

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)
Declaration number	EPD-ARG-20230544-IBG1-EN
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Valid to	01.04.2029

Padlocks

ARGE – The European Federation of Locks and Building Hardware Manufacturers

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1. General Information

ARGE – The European Federation of Locks and Building Hardware Manufacturers

Programme holder

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Declaration number

EPD-ARG-20230544-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

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Padlocks

Owner of the declaration

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Declared product / declared unit

1 kg of padlock

Scope:

This ARGE EPD covers padlocks and padlock fittings operated by means of a key. They are used for securing buildings, both outside and inside. The reference product used to calculate the impact this product group has on the environment is a padlock composed primarily of steel, Zamak and brass. This product is the only one assessed for this EPD and serves as reference to cover all products within this family. This product has been determined in accordance with ARGE and the market share as the most representative product of the family.

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	
<input type="checkbox"/>	internally
<input checked="" type="checkbox"/>	externally

Dr. Matthew Fishwick,
(Independent verifier)

2. Product

2.1 Product description/Product definition

This ARGE EPD covers external locking devices, including the corresponding fittings, used to secure doors and gates to frames. For the application and use the respective national provisions at the place of use apply.

2.2 Application

Padlocks are used as a stand-alone product to secure doors and gates without the need for a locking mechanism integrated into the door or gate.

2.3 Technical Data

Ideally, products comply with a suitable technical specification. *EN 12320:2021, Building hardware - Padlocks and padlock fittings - Requirements and test methods* is an example of such a specification and some products will comply with this. The relevant grading structure is shown in the following table:

Name	Value	Unit
Category of use	1	Grade
Durability	0,1	Grade
Corrosion resistance	1 - 6	Grade
Safety	1 - 6	Grade

Performance data of the product with 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 padlocks, 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	88.17	%
Zamak	5.97	%
Brass	3.05	%
Stainless steel	2.13	%
Nylon 6	0.64	%

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 different 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.

Brass is an alloy of zinc and copper. Components made of brass are made by extrusion, forging, die-casting 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.

Nylon 6 is a polymer, in particular polyamide. It is formed by

the ring-opening polymerisation of caprolactam. Components made of Nylon 6 are formed by injection moulding or other thermal forming processes.

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 a padlock 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 or gate 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, products shall require no servicing during their expected service lives. There shall be no consumption of water or energy 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

The reference service life is 30 years under normal working conditions. This corresponds to passing a mechanical endurance test of 10.000 cycles as specified in the *EN 12320*. The reference service life is dependent on the actual frequency of use and environmental conditions. 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

There are no fire resistance requirements in *EN 12320*. So, any fire resistance requirements would be a voluntary declaration by the manufacturer.

Water

The declared product is intended to be used on buildings under normal conditions (usually outdoors). 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 padlocks and their fittings (for re-use or recycling) shall have no adverse effect on the environment.

2.15 Disposal

Padlocks and their fittings should be recycled 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 and 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 declared product	0.469	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, the 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 for 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 padlock to the installation site.

There is nowaste associated with the installation of the product. The A5 module therefore represents only the disposal of the product packaging.

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 locks. 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 padlock 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 have been calculated using the production data of one ARGE member company. This company has 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.

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 shall be 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 the 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 on the composition of products, process technologies, wastage, etc. come from production site of the ARGE member company. Generic data on processing processes come from the *ecoinvent* database, representative for European production processes.

Technology: Material shaping technologies are based on European technology in the case of the use of generic data. In this EPD, a representative product has been selected to represent the product group, considering the most common materialisation of the products covered in this product group.

3.7 Period under review

The data of the LCA is based on the annual production data of an ARGE member from 2013, considered 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 one site. All data were provided by this manufacturer of the products per unit, and then divided by the mass of the product to give a value per kg of product produced.

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 CO₂.

Name	Value	Unit
Biogenic carbon content in product	0	kg C
Biogenic carbon content in accompanying packaging	0.0570	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	25.8	l/100km
Transport distance	3500	km
Capacity utilisation (including empty runs)	36	%

Installation into the building (A5)

Name	Value	Unit
Material loss	0.144	kg

Reference service life

Name	Value	Unit
Reference service life	30	a
Test cycles over RSL (EN 12320)	10'000	cycles

End of life (C1-C4)

Name	Value	Unit
Collected separately waste type (Mixed scenario)	1	kg
Recycling (Mixed scenario)	0.796	kg
Energy recovery (Mixed scenario)	0.094	kg
Landfilling (Mixed scenario)	0.11	kg
Incineration (100% incineration scenario) Scenario 1	1	kg
Landfilling (100% Landfill scenario) Scenario 2	1	kg
Recycling (100% recycling scenario) Scenario 3	1	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 not 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.

EEE	MJ	5.74E-04	0	3.71E-02	0	0	0	3.39E-03	0
EET	MJ	3.8E-03	0	2.45E-01	0	0	0	2.24E-02	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 padlock**

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	3.5E-07	5.24E-08	3E-10	0	1.5E-09	6.14E-11	5.66E-10	-7.26E-08
IR	kBq U235 eq	3.46E-01	4.29E-02	1.88E-04	0	1.23E-03	8.62E-04	2.05E-04	-1.07E-02
ETP-fw	CTUe	3.16E+02	7.76E+00	4.49E-02	0	2.22E-01	4.76E-02	1.17E-01	-9.28E+01
HTP-c	CTUh	2.63E-08	2.5E-10	3.37E-12	0	7.13E-12	1.27E-12	6.5E-12	-1.43E-10
HTP-nc	CTUh	4.02E-07	7.84E-09	1.37E-10	0	2.24E-10	4.13E-11	5.96E-11	-8.06E-09
SQP	SQP	5.9E+01	6.89E+00	3.03E-02	0	1.97E-01	1.45E-02	9.09E-02	-5.78E+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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, 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 as there is limited experience with the indicator.

6. LCA: Interpretation

Figure 1 illustrates the relative contributions of the different modules along the life cycle of the declared products.

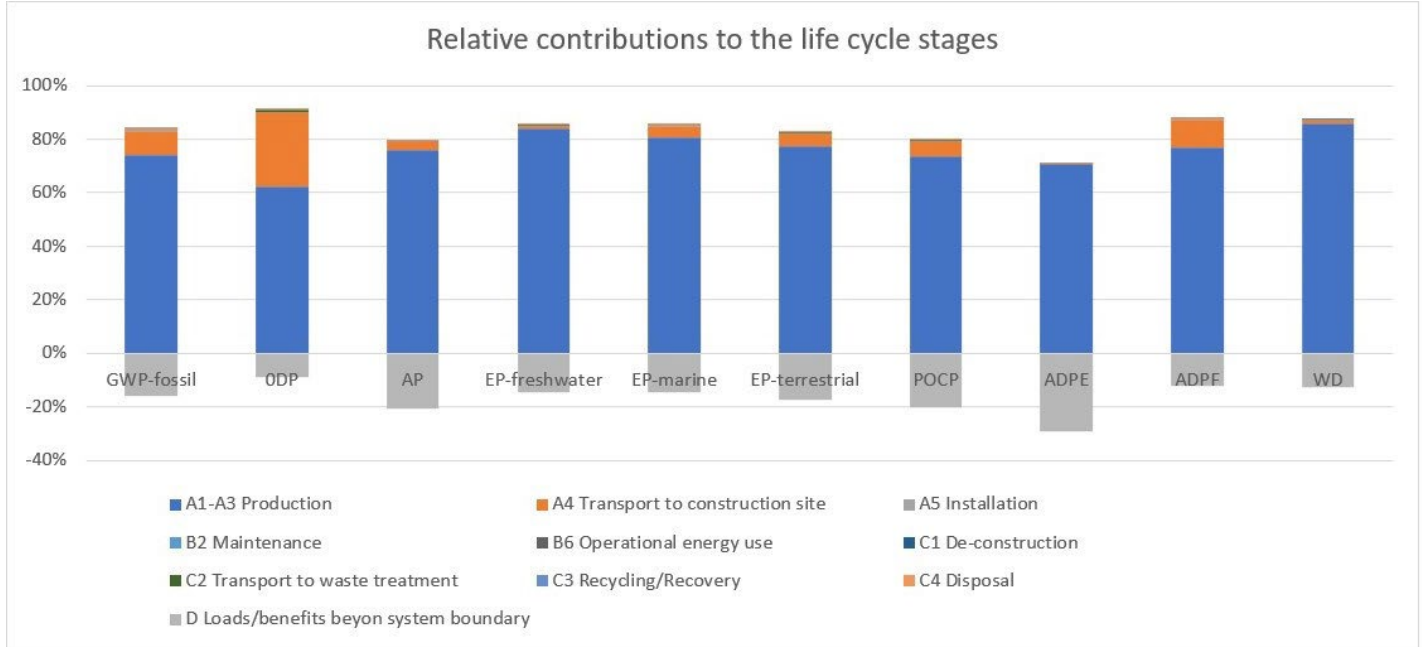


Figure 1: Environmental impacts of padlocks along its life cycle

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 padlock 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 10 % to 30 % of the impacts over the product life cycle (modules A1-A3) and relate basically to the recycling of metals.

In this EPD, a representative product has been selected to represent the product group, considering the most common materialisation of the products covered in this product group. This has been done based on the knowledge of ARGE members on the composition of the declared products. In in-

depth analysis of variability has not been conducted for this

product group.

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. Version 2023/04, 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 12320

EN 12320:2021, Building hardware - Padlocks and padlock fittings - Requirements and test methods.

ISO 15686

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

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.

ecoinvent v3.8

<http://www.ecoinvent.org>

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