# ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

| | |
|---|---|
| Owner of the Declaration | ARGE – The European Federation of Locks and Building Hardware Manufacturers |
| Publisher | Institut Bauen und Umwelt e.V. (IBU) |
| Programme holder | Institut Bauen und Umwelt e.V. (IBU) |
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## Electromechanical building hardware and swing door operators

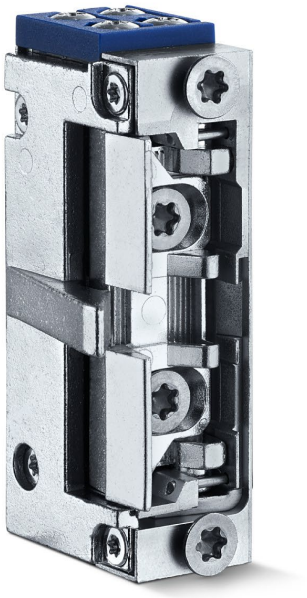
# ARGE – The European Federation of Locks and Building Hardware Manufacturers

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Institut Bauen und Umwelt e.V.

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# 1. General Information

## ARGE – The European Federation of Locks and Building Hardware Manufacturers

**Programme holder**

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

**Declaration number**

EPD-ARG-20230552-IBG1-EN

**This declaration is based on the product category rules:**

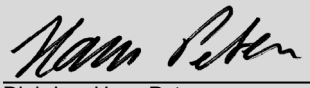
Building Hardware products, 01.08.2021
(PCR checked and approved by the SVR)

**Issue date**

02.04.2024

**Valid to**

01.04.2029



Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)



Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

## Electromechanical building hardware and swing door operators

**Owner of the declaration**

ARGE – The European Federation of Locks and Building Hardware Manufacturers
Offerstraße 12
42551 Velbert
Germany

**Declared product / declared unit**

1 kg of electromechanical building hardware or swing door operator

**Scope:**

This ARGE EPD covers electromechanical building hardware and swing door operators used to control access on doors or gates, or enable door or window opening and closing, as well as holding open of a door or window by means of electrical impulse. Several products of this product group have been assessed in separate LCA; from these LCA the worst values per indicator and module are declared as worst-case assumption. It can therefore be used to cover all electromechanical access control devices for doors and gates, as well as devices for opening, hold open and closing of doors, gates and windows manufactured in Europe by ARGE member companies.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

**Verification**

| The standard EN 15804 serves as the core PCR | | | |
|---|---|---|---|
| Independent verification of the declaration and data according to ISO 14025:2011 | | | |
| ☐ | internally | ☒ | externally |



Dr. Matthew Fishwick,
(Independent verifier)

## 2. Product

### 2.1 Product description/Product definition

This ARGE EPD covers electromechanical building hardware and swing door operators used to control access on doors or gates, or enable opening, holding open and closing of a door or window, designed to potentially being integrated into access control systems, building security and/or automation systems, etc.
There are 2 principal versions of such electromechanical hardware devices:
- battery-powered
- with external power supply

For certain products covered by this EPD the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) has to be compliant with *Regulation (EU) No. 305/2011 (CPR)*. These products need a declaration of performance taking into consideration *EN 14846:2008 Building hardware – Locks and latches – Electromechanically operated locks and striking plates – Requirements and test methods* and the CE-marking.

In addition to such products requiring a CE-marking under *EN 14846* all of the following products require a CE-marking as for placing in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) other legal provisions apply:

- Electromechanically operated locks and striking plates, if no CE-marking is required under *EN 14846:2008*.
- Mechatronic cylinders: *EN 15684:2020, Building hardware - Mechatronic cylinders - Requirements and test methods*.
- Mechatronic padlocks: *EN 16864:2017, Building hardware - Mechatronic padlocks - Requirements and test methods*.
- Mechatronic door furniture: *EN 16867:2020+A1:2021, Building hardware - Mechatronic door furniture - Requirements and test methods*.
- Electrically controlled exit systems for use on escape routes: *EN 13637:2015, Building hardware - Electrically controlled exit systems for use on escape routes - Requirements and test methods*.
- Electrically powered hold-open devices for swing doors: *EN 1155:1997+A1:2002+AC:2006, Building hardware - Electrically powered hold-open devices for swing doors - Requirements and test methods*.

These other legal provisions which might apply for the electromechanical building hardware devices are:

- Directive (EU) No. 2014/35 (Low Voltage Directive (LVD))
- Directive (EU) No. 2014/30 (Electromagnetic Compatibility (EMC) Directive)
- Directive (EU) No. 2014/53 (Radio Equipment Directive (RED))
- Directive (EU) No. 2011/65 (Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive))
- Directive (EU) No. 2006/42 (Machinery Directive)

The respective CE-marking takes into account the proof of conformity with the relevant harmonised standard(s) based on these legal provisions or with the legal provision itself.

For the application and use the respective national provisions apply.

### 2.2 Application

These products are designed to be integrated into or installed on door, gate and window assemblies consisting of various materials and used for various applications. They may be used for either interior or exterior doors, gates or windows, in accordance with manufacturer's instructions.

### 2.3 Technical Data

Ideally, products should comply with a suitable technical specification. *EN 14846:2008, Building hardware – Locks and latches – Electromechanically operated locks and striking plates – Requirements and test methods* is an example of such a specification and some products will comply with it.
Performance data of such products in accordance with the declaration of performance with respect to its essential characteristics according to this standard.
Performance data of other products in respect to its characteristics in accordance with the relevant technical provision (no CE-marking).

### 2.4 Delivery status

The products are sold by unit. Deliveries of individual items are possible but are an exception. Standard deliveries comprise a larger quantity of electromechanical building hardware devices, as they are marketed as "B2B" products and not to end-users.

### 2.5 Base materials/Ancillary materials

**Composition of product analysed for this EPD:**

The values given in the table below are for the product analysed for this EPD:

| Name | Value | Unit |
|---|---|---|
| Steel | 71.93 | % |
| Stainless steel | 20.8 | % |
| Zamak | 3.63 | % |
| Motor | 1.37 | % |
| PCB | 1.08 | % |
| ABS | 0.92 | % |
| Acetal | 0.26 | % |
| Neodymium | 0.0000159 | % |

**Steel** is produced by combining iron with carbon as well as other elements depending on the desired characteristics. Components made of steel are formed by stamping or other types of mechanical processing.

**Stainless steel** is produced by combining iron with chromium as well as other elements depending on the desired characteristics. Components made of steel are formed by stamping or other types of mechanical processing.

**Zamak** is an alloy with a base metal of zinc and alloying elements of aluminium, magnesium, and copper. Components made of Zamak are die-cast.

**Motor, PCB** are electronic components, which include copper wiring, etched copper sheets on non-conductive substrates, resistors, transistors, etc.

**ABS** (acrylonitrile butadiene styrene) is a terpolymer polymer made by polymerizing styrene and acrylonitrile in the presence of polybutadiene. Components made of ABS are made by injection moulding or other thermal forming processes.

**Acetal**, or polyoxymethylene (POM), is produced by polymerisation of anhydrous formaldehyde. Components made of Acetal are formed by injection moulding or other thermal

forming processes.

**Neodymium** is a chemical element and Neodymium alloys, used in high quality permanent magnets, consist of pure neodymium, iron, and boron.

**Battery** (in case of battery-powered electromechanical devices): AA 1.5V Lithium or similar.

1) This product/article/at least one partial article contains substances listed in the *ECHA candidate list* (date: 14.06.2023) exceeding 0.1 percentage by mass: Certain components may contain small amounts of lead (CAS no. 7439-92-1) as an alloying element.

2) This product/article/at least one partial article contains other cancerogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the *ECHA candidate list*, exceeding 0.1 percentage by mass: no.

3) Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) *Ordinance on Biocide Products No. 528/2012*): no.

### 2.6 Manufacture

The manufacture of an electromechanical building hardware device usually follows a 3-step process:

1. Manufacture of the components: this step may include surface treatment in the factory or by external contractors.
2. Pre-assembly of modules (in the factory).
3. Final assembly (in the factory).

### 2.7 Environment and health during manufacturing

Regular measurements of air quality and noise levels are carried out by the manufacturers, the ARGE member companies. The results shall be within the mandatory safety levels. In areas where employees are exposed to chemical products, the required protective clothing and technical protective devices shall be provided. Regular health checks are mandatory for employees in production facilities.

### 2.8 Product processing/Installation

The installation of the product may vary depending on the type of door, gate or window and the specific situation, but the products shall not require energy consumption for installation.

### 2.9 Packaging

Normally, each individual product is packed in paper or cardboard. These individual products are then packed in a cardboard box and stacked on wooden pallets for transport to the customer.

Waste from product packaging is collected separately for waste disposal (including recycling).

### 2.10 Condition of use

Once installed, the products shall require no servicing during their expected service lives. There shall be no consumption of water linked to their use, and they shall not cause any emissions.

### 2.11 Environment and health during use

No environmental damage or health risks are to be expected during normal conditions of use.

### 2.12 Reference service life

A reference service life according to *ISO 15686* cannot be declared.
The typical service life is 10 years under normal working conditions. The service life is not limited due to mechanical obsolescence but due to outdated electronic components/software.
It is required that installation, as well as maintenance of the product, must be done in line with instructions provided by the manufacturer.

### 2.13 Extraordinary effects

**Fire**

Certain products are suitable for use on fire resisting and/or smoke control door/window sets according to e.g., one of the classes A, B, N in *EN 12209*. Specific needs on fire resistance are addressed by individual manufacturers.

**Water**

The declared product is intended to be used in buildings under normal conditions (indoor or outdoor). It shall not emit hazardous substances in the event of flooding.

**Mechanical destruction**

Mechanical destruction of the declared product shall not materially alter its composition or have any adverse effect on the environment.

### 2.14 Re-use phase

Removal of electromechanical building hardware (for re-use or recycling) shall have no adverse effect on the environment.

### 2.15 Disposal

Electromechanical building hardware components should be re-cycled wherever possible, providing that there is no adverse effect on the environment. The waste code in accordance with the *European Waste Code* is 17 04 07.

### 2.16 Further information

Details of all types and variants can be found on the manufacturers' websites. The respective website addresses are available at https://arge.org.

## 3. LCA: Calculation rules

### 3.1 Declared Unit

The declared unit for all products covered by ARGE EPD is 1 kg (of product). Since individual products will rarely weigh exactly 1 kg it is necessary to establish the exact weight of the product then use this as a correction factor to determine the true values for 1 kg of product in the tables (Section 5).

**Declared unit**

| Name | Value | Unit |
|---|---|---|
| Declared unit | 1 | kg |
| Mass of assessed products | 0.63 - 7.5 | kg |
| Raw density | 1 | kg/m$^3$ |

### 3.2 System boundary

Type of the EPD: "cradle to gate with options, with modules C1 – C4, and module D (A1-A3, C1-C3, D and additional modules)"

The analysis of the product life cycle includes the production

and transport of the raw materials, manufacture of the product and the packaging materials which are declared in modules A1-A3.
Losses during production are considered as waste and are sent for recycling. No recycling processes are taken into account except transport and electricity consumption for grinding the metals. When recycled metals are used as raw material only their transformation process is taken into account and not the extraction of the raw material.
A4 module represents the transport of the finished electromechanical building hardware or swing door operator to the installation site.
There is no waste associated with the installation of the product. The A5 module therefore represents only the disposal of the product packaging.

Two alternatives are declared for the power supply:

- B6_1: replacement of the battery every 2 years (for battery-powered devices)
- B6_2: energy consumption from the grid (for grid-connected devices)

The End-of-Life (EoL) stages are also considered. The transportation to the EoL disposal site is taken into account in module C2. Module C4 covers the disposal of the electromechanical building hardware or swing door operator. Module C3 covers the recycling of the individual elements according to European averages, with the remaining waste divided between incineration and landfill.
Such a mixed scenario is declared due to the complex material mix of the product and the dependency of the EoL-route on the EoL-route of the product the electromechanical building hardware or swing door operator has been integrated into.
In practice, the end of life has been modelled as follows:

- when a material is sent for recycling, generic transport and electric consumption of a shredder is taken into account (corresponding to the process 'Grinding, metals'). Only then, is the material considered to have attained the 'end of waste' state.
- each type of waste is modelled as a transport to the treatment site with a distance of 30 km. Parts sent for recycling include electricity consumption (grinding) and a flow ('Materials for recycling, unspecified').

### 3.3 Estimates and assumptions

The LCA data of the declared product had been calculated by the production data from one ARGE member company. This company had been chosen by ARGE as being representative by means of its production processes and its market share. The product is chosen to be as representative as possible. In addition, data were used from another manufacturer to consider battery-powered devices in order to complete the LCA results.

### 3.4 Cut-off criteria

The cut-off criteria considered are 1% of renewable and non-renewable primary energy usage and 1% of the total mass of that unit process. The total neglected input flows per module amount to a maximum of 5% of energy usage and mass.

For this study, all input and output flows have been considered at 100%, including raw materials as per the product composition provided by the manufacturer and packaging of raw materials as well as the final product. Energy and water consumptions have also been considered at 100% according to the data provided.

With the approach chosen, no significant environmental impacts are known to have been cut off.

### 3.5 Background data

For life cycle modelling of the considered product, all relevant background datasets are taken from *ecoinvent v3.8* (system model: cut-off by classification).

### 3.6 Data quality

The objective of this evaluation is to evaluate the environmental impacts generated by the products throughout their entire life cycles. To this end, *ISO 14040*, *ISO 14044* and *EN 15804* have been met regarding the quality of data on the following different criteria:

Time: The life cycle inventory data used come from:

- Data collected specifically for this study on the ARGE member company's manufacturing site. Datasets are based on 1-year averaged data (time period: January 2013 to December 2013 considered representative for 2022).
- In the absence of collected data, generic data from the *ecoinvent v3.8* database have been used. This is updated regularly and is representative of current processes (the entire database having been updated in 2021).

Geography: Data come from the production site of the ARGE member company. Generic data come from the *ecoinvent* database, representative for European production processes.

Technology: Material shaping technologies are based on European technology in the case of use of generic data.

Several products of this product group have been assessed in separate LCAs; from these LCA the worst values per indicator and module are declared as worst-case assumption.

### 3.7 Period under review

The data of the LCA is based on the annual production data of an ARGE member from 2013, considered also representative for the year 2022.

### 3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

### 3.9 Allocation

The products covered by this EPD are produced in numerous sites. The product assessed for the calculation of this EPD is produced by one manufacturer on its own site. All data were provided by this manufacturer of the product per unit, and then divided by the mass of the product to give a value per kg of product produced.

In addition, a battery-powered device was considered to complete the evaluation. The data were provided by another manufacturer.

The assumptions relating to the EoL of the product are described in the section System Boundaries.

### 3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

*ecoinvent v3.8* (system model: cut-off by classification) has been used as the background database.

## 4. LCA: Scenarios and additional technical information

**Characteristic product properties of biogenic carbon**

**Information on the biogenic carbon content at factory gate**

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of $CO_2$.

| Name | Value | Unit |
|---|---|---|
| Biogenic carbon content in product | 0 | kg C |
| Biogenic carbon content in accompanying packaging | 0.0678 | kg C |

The following information is the basis of the declared modules within the LCA in this EPD.

**Transport to the building site (A4)**

| Name | Value | Unit |
|---|---|---|
| Litres of fuel | 28.5 | l/100km |
| Transport distance | 3500 | km |
| Capacity utilisation (including empty runs) | 36 | % |

**Installation into the building (A5)**

| Name | Value | Unit |
|---|---|---|
| Material loss | 0.00949 | kg |

**Reference service life**

| Name | Value | Unit |
|---|---|---|
| Life Span according to the manufacturer | 10 | a |

The service life is not limited due to mechanical obsolescence but due to outdated electronic components/software.
It is required that installation, as well as maintenance of the product, must be done in line with instructions provided by the manufacturer.

**Operational energy use (B6)**

Two alternatives are declared for the power supply:

- B6_1: replacement of the battery every 2 years (for battery-powered devices)
- B6_2: energy consumption from the grid (for grid-connected devices)

When electromechanical hardware devices are battery-powered, the batteries are assumed to be replaced every 2 years which leads to 2 replacements of a set of 2 batteries over a service life of 5 years.

The transport of the battery is assumed to be done by truck (3.5 tons) with a distance of 30 km.

The following scenario has been taken into account for the grid-connected version:
- 3 operative modes of the product: Active mode, standby and off
- Time share in each mode (in %)
- Average power for each mode (in Watts)

The total energy consumption during the RSL has been calculated with the following formulas:

**Energy consumption mode** (Wh) = Average power mode (W) * Time mode (%) * RSL * 365 * 24

**Energy consumption of the product** (Wh) = Energy consumption active + Energy consumption standby + Energy consumption off

It is assumed that, throughout its RSL (10 years), the product is active 1% of the time and is in stand-by or sleep-mode during 99 % of the time (data from companies).
The average power during the active time is 28.8 W (17660.16 Wh) and during stand-by is 3.6 W (218544.48 Wh). A European electricity mix has been taken into account for the energy consumption.

| Name | Value | Unit |
|---|---|---|
| Electricity consumption | 236.2 | kWh |

**End of life (C1-C4)**

| Name | Value | Unit |
|---|---|---|
| Collected separately waste type | 1 | kg |
| Recycling | 0.241 | kg |
| Energy recovery | 0.349 | kg |
| Landfilling | 0.41 | kg |

It is assumed that a 16–32-ton truck is used to transport the product:
- Transport to shredding facility for metal recovery: 150 km
- Transport to municipal waste incineration plant: 50 km
- Transport to landfill: 30 km

**Reuse, recovery and/or recycling potentials (D), relevant scenario information**

Module D contains the benefits and loads beyond the system boundary related to the recycling of metals, which result from the treatment of recycled materials from the point of end-of-waste status to the point of substitution (as costs) and the substitution of primary resources (as benefits).

According to *EN 16710*, clause 6.4.3.3: 'In module D substitution effects are calculated only for the resulting net output flow.

For building hardware, the following rules apply for the quantification of net output flows:
- all production scrap and cuttings leave modules A1-B3 as sorted scrap without allocated burdens from primary production; the corresponding amounts are declared as material for recycling (MFR);
- net amounts of a metal leaving the product system are quantified as the material for recycling leaving modules A1-C4 minus the input of secondary scrap (secondary material, SM) to the product system;
- in the case of brass and zinc alloys, which are composed of two different constituting metals, no difference shall be made between the input of secondary constituting metals (Cu and Zn; Cu and Sn) and its alloys (CuZn; CuSn).

Negative net output flows have been considered in the quantification of module D.

It also includes the benefits and loads related to 'exported energy electricity' and 'exported energy heat' resulting from the energy recovery from plastic wastes in a municipal waste incineration plant as modelled in Modules A3, A5 and C4.

## 5. LCA: Results

In Table 1 "Description of the system boundary", the declared modules are indicated with an "X"; all modules that are not declared within the EPD but where additional data are available are indicated with "MND". Those data can also be used for building assessment scenarios. The values are declared with three valid digits in exponential form.
The set of characterisation factors EF3.0 has been used for the life cycle assessment.

**DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)**

| Product stage | | | Construction process stage | | Use stage | | | | | | | End of life stage | | | | Benefits and loads beyond the system boundaries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw material supply | Transport | Manufacturing | Transport from the gate to the site | Assembly | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction demolition | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-potential |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
| X | X | X | X | X | MND | MND | MNR | MNR | MNR | X | MND | X | X | X | X | X |

**RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 kg of electromechanical building hardware and swing door operators**

| Parameter | Unit | A1-A3 | A4 | A5 | B6/1 | B6/2 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GWP-total | kg $CO_2$ eq | 1.18E+01 | 6.75E-01 | 3.14E-01 | 1.48E+00 | 2.03E+02 | 0 | 1.86E-02 | 1.86E-02 | 4.93E-02 | 4.85E-01 |
| GWP-fossil | kg $CO_2$ eq | 1.2E+01 | 6.74E-01 | 2.26E-02 | 1.47E+00 | 2.03E+02 | 0 | 1.86E-02 | 1.85E-02 | 4.93E-02 | 4.84E-01 |
| GWP-biogenic | kg $CO_2$ eq | -2.69E-01 | 0 | 2.92E-01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GWP-luluc | kg $CO_2$ eq | 2.82E-02 | 2.7E-04 | 1.8E-06 | 2.69E-03 | 5.07E-01 | 0 | 7.44E-06 | 3.14E-05 | 3.75E-06 | 7.47E-04 |
| ODP | kg CFC11 eq | 6.48E-07 | 1.56E-07 | 1.02E-09 | 1.15E-07 | 1.05E-05 | 0 | 4.31E-09 | 8.96E-10 | 1.52E-09 | 3.2E-08 |
| AP | mol $H^+$ eq | 3.08E-01 | 1.91E-03 | 1.95E-05 | 3.07E-02 | 1.11E+00 | 0 | 5.28E-05 | 2.03E-04 | 4.35E-05 | 2.35E-02 |
| EP-freshwater | kg P eq | 1.87E-03 | 4.81E-06 | 3.74E-08 | 1.66E-04 | 2.27E-02 | 0 | 1.33E-07 | 1.06E-06 | 8.24E-08 | 7.47E-05 |
| EP-marine | kg N eq | 3.85E-02 | 3.81E-04 | 6.46E-06 | 2.35E-03 | 1.38E-01 | 0 | 1.05E-05 | 1.67E-05 | 1.76E-05 | 1.02E-03 |
| EP-terrestrial | mol N eq | 2.8E-01 | 4.24E-03 | 6.99E-05 | 2.81E-02 | 1.6E+00 | 0 | 1.17E-04 | 1.85E-04 | 1.7E-04 | 1.4E-02 |
| POCP | kg NMVOC eq | 7.77E-02 | 1.63E-03 | 2.03E-05 | 8.53E-03 | 4.4E-01 | 0 | 4.5E-05 | 5.78E-05 | 4.98E-05 | 4.23E-03 |
| ADPE | kg Sb eq | 4.07E-03 | 2.39E-06 | 1.62E-08 | 5.7E-04 | 1.97E-03 | 0 | 6.59E-08 | 7.78E-07 | 2.26E-08 | 5.66E-04 |
| ADPF | MJ | 1.29E+02 | 1.02E+01 | 6.85E-02 | 1.93E+01 | 4.27E+03 | 0 | 2.82E-01 | 2.38E-01 | 1.11E-01 | 6.82E+00 |
| WDP | $m^3$ world eq deprived | 5.06E+00 | 3.11E-02 | 3.36E-04 | 8.35E-01 | 5.07E+01 | 0 | 8.58E-04 | 9.87E-03 | -3.16E-04 | 4.14E-01 |

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

**RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 kg of electromechanical building hardware and swing door operators**

| Parameter | Unit | A1-A3 | A4 | A5 | B6/1 | B6/2 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | 2.15E+01 | 1.44E-01 | -6.86E-01 | 2.56E+00 | 9.42E+02 | 0 | 3.96E-03 | 9.18E-02 | 6.71E-03 | 1.33E+00 |
| PERM | MJ | 2.35E+00 | 0 | -6.18E-01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PERT | MJ | 2.38E+01 | 1.44E-01 | -1.3E+00 | 2.56E+00 | 9.42E+02 | 0 | 3.96E-03 | 9.18E-02 | 6.71E-03 | 1.33E+00 |
| PENRE | MJ | 1.31E+02 | 1.02E+01 | 2.17E-01 | 1.93E+01 | 4.32E+03 | 0 | 2.82E-01 | 2.39E-01 | 1.11E-01 | 6.85E+00 |
| PENRM | MJ | 1.43E+00 | 0 | -1.48E-01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PENRT | MJ | 1.33E+02 | 1.02E+01 | 6.85E-02 | 1.93E+01 | 4.32E+03 | 0 | 2.82E-01 | 2.39E-01 | 1.11E-01 | 6.85E+00 |
| SM | kg | 4.47E-01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RSF | MJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NRSF | MJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FW | $m^3$ | 1.62E-01 | 1.08E-03 | 5.13E-05 | 1.88E-02 | 2.84E+00 | 0 | 2.99E-05 | 2.75E-04 | 2.23E-04 | 6.66E-03 |

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; 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 = Use of net fresh water

**RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 kg of electromechanical building hardware and swing door operators**

| Parameter | Unit | A1-A3 | A4 | A5 | B6/1 | B6/2 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HWD | kg | 1.47E-03 | 2.67E-05 | 2.49E-07 | 7.99E-04 | 3.41E-03 | 0 | 7.36E-07 | 4.47E-07 | 2.15E-07 | 1.92E-04 |
| NHWD | kg | 4.71E+00 | 5.38E-01 | 4.05E-03 | 5.53E-01 | 1.72E+01 | 0 | 1.48E-02 | 1.37E-02 | 3.8E-01 | 1.71E-01 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RWD | kg | 2.12E-03 | 1.48E-04 | 9.43E-07 | 9.02E-05 | 5.73E-02 | 0 | 4.08E-06 | 1.95E-06 | 1.41E-06 | 5.49E-05 |
| CRU | kg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MFR | kg | 2.89E-01 | 0 | 1.61E-01 | 0 | 0 | 0 | 0 | 6.72E-01 | 0 | 0 |
| MER | kg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EEE | MJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EET | MJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

**RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 kg of electromechanical building hardware and swing door operators**

| Parameter | Unit | A1-A3 | A4 | A5 | B6/1 | B6/2 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PM | Disease incidence | 1.29E-06 | 5.42E-08 | 3.98E-10 | 1.34E-07 | 3.24E-06 | 0 | 1.49E-09 | 1.19E-09 | 1.05E-09 | 5.38E-08 |
| IR | kBq U235 eq | 7.95E-01 | 4.44E-02 | 2.85E-04 | 5.64E-02 | 3.89E+01 | 0 | 1.22E-03 | 1.32E-03 | 5.02E-04 | 3.51E-02 |
| ETP-fw | CTUe | 2.54E+03 | 8.02E+00 | 5.87E-02 | 2.18E+02 | 2.67E+03 | 0 | 2.21E-01 | 1.06E+00 | 5.48E+01 | 1.28E+02 |
| HTP-c | CTUh | 6.79E-08 | 2.58E-10 | 3.64E-12 | 8.96E-09 | 8.58E-08 | 0 | 7.12E-12 | 2.13E-11 | 1.22E-11 | 5.6E-09 |
| HTP-nc | CTUh | 3.43E-06 | 8.11E-09 | 1.44E-10 | 3.53E-07 | 2.7E-06 | 0 | 2.24E-10 | 5.82E-10 | 3.96E-10 | 3.81E-07 |
| SQP | SQP | 1.14E+02 | 7.13E+00 | 4.58E-02 | 1.12E+01 | 8.22E+02 | 0 | 1.96E-01 | 7.52E-02 | 1.89E-01 | 8.77E+00 |

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'. This impact category deals mainly with the eventual impact of low dose ionizing 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 ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. 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 experienced with the indicator.

## 6. LCA: Interpretation

The following interpretation is based on the LCA scores of one of the assessed products, whereas two types of power supply have been analysed.
Figure 1 illustrates the relative contributions of the different modules along the life cycle of the declared products, assuming power supply from the grid.

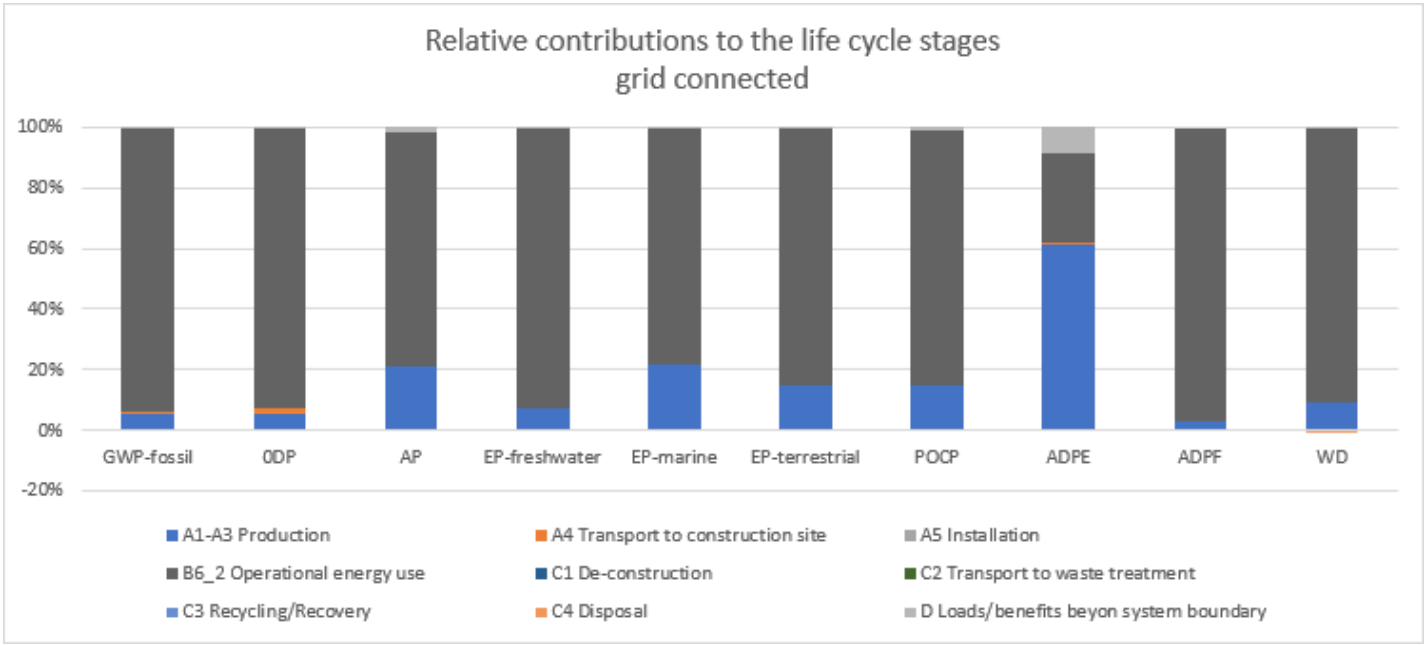



**Figure 1: Environmental impacts of electromechanical building hardware and swing door operators with external power supply along their life cycle**

By far the largest part of environmental impact is caused by the electricity from the grid during standby. With the exception of the ADP elements, the production (modules A1-A3) of the electromechanical building hardware and swing door operators has negligible impacts.
All the other modules related to the product life cycle and module D are not significant.

Figure 2 illustrates the relative contributions of the different modules along the life cycle of the battery-powered products.

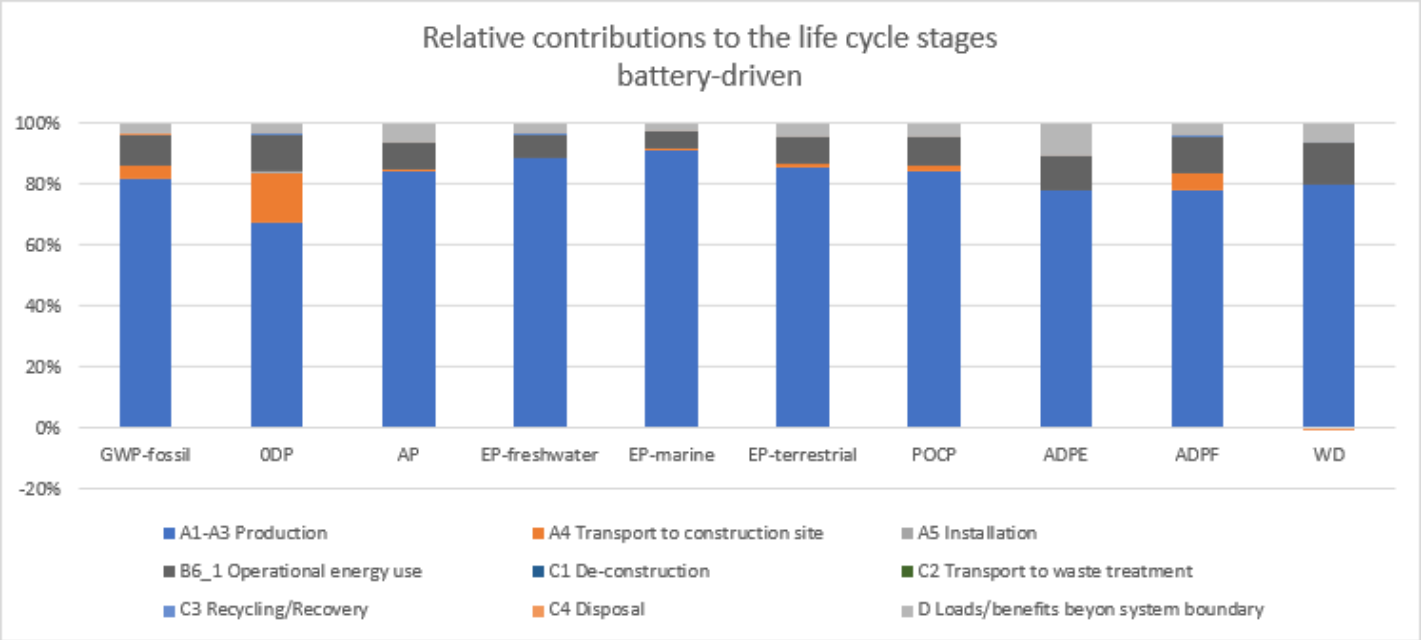



**Figure 2: Environmental impacts of battery-powered electromechanical building hardware along its life cycle**

The largest part of environmental impacts is caused during production (modules A1-A3); comparably small impacts are caused during the transport of the product to the construction site (via the manufacturer of the product, which the electromechanical hardware has been integrated into).
All the other modules related to the product life cycle are not significant.

Benefits and burdens beyond the system boundary (module D) are in the order of +5 % to +15 % hence resulting in net burdens due to a negative net flow of recycled materials over the product life cycle.

Several typical products (based on sales figures) have been evaluated and the worst-case results are used in section 5 of this EPD. In chapter 2.5, the tabulated range of relative weight per material ensures that the variability of results stays within +/- 40% of the declared values (assessed for the indicators GWP, PENRT, and non-hazardous waste).

## 7. Requisite evidence

No testing results are required by the PCR part B.

## 8. References


**Product category rules of IBU**

**IBU (2021)**
IBU (2021): General Instructions for the EPD Programme of the Institut Bauen und Umwelt e.V. (General Instructions for the IBU EPD Programme). Version 2.0, Institut Bauen und Umwelt, Berlin.

**IBU (2021)**
IBU (2021): PCR Part A: Calculation rules for the life cycle assessment and requirements on the project report according to EN 15804+A2. Version 1.3., Institut Bauen und Umwelt, Berlin.

**IBU (2023)**
IBU (2023): PCR Part B: Requirements on the EPD for building hardware products, Institut Bauen und Umwelt, Berlin.

**Standards and legal documents**

**EN 15804**
EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

**EN 17610**
EN 17610:2022, Building hardware - Environmental product declarations - Product category rules complementary to EN 15804 for building hardware.

**ISO 14025**
ISO 14025:2006-07, Environmental labels and declarations - Type III Environmental declarations - Principles and procedures.

**ISO 14044**
EN ISO 14044:2006-07, Environmental management - Life cycle assessment - Requirements and guidance (ISO 14044:2006); German and English versions EN ISO 14044:2006.

**EN 15684**
EN 15684:2020, Building hardware - Mechatronic cylinders - Requirements and test methods.

**EN 16864**
EN 16864:2017, Building hardware - Mechatronic padlocks - Requirements and test methods.

**EN 16867**
EN 16867:2020+A1:2021, Building hardware - Mechatronic door furniture - Requirements and test methods.

**EN 14846**
EN 14846:2008, Building hardware - Locks and latches - Electromechanically operated locks and striking plates - Requirements and test methods.

**EN 1155**
EN 1155:1997+A1:2002+AC:2006, Electrically powered hold-open devices for swing doors: Building hardware - Electrically powered hold-open devices for swing doors - Requirements and test methods.

**EN 13637**
EN 13637:2015, Building hardware - Electrically controlled exit systems for use on escape routes - Requirements and test methods.

**EN 13501-1**
EN 13501-1:2018, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

**ISO 15686**
ISO 15686:1, -2, -7 and -8. Service life planning (various parts).

**Regulation No. 305/2011**
Regulation No. 305/2011 (Construction Products Regulation, or CPR) of the European Parliament and of the European Council is a regulation of 9 March 2011 that lays down harmonised conditions for the marketing of construction products and replaces Construction Products Directive (89/106/EEC).

**Directive No. 2014/35**
Directive No. 2014/35/EU (Low Voltage Directive, or LVD) of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (recast).

**Directive No. 2014/30**
Directive No. 2014/30 (Electromagnetic Compatibility Directive, or EMC) of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility.

**Directive No. 2014/53**
Directive No. 2014/53 (Radio Equipment Directive, or RED) of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5.

**Directive No. 2011/65**
Directive No. 2011/65 (RoHS) of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

**Directive No. 2006/42**
Directive No. 2006/42 (Machinery Directive) of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast).

**ECHA candidate list**
Candidate List of substances of very high concern for Authorisation, published in accordance with Article 59(10) of the REACH Regulation. European Chemicals Agency, Brussels.

**Ordinance on Biocide Products No. 528/2012**
REGULATION (EU) No 528/2012 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 May 2012 concerning the making available on the market and use of biocidal products.

**European List of Waste**
Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous

waste (notified under document number C(2000) 1147).

**Additional references**

**BBSR 2017**
BBSR (2017): Nutzungsdauer von Bauteilen in Lebenszyklusanalysen nach Bewertungssystem Nachhaltiges Bauen (BNB). Version vom 24.10.2017, Bundesinstitut für Bau-, Stadt- und Raumforschung, Berlin.

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http://www.ecoinvent.org

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