER | kg | **0.00** | 0.00 | 0.00 | 0.00 |
| EEE | MJ | **0.00** | 0.00 | 0.00 | 0.00 |
| EET | MJ | **0.00** | 0.00 | 0.00 | 0.00 |

## B2.2 Maintenance

| No. | Scenario | Description |
|---|---|---|
| B2.2.1 | Low use (e.g. residential construction) | Every two years functional check, visual inspection, greasing/lubrication of hardware and, if necessary, repair - 0.125 kg lubricants per 50 yr (1) |
| **B2.2.2** | **Normal use (e.g. office or public buildings)** | **Annual functional check, visual inspection, greasing / lubrication of hardware and, if necessary, repair - 0.250 kg lubricants per 50 yr** (1) |
| B2.2.3 | Heavy use (e.g. schools and hotels) | Biannual functional check, visual inspection, greasing / lubrication of hardware and, if necessary, repair - 0.500 kg lubricants per 50 yr (1) |

Ancillary materials, consumables, use of energy and water, waste, material losses and transport distances during maintenance are negligible.

| B2.2 Maintenance per 1 m² | Unit | B2.2.1 | **B2.2.2** | B2.2.3 |
|---|---|---|---|---|
| **Central environmental impacts** | | | | |
| GWP | kg $CO_2$ eq. | 0.13 | **0.27** | 0.53 |
| ODP | kg R11 eq. | 5.94E-16 | **1.19E-15** | 2.38E-15 |
| AP | kg $SO_2$ eq. | 2.83E-04 | **5.67E-04** | 1.13E-03 |
| EP | kg $PO_4^{3-}$ eq. | 2.41E-05 | **4.83E-05** | 9.66E-05 |
| POCP | kg $C_2H_4$ eq. | 4.46E-05 | **8.92E-05** | 1.78E-04 |
| ADPE | kg Sb eq. | 2.29E-08 | **4.59E-08** | 9.17E-08 |
| ADPF | MJ | 6.37 | **12.70** | 25.50 |
| **Use of resources** | | | | |
| PERE | MJ | 0.11 | **0.22** | 0.45 |
| PERM | MJ | 0.00 | **0.00** | 0.00 |
| PERT | MJ | 0.11 | **0.22** | 0.45 |
| PENRE | MJ | 6.41 | **12.80** | 25.60 |
| PENRM | MJ | 0.00 | **0.00** | 0.00 |
| PENRT | MJ | 6.41 | **12.80** | 25.60 |
| SM | kg | 0.00 | **0.00** | 0.00 |
| RSF | MJ | 0.00 | **0.00** | 0.00 |
| NRSF | MJ | 0.00 | **0.00** | 0.00 |
| FW | m³ | 7.80E-05 | **1.56E-04** | 3.212E-04 |
| **Waste categories** | | | | |
| HWD | kg | 1.69E-10 | **3.38E-10** | 6.76E-10 |
| NHWD | kg | 8.99E-04 | **1.80E-03** | 3.60E-03 |
| RWD | kg | 1.51E-05 | **3.01E-05** | 6.03E-05 |
| **Output material flows** | | | | |
| CRU | kg | 0.00 | **0.00** | 0.00 |
| MFR | kg | 0.00 | **0.00** | 0.00 |
| MER | kg | 0.00 | **0.00** | 0.00 |
| EEE | MJ | 0.00 | **0.00** | 0.00 |
| EET | MJ | 0.00 | **0.00** | 0.00 |

**B3 Repair**

| No. | Scenario | Description |
|---|---|---|
| B3 | Normal use and heavy use | One replacement*: all hardware, glass incl. glazing gaskets and seals (1) |

* Assumptions for evaluation of possible environmental impacts; statements made do not constitute any guaranty or warranty of performance.

For updated information refer to the relevant manufacturer instructions for assembly/installation, operation and maintenance

Ancillary materials, consumables, use of energy and water, waste, material losses and transport distances during repair are negligible.

Since only one scenario is used, the results are shown in the relevant summary table.

**B4 Interchange / replacement (not relevant)**

| No. | Scenario | Description |
|---|---|---|
| B4 | Normal use and heavy use | No replacement over a 50 year period* |

* Assumptions for evaluation of possible environmental impacts; statements made do not constitute any guaranty or warranty of performance.

The statements made in this EPD are only informative to allow evaluation at the building level.

It is assumed that no replacement will be necessary during the 50-year reference service life and the 50-year building service life.

For updated information refer to the relevant manufacturer instructions for assembly/installation, operation and maintenance

Ancillary materials, consumables, use of energy and water, material losses, waste as well as transport distances during installation are negligible.

Since only one scenario is used, the results are shown in the relevant summary table.

**B5 Improvement / Modernisation**

| No. | Scenario | Description |
|---|---|---|
| B5 | Normal use and heavy use | One replacement in the context of upgrade / renovation / refurbishment of the building* |

* Assumptions for evaluation of possible environmental impacts; statements made do not constitute any guaranty or warranty of performance.

The environmental impacts of the selected scenario originate from the product, construction and disposal phases.
Ancillary materials, consumables, use of energy and water, waste, material losses and transport distances are taken into account.
For updated information refer to the relevant manufacturer instructions for assembly/installation, operation and maintenance

Since only one scenario is used, the results are shown in the relevant summary table.

**B6 Operational energy use**

| No. | Scenario | Description |
|---|---|---|
| **B6.1** | **Hand-operated** | **No energy consumed when used** |
| B6.2 | Power-operated<br>Normal use | Per drive mechanism: 34.61 kWh / 50 yr electricity (incl. standby operation), for 0.018 kW drive capacity, 10 cycles per day, 48 weeks building use per year; electricity mix (EU 28) |

* Frequencies, times of use, number of users, cycles, etc.

There is no transport consumption for energy use in buildings. Ancillary materials, consumables and water, waste materials and other scenarios are negligible.

| B6 Operational energy use per 1 kg | Unit | B6.1 | B6.2 |
|---|---|---|---|
| **Central environmental impacts** | | | |
| GWP | kg $CO_2$ eq. | **0.00** | 13.60 |
| ODP | kg CFC -11 eq. | **0.00** | 4.39E-13 |
| AP | kg $SO_2$ eq. | **0.00** | 2.67E-02 |
| EP | kg $PO_4^{3-}$ eq. | **0.00** | 3.15E-03 |
| POCP | kg ethene eq. | **0.00** | 1.94E-03 |
| ADPE | kg Sb eq. | **0.00** | 4.58E-06 |
| ADPF | MJ | **0.00** | 153.00 |
| **Use of resources** | | | |
| PERE | MJ | **0.00** | 113.00 |
| PERM | MJ | **0.00** | 0.00 |
| PERT | MJ | **0.00** | 113.00 |
| PENRE | MJ | **0.00** | 245.00 |
| PENRM | MJ | **0.00** | 0.00 |
| PENRT | MJ | **0.00** | 245.00 |
| SM | kg | **0.00** | 0.00 |
| RSF | MJ | **0.00** | 0.00 |
| NRSF | MJ | **0.00** | 0.00 |
| FW | $m^3$ | **0.00** | 0.11 |
| **Waste categories** | | | |
| HWD | kg | **0.00** | 6.47E-08 |
| NHWD | kg | **0.00** | 0.17 |
| RWD | kg | **0.00** | 3.65E-02 |
| **Output material flows** | | | |
| RU | kg | **0.00** | 0.00 |
| MFR | kg | **0.00** | 0.00 |
| MER | kg | **0.00** | 0.00 |
| EEE | MJ | **0.00** | 0.00 |
| EET | MJ | **0.00** | 0.00 |

**B7 Operational water use (not relevant)**

No water consumption when used as intended. Water consumption for cleaning is specified in Module B2.1.

There is no transport consumption for water use in buildings. Ancillary materials, consumables, waste materials and other scenarios are negligible.

Since only one scenario is used, the results are shown in the relevant summary table.

**C1 Deconstruction**

| No. | Scenario | Description |
|---|---|---|
| C1 | Deconstruction | **Based on EN 17213 (metal windows/doors – Figure B.1):<br>Deconstruction 30% for glass;<br>Deconstruction remaining materials 95%<br>Remainder to landfill.<br><br>Further deconstruction rates are possible, give adequate reasons.** |

No relevant inputs or outputs apply to the scenario selected. The energy consumed for deconstruction is negligible. Any arising consumption is marginal.

Since only one scenario is used, the results are shown in the summary table.

In case of deviating consumption the removal of the products forms part of site management and is covered at the building level.

**C2 Transport**

| No. | Scenario | Description |
|---|---|---|
| C2 | Transport | **Transport to collection point using 7.5 t truck (Euro 0-6 mix), full capacity, approx. 50 km to collection point and empty return trip.<br>From collection point to recycling plant using 34 - 40 t truck (Euro 0-6 mix), 27 t payload, full capacity, approx. 150 km and empty return trip.** |

Since only one scenario is used, the results are shown in the summary table.

**C3 Waste management**

| No. | Scenario | Description |
|---|---|---|
| C3 | Disposal | **Share for recirculation of materials:**<br>• **100% metals in melt**<br>• **100% glass in melt**<br>• **plastics 100% thermal recycling in waste incineration plant (R1>0,6)**<br>• **remainder (e.g. fire resistant material) sent to landfill** |

As the products are placed on the European market, the disposal scenario is based on average European data sets.

The below table presents the disposal processes and their percentage by mass/weight. The calculation is based on the above mentioned shares in percent related to the declared unit of the product system.

| C3 Disposal | Unit | F1 | F2 | F3 | H1 | H2 |
|---|---|---|---|---|---|---|
| Collection process, collected separately | kg | 24.99 | 19.11 | 25.16 | 21.32 | 8.51 |
| Collection process, collected as mixed construction waste | kg | 19.03 | 16.34 | 13.84 | 18.87 | 6.33 |
| Recovery system, for re-use | kg | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Recovery system, for recycling | kg | 21.50 | 16.40 | 20.91 | 18.00 | 6.93 |
| Recovery system, for energy recovery | kg | 3.49 | 2.71 | 4.45 | 3.32 | 1.58 |
| Disposal | kg | 19.03 | 16.34 | 13.84 | 18.87 | 6.33 |

Since only one scenario is used, the results are shown in the summary table.

**C4 Disposal**

| No. | Scenario | Description |
|---|---|---|
| **C4** | **Disposal** | **The non-recordable amounts and losses within the re-use/recycling chain (C1 and C3) are modelled as “disposed”.** |

The consumption in scenario C4 results from physical pre-treatment, waste recycling and management of the disposal site. The benefits obtained here from the substitution of primary material production are allocated to Module D, e.g. electricity and heat from waste incineration.

Since only one scenario is used, the results are shown in the summary table.

**D Benefits and loads from beyond the system boundaries**

| No. | Scenario | Description |
|---|---|---|
| **D** | **Recycling potential** | **Aluminium recyclate from C3 excluding the recyclate used in A3 replaces 60% of aluminium compound;<br>Stainless steel scrap from C3 excluding the scrap used in A3 replaces 60% of stainless steel;<br>Steel scrap from C3 excluding the scrap used in A3 replaces 60% of steel;<br>Glass recyclate from C3 excluding the glass shards used in A3 replace 60% of glass;<br>Benefits from waste incineration: electricity replaces electricity mix (EU-28); thermal energy replaces thermal energy from natural gas (EU-28).** |

The values in Module D result from recycling of the packaging material in Module A5 and from deconstruction at the end of service life.

Since only one scenario is used, the results are shown in the summary table.

## Imprint

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