Environmental Product Declaration

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

Note: This EPD is based on the heroal aluminium façades model EPD. The EPD becomes valid with transmission to the manufacturer by the **ift**.

heroal-Johann Henkenjohann GmbH & Co. KG

heroal "Façades

C50

Basis:

DIN EN ISO 14025
EN15804

Company EPD
Environmental
Product **D**eclaration

Publication date:
15.04.2021

Next revision:
15.04.2026

www.ift-rosenheim.de/
published EPDs

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Prüfung und Kalibrierung – EN ISO/IEC 17025
Inspektion – EN ISO/IEC 17020
Zertifizierung Produkte – EN ISO/IEC 17065
Zertifizierung Managementsysteme – EN ISO/IEC 17021

Notified Body **0757**
PÜZ-Stelle: **BAY 18**

DAkkS Deutsche Akkreditierungsstelle D-ZE-11349-01-00

Environmental Product Declaration

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

Programme operator	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 D-83026 Rosenheim
Practitioner of the LCA	ift Rosenheim GmbH Theodor-Gietl-Straße 7-9 D-83026 Rosenheim
Supported by	heroal-Johann Henkenjohann GmbH & Co. KG Österwieher Straße 80 33415 Verl Note: Declaration holder are listed on page 3.
Declaration code	M-EPD-HFA-GB-38.000
Designation of declared product	heroal aluminium façades C50 FP, C50 PH, C50 HI, C50, C50 ID
Scope	Façade system 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 "Façades and roofs made of glass and plastics" PCR-FA-3.1:2018.”
Validity	Publication date: 15.04.2021 / Last revision: 09.06.2021 / Next revision: 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. The declaration holder assumes full liability for the underlying data, certificates and verifications.

Christian Kehrer Head of Certification and Surveillance Body	Dr. Torsten Mielecke Chairman of Expert Committee ift-EPD and PCR	Patrick Wortner 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 "Façades" and applies to:

1 m² of aluminium façade

The functional unit is obtained by summing up:

Assessed product	Weight per unit area	Installation depth
C50 (face width 50 mm)	39.58 kg/m²	0.333 m

Table 1: Product groups

The average unit is declared as follows:
Directly used material flows are determined using the average sizes (5.5 m x 7.0 m) in accordance with EN 13830 and 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:

PG 1- Façade
C50 FP
C50 PH
C50 HI
C50
C50 ID

*Bold = reference products

Product description

The heroal C50, C50 HI, C50 PH, C50 ID and C50 GD thermally insulated façade system can be designed as vertical or vertical-bending mullion-transom, transom-transom or mullion-mullion façades. The façade can also be used as a roof area, light roof pyramid or conservatory.

The system offers creative freedom thanks to various cover and pressure plates. With an adequate façade panel and glazing, the system is passive-house-certified. On this basis the fire-rated heroal C50 FP curtain wall system can be expanded to create an EI 30 façade of the same appearance.

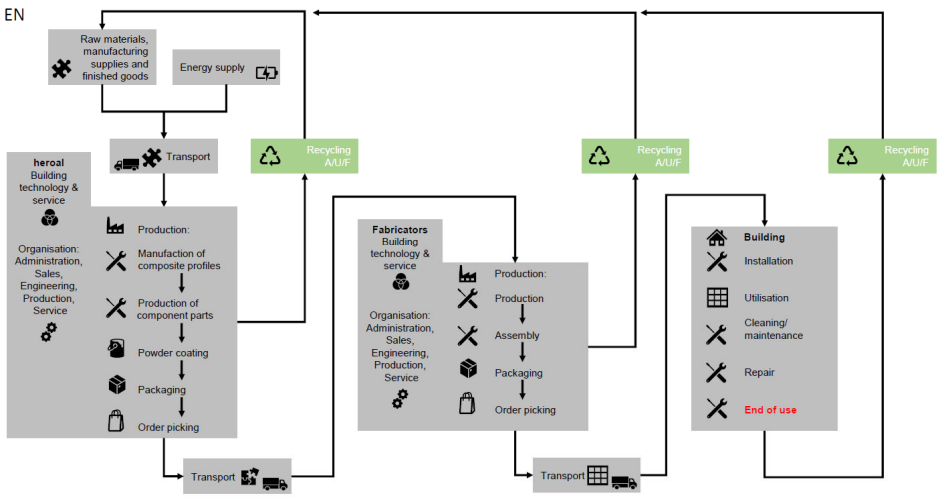
	Façades
Profile system	Face widths 50 mm Installation depth: 28 – 260 mm Transom profile depth: 6 - 215 mm Thickness of glass/infill panel: 8 – 62 mm Max. weight of infill panel: 800 kg
System supplier	heroal-Johann Henkenjohann GmbH & Co. KG
Opening type/direction	Can be combined with fixed lights and all heroal window/lifting/sliding and door systems
Frame material	Aluminium frame (with (stainless) steel reinforcements).
Construction type	Mullion-transom, transom-transom or mullion-mullion construction
Rebate seal	ABS- insulators/mineral insulators.
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) according to EPD "Insulating glass units". Fire resistant glass according to EPD "Pilkington Pyrostop and Pilkington Pyrodur monolithic fire-rated glass" (here: 32 mm)
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 façade shading devices, heroal provides ideal combination options from the tried and tested heroal C 50 façade system and the high-quality heroal VS Z solar shading devices.

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

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

Product manufacture



Applications

Aluminium façade 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:

- Performance characteristics according to EN 13830
- Performance characteristics according to EN 1363-1
- Quality seal Qualicoat (Powder coating)
- Powder coating quality according 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 façades 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 façades 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.

A life cycle assessment has been developed as the basis for aluminium façades. This LCA is 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 façades.
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 façades. 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 façades 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 façade:

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 façades 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 10.37 l per m² of the 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 used for cooling.

Raw material / pre-products
The chart below shows the share of raw materials/pre-products in percent.

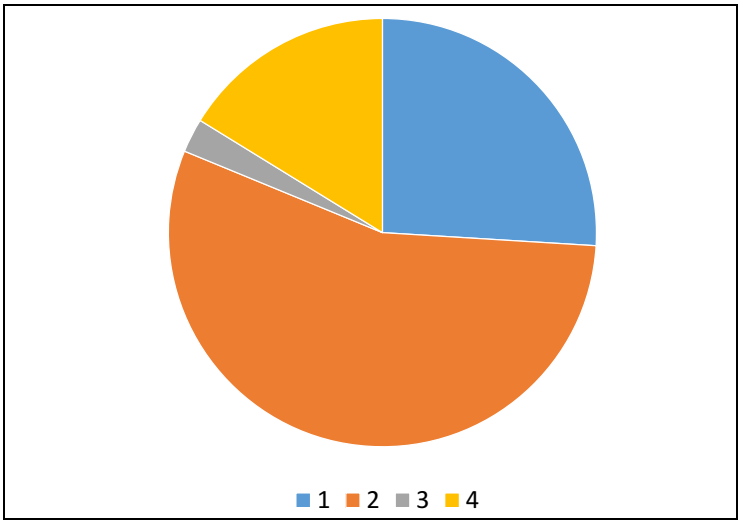


Figure 1: Percentage of individual materials per declared unit

No.	Material	Mass in %
1	Metals	23.11
2	Glass	49.12
3	Plastics	2.29
4	Other	14.43

Table 3: Percentage of individual materials per declared unit

Ancillary materials and consumables
16.76 g of ancillary materials and consumables are used.

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

No.	Material	Mass in g
1	Wood	1.24
2	Cardboard	157.92
3	PE film	172.41

Table 4: Weight in kg of packaging per declared unit

Outputs

The LCA includes the following production-relevant outputs per 1 m² of aluminium façade:

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

Waste water
Manufacture produces 6.34 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 façade 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 aluminium façade																
	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	6.68	1.16	-	48.20	72.10	0.00	148.23	0.00	0.00	0.43	1.15	3.09	0.32	-55.70
ODP	kg CFC -11 eq.	2.07E-07	1.17E-15	1.28E-14	-	1.04E-13	8.34E-09	0.00	2.07E-07	0.00	0.00	1.40E-14	2.01E-16	2.07E-15	1.75E-15	-2.08E-13
AP	kg SO_2 eq.	0.71	1.55E-02	8.50E-04	-	4.74E-02	0.38	0.00	0.54	0.00	0.00	8.49E-04	2.23E-03	2.92E-04	1.93E-03	-0.25
EP	kg PO_4^{3-} eq.	7.82E-02	3.85E-03	1.07E-04	-	7.87E-03	4.82E-02	0.00	7.10E-02	0.00	0.00	9.99E-05	5.51E-04	5.35E-05	2.19E-04	-1.99E-02
POCP	kg ethene eq.	4.57E-02	-5.50E-03	6.25E-05	-	1.29E-02	2.46E-02	0.00	3.25E-02	0.00	0.00	6.16E-05	-7.24E-04	2.73E-05	1.47E-04	1.24E-03
ADPE	kg Sb eq.	4.55E-04	5.83E-07	1.40E-07	-	1.05E-05	2.17E-04	0.00	3.76E-04	0.00	0.00	1.46E-07	1.01E-07	3.51E-08	1.18E-07	-1.01E-04
ADPF	MJ	2360.00	91.00	4.54	-	1470	1060.00	0.00	1988.39	0.00	0.00	4.86	15.70	0.93	4.36	-667.00
Use of resources																
PERE	MJ	981.00	5.09	4.06	-	21.10	462.00	0.00	777.73	0.00	0.00	3.58	0.88	0.53	0.60	-237.00
PERM	MJ	2.55	0.00	-0.77	-	0.00	0.00	0.00	1.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	983.00	5.09	3.29	-	21.10	462.00	0.00	778.97	0.00	0.00	3.58	0.88	0.53	0.60	-237.00
PENRE	MJ	3660.00	91.30	8.27	-	1480.00	2160.00	0.00	3237.79	0.00	0.00	7.78	15.70	21.22	5.52	-760.00
PENRM	MJ	24.50	0.00	-1.06	-	0.00	0.00	0.00	2.52	0.00	0.00	0.00	0.00	-19.87	-1.05	0.00
PENRT	MJ	3690.00	91.30	7.21	-	1480.00	2160.00	0.00	3245.81	0.00	0.00	7.78	15.70	1.35	4.47	-760.00
SM	kg	7.88	0.00	0.00	-	0.00	7.38	0.00	7.88	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	0.96	5.82E-03	5.00E-03	-	0.28	1.79E-02	0.00	0.43	0.00	0.00	3.49E-03	1.00E-03	6.99E-03	1.10E-03	-0.58
Waste categories																
HWD	kg	3.93E-07	4.60E-09	1.90E-09	-	2.02E-07	1.12E-08	0.00	2.82E-08	0.00	0.00	2.06E-09	7.93E-10	3.26E-10	4.75E-10	-1.06E-07
NHWD	kg	20.40	1.36E-02	1.42E-02	-	0.45	3.86E-02	0.00	31.55	0.00	0.00	5.52E-03	2.34E-03	1.27E-02	22.30	-12.60
RWD	kg	8.34E-02	1.10E-04	1.06E-03	-	3.31E-03	1.25E-03	0.00	5.53E-02	0.00	0.00	1.16E-03	1.90E-05	1.67E-04	4.70E-05	-3.66E-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	0.21	0.00	0.00	-	0.00	21.90	0.00	16.51	0.00	0.00	0.00	0.00	16.30	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	0.96	0.00	1.49	-	0.00	6.80	0.00	8.92	0.00	0.00	0.00	0.00	6.47	0.00	0.00
EET	MJ	2.11	0.00	2.67	-	0.00	12.10	0.00	16.28	0.00	0.00	0.00	0.00	11.50	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

6.4 Interpretation, LCA presentation and critical review

Evaluation

The environmental impacts of the manufacture of façades result mainly from the use of aluminium / its upstream chains and the anodisation of the profiles. In addition, the environmental impacts result mainly from the use of (fire-resistant) glass and its upstream chains.

The façade cleaning operations using glass cleaners over the 50-year use stage also play a notable role in environmental impacts. Additional central values during the use stage originate from repair of wearing parts (in particular glass) as well as the one-off replacement of the façade or frame profile 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, approx. 8% of the environmental impacts can be assigned as benefits to scenario D.

The chart below shows the allocation of the main environmental impacts.

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

Chart

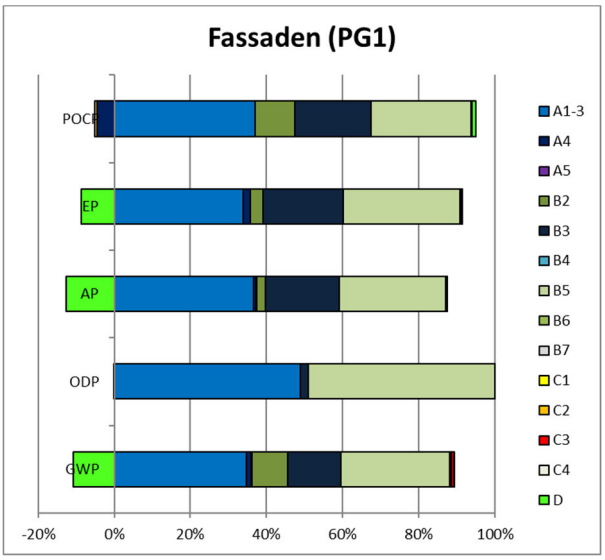


Figure 2: Percentage of the modules in selected environmental impact categories

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 "Façades and roofs made of glass and plastics" PCR-FA-3.1:2018.”

The European standard EN 15804 serves as the core PCR [a)]
Independent verification of the Declaration and statement according to EN ISO 14025:2010 ☐ internal ☒ external
Independent third party verifier: [b)] Patrick Wortner
[a)] Product category rules [b)] Optional for business-to-business communication Mandatory for business-to-consumer communication (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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3 Annex

Description of life cycle scenarios for aluminium façades

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: C50 39.91 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. 0.0 kWh/m² electricity consumed for manual installation
A5.2	**Small lifting trolley / lifting platform**	**A small lifting device or fork-lift truck is required for the installation of the elements.** **1.0 kWh/m² electricity consumed by lifting platform** (1)
A5.3	Crane	A (construction) crane is required for the installation of the elements. 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*: 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 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	Unit	B6.1	B6.2
Central environmental impacts			
GWP	kg CO_2 eq.	**0.00**	13.60
ODP	kg R11 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 C_2H_4 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			
CRU	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): Deconstruction 30% for glass; Deconstruction remaining materials 95% Remainder to landfill. Further deconstruction rates are possible, give adequate reasons. A small lifting device or fork-lift truck is required for the removal of the elements. 0.1 MJ/kg electricity consumed**

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. 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:** • **100% metals in melt** • **100% glass in melt** • **plastics 100% thermal recycling in waste incineration plant (R1>0.6)** • **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	C3
Collection process, collected separately	kg	23.40
Collection process, collected as mixed construction waste	kg	16.19
Recovery system, for re-use	kg	0.00
Recovery system, for recycling	kg	16.33
Recovery system, for energy recovery	kg	0.97
Disposal	kg	22.29

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; Steel scrap from C3 excluding the scrap used in A3 replaces 60% of steel; Stainless steel scrap from C3 excluding the scrap used in A3 replaces 60% of stainless steel; Copper scrap from C3 excluding the scrap used in A3 replaces 60% of copper; Glass recyclate from C3 excluding the glass shards used in A3 replace 60% of glass; Plastic recyclate from C3 excluding the plastics used in A3 replaces 60% of polyethylene granules; 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.

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Notes
This EPD is mainly based on the work and findings of the Institut für Fenstertechnik e.V., Rosenheim (ift Rosenheim) and specifically on the ift-Richtlinie NA-01/3 Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen. (Guideline NA.01/3 - Guidance on preparing Type III Environmental Product Declarations)

Layout
ift Rosenheim GmbH - 2018

Photographs (front page)
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