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-20160187-IBG1-EN
ECO EPD Ref. No.	ECO-00000460
Issue date	02.12.2016
Valid to	01.12.2021

Push button locks

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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1. General Information

ARGE

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

Declaration number
EPD-ARG-20160187-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
02.12.2016

Valid to
01.12.2021

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

Dr. Burkhart Lehmann
(Managing Director IBU)

Push button locks

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 push button lock

Scope:
This ARGE EPD covers mechanically operated push button locks, used to secure openings by purely mechanical means (i.e.no electrics/electronics). The reference product selected to calculate the impact this group of products has on the environment is a push button lock composed primarily of brass and zinc-based alloy. This product is the only one assessed for this EPD and serves as a reference to cover all ARGE member products within this family. It 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, but the ARGE programme holder (IBU) cannot be held responsible for manufacturer's information, life cycle assessment data or evidence.

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 EPD covers mechanically operated push button locks designed to secure doors in the closed position until the correct combination of buttons is entered.

2.2 Application
These products are designed to be integrated into door assemblies of varying materials and applications. They can be used for either interior or exterior doors, following the instructions of the manufacturer.

2.3 Technical Data
No classes are defined as no EN or national standard is available.

2.4 Placing on the market / Application rules
Since there is no harmonized standard for this product, it is not subject to the terms of the CPR. National provisions however (e.g. Building Regulations) may still apply.

2.5 Delivery status
The products are sold by unit. Deliveries of a single unit are possible but will be an exception. Regular deliveries will cover a larger amount of locks as they are put on the market as "B2B" product 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
Zinc-based alloy	78.24	%
Steel	9.87	%
Stainless steel	9.6	%
Brass	1.79	%
Iron	0.44	%
Acrylic	0.000269	%
Nylon 66	0.000179	%

The product does not contain substances cited on the REACH list of hazardous substances.

Zinc-based alloy is an alloy of four separate metals: zinc, aluminium, magnesium and copper. Subcomponents of the lock which are made from zinc-based alloy are diecast.
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 stamping.
Stainless steel is produced by combining iron with chromium as well as other elements depending on the desired characteristics. The subcomponents made of steel are formed by stamping.
Brass is an alloy of zinc and copper. Subcomponents made of brass are made by forging.
Iron is a metal produced in blast furnace. Subcomponents made of iron are made by sintering.
Acrylic, used in resin form, is a thermoplastic derived from acrylic acid. Subcomponents made of acrylic are made by injection moulding.
Nylon 66 is a polyamide produced by the polycondensation of hexamethylenediamine and adipic acid in equal parts. This can then be combined with glass fibres to improve its mechanical properties. Subcomponents made of nylon are formed by injection moulding.

2.7 Manufacture

The production of a push button lock normally 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 product are assembled manually.

2.8 Environment and health during manufacturing

Regular measurements of air quality and noise levels are performed by ARGE member manufacturers. resulting levels shall be within compulsory safety limits. 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 shall 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.
Waste from product packaging is collected separately for waste disposal (including recycling).

2.11 Condition of use

Once installed, the 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.

2.12 Environment and health during use

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

2.13 Reference service life

The Reference Service Life is 12 years under normal working conditions. This corresponds to passing a mechanical endurance test of 50.000 cycles as specified in the British Standard /BS8607/. 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.

2.14 Extraordinary effects

Fire
There are no specific fire resistance requirements.

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

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

2.15 Re-use phase

Removal of push button locks (for re-use or re-cycling) shall have no adverse effect on the environment.

2.16 Disposal

Push button locks 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.

2.17 Further information

Details of all types and variants are to be shown on the manufacturers' websites listed on:
http://arge.org/members/members-directory.htm

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).

Correction factor

Name	Value	Unit
Declared unit mass	1	kg
Mass of declared product	1.115	Kg
Correction factor	Divide by 1.115	

3.2 System boundary

The type of the EPD covers “cradle-to-grave” requirements.
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 electricity consumption for grinding the metals. When recycled metals are used as raw material, only their transformation process is taken into account - not the extraction process.
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 locks. 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 this document 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 is the material is considered to have attained the “end of waste” state.
- Each type of waste is modelled as a transport to the treatment site over 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:
- 1. 100% of the product going in landfill
- 2. 100% of the product going in incineration
- 3. 100% of the product going in recycling
- 4. 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 push button lock has been calculated by the production data from a total of 1 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.

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 modelling 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 (V8.0.5), developed by PRé Consulting.

3.6 Data quality

The time factor and the life cycle inventory data used comes from data 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 an ARGE member company from 2013.
Other values, e.g. for the processing of the base materials, are taken from /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 was 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 for Modules 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	0.0949	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)	0.241	kg
Energy recovery (Mixed scenario)	0.349	kg
Landfilling (Mixed scenario)	0.41	kg
Incineration (100% incineration scenario) Scenario 1	1	kg
Landfilling (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 over the (up to) 30 km distance between the dismantling site and the next treatment site (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.

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 push button lock

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.]	5.72E+0	5.89E-1	1.12E-2	0.00E+0	5.05E-3	5.05E-3	5.05E-3	5.05E-3	4.09E-3	0.00E+0	0.00E+0	8.66E-3	2.51E-3	5.23E-1	4.97E-1	0.00E+0
ODP	[kg CFC11-Eq.]	3.46E-7	1.08E-7	2.64E-10	0.00E+0	9.26E-10	9.26E-10	9.26E-10	9.26E-10	4.39E-10	0.00E+0	0.00E+0	9.30E-10	1.83E-11	4.02E-9	3.43E-9	0.00E+0
AP	[kg SO_2-Eq.]	6.37E-2	2.39E-3	1.08E-5	0.00E+0	2.05E-5	2.05E-5	2.05E-5	2.05E-5	1.70E-5	0.00E+0	0.00E+0	3.60E-5	9.18E-7	2.58E-4	1.24E-4	0.00E+0
EP	[kg $(PO_4)^{3-}$-Eq.]	9.68E-3	4.06E-4	3.92E-6	0.00E+0	3.48E-6	3.48E-6	3.48E-6	3.48E-6	1.91E-6	0.00E+0	0.00E+0	4.04E-6	1.75E-6	7.52E-5	5.94E-4	0.00E+0
POCP	[kg ethene-Eq.]	3.87E-3	2.68E-4	2.13E-6	0.00E+0	2.30E-6	2.30E-6	2.30E-6	2.30E-6	9.37E-7	0.00E+0	0.00E+0	1.98E-6	4.11E-7	1.60E-5	1.41E-4	0.00E+0
ADPE	[kg Sb-Eq.]	5.78E-3	1.95E-6	3.00E-9	0.00E+0	1.67E-8	1.67E-8	1.67E-8	1.67E-8	1.67E-9	0.00E+0	0.00E+0	3.53E-9	1.72E-10	4.69E-8	2.47E-8	0.00E+0
ADPF	[MJ]	7.76E+1	8.97E+0	2.32E-2	0.00E+0	7.69E-2	7.69E-2	7.69E-2	7.69E-2	6.28E-2	0.00E+0	0.00E+0	1.33E-1	1.59E-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 push button lock

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]	8.77E+0	1.12E-1	1.26E-3	0.00E+0	9.61E-4	9.61E-4	9.61E-4	9.61E-4	8.12E-3	0.00E+0	0.00E+0	1.72E-2	8.21E-5	1.14E-2	2.11E-2	0.00E+0
PERM	[MJ]	1.51E+0	0.00E+0	-7.57E-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
PERT	[MJ]	1.03E+1	1.12E-1	-7.55E-1	0.00E+0	9.61E-4	9.61E-4	9.61E-4	9.61E-4	8.12E-3	0.00E+0	0.00E+0	1.72E-2	8.21E-5	1.14E-2	2.11E-2	0.00E+0
PENRE	[MJ]	8.23E+1	9.13E+0	2.68E-2	0.00E+0	7.82E-2	7.82E-2	7.82E-2	7.82E-2	9.21E-2	0.00E+0	0.00E+0	1.95E-1	1.82E-3	3.86E-1	3.53E-1	0.00E+0
PENRM	[MJ]	3.52E-1	0.00E+0	-8.51E-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]	8.26E+1	9.13E+0	-5.83E-2	0.00E+0	7.82E-2	7.82E-2	7.82E-2	7.82E-2	9.21E-2	0.00E+0	0.00E+0	1.95E-1	1.82E-3	3.86E-1	3.53E-1	0.00E+0
SM	[kg]	1.09E-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]	6.99E-2	1.72E-3	2.26E-5	0.00E+0	1.48E-5	1.48E-5	1.48E-5	1.48E-5	3.09E-5	0.00E+0	0.00E+0	6.54E-5	3.56E-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 push button lock

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]	7.75E-1	5.64E-3	2.71E-4	0.00E+0	4.83E-5	4.83E-5	4.83E-5	4.83E-5	2.90E-4	0.00E+0	0.00E+0	6.14E-4	6.07E-4	2.66E-1	1.24E-3	0.00E+0
NHWD	[kg]	5.74E+0	4.68E-1	2.32E-2	0.00E+0	4.01E-3	4.01E-3	4.01E-3	4.01E-3	1.31E-3	0.00E+0	0.00E+0	2.77E-3	2.71E-3	1.45E-2	1.00E+0	0.00E+0
RWD	[kg]	1.68E-4	6.13E-5	1.48E-7	0.00E+0	5.25E-7	5.25E-7	5.25E-7	5.25E-7	4.98E-7	0.00E+0	0.00E+0	1.05E-6	1.01E-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]	1.26E-2	0.00E+0	5.35E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.72E-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]	0.00E+0	0.00E+0	3.12E-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	3.16E-3	1.39E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	6.49E-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	6.47E-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

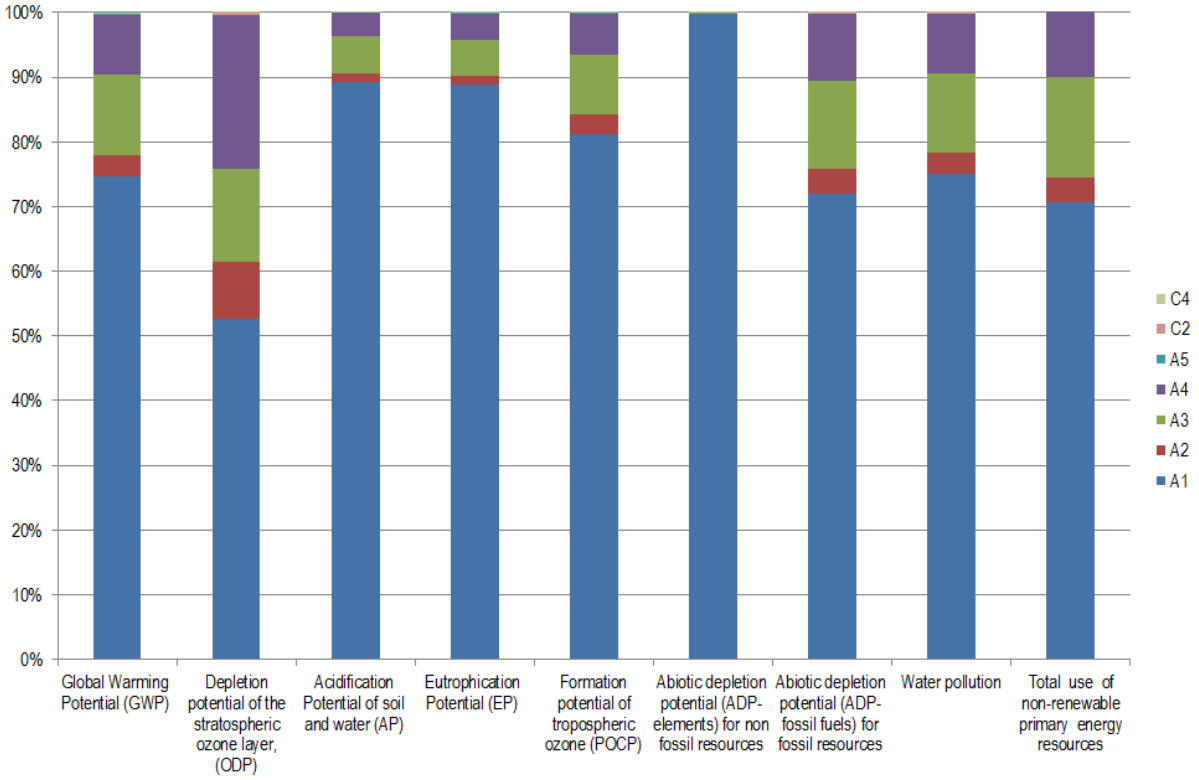
Other end of life scenarios have been calculated in order to build specific end of life scenario at the building level:

- 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

This chapter contains an interpretation of the Life Cycle Impact Assessment categories. When expressed as a percentage, the impact refers to its magnitude expressed as a percentage of total product impact across all modules, with the exception of module D.

The majority of the product's impacts are due to the extraction and supply of raw materials (A1). The manufacturing stage (A3) represents a significant percentage of the impacts, as does the transportation of the finished product (A4), especially for the indicator concerning ozone depletion.



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
DIN EN ISO 14044:2006-10, Environmental Management — Life Cycle Assessment Requirements and Instructions (ISO 14044:2006); German and English version EN ISO 14044:2006

CEN/TR 15941
CEN/TR 15941:2010-03, Sustainability of construction works —Environmental Product Declarations — Methodology for selection and use of generic data; German version CEN/TR 15941:2010

FD P01-015
FD P01-015: 2006**,** Environmental quality of construction products - Energy and transport data sheet

European Waste Code
epa - European Waste Catalogue and Hazardous Waste List - 01-2002.

Ecoinvent 3.1
Ecoinvent 3.1 - Allocation Recycling database

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Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report

IBU PCR part B
Part B: Requirements on the EPD for Locks and fittings

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Publisher
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