ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	ARGE; European Federation of Associations of Lock and Builders Hardware Manufacturers
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ARG-20160190-IBG1-EN
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Issue date	24.10.2016
Valid to	23.10.2022

Padlocks

ARGE; European Federation of Associations of Lock and Builders Hardware Manufacturers

(This EPD is valid only for products supplied by an ARGE EPD licence holder)

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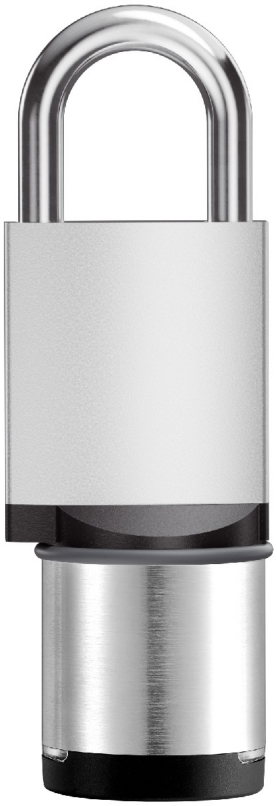

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1. General Information

Name of the manufacturer

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-ARG-20160190-IBG1-EN

This Declaration is based on the Product Category Rules:
Building Hardware products, 07.2014
(PCR tested and approved by the SVR)

Issue date
24.10.2016

Valid to
23.10.2021

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhart Lehmann
(Managing Director IBU)

Name of the product

Owner of the Declaration
ARGE; European Federation of Associations of Lock and Builders Hardware Manufacturers
Offerstraße 12, 42551 Velbert
Germany

Declared product / Declared unit
1 kg of padlocks

Scope:
This Association EPD covers padlocks, security devices used in buildings by means of a key. The reference product used to calculate the impacts for this group of products is a padlock composed primarily of steel, zinc 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.

Verification

The CEN Norm /EN 15804/ serves as the core PCR
Independent verification of the declaration according to /ISO 14025/
☐ internally ☒ externally

Dr. Frank Werner
(Independent verifier appointed by SVR)

2. Product

2.1 Product description
This Association Environmental Product Declaration covers padlocks, mechanisms used to secure a detachable shackle or loop by means of a locking cylinder.

2.2 Application
Padlocks are used as a single product to protect doors without an integrated locking mechanism.

2.3 Technical Data
Normative reference: EN 12320

Padlocks acc. to the classification in EN 12320

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

2.4 Placing on the market / Application rules
For the placing on the market in the EU/EFTA (with the exception of Switzerland) the Regulation (EU) No 305/2011 “Construction products regulation” has to be regarded.
In detail, the following harmonized product standard applies:
EN 12320:2012, Building hardware – Padlocks – Requirements and test methods
In case that the products need to get CE-marked, a “declaration of performance” in accordance with this standard is obligatory.
For the application and use, respective additional national provisions may apply.

2.5 Delivery status
The products are sold by unit. Deliveries of a single unit might be possible but will be an exception. Regular deliveries will cover a larger amount of padlocks as they are put on the market as "b to b" products and not for a final customer.

2.6 Base materials / Ancillary materials

The base materials of the product studied for this EPD is shown in the following table:

Name	Value	Unit
Steel	88.17	%

Zinc	5.97	%
Brass	3.05	%
Chromium steel	2.13	%
Nylon 6	0.64	%

The product contains no substances cited on the REACH list of hazardous substances.

Steel is produced by combining iron with carbon as well as other elements depending on the desired characteristics. The subcomponents made of steel are formed by turning.
Zinc metal is produced using extractive metallurgy. The subcomponents made of zinc are made by turning.
Brass is an alloy of zinc and copper. Subcomponents made of brass are made by forging.
Nylon 6 is a polymer synthesized by ring-opening polymerization of caprolactam. Sub-components made of Nylon 6 are made by injection moulding.

2.7 Manufacture

The production of a padlock regularly follows a 3 step procedure:
1. Prefabrication of the semi-finished products, this step might include a surface treatment on factory site or by external manufacturers.
2. Preassembly of assembly modules (onsite factory)
3. Final assembly (onsite factory)
The individual parts of the padlock are assembled manually.

2.8 Environment and health during manufacturing

Regular measurements of air quality and noise levels are performed by ARGE members manufacturers. The results are within the compulsory safety levels. In areas where employees are exposed to chemical products, prescribed safety clothes and technical safety devices are provided. Regular health checks are mandatory for employees of production sites.

2.9 Product processing/Installation

The installation of the product could vary depending on the type of door and the specific situation but products do not require energy consumption for installation.

2.10 Packaging

The product assessed for this EPD is packaged in paper. The product is then packed by batch in a cardboard box and stacked on wooden pallets for transport to the customer.
Wastes of product packaging are collected separately for waste valorisation including recycling.

2.11 Condition of use

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

2.12 Environment and health during use

No environmental damage or health risks are expected within the normal conditions of use of the product

2.13 Reference service life

The Reference Service Life for this product is 10 years. This is based on mechanical endurance tests as specified in the /EN 12320/. The product is guaranteed to maintain its performance for at least 10 000 cycles of use.

2.14 Extraordinary effects

Fire
Fire resistance characteristics are defined by manufacturers as no specific requirements are defined for the reference product in the /EN 12320/.

Water
The declared product is designated to be used in regular conditions of a building indoor or outdoor use. A padlock is composed mainly of metal or plastic components and does not eluate hazardous ingredients in case of an unforeseen flooding.

Mechanical destruction
In case of mechanical destruction of the declared product, it does not perform any impact on the environment or alter its substantial composition.

2.15 Re-use phase

Used components of a padlock are materials of high quality. After use stage, they can be recycled. In case of the disassembly of the product, no impacts on the environment are to be concerned.

2.16 Disposal

In case of the disassembly, the components of the product might be removed and disposed separately. Since this is a simple procedure, the padlocks might get recycled completely. The waste code in accordance with the /European Waste Code/ is 17 04 07.

2.17 Further information

Builders hardware padlocks are manufactured in several different designs and construction types in general. Variations are subject to different types, sizes and requirements of the door/window. In general, the same product types might be suitable for wooden, steel or plastic based doors.
Details to be shown on the manufacturers' websites listed on http://arge.org/members/members-directory.html

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit for padlocks covered in this Association EPD is 1 kg. As single padlock units of the same production type can be custom made for an application situation and the weight of those variations of the same product type may be considerable, it is more appropriate to declare the weight of the product and the weight of the representative product either than one item.

Declared unit

Name	Value	Unit
Declared unit mass	1	kg
Mass of declared product	0.469	kg

3.2 System boundary

The type of the EPD is “cradle-to-grave”.

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 to recycling. No recycling processes are taken into account except transport and an 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 product 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.
For the RSL considered for this study, there are no inputs or outputs for the stages B1-B7.
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 padlocks. Module C3 covers the recycling of the individual elements according to European averages, with the remaining waste divided between incineration and landfill. The same assumption as for waste to recycling in A3 is used here.
For end of life modules (C1 to C4) the system boundaries from the /XP P01-064/CN/ standard have been followed, see annex H.2 and H.6 of the standard document cited previously for figures and further details.

In practice, the end-of-life has been modeled as follows:
- When material is sent to recycling, generic transport and electric consumption of a shredder is taken into account (corresponding to the process “Grinding, metals”). Only then, the material is considered to have attained the “end-of-waste” state.
- Each type of waste is modeled as a transport to the treatment site with a distance of 30 km (source: /FD P01-015/). Parts sent to recycling include an electricity consumption (grinding) and a flow (“Materials for recycling, unspecified”).

Four scenarios for the end-of-life of the products have been declared for this EPD:
- one with 100% of the product going to landfill
- one with 100% of the product going to incineration
- one with 100% of the product going to recycling
- one mixed scenario consisting of the previous three scenarios, values depending of the amount of waste going to recycling.

Module D has not been declared.

3.3 Estimates and assumptions

The LCA data of the declared product had been calculated by the production data of 1 member company of the ARGE associations. 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 life cycle modeling of the considered product, all relevant background datasets are taken from the ecoinvent 3.1 – Alloc Rec database. The life cycle analysis software used is SimaPro (V8.1), developed by PRé Consulting.

3.6 Data quality

The time factor, the life cycle inventory data used comes from:
Data has been collected specifically for this study on the ARGE manufacturer’s site. Data sets are based on 1-year averaged data (time period: January 2013 to December 2013).
In the absence of collected data, generic data from the ecoinvent V3 database. This is updated regularly and is representative of current processes (the entire database having been updated in 2014).

3.7 Period under review

The data of the LCA is based on the annual production data of a member company of ARGE Associations from 2013.
Other values, e.g. for the processing of the base materials, are taken from the/ ecoinvent v3/.1 Alloc Rec where the dataset age varies for each dataset, see ecoinvent documentation for more information.

3.8 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.

3.9 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.

4. LCA: Scenarios and additional technical information

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel	0.0045	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 (condition of use: see §2.13)	12	a

End of life (C1-C4)

Name	Value	Unit
Collected separately (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

An assumption of a 16-32 tons truck transport of the product over 30 km between the dismantling site and the next treatment site is made (source: FD P01-015).

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

As Module D has not been declared, materials destined for recycling have been accounted for in the indicator “Materials for recycling” however no benefit has been allocated.

Name	Value	Unit

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.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

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	MND	MND	MND	MND	MND	X	X	X	X	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg of padlock

Parameter	Unit	A1-A3	A4	A5	C1	C2	C2/1	C2/2	C2/3	C3	C3/1	C3/2	C3/3	C4	C4/1	C4/2	C4/3
GWP	[kg CO_2-Eq.]	5.56E+0	5.89E-1	1.36E-2	0.00E+0	5.05E-3	5.05E-3	5.05E-3	5.05E-3	5.95E-3	0.00E+0	0.00E+0	8.66E-3	3.56E-3	5.23E-1	4.97E-1	0.00E+0
ODP	[kg CFC11-Eq.]	4.32E-7	1.08E-7	3.60E-10	0.00E+0	9.26E-10	9.26E-10	9.26E-10	9.26E-10	6.38E-10	0.00E+0	0.00E+0	9.30E-10	2.59E-11	4.02E-9	3.43E-9	0.00E+0
AP	[kg SO_2-Eq.]	3.75E-2	2.39E-3	1.41E-5	0.00E+0	2.05E-5	2.05E-5	2.05E-5	2.05E-5	2.47E-5	0.00E+0	0.00E+0	3.60E-5	1.30E-6	2.58E-4	1.24E-4	0.00E+0
EP	[kg $(PO_4)^{3-}$-Eq.]	7.89E-3	4.06E-4	6.29E-6	0.00E+0	3.48E-6	3.48E-6	3.48E-6	3.48E-6	2.77E-6	0.00E+0	0.00E+0	4.04E-6	2.49E-6	7.52E-5	5.94E-4	0.00E+0
POCP	[kg ethene-Eq.]	3.90E-3	2.68E-4	3.22E-6	0.00E+0	2.30E-6	2.30E-6	2.30E-6	2.30E-6	1.36E-6	0.00E+0	0.00E+0	1.98E-6	5.83E-7	1.60E-5	1.41E-4	0.00E+0
ADPE	[kg Sb-Eq.]	7.29E-4	1.95E-6	4.10E-9	0.00E+0	1.67E-8	1.67E-8	1.67E-8	1.67E-8	2.42E-9	0.00E+0	0.00E+0	3.53E-9	2.45E-10	4.69E-8	2.47E-8	0.00E+0
ADPF	[MJ]	7.50E+1	8.97E+0	3.31E-2	0.00E+0	7.69E-2	7.69E-2	7.69E-2	7.69E-2	9.12E-2	0.00E+0	0.00E+0	1.33E-1	2.26E-3	3.73E-1	2.80E-1	0.00E+0

Caption	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

RESULTS OF THE LCA - RESOURCE USE: 1 kg of padlock

Parameter	Unit	A1-A3	A4	A5	C1	C2	C2/1	C2/2	C2/3	C3	C3/1	C3/2	C3/3	C4	C4/1	C4/2	C4/3
PERE	[MJ]	7.43E+0	1.12E-1	2.06E-3	0.00E+0	9.61E-4	9.61E-4	9.61E-4	9.61E-4	1.18E-2	0.00E+0	0.00E+0	1.72E-2	1.16E-4	1.14E-2	2.11E-2	0.00E+0
PERM	[MJ]	2.21E+0	0.00E+0	-1.40E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	9.63E+0	1.12E-1	-1.40E+0	0.00E+0	9.61E-4	9.61E-4	9.61E-4	9.61E-4	1.18E-2	0.00E+0	0.00E+0	1.72E-2	1.16E-4	1.14E-2	2.11E-2	0.00E+0
PENRE	[MJ]	8.99E+1	9.13E+0	3.95E-2	0.00E+0	7.82E-2	7.82E-2	7.82E-2	7.82E-2	1.34E-1	0.00E+0	0.00E+0	1.95E-1	2.58E-3	3.86E-1	3.53E-1	0.00E+0
PENRM	[MJ]	4.87E-1	0.00E+0	-6.97E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	9.04E+1	9.13E+0	-3.02E-2	0.00E+0	7.82E-2	7.82E-2	7.82E-2	7.82E-2	1.34E-1	0.00E+0	0.00E+0	1.95E-1	2.58E-3	3.86E-1	3.53E-1	0.00E+0
SM	[kg]	5.75E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	5.93E-2	1.72E-3	2.77E-5	0.00E+0	1.48E-5	1.48E-5	1.48E-5	1.48E-5	4.49E-5	0.00E+0	0.00E+0	6.54E-5	5.06E-6	1.17E-3	3.42E-4	0.00E+0

Caption	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 – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg of padlock

Parameter	Unit	A1-A3	A4	A5	C1	C2	C2/1	C2/2	C2/3	C3	C3/1	C3/2	C3/3	C4	C4/1	C4/2	C4/3
HWD	[kg]	8.26E-1	5.64E-3	3.13E-4	0.00E+0	4.83E-5	4.83E-5	4.83E-5	4.83E-5	4.21E-4	0.00E+0	0.00E+0	6.14E-4	8.60E-4	2.66E-1	1.24E-3	0.00E+0
NHWD	[kg]	5.17E+0	4.68E-1	2.54E-2	0.00E+0	4.01E-3	4.01E-3	4.01E-3	4.01E-3	1.90E-3	0.00E+0	0.00E+0	2.77E-3	3.84E-3	1.45E-2	1.00E+0	0.00E+0
RWD	[kg]	3.22E-4	6.13E-5	2.23E-7	0.00E+0	5.25E-7	5.25E-7	5.25E-7	5.25E-7	7.23E-7	0.00E+0	0.00E+0	1.05E-6	1.44E-8	1.35E-6	2.65E-6	0.00E+0
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	1.99E-1	0.00E+0	9.94E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.86E-1	0.00E+0	0.00E+0	1.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	1.43E-3	0.00E+0	3.28E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.48E-3	1.39E+0	0.00E+0	0.00E+0
EET	[MJ]	2.90E-3	0.00E+0	6.82E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.18E-3	2.85E+0	0.00E+0	0.00E+0

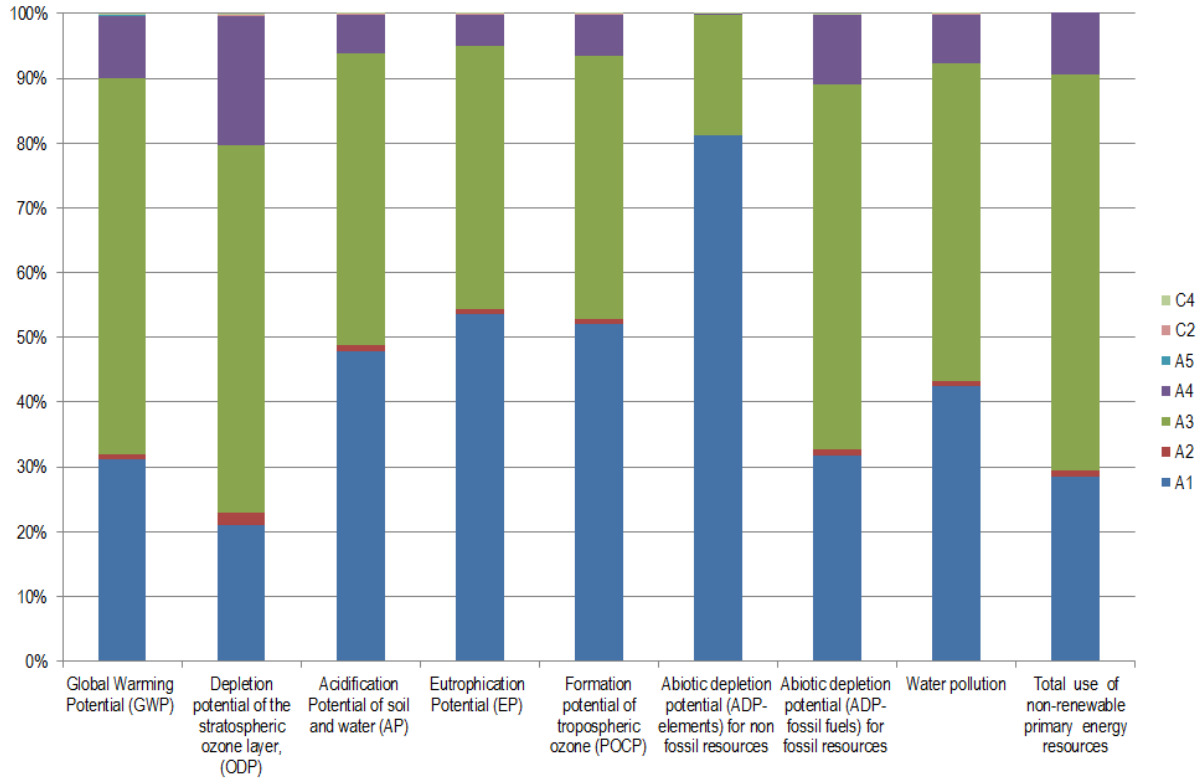
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

Other end of life scenarios have been calculated in order to build specific end of life scenario at the building level:
- scenario 1: the product is considered to be 100% incinerated

- scenario 2: the product is considered to be 100% landfilled
- scenario 3: the product is considered to be 100% recycled

6. LCA: Interpretation

Raw material extraction (A1) and production (A3) phases are the main contributors to all indicators. Their impacts come from steel extraction and transformation (turning process). Transport phase (A4) to building site is a non-negligible contributor to the impacts, especially for ODP indicator.



7. Requisite evidence

No testing results are required by the PCR part B.

8. References

ISO 14040
ISO 14040:2006 - 10, Environmental management – Life cycle assessment – Principles and framework (ISO 14040:2006)." German and English version EN ISO 14040:2006

DIN EN ISO 14044
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Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Programme holder
Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Author of the Life Cycle Assessment
CETIM
rue de la Presse 7
42952 Saint-Etienne Cedex 1
France

Tel 0033477794042
Fax 0033477794107
Mail sqr@cetim.fr
Web **www.cetim.fr**

Owner of the Declaration
ARGE; European Federation of
Associations of Lock and Builders
Hardware Manufacturers
Offerstraße 12
42551 Velbert
Germany

Tel +49 (0)2051 9506 36
Fax +49 (0)2051 9506 25
Mail info@arge.org
Web **www.arge.org**