Environmental Product Declaration (EPD)

Declaration Code: M-EPD-SVR-GB-2.03

Note: This EPD is based on the model EPD Electrical control units, alert stations and pneumatic valves.

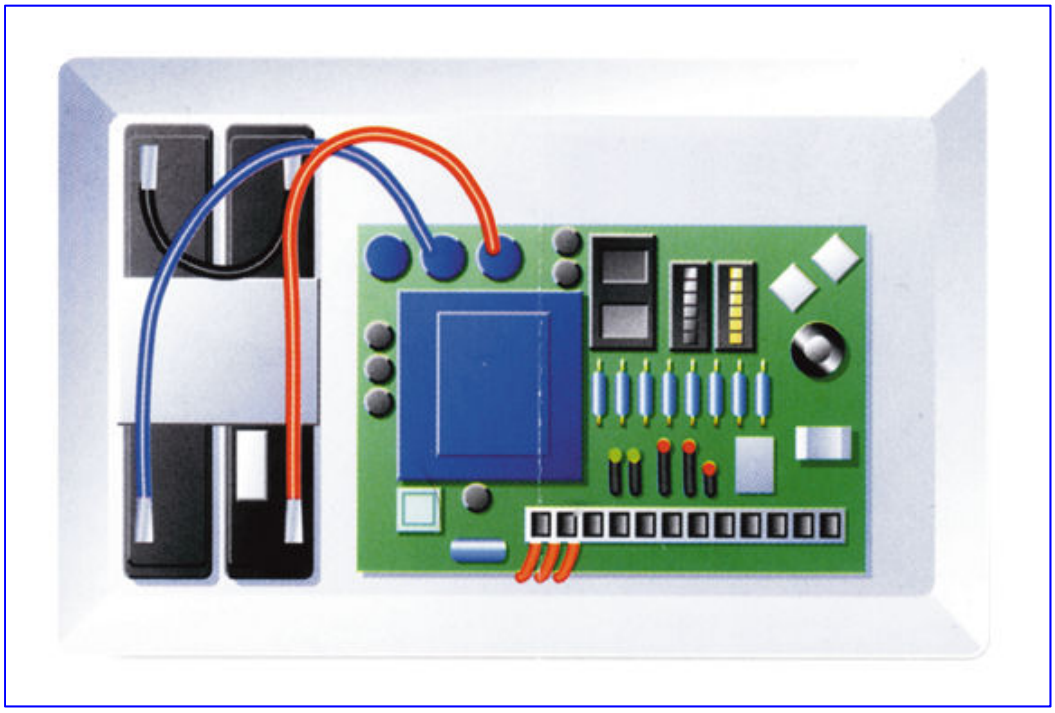




GEZE GmbH

Building components for smoke and heat control system

Electrical control units, alert stations and pneumatic valves



Basis:

DIN EN ISO 14025
EN 15804 + A2

Model EPD
Environmental
Product **D**eclaration

Publication date:
02.07.2024

Valid until:
02.07.2029

www.ift-rosenheim.de/
published EPDs

ift Rosenheim GmbH
Theodor-Gietl-Str. 7-9
D-83026 Rosenheim

Kontakt
Tel.: +49 8031 261-0
Fax: +49 8031 261-290
www.ift-rosenheim.de

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 (EPD)

Declaration Code: M-EPD-SVR-GB-2.03

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
Declaration holder	GEZE GmbH Reinhold-Vöster-Straße 21-29 71229 Leonberg www.geze.de
Declaration code	M-EPD-SVR-GB-2.03
Designation of declared product	Electrical control units, alert stations and pneumatic valves for SHEV and ventilation systems
Scope	Smoke and heat exhaust ventilation systems, or their components, which, through their interaction, exhaust smoke and heat from buildings. Smoke and heat control systems. Ventilation systems for maintaining specific air change rates.
Basis	This EPD was prepared on the basis of EN ISO 14025:2011 and DIN EN 15804:2012+A2:2019. 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 „Bauteile für Anlagen zur Rauch- und Wärmefreihaltung“ PCR RW-3.0: 2023 and PCR Teil A" PCR-A-1.0:2023.
Validity	Publication date: 02.07.2024 / Last revision: 10.07.2024 / Valid until 02.07.2029 This verified model Environmental Product Declaration applies solely to the specified products 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 base data includes both the data collected at the production sites of the participating member companies of the Verbands Fensterautomation und Entrauchung e.V. (VFE) and the generic data from the ”LCA for Experts 10“ database. LCA calculations were carried out for the included “cradle to gate with options” life cycle 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.

Christoph Seehauser Deputy Head of Sustainability	Dr. Torsten Mielecke Chairman of Expert Committee ift-EPD and PCR	Patrick Wortner External verifier

1 General product information

Product definition

The EPD relates to the product group Building components for smoke and heat control system and applies to the following products of the members of the VFE:

1 Watt (Power) electrical control unit
1 piece alert stations
1 piece pneumatic valve
of the company GEZE GmbH

The declared unit is obtained as follows:

Product group (PG)	Calculated average product	Declared unit
1	**electrical control unit** power: 1496 W/pcs. mass: 93.5 kg/pcs.	1 W
2	**alert station** mass: 4.75 kg/pcs.	1 pcs.
3	**pneumatic valve** mass: 0.61 kg/pcs.	1 pcs.

Table 1: Product groups

The average unit is declared as follows:
The directly used material flows were divided by the number of considered products and assigned to the declared unit. All other inputs and outputs in the manufacture were scaled to the declared unit as a whole. The reference period is 2022.

Product description

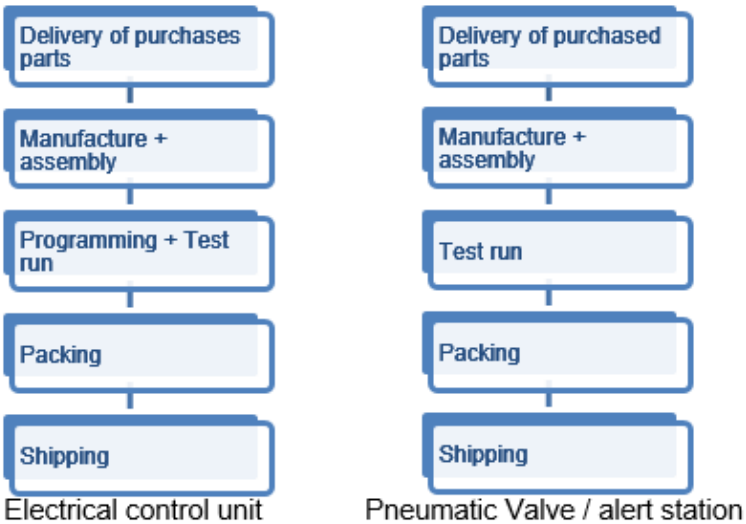
Control unit:
The unit is equipped with a control module and an electric power supply that ensures continuous operation even in the situation of a power failure. The wires to the release mechanisms are monitored. In addition to that a variety of comfort ventilation functions are available, e.g. automatic, time-limited ventilation or travel restriction in ventilation mode for demand-based everyday ventilation.

Pneumatic valve:
Manual or automatic control module for activating pneumatic cylinders with compressed air or CO_2.

Alert station:
Manual or automatic control module for activating pneumatic cylinders with compressed air or CO_2.

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

Product manufacture



Scope

Smoke and heat exhaust ventilation systems, or their components, which, through their interaction, exhaust smoke and heat from buildings. Smoke and heat control systems. Ventilation systems for maintaining specific air change rates.

Management systems

The following management systems are in place:

- Quality management system in accordance with DIN EN ISO 9001:2015
- Energy management system in accordance with DIN EN ISO 50001:2018
- Environmental management system in accordance with DIN EN ISO 14001:2015

Additional information

For additional evidence of fitness for use or certificates of conformity, if applicable, please refer to the CE marking and the documents accompanying the product.

2 Materials used

Primary materials

The primary materials used are specified in Section 6.2 Inventory analysis (Inputs).

Declarable substances

The product contains substances from the REACH candidate list (declaration dated 10 July 2024).

- Lead: concentration > 0.1 % by weight

All relevant safety data sheets are available from GEZE GmbH

3 Construction process stage

Processing recommendations, installation

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

4 Use stage

Emissions to the environment

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

Reference service life (RSL)

The RSL information was provided by the manufacturer. The RSL shall be specified under defined reference in-use conditions and shall refer to the declared technical and functional performance of the product within the building. It shall be established in accordance with any specific rules given in European product standards, or, if not available, in accordance with a c-PCR. It shall also take into account ISO 15686-1, -2, -7 and -8. Where European product standards or a c-PCR provide guidance on deriving the 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:
For a “Cradle to gate with options” EPD with the modules C1-C4 and module D (A1-A3 + C + D and one or more additional modules from A4 to B7), the reference service life (RSL) can only be stated if the reference in-use conditions are specified.
According to the manufacturer an optional service life of 25 years is specified for the products.

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

- Outdoor environment: no outdoor use permitted.
- Indoor environment: certain factors (e.g. humidity, temperature) are known that may have a negative effect on the service life.

The service life applies solely to the characteristics specified in this EPD or the corresponding references.
The 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 Electrical control units, alert stations and pneumatic valves are shipped to central collection points. There the products are generally shredded and sorted into their original 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 according to the market situation.
Specific components of steel, copper, brass and plastics are recycled. Residual fractions are sent to landfill or partially thermally recycled.

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.

Such life cycle assessments were developed for Electrical control units, alert stations and pneumatic valves, serving as the basis. The 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 and EN ISO 14025 as well as based on ISO 21930.

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. Apart from these, no other environmental impacts are specified.

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

The specific data originate exclusively from the 2022 fiscal year. They were collected on-site at the plants of the participating member companies of the Verband Fensterautomation und Entrauchung e.V. (VFE). and come in parts from company records and partly from values directly obtained by measurement. Validity of the data was checked by the ift Rosenheim.

The generic data come from the “LCA for Experts 10” professional and building materials databases. The last update of both databases was in 2024. Data from before this date come also from these databases and are not more than three years old. No other generic data were used for the calculation.

The generic data selected are as accurate as possible in terms of geographical reference. If no country-specific datasets are available or regional reference cannot be established, European or global datasets are used.

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 “LCA for Experts" for the development of life cycle assessments.

The data quality complies with the requirements of prEN15941:2022.

Scope / system boundaries

The system boundaries refer to the supply of raw materials and purchased parts, production, use and end-of-life stage of Electrical control units, alert stations and pneumatic valves.
No additional data from pre-suppliers/subcontractors or other sites were taken into consideration.

Cut-off criteria

All the data that the company records, i.e. all commodities/input and raw materials used, the thermal energy used 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 raw materials, ancillary materials and packagings were taken into consideration. Transport to production plant using 40 t truck (Euro 0-6 mix), diesel, 27 t payload. As the transportation is exclusively handeled by forwarding agencies a 85 % capacity is used.

In addition to the transport distances for pre-products, the transport distances for waste were also taken into consideration. The transport of waste in A3 was presented by the following standard scenario
Transport to collection point using 40 t truck (Euro 0-6 mix), diesel, 27 t payload, 50 % capacity used, distance as provided by the manufacturer or 100 km (1)

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. All in all, 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 unit.

Life cycle stages

The Annex shows the entire life cycle of Electrical control units, alert stations and pneumatic valves. The “Product stage” (A1 – A3), “Construction process stage” (A4 – A5), “Use stage” (B2 – B5), “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 in accordance with DIN EN 15804:

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

Allocation of co-products

The manufacture does not give rise to allocations.

Allocations for reuse, recycling and recovery

If the products are recycled and recovered during the product stage (rejects) the components are shredded/broken if necessary and then sorted into their single 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 state.

Allocations beyond life cycle boundaries

The use of recycled materials in the manufacturing process was based on the current market-specific situation. A recycling potential that reflects the economic value of the product after recycling (recyclate) was also taken into account.

Secondary material stated as input into the production process, is calculated in module 1 without loads. No benefits are allocated to module D, but consumption is allocated to module/modules C3 and C4 (worst case scenario).

The system boundary set for the recycled material refers to collection.

Secondary material

The use of secondary material by the manufacturers was considered in module A3. Secondary material was not used.

Inputs

The LCA includes the following production-relevant inputs per 1 W of electrical control unit, 1 piece of alert station and 1 piece of pneumatic valve.

Energy
The gas input material is based on “Erdgas Deutschland“ (natural gas Germany). Diesel is based on ”Diesel Deutschland” (diesel Germany). The electricity mix is based on ”Strommix Deutschland” (electricity mix germany). District heating is based on “Fernwärmemix Deutschland” (district heating mix germany).

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

Water
0.12 l water consumed by the individual process steps for the production of a alert station.
2.60E-02 l water consumed by the individual process steps for the production of a pneumatic valve.
No water water consumed by the individual process steps for the production of electric control units
.
The consumption of freshwater specified in Section 6.3 originates (among others) from the process chain of the pre-products and the process water.

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

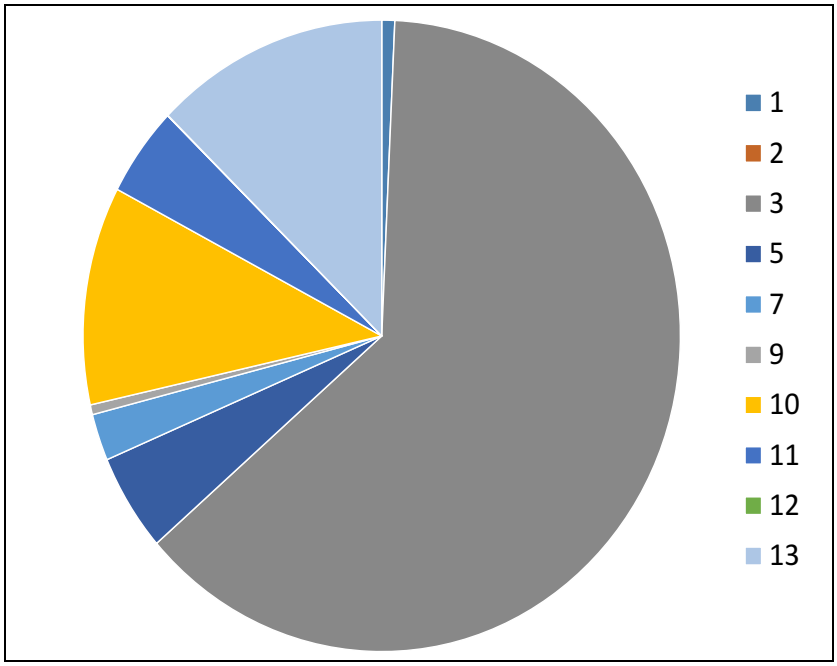


Figure 1: Percentage of individual materials per declared unit for PG1

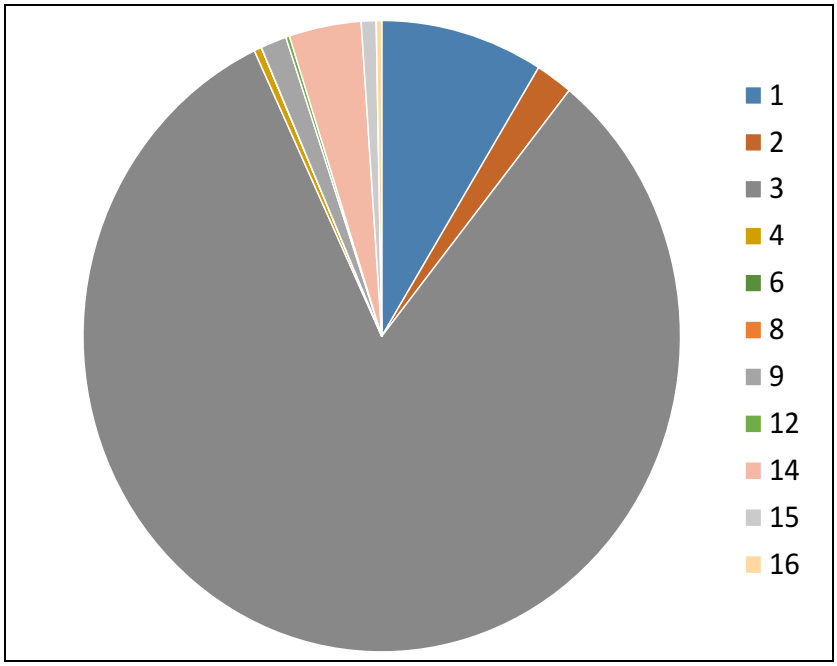


Figure 2: Percentage of individual materials per declared unit for PG2

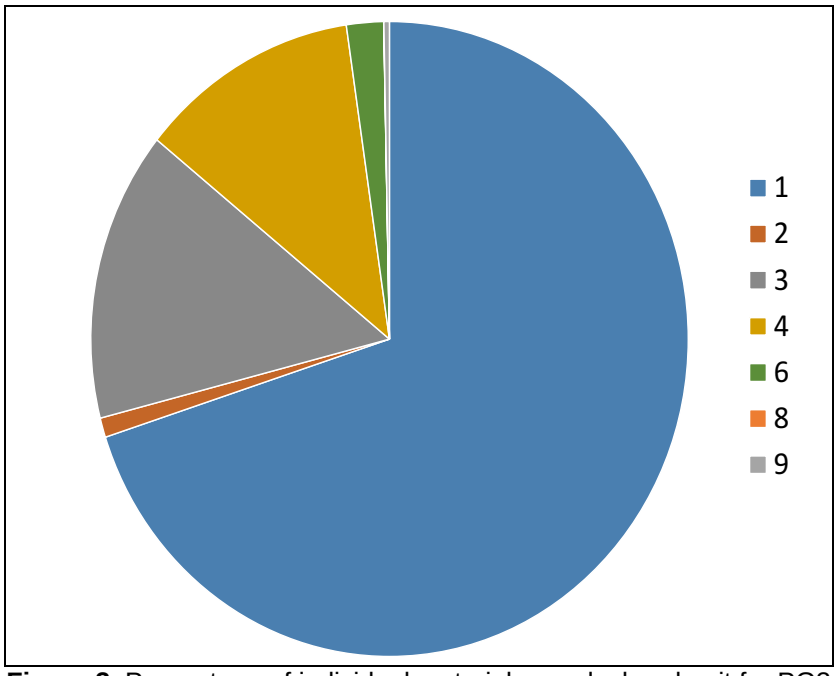


Figure 3: Percentage of individual materials per declared unit for PG3

No.	Material / pre-Product	Mass in %		
		PG 1	PG 2	PG 3
1	Aluminium	< 1	8.8	70.0
2	Brass		2.0	1.0
3	Steel	62.9	82.2	14.8
4	Steel, stainless		< 1	11.9
5	Copper	5.0		
6	EPDM		< 1	2.0
7	PVC	2.4		
8	PE		< 1	< 1
9	PA	< 1	1.4	< 1
10	Epoxid	11.2		
11	PS	4.6		
12	Paper	< 1	< 1	
13	Battery	12.7		
14	Powder coating		3.9	
15	Zinc		< 1	
16	Glass		< 1	

Table 2: Percentage of individual materials per declared unit

Ancillary materials and consumables
Ancillary materials and consumables are used as follows:

PG	Product	Mass in kg
1	Electrical control unit	3.31E-05
2	Alert station	1.44E-01
3	Pneumatic valve	7.08E-02

Table 3: Weight in kg of packaging per declared unit

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

No.	Material	Mass in kg		
		PG 1	PG 2	PG 3
1	PE film	1.52E-05	6.89E-03	2.78E-02
2	Cardboard	1.81E-04	1.58E-01	6.41E-02
3	Wood	6.77E-06	1.48E-01	7.10E-02

Table 4: Weight in kg of packaging per declared unit

Biogenic carbon content
In accordance with EN 16449, the amounts of biogenic carbon are as follows:

No.	Component	Content in kg C per decl. unit		
		PG 1	PG 2	PG 3
1	Product	4.39E-06	3.23E-03	0
2	Associated packaging	6.80E-05	0.12	5.47E-02

Table 5: Biogenic carbon content of the product and the packaging at gate

Outputs

The LCA includes the following production-relevant outputs per declared unit of electrical control unit, alert station and pneumatic valve:

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

Waste water
The manufacture does not produce any waste water.

6.3 Impact assessment

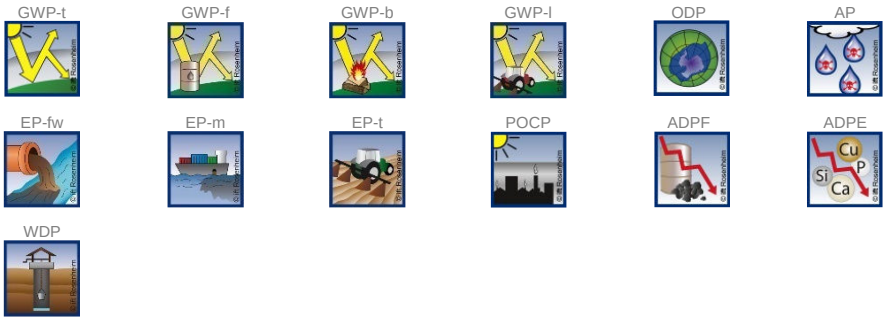
Goal

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

Core indicators

The models for impact assessment were applied as described in DIN EN 15804+A2. The impact categories presented in the EPD as core indicators are as follows:

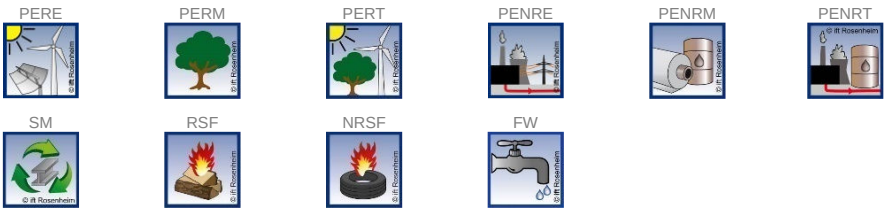
- Climate change – total (GWP-t)
- Climate change – fossil (GWP-f)
- Climate change – biogenic (GWP-b)
- Climate change - land use and land use change (GWP-l)
- Ozone depletion (ODP)
- Acidification (AP)
- Eutrophication aquatic freshwater (EP-fw)
- Eutrophication aquatic marine (EP-m)
- Eutrophication terrestrial (EP-t)
- Photochemical ozone creation (POCP)
- Depletion of abiotic resources - fossil fuels (ADPF)
- Depletion of abiotic resources - minerals and metals (ADPE)
- Water use (WDP)



Use of resources

The models for impact assessment were applied as described in DIN EN 15804-A2.The following parameters for the use of resources are shown in the EPD:

- Renewable primary energy as energy source (PERE)
- Renewable primary energy for material use (PERM)
- Total use of renewable primary energy (PERT)
- Non-renewable primary energy as energy resource (PENRE)
- Renewable primary energy for material use (PENRM)
- Total use of non-renewable primary energy (PENRT)
- Use of secondary materials (SM)
- Use of renewable secondary fuels (RSF)
- Use of non-renewable secondary fuels (NRSF)
- Net use of freshwater resources (FW)

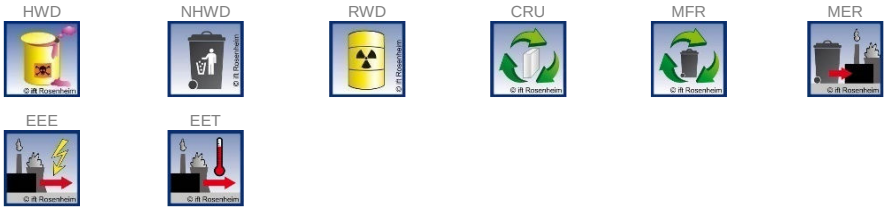


Waste

The waste generate during the production of 1 W of electrical drive or 1 mm (diameter) of pneumatic cylinder 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.

The models for impact assessment were applied as described in DIN EN 15804-A2.
The waste categories and indicators for output material flows presented in the EPD are as follows:

- Hazardous waste disposed (HWD)
- Non-hazardous waste disposed (NHWD)
- Radioactive waste disposed (RWD)
- Components for reuse (CRU)
- Materials for recycling (MFR)
- Materials for energy recovery (MER)
- Exported electrical energy (EEE)
- Exported thermal energy (EET)



Additional environmental impact indicators

The models for impact assessment were applied as described in DIN EN 15804-A2.
The additional impact categories presented in the EPD are as follows:

- Particulate matter emissions (PM)
- Ionising radiation, human health (IRP)
- Ecotoxicity – freshwater (ETP-fw)
- Human toxicity - cancer effect (HTP-c)
- Human toxicity - non-cancer effect (HTP-nc)
- Land use related impacts / soil quality (SQP)



Uncertainty penalties

In accordance with the ÖKOBAUDAT Manual, an uncertainty penalty of 20% is applied to some indicator values of this EPD. These uncertainty penalties shall give a conservative estimate of the environmental impact, assuming worst case conditions. The relevant indicators and the reason for the penalty value applied are documented in the background report.

Results per 1 W of electrical control unit															
Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Core indicators															
GWP-t	kg CO_2 eq.	0.34	1.64E-02	3.14E-04	ND	0.10	0.00	0.28	ND	0.20	0.00	0.00	5.33E-04	1.93E-02	5.41E-04	-0.96
GWP-f	kg CO_2 eq.	0.34	1.64E-02	5.32E-05	ND	0.10	0.00	0.27	ND	0.20	0.00	0.00	5.35E-04	1.93E-02	5.40E-04	-0.97
GWP-b	kg CO_2 eq.	4.33E-03	-3.63E-04	2.61E-04	ND	-2.87E-04	0.00	4.49E-03	ND	1.88E-03	0.00	0.00	-1.08E-05	2.44E-05	-1.13E-06	3.86E-03
GWP-l	kg CO_2 eq.	3.16E-04	3.00E-04	7.04E-09	ND	8.74E-05	0.00	5.40E-04	ND	3.01E-05	0.00	0.00	8.66E-06	6.54E-07	2.11E-06	-8.22E-04
ODP	kg CFC-11 eq.	9.91E-10	3.65E-15	5.32E-17	ND	4.76E-10	0.00	6.75E-10	ND	4.50E-12	0.00	0.00	5.20E-17	5.86E-14	1.69E-15	-4.31E-09
AP	mol H^+ eq.	1.44E-03	1.72E-05	9.36E-08	ND	4.99E-04	0.00	1.01E-03	ND	3.83E-04	0.00	0.00	5.88E-07	9.68E-06	3.23E-06	-4.64E-03
EP-fw	kg P eq.	1.04E-06	4.21E-08	1.48E-11	ND	2.96E-07	0.00	1.12E-06	ND	8.21E-07	0.00	0.00	2.20E-09	1.09E-08	2.57E-07	-2.71E-06
EP-m	kg N eq.	2.36E-04	5.88E-06	3.37E-08	ND	8.21E-05	0.00	1.72E-04	ND	9.55E-05	0.00	0.00	2.03E-07	2.71E-06	7.19E-07	-7.64E-04
EP-t	mol N eq.	2.55E-03	7.10E-05	4.28E-07	ND	8.83E-04	0.00	1.88E-03	ND	1.00E-03	0.00	0.00	2.40E-06	3.60E-05	7.90E-06	-8.22E-03
POCP	kg NMVOC eq.	9.02E-04	1.66E-05	8.99E-08	ND	3.23E-04	0.00	6.49E-04	ND	2.53E-04	0.00	0.00	5.65E-07	7.12E-06	2.28E-06	-2.99E-03
ADPF*[2]	MJ	4.79	0.20	1.18E-04	ND	1.41	0.00	3.68	ND	4.16	0.00	0.00	6.73E-03	5.59E-02	8.59E-03	-13.23
ADPE*[2]	kg Sb eq.	2.57E-05	2.64E-09	5.42E-13	ND	7.39E-06	0.00	1.70E-05	ND	3.56E-08	0.00	0.00	4.36E-11	4.66E-10	3.42E-11	-7.06E-05
WDP*[2]	m^3 world eq. deprived	6.99E-02	1.10E-04	4.39E-05	ND	2.73E-02	0.00	5.03E-02	ND	5.47E-02	0.00	0.00	7.68E-06	2.39E-03	6.67E-05	-0.25
Use of resources															
PERE	MJ	1.64	2.21E-02	3.64E-03	ND	0.56	0.00	1.28	ND	3.01	0.00	0.00	5.69E-04	3.89E-02	1.33E-03	-5.09
PERM	MJ	3.20E-03	0.00	-3.01E-03	ND	0.00	0.00	2.71E-20	ND	0.00	0.00	0.00	0.00	-1.86E-04	-9.78E-06	0.00
PERT	MJ	1.64	2.21E-02	6.33E-04	ND	0.56	0.00	1.28	ND	3.01	0.00	0.00	5.69E-04	3.87E-02	1.32E-03	-5.09
PENRE	MJ	3.27	0.20	-1.91E-05	ND	1.41	0.00	3.69	ND	4.16	0.00	0.00	6.73E-03	1.52	8.54E-02	-13.23
PENRM	MJ	1.28	0.00	1.22E-04	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	-1.22	-6.40E-02	0.00
PENRT	MJ	4.55	0.20	1.03E-04	ND	1.41	0.00	3.69	ND	4.16	0.00	0.00	6.73E-03	0.30	2.14E-02	-13.23
SM	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	m^3	2.29E-03	2.10E-05	1.04E-06	ND	8.74E-04	0.00	1.68E-03	ND	2.30E-03	0.00	0.00	6.38E-07	6.89E-05	2.00E-06	-8.05E-03
Waste categories															
HWD	kg	2.82E-08	8.66E-12	6.73E-14	ND	1.22E-08	0.00	2.01E-08	ND	6.00E-09	0.00	0.00	2.17E-13	7.78E-11	2.12E-12	-1.11E-07
NHWD	kg	5.73E-02	3.37E-05	1.40E-05	ND	2.34E-02	0.00	6.07E-02	ND	3.43E-03	0.00	0.00	1.05E-06	4.01E-04	2.04E-02	-0.21
RWD	kg	1.36E-04	2.75E-07	5.62E-09	ND	4.62E-05	0.00	1.07E-04	ND	6.67E-04	0.00	0.00	8.70E-09	8.36E-06	1.17E-07	-4.26E-04
Output material flows															
CRU	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	0.00	0.00	0.00	ND	0.00	0.00	4.15E-02	ND	0.00	0.00	0.00	0.00	4.15E-02	0.00	6.65E-02
MER	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	MJ	6.68E-03	0.00	4.72E-04	ND	0.00	0.00	3.07E-02	ND	0.00	0.00	0.00	0.00	2.35E-02	0.00	0.00
EET	MJ	1.55E-02	0.00	8.55E-04	ND	0.00	0.00	7.02E-02	ND	0.00	0.00	0.00	0.00	5.38E-02	0.00	0.00

Key:
GWP-t – climate change - total **GWP-f** – climate change - fossil **GWP-b** – climate change - biogenic **GWP-l** – climate change - land use and land use change **ODP** – ozone depletion **AP** - acidification **EP-fw** - eutrophication - aquatic freshwater **EP-m** - eutrophication - aquatic marine **EP-t** - eutrophication - terrestrial **POCP** - photochemical ozone formation **ADPF*[2]** - depletion of abiotic resources – fossil fuels **ADPE*[2]** - depletion of abiotic resources – minerals and metals **WDP*[2]** – water use **PERE** - use of renewable primary energy **PERM** - use of renewable primary energy resources used as raw materials **PERT** - total use of renewable primary energy **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources used as raw materials **PENRT** - total use of non-renewable primary energy **SM** - use of secondary materials **RSF** - use of renewable secondary fuels **NRSF** - use of non-renewable secondary fuels **FW** - net use of freshwater **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for reuse **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy **ND** – not determined

Results per 1 W of electrical control unit															
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	1.73E-08	1.49E-10	5.56E-13	ND	6.34E-09	0.00	1.20E-08	ND	3.20E-09	0.00	0.00	5.32E-12	6.70E-11	3.47E-11	-5.85E-08
IRP*[1]	kBq U235 eq.	1.43E-02	2.80E-05	8.70E-07	ND	4.75E-03	0.00	-2.85E-02	ND	0.11	0.00	0.00	1.21E-06	1.37E-03	1.58E-05	-4.42E-02
ETP-fw*[2]	CTUe	2.68	0.16	6.02E-05	ND	0.82	0.00	-4.75	ND	1.91	0.00	0.00	4.90E-03	2.52E-02	1.85E-02	-7.64
HTP-c*[2]	CTUh	5.56E-10	3.24E-12	3.26E-15	ND	2.35E-10	0.00	-1.59E-09	ND	6.77E-11	0.00	0.00	9.92E-14	1.02E-12	2.57E-13	-2.15E-09
HTP-nc*[2]	CTUh	5.49E-09	1.62E-10	1.60E-13	ND	1.47E-09	0.00	-8.14E-09	ND	1.56E-09	0.00	0.00	5.27E-12	3.01E-11	8.20E-12	-1.38E-08
SQP*[2]	Dimensionless.	1.26	0.14	3.52E-05	ND	0.36	0.00	-1.93	ND	1.75	0.00	0.00	3.32E-03	2.30E-02	1.57E-03	-3.35

Key:
PM – particulate matter emissions **IRP*[1]** – ionising radiation – human health **ETP-fw*[2]** - ecotoxicity – aquatic freshwater **HTP-c*[2]** - human toxicity potential – cancer effect **HTP-nc*[2]** - human toxicity potential – non-cancer effect **SQP*[2]** – land use related impacts / soil quality **ND** – not determined

Disclaimers

*1 This impact category deals mainly with the eventual impact of low-dose ionising radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionising radiation from the soil, from radon and from some building materials is also not measured by this indicator

*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator

Results per 1 piece alert station

Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Core indicators															
GWP-t	kg CO_2 eq.	17.58	1.59	0.49	ND	0.00	0.00	16.73	ND	0.00	0.00	0.00	4.88E-02	0.66	6.33E-03	-3.65
GWP-f	kg CO_2 eq.	17.79	1.60	3.23E-02	ND	0.00	0.00	16.49	ND	0.00	0.00	0.00	4.90E-02	0.66	6.32E-03	-3.65
GWP-b	kg CO_2 eq.	-0.21	-3.53E-02	0.46	ND	0.00	0.00	0.21	ND	0.00	0.00	0.00	-9.84E-04	2.16E-03	-3.16E-05	1.12E-03
GWP-l	kg CO_2 eq.	8.34E-03	2.92E-02	7.93E-06	ND	0.00	0.00	3.73E-02	ND	0.00	0.00	0.00	7.92E-04	4.14E-05	3.71E-05	-1.09E-03
ODP	kg CFC-11 eq.	1.81E-10	3.54E-13	7.32E-14	ND	0.00	0.00	1.75E-10	ND	0.00	0.00	0.00	4.75E-15	5.17E-12	1.67E-14	-1.18E-11
AP	mol H^+ eq.	4.62E-02	1.66E-03	1.26E-04	ND	0.00	0.00	3.81E-02	ND	0.00	0.00	0.00	5.38E-05	5.62E-04	4.39E-05	-1.06E-02
EP-fw	kg P eq.	4.98E-05	4.08E-06	1.98E-08	ND	0.00	0.00	5.14E-05	ND	0.00	0.00	0.00	2.02E-07	9.52E-07	1.40E-08	-3.69E-06
EP-m	kg N eq.	1.17E-02	5.71E-04	4.24E-05	ND	0.00	0.00	9.99E-03	ND	0.00	0.00	0.00	1.86E-05	1.48E-04	1.13E-05	-2.50E-03
EP-t	mol N eq.	0.13	6.90E-03	5.57E-04	ND	0.00	0.00	0.11	ND	0.00	0.00	0.00	2.20E-04	1.74E-03	1.25E-04	-2.70E-02
POCP	kg NMVOC eq.	3.55E-02	1.61E-03	1.14E-04	ND	0.00	0.00	3.00E-02	ND	0.00	0.00	0.00	5.17E-05	3.90E-04	3.46E-05	-7.61E-03
ADPF*[2]	MJ	225.43	19.80	0.16	ND	0.00	0.00	209.57	ND	0.00	0.00	0.00	0.62	4.84	8.15E-02	-41.36
ADPE*[2]	kg Sb eq.	1.27E-04	2.57E-07	7.51E-10	ND	0.00	0.00	1.07E-04	ND	0.00	0.00	0.00	3.98E-09	4.09E-08	3.95E-10	-2.04E-05
WDP*[2]	m^3 world eq. deprived	1.48	1.07E-02	6.72E-02	ND	0.00	0.00	1.35	ND	0.00	0.00	0.00	7.02E-04	0.11	7.07E-04	-0.32
Use of resources															
PERE	MJ	115.76	2.15	5.93	ND	0.00	0.00	114.56	ND	0.00	0.00	0.00	5.21E-02	3.61	2.28E-02	-12.96
PERM	MJ	5.05	0.00	-4.91	ND	0.00	0.00	-1.67E-16	ND	0.00	0.00	0.00	0.00	-0.14	-7.20E-03	0.00
PERT	MJ	120.81	2.15	1.03	ND	0.00	0.00	114.56	ND	0.00	0.00	0.00	5.21E-02	3.47	1.56E-02	-12.96
PENRE	MJ	108.58	19.80	0.33	ND	0.00	0.00	209.57	ND	0.00	0.00	0.00	0.62	115.69	5.92	-41.36
PENRM	MJ	97.38	0.00	-0.14	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	-92.38	-4.86	0.00
PENRT	MJ	205.96	19.80	0.19	ND	0.00	0.00	209.57	ND	0.00	0.00	0.00	0.62	23.31	1.05	-41.36
SM	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	m^3	6.70E-02	2.04E-03	1.58E-03	ND	0.00	0.00	6.32E-02	ND	0.00	0.00	0.00	5.84E-05	3.65E-03	2.16E-05	-1.12E-02
Waste categories															
HWD	kg	1.94E-06	8.41E-10	9.40E-11	ND	0.00	0.00	1.93E-06	ND	0.00	0.00	0.00	1.99E-11	6.90E-09	2.03E-11	-1.46E-08
NHWD	kg	3.18	3.26E-03	1.61E-02	ND	0.00	0.00	3.04	ND	0.00	0.00	0.00	9.58E-05	1.31E-02	0.41	-0.58
RWD	kg	1.07E-02	2.66E-05	8.29E-06	ND	0.00	0.00	1.01E-02	ND	0.00	0.00	0.00	7.96E-07	7.57E-04	8.54E-07	-1.46E-03
Output material flows															
CRU	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	0.38	0.00	0.00	ND	0.00	0.00	4.63	ND	0.00	0.00	0.00	0.00	4.25	0.00	0.00
MER	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	MJ	0.60	0.00	0.71	ND	0.00	0.00	1.92	ND	0.00	0.00	0.00	0.00	0.61	0.00	0.00
EET	MJ	1.35	0.00	1.28	ND	0.00	0.00	4.02	ND	0.00	0.00	0.00	0.00	1.39	0.00	0.00

Key:
GWP-t – climate change - total **GWP-f** – climate change - fossil **GWP-b** – climate change - biogenic **GWP-l** – climate change - land use and land use change **ODP** – ozone depletion **AP** - acidification **EP-fw** - eutrophication - aquatic freshwater **EP-m** - eutrophication - aquatic marine **EP-t** - eutrophication - terrestrial **POCP** - photochemical ozone formation **ADPF*[2]** - depletion of abiotic resources – fossil fuels **ADPE*[2]** - depletion of abiotic resources – minerals and metals **WDP*[2]** – water use **PERE** - use of renewable primary energy **PERM** - use of renewable primary energy resources used as raw materials **PERT** - total use of renewable primary energy **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources used as raw materials **PENRT** - total use of non-renewable primary energy **SM** - use of secondary materials **RSF** - use of renewable secondary fuels **NRSF** - use of non-renewable secondary fuels **FW** - net use of freshwater **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for reuse **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy **ND** – not determined

	Results per 1 piece alert station														
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	7.31E-07	1.45E-08	7.64E-10	ND	0.00	0.00	5.78E-07	ND	0.00	0.00	0.00	4.86E-10	4.33E-09	5.51E-10	-1.74E-07
IRP*[1]	kBq U235 eq.	1.14	2.72E-03	1.31E-03	ND	0.00	0.00	1.10	ND	0.00	0.00	0.00	1.11E-04	0.12	9.88E-05	-0.17
ETP-fw*[2]	CTUe	102.66	15.84	8.08E-02	ND	0.00	0.00	105.43	ND	0.00	0.00	0.00	0.45	2.20	4.73E-02	-15.84
HTP-c*[2]	CTUh	5.20E-08	3.14E-10	5.50E-12	ND	0.00	0.00	4.78E-08	ND	0.00	0.00	0.00	9.08E-12	8.14E-11	1.11E-12	-4.61E-09
HTP-nc*[2]	CTUh	2.32E-07	1.57E-08	3.02E-10	ND	0.00	0.00	2.19E-07	ND	0.00	0.00	0.00	4.82E-10	2.05E-09	7.32E-11	-3.08E-08
SQP*[2]	Dimensionless.	150.61	13.20	5.00E-02	ND	0.00	0.00	160.30	ND	0.00	0.00	0.00	0.30	2.03	2.24E-02	-5.91

Key:
PM – particulate matter emissions **IRP*[1]** – ionising radiation – human health **ETP-fw*[2]** - ecotoxicity – aquatic freshwater **HTP-c*[2]** - human toxicity potential – cancer effect **HTP-nc*[2]** - human toxicity potential – non-cancer effect **SQP*[2]** – land use related impacts / soil quality **ND** – not determined

Disclaimers

*1 This impact category deals mainly with the eventual impact of low-dose ionising radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionising radiation from the soil, from radon and from some building materials is also not measured by this indicator

*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator

Results per 1 piece pneumatic cylinder															
Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Core indicators															
GWP-t	kg CO_2 eq.	9.11	0.24	0.29	ND	0.00	0.00	7.73	ND	0.00	0.00	0.00	6.26E-03	5.73E-02	9.85E-04	-1.98
GWP-f	kg CO_2 eq.	9.15	0.24	8.84E-02	ND	0.00	0.00	7.57	ND	0.00	0.00	0.00	6.29E-03	5.70E-02	9.84E-04	-1.98
GWP-b	kg CO_2 eq.	-4.45E-02	-5.39E-03	0.20	ND	0.00	0.00	0.15	ND	0.00	0.00	0.00	-1.27E-04	2.76E-04	-4.92E-06	1.07E-03
GWP-l	kg CO_2 eq.	3.35E-03	4.45E-03	6.96E-06	ND	0.00	0.00	7.53E-03	ND	0.00	0.00	0.00	1.02E-04	4.85E-06	5.77E-06	-3.94E-04
ODP	kg CFC-11 eq.	1.12E-10	5.41E-14	4.79E-14	ND	0.00	0.00	9.92E-11	ND	0.00	0.00	0.00	6.11E-16	6.60E-13	2.59E-15	-1.32E-11
AP	mol H^+ eq.	2.80E-02	2.54E-04	6.38E-05	ND	0.00	0.00	2.14E-02	ND	0.00	0.00	0.00	6.91E-06	6.40E-05	6.83E-06	-7.00E-03
EP-fw	kg P eq.	2.71E-05	6.24E-07	1.25E-08	ND	0.00	0.00	2.50E-05	ND	0.00	0.00	0.00	2.59E-08	1.21E-07	2.18E-09	-2.84E-06
EP-m	kg N eq.	6.71E-03	8.72E-05	2.08E-05	ND	0.00	0.00	5.19E-03	ND	0.00	0.00	0.00	2.39E-06	1.64E-05	1.75E-06	-1.65E-03
EP-t	mol N eq.	7.41E-02	1.05E-03	2.83E-04	ND	0.00	0.00	5.77E-02	ND	0.00	0.00	0.00	2.82E-05	1.85E-04	1.93E-05	-1.79E-02
POCP	kg NMVOC eq.	1.87E-02	2.45E-04	5.65E-05	ND	0.00	0.00	1.44E-02	ND	0.00	0.00	0.00	6.65E-06	4.34E-05	5.38E-06	-4.73E-03
ADPF*[2]	MJ	113.67	3.01	0.10	ND	0.00	0.00	93.50	ND	0.00	0.00	0.00	7.91E-02	0.61	1.27E-02	-24.00
ADPE*[2]	kg Sb eq.	1.84E-05	3.92E-08	4.88E-10	ND	0.00	0.00	1.68E-05	ND	0.00	0.00	0.00	5.12E-10	5.23E-09	6.13E-11	-1.58E-06
WDP*[2]	m^3 world eq. deprived	1.05	1.63E-03	3.67E-02	ND	0.00	0.00	0.82	ND	0.00	0.00	0.00	9.02E-05	1.08E-02	1.10E-04	-0.28
Use of resources															
PERE	MJ	77.37	0.33	2.85	ND	0.00	0.00	67.80	ND	0.00	0.00	0.00	6.68E-03	0.44	2.21E-03	-13.20
PERM	MJ	2.35	0.00	-2.35	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	79.72	0.33	0.50	ND	0.00	0.00	67.80	ND	0.00	0.00	0.00	6.68E-03	0.44	2.21E-03	-13.20
PENRE	MJ	98.26	3.01	0.49	ND	0.00	0.00	93.50	ND	0.00	0.00	0.00	7.91E-02	14.89	0.76	-24.00
PENRM	MJ	12.85	0.00	-0.32	ND	0.00	0.00	1.78E-15	ND	0.00	0.00	0.00	0.00	-11.90	-0.63	0.00
PENRT	MJ	111.11	3.01	0.17	ND	0.00	0.00	93.50	ND	0.00	0.00	0.00	7.91E-02	2.99	0.14	-24.00
SM	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	m^3	4.13E-02	3.11E-04	8.65E-04	ND	0.00	0.00	3.40E-02	ND	0.00	0.00	0.00	7.51E-06	4.02E-04	3.36E-06	-8.88E-03
Waste categories															
HWD	kg	1.42E-07	1.28E-10	5.99E-11	ND	0.00	0.00	1.27E-07	ND	0.00	0.00	0.00	2.56E-12	8.82E-10	3.16E-12	-1.56E-08
NHWD	kg	2.26	4.99E-04	1.37E-02	ND	0.00	0.00	1.64	ND	0.00	0.00	0.00	1.24E-05	1.09E-03	6.43E-02	-0.70
RWD	kg	6.95E-03	4.07E-06	4.74E-06	ND	0.00	0.00	5.69E-03	ND	0.00	0.00	0.00	1.02E-07	9.72E-05	1.33E-07	-1.36E-03
Output material flows															
CRU	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	kg	0.11	0.00	0.00	ND	0.00	0.00	0.64	ND	0.00	0.00	0.00	0.00	0.53	0.00	0.00
MER	kg	0.00	0.00	0.00	ND	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	MJ	0.53	0.00	0.42	ND	0.00	0.00	0.99	ND	0.00	0.00	0.00	0.00	3.85E-02	0.00	0.00
EET	MJ	1.16	0.00	0.77	ND	0.00	0.00	2.01	ND	0.00	0.00	0.00	0.00	8.84E-02	0.00	0.00

Key:
GWP-t – climate change - total **GWP-f** – climate change - fossil **GWP-b** – climate change - biogenic **GWP-l** – climate change - land use and land use change **ODP** – ozone depletion **AP** - acidification **EP-fw** - eutrophication - aquatic freshwater **EP-m** - eutrophication - aquatic marine **EP-t** - eutrophication - terrestrial **POCP** - photochemical ozone formation **ADPF*[2]** - depletion of abiotic resources – fossil fuels **ADPE*[2]** - depletion of abiotic resources – minerals and metals **WDP*[2]** – water use **PERE** - use of renewable primary energy **PERM** - use of renewable primary energy resources used as raw materials **PERT** - total use of renewable primary energy **PENRE** - use of non-renewable primary energy **PENRM** - use of non-renewable primary energy resources used as raw materials **PENRT** - total use of non-renewable primary energy **SM** - use of secondary materials **RSF** - use of renewable secondary fuels **NRSF** - use of non-renewable secondary fuels **FW** - net use of freshwater **HWD** - hazardous waste disposed **NHWD** - non-hazardous waste disposed **RWD** - radioactive waste disposed **CRU** - components for reuse **MFR** - materials for recycling **MER** - materials for energy recovery **EEE** - exported electrical energy **EET** - exported thermal energy **ND** – not determined

	Results per 1 piece pneumatic cylinder														
	Unit	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Additional environmental impact indicators																
PM	Disease incidence	4.77E-07	2.21E-09	4.49E-10	ND	0.00	0.00	3.51E-07	ND	0.00	0.00	0.00	6.25E-11	5.11E-10	8.56E-11	-1.29E-07
IRP*[1]	kBq U235 eq.	0.72	4.15E-04	7.24E-04	ND	0.00	0.00	0.60	ND	0.00	0.00	0.00	1.43E-05	1.60E-02	1.54E-05	-0.15
ETP-fw*[2]	CTUe	51.34	2.41	5.56E-02	ND	0.00	0.00	43.43	ND	0.00	0.00	0.00	5.76E-02	0.28	7.36E-03	-10.72
HTP-c*[2]	CTUh	1.53E-07	4.81E-11	3.54E-12	ND	0.00	0.00	1.51E-07	ND	0.00	0.00	0.00	1.17E-12	1.02E-11	1.73E-13	-1.43E-09
HTP-nc*[2]	CTUh	8.18E-08	2.40E-09	2.39E-10	ND	0.00	0.00	6.65E-08	ND	0.00	0.00	0.00	6.20E-11	2.46E-10	1.14E-11	-1.83E-08
SQP*[2]	Dimensionless.	79.50	2.02	3.05E-02	ND	0.00	0.00	76.13	ND	0.00	0.00	0.00	3.91E-02	0.26	3.49E-03	-5.72

Key:
PM – particulate matter emissions **IRP*[1]** – ionising radiation – human health **ETP-fw*[2]** - ecotoxicity – aquatic freshwater **HTP-c*[2]** - human toxicity potential – cancer effect **HTP-nc*[2]** - human toxicity potential – non-cancer effect **SQP*[2]** – land use related impacts / soil quality **ND** – not determined

Disclaimers

*1 This impact category deals mainly with the eventual impact of low-dose ionising radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionising radiation from the soil, from radon and from some building materials is also not measured by this indicator

*2 The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator

6.4 Interpretation, LCA presentation and critical review

Evaluation

The environmental impacts of

- Electrical control unit
- Alert unit
- Pneumatic valve

differ considerably. The differences result from the different pre-products and raw materials used / from the amount of relevant pre-products and raw materials used. Due to the different declared units the product groups can´t be compared directly.

The environmental impacts during the manufacture of electrical control units result mainly from the use of batteries.
Further important parameters in the use stage originate from the energy consumption and the 12-time replacement of the batteries over the 50-year period. The environmental impacts during the manufacture of alert stations result mainly from the use of aluminium, steel und powder coating or their upstream chains. The environmental impacts during the manufacture of pneumatic valves result mainly from the use of aluminium and stainless steel and their upstream chains. Furthermore causes the energy consumption for the manufacture of alert stations and pneumatic valves significant environmental impacts.

In 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.
As regards the recycling of Electrical control units for batteries around 27% of the environmental impacts arising during manufacture can be assigned as benefits to scenario D. For alert stations and pneumatic valves the recycling of the contained metals results in about 20 % resp. 25 % of the environmental impacts assigned as benefits to scenario D.

Some of the LCA results differ considerably from those presented in the EPD prepared five years ago. The differences are due to differences in normative regulations, the application of uncertainty penalties, the use of other, more suitable “LCA for Experts” datasets, modification of the underlying “LCA for Experts” data and a new data collection at a different set of participating member companies of the VFE.

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

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

Charts

The following charts show the B modules related to the specified RSL during the 50-year building service life.

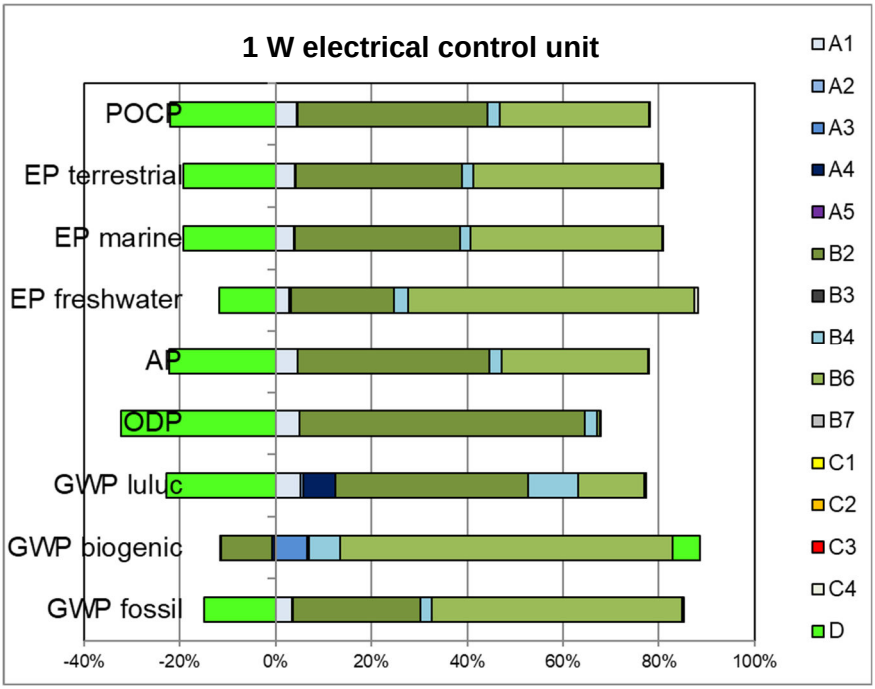


Figure 4: Percentage of the modules in selected environmental impact categories

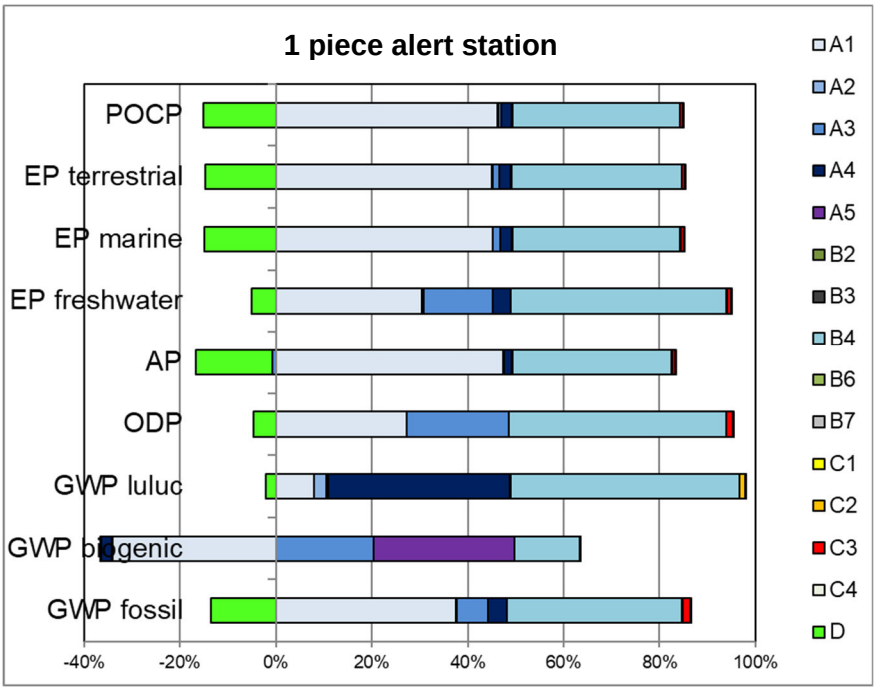


Figure 5: Percentage of the modules in selected environmental impact categories

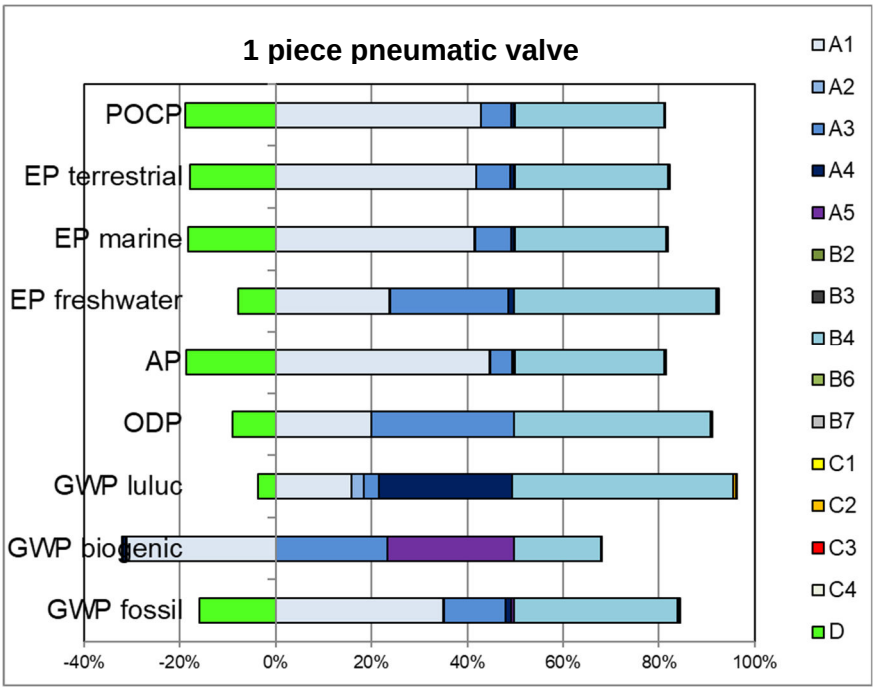


Figure 6: Percentage of the modules in selected environmental impact categories

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 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).

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. The establishment 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 „Bauteile für Anlagen zur Rauch- und Wärmefreihaltung“ PCR RW-3.0: 2023 sowie PCR „part A“ PCR-A-1.0:2023.

The European standard EN 15804 serves as the core PCR [a)]
Independent external verification of the Declaration and statement according to EN ISO 14025:2010
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	Verifier
1	02.07.2024	External verification	Brechleiter	Wortner

8 Literature

1. **Forschungsvorhaben.** *EPDs für transparente Bauelemente - Abschlussbericht.* Rosenheim : ift Rosenheim GmbH, 2011. SF-10.08.18.7-09.21/II 3-F20-09-1-067.
2. **Umweltbundesamt (UBA).** *Recyclingpotenzial strategischer Metalle (ReStra).* Dessau-Roßlau : Umweltbundesamt (UBA), 2017. ISSN 1862-4359.
3. **PCR Teil B - Bauteile für Anlagen zur Rauch- und Wärmefreihaltung.** *Produktkategorieregeln für Umweltprodukdeklarationen nach EN ISO 14025 und EN 15804.* Rosenheim : ift Rosenheim, 2018.
4. **PCR Teil A.** *Allgemeine Produktkategorieregeln für Umweltprodukdeklarationen nach EN ISO 14025 und EN 15804.* Rosenheim : ift Rosenheim, 2023.
5. **Bundesverband Baustoffe - Steine und Erden e. V. (bbs).** ***Kreislaufwirtschaft Bau - Mineralische Bauabfälle - Monitoring 2020.*** **[Online] 00 01 2023. [Cited: 10 05 2023.] https://kreislaufwirtschaft-bau.de/Download/Bericht-13.pdf.**
6. **Klöpffer, W and Grahl, B.** ***Ökobilanzen (LCA).*** **Weinheim : Wiley-VCH-Verlag, 2009.**
7. **ISO 15686-7:2017-04.** ***Hochbau und Bauwerke - Planung der Lebensdauer - Teil 7: Leistungsbewertung für die Rückmeldung von Daten über die Nutzungsdauer aus der Praxis .*** **s.l. : Beuth Verlag GmbH, 2017.**
8. **ISO 15686-2:2012-05 .** ***Hochbau und Bauwerke - Planung der Lebensdauer - Teil 2: Verfahren zur Voraussage der Lebensdauer .*** **s.l. : Beuth Verlag GmbH, 2012.**
9. **ISO 15686-1:2011-05.** ***Hochbau und Bauwerke - Planung der Lebensdauer - Teil 1: Allgemeine Grundlagen und Rahmenbedingungen.*** **s.l. : Beuth Verlag GmbH, 2011.**
10. **ISO 15686-8:2008-06.** ***Hochbau und Bauwerke - Planung der Lebensdauer - Teil 8: Referenznutzungsdauer und Bestimmung der Nutzungsdauer .*** **s.l. : Beuth Verlag GmbH, 2008.**
11. **IKP Universität Stuttgart und PE Europe GmbH.** ***GaBi 10: Software und Datenbank zur Ganzheitlichen Bilanzierung.*** **Leinfelden-Echterdingen : s.n., 2020.**
12. **ift Rosenheim GmbH.** ***Bedingungen und Hinweise zur Verwendung von ift-Prüfdokumentationen.*** **Rosenheim : s.n., 2016.**
13. **ift-Richtlinie NA-01/4.** ***Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen.*** **Rosenheim : ift Rosenheim GmbH, 2023.**
14. **Gefahrstoffverordnung - GefStoffV.** ***Verordnung zum Schutz vor Gefahrstoffen.*** **Berlin : BGBl. I S. 3758, 2017.**
15. **GDA - Gesamtverband der Aluminiumindustrie e. V.** ***Jahresbericht 2018.*** **Düsseldorf : GDA - Gesamtverband der Aluminiumindustrie e. V., 2018.**
16. **EN ISO 14025:2011-10.** ***Umweltkennzeichnungen und -deklarationen Typ III Umweltdecklarationen - Grundsätze und Verfahren.*** **Berlin : Beuth Verlag GmbH, 2011.**
17. **DIN EN ISO 16000 Teil 6, 9, 11.** ***Innenraumluftverunreinigungen: Bestimmung der Emissionen von flüchtigen organischen Verbindungen aus Bauprodukten und Einrichtungsgegenständen.*** **Berlin : Beuth Verlag GmbH, 2012, 2008, 2006.**
18. **EN 15942:2012-01.** ***Nachhaltigkeit von Bauwerken - Umweltproduktdeklarationen - Kommunikationsformate zwischen Unternehmen.*** **Berlin : Beuth Verlag GmbH, 2012.**
19. **DIN EN 15804:2012+A2:2019+AC:2021.** ***Nachhaltigkeit von Bauwerken - Umweltproduktdeklarationen - Grundregeln für die Produktkategorie Bauprodukte.*** **Berlin : Beuth Verlag GmbH, 2022.**
20. **DIN EN ISO 14067:2019-02.** ***Treibhausgase - Carbon Footprint von Produkten - Anforderungen an die Leitlinien für Quantifizierung.*** **Berlin : Beuth Verlag GmbH, 2019.**
21. **DIN EN ISO 14040:2018-05.** ***Umweltmanagement - Ökobilanz - Grundsätze und Rahmenbedingungen.*** **Berlin : Beuth Verlag GmbH, 2018.**
22. **DIN EN 13501-1:2010-01.** ***Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten - Teil 1: Klassifizierung mit den Ergebnissen aus den Prüfungen zum Brandverhalten von Bauprodukten.*** **Berlin : Beuth Verlag GmbH, 2010.**
23. **DIN EN ISO 14044:2006-10.** ***Umweltmanagement - Ökobilanz - Anforderungen und Anleitungen.*** **Berlin : Beuth Verlag GmbH, 2006.**
24. **DIN EN ISO 12457 Teil 1-4.** ***Charakterisierung von Abfällen - Auslaugung; Übereinstimmungsuntersuchung für die Auslaugung von körnigen Abfällen und Schlämmen - Teil 1-4.*** **Berlin : Beuth Verlag GmbH, 2003.**
25. **Chemikalien-Verbotsverordnung - ChemVerbotsV.** ***Verordnung über Verbote und Beschränkungen des Inverkehrbringens gefährlicher Stoffe, Zubereitungen und Erzeugnisse nach Chemikaliengesetz.*** **Berlin : BGBl. I S. 1328, 2017.**
26. **Chemikaliengesetz - ChemG.** ***Gesetz zum Schutz vor gefährlichen Stoffen - Unterteilt sich in Chemikaliensetz und eine Reihe von Verordnungen; hier relevant: Gesetz zum Schutz vor gefährlichen Stoffen.*** **Berlin : BGBl. I S. 1146, 2017.**
27. **Bundesimmissionsschutzgesetz - BImSchG.** ***Gesetz zum Schutz vor schädlichen Umwelteinwirkungen durch Luftverunreinigungen, Geräusche, Erschütterungen und ähnlichen Vorgängen.*** **Berlin : BGBl. I S. 3830, 2017.**
28. **Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit.** ***Leitfaden Nachhaltiges Bauen.*** **Berlin : s.n., 2016.**
29. **Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR).** ***Zukunft Bauen: Materialströme ich Hochbau, Band 06.*** **Bonn : Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR), 2017. 978-3-87994-284-8.**

9 Annex

Description of life cycle scenarios for Electrical control units, alert stations and pneumatic valves

Product stage			Con-struction process 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 process	Use	Maintenance	Repair	Replacement	Modification/refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport	Waste processing	Disposal	Reuse Recovery Recycling potential
✓	✓	✓	✓	✓	—	✓	✓	✓	—	✓	✓	✓	✓	✓	✓	✓

* For the declared B modules, the calculation of the results is based on the specified RSL related to one year.

Table 6: Overview of applied life cycle stages

Calculation of the scenarios was based on a defined RSL (see 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

No.	Scenario	Description
A4	Direct shipment to construction site/branch	34-40 t truck (Euro 0-6 mix), diesel, 27 t payload, 50% capacity used[1], about 2900 km to site and return empty

[1] capacity used: used loading capacity of truck

A4 Transport to the construction site	Transport weight [kg/decl. unit]	Density [kg/m³]	Volume capacity utilisation factor[2]
PG 1	5.22E-02	165	< 1
PG 2	5.07	1345	< 1
PG 3	0.77	2245	< 1

[2] Volume capacity utilisation factor:
= 1 product completely fills packaging (without air inclusion)
< 1 packaging contains unused volume (e.g.: air, filling material
> 1 product is packed in compressed form

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

A5 Construction/installation process

No.	Scenario	Description
A5	Manual	According to the manufacturer the products are installed without using additional lifting and auxiliary devices

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

Ancillary materials, consumables, use of energy and water, use of other resources, material losses, direct emissions as well as waste materials 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 or disposed of in line with the conservative approach. Films/foils / protective covers, wood and cardboard in waste incineration plants. Benefits from A5 are specified in module D. Benefits from waste incineration: electricity replaces electricity mix (RER); thermal energy replaces thermal energy from natural gas (RER).
Transport to the recycling plants is not taken into account.

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

B2 Cleaning, servicing and maintenance

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

B2.1 Cleaning

No.	Scenario	Description
B2.1	Rarely manual	No cleaning neccessary

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

B2.2 Servicing and maintenance

No.	Scenario	Description
B2.2	Normal use	**All product groups:** **Annual functional check, visual inspection, if necessary repair.** **Electrical control units:** **Battery has to be replaced every 4 years. (12-times replacement during a period of 50 years)**

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

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

A 25-year service life has been specified for the Electrical control units, alert stations and pneumatic valves by the manufacturer. Scenario B2.2 presents the LCA of the components of building elements with a service life of less than the specified RSL. The results include the RSL related to one year.

Is is assumed that the replaced components in the module “Servicing and maintenance” are recycled. Batteries: 84 % material recycling, 16 % disposed on landfill (RER). Benefits from B2.2 are specified in module D.

Transport to the recycling plants is not taken into account.

B3 Repair

No.	Scenario	Description
B3	Normal use and heavy use	No replacement necessary In accordance with EN 15804: The module “Repair“ covers a combination of all planned technical and associated administrative actions […].

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 Replacement

No	Scenario	Description
B4	Normal use and heavy use	One replacement over a 25-year period (RSL)*

*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 construction works level.

It is assumed that 1-time replacement will be necessary during the RSL of 25 years and the 50-year building service life. The results include the RSL and related to one year.

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

The environmental impacts of the selected scenario result from the product, construction and disposal stages.

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

B6 Operational energy use

No.	Scenario	Description
B6	**Power-operated Normal use**	**<u>PG 1 (elektrical control unit):</u> 13,828 kWh/50a per 1 W electrical power (standby consumption and 22.000 cycles) <u>PG 2 and PG 3:</u> No energy consumption**

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

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

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

B7 Operational water use

There's no water consumption when used as intended. Water consumption for cleaning is specified in module B2.1.

There is no transport consumption during 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, demolition

No.	Scenario	Description
C1	**Deconstruction**	• **deconstruction 95%** • **residues on landfill**

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 relevant summary table.

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

C2 Transport

No.	Scenario	Description
C2	Transport	**Transport to collection point using 40 t truck (Euro 0-6 mix), diesel, 27 t payload, 50% capacity used, 100 km** (1)

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

C3 Waste management

No.	Scenario	Description
C3	Current market situation	**Share for recirculation of materials:** • **Steel 98% in melt** (UBA, 2017) • **Aluminium 95% in melt** (GDA, 2018) • **Remaining metals 97% in melt** (UBA, 2017) • **Plastics 66%, thermal recycling in waste incineration plant** (Zukunft Bauen, 2017) • **Plastics 34%, material recycling** (Zukunft Bauen, 2017) • **Glass 100 % in melt** (EN 17074) • **Batteries 84 % material recycling** (UBA, 2018) **Remainder to landfill**

Electricity consumption of incineration plant 0.5 MJ/kg.

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

The table below describes the disposal processes and their share by mass. The calculation is based on the above mentioned proportions in percent related to the declared unit of the product system.

C3 Disposal	Unit	PG 1	PG 2	PG 3
Collection process, collected separately	kg	4.94E-02	4.51	0.58
Collection process, collected as mixed construction waste	kg	2.60E-03	0.24	3.06E-02
Recovery system, for reuse	kg	0	0	0
Recovery system, for recycling	kg	4.15E-02	4.25	0.53
Recovery system, for energy recovery	kg	6.09E-03	0.16	1.00E-02
Disposal	kg	4.32E-03	0.34	5.35E-02

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" (RER).

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[1]
D	Recycling potential (Current market situation)	• Steel scrap from C3 excluding the scrap used in A3 replaces 70.2% of steel; • Aluminium scrap from C3 excluding the recyclate used in A3 replaces 70.2% of aluminium; • Brass scrap from C3 excluding the recyclate used in A3 replaces 60% of brass parts; • Copper scrap from C3 excluding the recyclate used in A3 replaces 60% of copper sheets; • Plastic recyclate from C3 excluding the plastics used in A3 replaces 60% of polyamide PA6.6; • Glass recyclate from C3 excluding the recyclate used in A3 replaces 60% of container glass • Batteries from C3 and B2.2 excluding the recyclate used in A3 replaces 60% of batteries Benefits from waste incineration: • electricity replaces electricity mix (RER); • thermal energy replaces thermal energy from natural gas (RER).

[1] Value correction factor 70.2% according to metal specific data set, 60% according to standard data set for other materials.

The values in module "D" result from recycling of the packaging material in module A5, the recycling of batteries in B2.2 and from deconstruction at the end of service life.

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

Imprint

Practitioner of the LCA
ift Rosenheim GmbH
Theodor-Gietl-Straße 7-9
D-83026 Rosenheim

Programme operator
ift Rosenheim GmbH
Theodor-Gietl-Str. 7-9
D-83026 Rosenheim
Phone: +49 80 31/261-0
Fax: +49 80 31/261 290
Email: info@ift-rosenheim.de
www.ift-rosenheim.de

Declaration holder
GEZE GmbH
Reinhold-Vöster-Straße 21-29
71229 Leonberg

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-01/4 Allgemeiner Leitfaden zur Erstellung von Typ III Umweltproduktdeklarationen”. (Guideline NA-01/4 - Guidance on preparing Type III Environmental Product Declarations)
The publication and all its parts are protected by copyright. Any utilisation outside the confined limits of the copyright provisions is not permitted without the consent of the publishers and is punishable. In particular, this applies to any form of reproduction, translations, storage on microfilm and the storage and processing in electronic systems.

Layout
ift Rosenheim GmbH – 2021

Photographs (front page)
Verband Fensterautomation und Entrauchung e.V.

© ift Rosenheim, 2024



ift Rosenheim GmbH
Theodor-Gietl-Str. 7-9
D-83026 Rosenheim
Phone: +49 (0) 80 31/261-0
Fax: +49 (0) 80 31/261-290
Email: info@ift-rosenheim.de
www.ift-rosenheim.de