ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	dormakaba International Holding GmbH
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-DOR-20190115-IBA3-EN
Issue date	05.12.2019
Valid to	04.12.2024

TS 98 XEA incl. slide channel G-N

dormakaba

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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1. General Information

dormakaba

Programme holder

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

Declaration number

EPD-DOR-20190115-IBA3-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

05.12.2019

Valid to

04.12.2024

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

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

TS 98 XEA incl. slide channel G-N

Owner of the declaration

dormakaba International Holding GmbH
DORMA Platz 1
58256 Ennepetal
Germany

Declared product / declared unit

The declaration represents one (1) door closer system, consisting of the following items:
- the closer body TS 98 XEA
- the standard slide channel G-N- packaging

Scope:

This declaration is a specific product declaration for the door closer TS 98 XEA including the standard slide channel G-N. The underlying life cycle assessment is based on the entire life cycle of this specific door closer system manufactured by dormakaba. The various technical features are outlined in chapter 2. The products are manufactured at the dormakaba production facility in Ennepetal, Germany.
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+A1. 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.-Ing. Wolfram Trinius,
(Independent verifier)

2. Product

2.1 Product description/Product definition

The centerpiece of the TS 98 XEA slide channel door closer system is the heart-shaped cam. Together with the innovative, hydraulic functions, the TS 98 XEA system's unique Cam Action Technology makes it very comfortable to pass through the door. The door closer system in XEA design can be used for all installation types. As a result, the number of product variants and complexity in installation is reduced while simultaneously increasing flexibility at the construction site. A further plus point are three different closing ranges. The door closer has a standard delayed closing and backcheck. Adjustments are easily made from the front. Door widths up to 1,400 mm are covered. TS 98 XEA is usable down to -40°C.
This EPD declares a TS 98 XEA door closer standard version EN 1-6 for single-leaf doors with referring G-N slide channel in XEA design. The G-N XEA includes the main arm, slide channel, slide block, fixings, screws and end caps.
The G-N XEA slide channel can be used for both DIN-L and DIN-R doors on push and pull side and may be combined with all door closer versions in XEA design. For placing TS 98 XEA on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No. 305/2011 (/CPR/) applies. The product needs a declaration of performance taking into consideration the /EN 1154:
1996/A1:2002/AC:2006/ for slide channel door closer applicable for fire and smoke check doors. The CE mark for building products is availableFor the application and use the respective national provisions apply.

2.2 Application

The product can be universally used for one and two-leaf door applications. The TS 98 XEA can be used for fire and smoke control doors. Application on external doors, outward opening, as well as on standard doors is also possible.

2.3 Technical Data

Data and features			TS 98 XEA
Variable closing force	Size		EN 1-6
Standard doors[1)]	≤ 1400 mm		●
External doors, outward opening[1)]	≤ 1400 mm		●
For fire and smoke control doors[1)]	≤ 1400 mm		●
Same design for DIN-L and DIN-R			●
Same design for pull and push side			●
Arm assembly type	Standard		–
	Slide channel		●
Closing force can be adjusted from the front with the adjusting screw			●
Visual closing force indicator			●
Closing speed adjustable by valve			●
SoftFlow: second closing range, 15°–0° and adjustable via valve			●
Latching speed adjustable via valve			●
Backcheck (BC/OD), adjustable via valve			●
Delayed closing (DC/SV) adjustable via valve			●
Hold-open			O
Weight in kg			4.5
Dimensions in mm	Length	(L)	327
	Depth	(W)	59
	Height	(H)	60
Door closer tested according to EN 1154 Certificate number 0432-CPR-00026-90			●
Hold-open devices tested according to EN 1155			●
Door coordinator tested according to EN 1158			●
Smoke detection (integrated or external) tested according to EN 14637			●
CE-mark for building products			●
Barrier-free according to DIN 18040 for door widths (mm) up to a max of			1250
Environmental Product Declaration as per ISO 14025 and EN 15804; Programme holder and publisher: Institut Bauen und Umwelt e.V. (IBU) Declaration number: EPD-ARG-20160183-IBG1-EN			●
Temperature range up to -40°C			●

● Yes – No O Option

Product according to the CPR, based on a hEN: performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to /DIN EN 1154/: 2003-04 (door closer), /EN 1155/:2003-04 and /EN 1158/: 2003-04 (slide channel system) and /DIN EN 14637/: 2008-01 (smoke detection panel).

2.4 Delivery status

The declared door closer TS 98 XEA EN 1-6 including G-N XEA slide channel will be supplied with a weight of 5.4 kg and the following dimensions (see also chapter 2.3 for dimensions of the individual variants):

Dimensions	TS 98 XEA EN 1-6	Packaging	Slide channel G-N XEA	Packaging
Length (mm)	327	400	518	557
Width (mm)	59	195	32	60
Height (mm)	60	90	23	40

2.5 Base materials/Ancillary materials

For the main product components, the declared door closer TS 98 XEA EN 1-6 including
G-N XEA slide channel and packaging, the following material proportions result
in mass % of the various basic materials in kg:

Constituents	TS 98 XEA EN 1-6	Slide channel G-N XEA	Declared Unit	Mass proportion
Grey Cast Iron	2.030	0.000	2.030	35%
Steel	1.670	0.401	2.071	35%
Aluminum	0.450	0.337	0.787	13%
Paper/ Cardboard	0.547	0.060	0.607	10%
Zinc Die Cast	0.000	0.124	0.124	2%
Oil	0.110	0.000	0.110	2%
Brass	0.031	0.000	0.031	1%
Plastics	0.042	0.012	0.054	1%
Paint	0.014	0.032	0.046	1%

The product TS 98 XEA including slide channel G-N XEA contains substances of the candidate
list (date: 31.05.2019) above 0.1 mass per cent in the alloy.

- Lead (Pb): 7439-290-1 (CAS No.)

The candidate list can be found on the /ECHA/ website address: https://echa.europa.eu/de/home.

2.6 Manufacture

A. Closer

After delivery of the unmachined housing, an initial machining process is performed in the dormakaba plant in Ennepetal (milling, drilling, cutting, washing, degreasing, checking the finished blank part). This is followed by the assembly of the housing components (axle, axle bearing, pressure spring, pistons, valves, oil). After inspecting the assembled housing components, the closer is painted, stippled and printed.

B. Slide channel

Delivery of the slide channel profile in Ennepetal, sawing and assembly of the slide channel components (slider, fixing pieces, screws)

C. Slide channel lever

Delivery of the slide channel "eye" in Ennepetal is followed by degreasing, punching, perforating, embossing, polishing, welding, galvanizing and painting the finished slide channel lever.

D. Packaging

• Packing the closer (grey board)

• Packing the slide channel (grey board)

• Packing the screws (PE pouch bag)

The certified Quality Management system in accordance with /DIN EN ISO 9001/ ensures the high quality standard of dormakaba products.

2.7 Environment and health during manufacturing

No health protection measures beyond the legally specified measures are required. The maximum allowable concentrations are clearly complied with at each point of production.

- Air: Waste air generated during production is cleaned in accordance with statutory specifications. Emissions are significantly below the Technical Instructions on Air Quality "TA Luft".
- Water/Ground: No contamination of water or ground. Production-related waste water is treated internally and redirected to the production process.
- Sound protection analyses have established that all values communicated inside and outside the production facilities are far below the standards applicable in Germany.

The Environment Management system in the dormakaba production facilities Ennepetal is certified to /DIN EN ISO 14001/; industrial safety is certified to /OHSAS 18001/.

2.8 Product processing/Installation

dormakaba door
closers are installed by independent installers.

2.9 Packaging

Packaging contains the following materials in kg:

Constituents	TS 98 XEA EN 1-6 incl. G-N XEA	Mass proportion
Paper/Cardboard	0.607	99.9%
PE plastic	0.001	0.1%

2.10 Condition of use

Product maintenance is not required if used as designated. During installation of a TS 98 XEA, the standard safety regulations must be complied with and the provisions of the professional liability associations observed.

2.11 Environment and health during use

There are no known impact relations between product, environment and health during use.

2.12 Reference service life

In accordance with /DIN EN 1154/, the durability
of EN variants corresponds to 500,000 closing cycles. Based on 25,000 closing
cycles per year, the reference service life for the EN variants is 20
years.

2.13 Extraordinary effects

Fire

In accordance with /EN 1154/, Annex A, the upper door closer complies with the requirements on door closing devices to be used on fire resistance and/or smoke control door sets.

Fire protection

Name	Value
Building material class	Not applicable
Burning droplets	Not applicable
Smoke gas development	Not applicable

Water
Unforeseen water ingress, e.g. caused by activation of a sprinkler system or flooding, does not have any impact on the function and usability or service life of the upper door closer thanks to its metallurgical product features.

Mechanical destruction
No environmental hazard is associated with mechanical destruction.

2.14 Re-use phase
With reference to the material composition of the product system in accordance with
section 2.6, the following possibilities arise:

Re-use
Duringnrefurbishment or de-construction, door closers can be easily segregated and re-used for the same application.

Material recycling
The metallurgical materials contained in the materials are suitable for material recycling.

Energy recovery
The plastics contained in the materials are suitable for energetic recovery.

Landfilling
As the product contains lubricants and hydraulic oil, landfilling is not possible.

2.15 Disposal
Cuttings incurred during the manufacturing phase are directed towards metallurgical recycling and energy recovery. Cuttings are collected separately and collected by a disposal company. Following European Waste Catalogue Codes are relevant:

- /EWC/ 07 02 03 Plastic waste
- /EWC/ 12 01 01 Ferrous metal filings and turnings
- /EWC/ 12 01 03 Non-ferrous metal filings and turnings

Packaging
Packaging incurred for installation in the building is directed towards energy recovery.

- /EWC/ 15 01 01 Paper and cardboard packaging
- /EWC/ 15 01 02 Plastic packaging

End of Life
All materials are directed to energy recovery or metallurgical recycling.

- /EWC/ 17 02 03 Plastics
- /EWC/ 17 04 01 Copper, bronze, brass
- /EWC/ 17 04 02 Aluminum
- /EWC/ 17 04 05 Iron and steel

2.16 Further information
More information on dormakaba products available from:

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Dorma Platz 1
58256 Ennepetal
Germany

Tel.: +49 (0) 2333 793-0

Internet: www.dormakaba.com

3. LCA: Calculation rules

3.1 Declared Unit
The declared unit is one (1) door closer system, consisting of the following items:

- the door closer TS 98 in XEA design

- the slide channel G-N

- the respective packaging materials

Declared unit

Name	Value	Unit
Mass of the declared unit	5.86	kg
Declared unit	1	piece/product
Conversion factor to 1 kg	0.171	-

3.2 System boundary
Type of the EPD: cradle to gate - with options *Modules A1-3, A4, and A5*

The product stage (A1-3) begins with considering the production of the necessary raw materials and energies, including all corresponding upstream chains and the actual procurement transports. Furthermore, the entire manufacturing phase was mapped, including treatment of production waste until end-of-waste status (EoW) was reached. In addition, both the distribution transports from Ennepetal (Germany)(A4) and the packaging waste generated during installation (A5) were taken into account. Product losses as well as power consuming tools, auxiliary materials, and installation materials were not considered in A5.

Modules C2-C3
The modules include the environmental impacts for the treatment of the waste categories until end-of-waste status (EoW) is reached, including the associated transports at the end of the product life cycle.

Module D
Identification of the benefits and costs of the product outside the system boundary. For plastics, these consist of energy credits from thermal utilization (C3) in the form of the average European electricity mix or thermal energy from natural gas. Recycling of metal scrap results in credits of the respective raw materials.

3.3 Estimates and assumptions
It was assumed that End of Life thermal waste incineration plants are plants with an R1 factor (energy conversion efficiency or energy efficiency of waste incineration plants according to the European Waste Framework Directive) >0.6. Since there is no usable dataset for recycling brass and zinc, it was assumed that the loads from recycling aluminum were comparable to those from recycling brass and zinc and the corresponding dataset was chosen as a substitute. Since the mass fraction of brass is far below 1% and the mass fraction of zinc is 1.4 %, the impact of this assumption on the overall result is considered negligible.

3.4 Cut-off criteria

The effect associated with the neglected mass shares is less than 5% of the effect categories per module. The minimum limit of 1% total mass and the use of renewable and non-renewable primary energy is not exceeded.

Due to the small quantity and inadequate background data, the adhesive tapes (material input 0.002% in relation to the total mass input) were cut off.

3.5 Background data

The LCA software /umberto LCA+ Version 10.0/ was used to model the life cycle. The entire manufacturing process as well as the energy consumption were modelled on the basis of manufacturer-specific data. However, generic background datasets were used for the upstream and downstream processes. The majority of the background datasets used were taken from the current version of the GaBi database. /Ecoinvent/ datasets and datasets from other databases were only used for substances which in any case have only a very small mass fraction and could theoretically be excluded.

The datasets contained in the databases are documented online. Where possible, German datasets were used for modules A1-3, and the corresponding European datasets for distribution transports (A4) and disposal scenarios (C modules).

3.6 Data quality

The background datasets used for accounting purposes originate from the respective updated /GaBi 9.2/ databases at the time of calculation.

The data for the examined products was captured on the basis of evaluations of internal production and environmental data, the collection of LCA-relevant data within the supply chain, as well as the evaluation of relevant data for the energy supply.

The collected data were checked for plausibility and consistency. Good representativity can be assumed.

3.7 Period under review

The life cycle assessment data were collected for the 2018 observation period.

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: Global

3.9 Allocation

All required energies, raw materials, and supplies could be clearly assigned to the declared product. No by-products are produced and no allocation is required. In module A1-A3, credits are issued for recycling of metallurgical waste. Packaging materials and the combustible product parts are incinerated at the end of life in a waste incineration plant. Metallurgical parts are recycled. Any emissions that occur are taken into account in the model. Depending on their elementary composition and the resulting heating values, credits for recycling are taken into account in module D.

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.
The used background database has to be mentioned.

The background database used is /GaBi 9.2/

4. LCA: Scenarios and additional technical information

Transport from manufacturer to point of use (A4)

Name	Value	Unit
Transport distance (Lorry)	631	km
Capacity utilisation (including empty runs) (Lorry)	61	%
Transport distance (Container Ship)	214	km

Assembly (A5)

There are no environmental burdens during assembly. Module A5 covers only the environmental burdens for the disposal of the packaging.

Name	Value	Unit
Output substances following waste treatment on site	0.608	kg

Reference Service Life

Name	Value	Unit
Reference service life (according to /BNB/)	20	a

End of Life (C1-C4)

Name	Value	Unit
Collected separately waste type	5.247	kg
Recycling	5.043	kg
Energy recovery	0.203	kg

Reuse, recovery and recycling potential (D), relevant scenario data

Metals are used for material recycling, plastics and packaging materials for energy recovery. The resulting credits are allocated to Module D.

Name	Value	Unit
Materials for energy recovery	0.093	kg
R1-factor	>60	%
Lower calorific value	43	MJ/kg

5. LCA: Results

The following table declares the results of the LCA for 1 piece TS 98 XEA incl. G-N XEA. Results for the TS 98 XEA and the G-N XEA separately can be found in the attachment

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE 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	MND	MND	MND	X	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 piece TS 98 XEA incl. G-N

Parameter	Unit	A1-A3	A4	A5	C2	C3	D
Global warming potential (GWP)	kg CO_2 eq	1.27E+01	3.01E-01	8.68E-01	4.81E-02	5.64E-01	-4.54E+00
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11 eq	5.13E-08	4.89E-17	2.09E-16	1.2E-17	3.66E-10	1.27E-12
Acidification potential of land and water (AP)	kg SO_2 eq	3.51E-02	1.71E-03	2.04E-04	2.07E-04	8.78E-05	-1.48E-02
Eutrophication potential (EP)	kg PO_4^3 eq	4.06E-03	3.58E-04	4E-05	5.23E-05	1.71E-04	-9.73E-04
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg Ethen eq	3.07E-03	-4.65E-04	3.09E-06	-7.62E-05	4.35E-06	-1.08E-03
Abiotic depletion potential for non fossil resources (ADPE)	kg Sb eq	2.26E-04	2.25E-08	1.6E-08	4.27E-09	4.57E-08	-1.89E-04
Abiotic depletion potential for fossil resources (ADPF)	MJ	1.39E+02	4.06E+00	3.14E-01	6.55E-01	1.32E-01	-4.86E+01

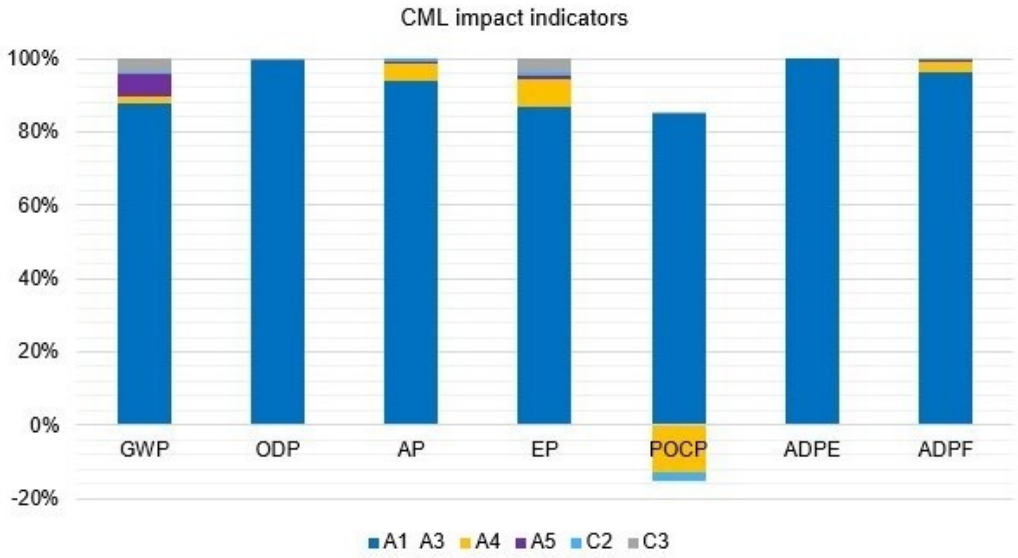
RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 piece TS 98 XEA incl. G-N

Parameter	Unit	A1-A3	A4	A5	C2	C3	D
Renewable primary energy as energy carrier (PERE)	MJ	6.03E+01	2.24E-01	1.28E+01	3.91E-02	3.04E-02	-1.58E+01
Renewable primary energy resources as material utilization (PERM)	MJ	1.27E+01	0	-1.27E+01	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	7.3E+01	2.24E-01	5.23E-02	3.91E-02	3.04E-02	-1.58E+01
Non renewable primary energy as energy carrier (PENRE)	MJ	1.52E+02	4.07E+00	3.83E-01	6.58E-01	8.8E+00	-5.92E+01
Non renewable primary energy as material utilization (PENRM)	MJ	8.68E+00	0	-2.71E-02	0	-8.65E+00	0
Total use of non renewable primary energy resources (PENRT)	MJ	1.61E+02	4.07E+00	3.56E-01	6.58E-01	1.46E-01	-5.92E+01
Use of secondary material (SM)	kg	7.35E+00	0	0	0	0	8.57E-01
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0
Use of non renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	0
Use of net fresh water (FW)	m^3	1.05E-01	3.79E-04	2.52E-03	6.59E-05	7.15E-04	-3.33E-02

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 piece TS 98 XEA incl. G-N

Parameter	Unit	A1-A3	A4	A5	C2	C3	D
Hazardous waste disposed (HWD)	kg	9.67E-05	2.15E-07	4.59E-09	3.5E-08	6.36E-10	-6.42E-07
Non hazardous waste disposed (NHWD)	kg	1.91E+00	3.15E-04	2.7E-02	5.31E-05	2.58E-02	-6.24E-01
Radioactive waste disposed (RWD)	kg	1.22E-02	5.49E-06	1.63E-05	1.29E-06	4.97E-06	-4.22E-03
Components for re-use (CRU)	kg	0	0	0	0	0	0
Materials for recycling (MFR)	kg	2.93E+00	0	0	0	5.04E+00	0
Materials for energy recovery (MER)	kg	0	0	6.08E-01	0	2.01E-01	0
Exported electrical energy (EEE)	MJ	0	0	1.31E+00	0	4.8E-01	0
Exported thermal energy (EET)	MJ	0	0	2.37E+00	0	1.16E+00	0

6. LCA: Interpretation



All /CML/ indicators are significantly dominated by the production stage and the material and energetic upstream chains (module A1-A3). The main causes of the environmental impacts lie in the manufacturing processes of the casing. In terms of mass, this also has by far the largest share of the total product. Exceptions are Ozone Depletion Potential (ODP) and Abiotic Depletion Potential for Elements (ADPE). Here, the packaging materials (ODP) and the slide rail including cladding (ADPE) are the main contributors to the balanced environmental impacts.

Global Warming Potential (GWP) is dominated by aluminum (33 %), grey cast iron (31 %) and steel (19 %).

ODP is dominated by the paper required for packaging.

The aluminum used has the greatest influence on the Acidification Potential (AP) (45 %). This is followed by steel (22 %) and grey cast iron (14 %).

Paper has the greatest influence on Eutrophication Potential (EP) (28 %). This is followed by aluminum (24 %), steel (16 %) and grey cast iron (14 %).

Steel has a very high influence on Photochemical Ozone Creation Potential (POCP) (46 %), followed by aluminum (43 %) and grey cast iron (23 %). For the POCP, the transports result in small credits, which are due to a weighting of the environmental indicators according to the current CML methodology (as of 2013). Despite the seemingly paradoxical results that more transports would lead to a reduction of the total ground-level ozone, the model does not contain any errors here.

ADPE is dominated by zinc (72 %).

Aluminum has the greatest influence on ADPF (36 %), followed by grey cast iron (26 %) and steel (15 %).

7. Requisite evidence

This Environmental Product Declaration does not require any evidence relating to the material composition of the product and its area of applicability.

8. References

/CML/
Impact indicators of the Centrum voor Milieukunde (CML) of the University of Leiden

/CPR/
Construction Product Regulation EU

/DIN 18040/
Construction of accessible buildings - Design principles

/DIN EN 1154/
Building hardware
– Controlled door closing devices –
Requirements and test methods (includes amendment A1:2002); German version /EN 1154:1996 + A1:2002/

/DIN EN 1155/
Building hardware – Electrically-powered hold-open devices for swing doors – Requirements
and test methods (includes amendment A1:2002); German version /EN 1155:1997 + A1:2002/

/DIN EN 1158/
2003-04: Building
hardware – Door coordinator devices –
Requirements and test methods (includes amendment A1:2002); German version /EN 1158:1997 + A1:2002/

/DIN EN 1191/
2013-04
Windows and doors - Resistance to repeated
opening and closing - Test method; German version EN 1191:2012

/DIN EN 14637/
Building hardware - Electrically controlled hold-open systems for fire/smoke door assemblies - Requirements, test methods, application and maintenance; German version EN 14637:2007

/DIN EN ISO 9001/

2015-11: Quality
Management Systems – Requirements; German version EN ISO 9001:2015

/DIN EN ISO 14001/
2015-11: Environmental management systems – Requirements with guidance for use; German version EN ISO 14001:2015

/Ecoinvent/
Database for life cycle assessment (life cycle inventory data), Version 2.2 Swiss Centre for Life Cycle Inventories, St. Gallen, 2010.

/ECHA/
European Chemicals Agency
https://echa.europa.eu/de/candidate-list-table (accessed 25-Jul-2019; 201
substances listed)

/EWC/
European Waste Catalogue Commission Decision on the European List of Waste (COM 2000/532/EC)

/GaBi 9.2/
Life cycle engineering (GaBi) software and database. LBP, University of Stuttgart and thinkstep AG, Documentation of GaBi 9.2 data sets http://documentation.gabi-software.com/, 2019.

/Product Category Rules Part A/
Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report. Version
1.8 (04.07.2019)

/Product Category Rules Part B/
PCR Guidance-Texts for Building-Related Products and Services; Part B: Requirements on the EPD for Building Hardware Products, 2016-02

/OHSAS 18001/
2007: Occupational health and safety – Management systems – Requirements

/umberto LCA+ Version 10.0/
ifu Hamburg GmbH

Publisher

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