ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	dormakaba International Holding GmbH
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-DOR-20210285-CBA2-EN
Issue date	08.08.2022
Valid to	07.08.2027

Automatic Revolving Door KTV A

dormakaba

dormakaba

General Information

dormakaba	**Automatic Revolving Door KTV A**
Programme holder IBU – Institut Bauen und Umwelt e.V. Hegelplatz 1 10117 Berlin Germany	**Owner of the declaration** dormakaba International Holding AG Hofwisenstr.24 CH-8153 Rümlang Switzerland
Declaration number EPD-DOR-20210285-CBA2-EN	**Declared product / declared unit** The declaration represents one automatic revolving door, consisting of four (4) door leaves with a diameter of 3000 mm and a height of 2200 mm, consisting of the following items: 1) Drum wall 2) Canopy construction 3) Door wings 4) Turnstile fittings 5) KT FLEX Direct drive unit 6) Electric accessories / sensors 7) Floor ring
This declaration is based on the product category rules: Automatic doors, automatic gates, and revolving door systems, 07.2014 (PCR checked and approved by the SVR)	**Scope:** This EPD is a specific product declaration for the KTV A automatic revolving door. The underlying life cycle assessment is based on the entire life cycle of this specific revolving door. The KTV A is manufactured at the dormakaba production facility in Sofia, Bulgaria. Data represents the year 2021.
Issue date 08.08.2022	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*.
Valid to 07.08.2027	**Verification**

Verification

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

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

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

Dr.-Ing. Wolfram Trinius
(Independent verifier)

Product

Product description/Product definition
The KTV revolving door range is designed for installation in entrance areas where interior environmental control coupled with elegant aesthetics are desired.

dormakaba KTV revolving doors hold back noise, dust and dirt, reliably protect employees near the entrances from drafts, and help to keep heating cost down. They also allow for a smooth flow of traffic.

Revolving doors offer a number of benefits for installers, architects, specifiers and user among others:

- Extensive design flexibility in terms of planning and technical requirements

- Visually, technically and economically the ideal application
- Optimization of the building energy balance
- Efficient noise protection
- Tailored integrated application combining industrial engineering precision and assured quality.

For placing the product on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland), the following legal provisions apply:
- *20111765/EU ROHS3 Directive*

as well as the harmonized norms based on these provisions:

- *DIN EN ISO 13849-1: Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design.*
- *DIN EN ISO 12100: Safety of machinery - Basic concepts - Risk assessment and risk reduction.*
- *DIN EN 16005: Power operated pedestrian doorsets - Safety in use - Requirements and test methods.*
- *DIN EN 61000 - 6 - 2: Electromagnetic compatibility (EMC). Part 6-2: Generic standards: Interference resistance for industrial environments.*
- *DIN EN 61000 - 6 - 3: Electromagnetic compatibility (EMC). Part 6-3: Generic standards: Emission standard for residential, commercial and light-industrial environments.*
- *DIN EN 61000 - 3 - 2: Electromagnetic compatibility-3-2: Limits - Limits for harmonic current emissions.*
- *DIN EN 61000 - 3 - 3: Electromagnetic compatibility-3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.*
- *DIN EN 55022: Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.*
- *DIN EN 60335 - 1: Safety of household and similar electrical appliances. Part 1: General requirements.*
- *EN 60335-2-103: Household and similar electrical appliances. Safety. Particular requirements for drives for gates, doors and windows.*

The CE-marking takes into account the proof of conformity with the respective harmonized norms based on the legal provisions above. For the application and use, the respective national provisions apply.

In addition to the harmonized standards, the following national standards have also been applied and complied with:

- *DIN 18650-1: Powered pedestrian doors. Part 1: Product requirements and test methods.*
- *DIN 18650-2: Powered pedestrian doors. Part 2: Safety at powered pedestrian doors.*

Application
Automatic revolving doors may be used to provide a comfortable entry and exit in many applications in the facade of or within a building.

Typical applications include:
- Office / commercial buildings
- Airports
- Public buildings
- Hospitals
- Hotels

Automatic revolving doors are used to control the pedestrian flow in combination with an optimal thermal separation of the inside and outside climates during normal use.

KTV A revolving doors can optionally be equipped with:

- 3- or 4-wing design
- Glazed drum walls or with metal paneling
- Additional curved sliding doors in front of the entrance to act as night shields

Observance of the applicable regulations and standards guarantee the highest level of pedestrian safety.

Technical Data
Performance data of the product according to the harmonized norms, based on the harmonization provisions. The following technical data excluding lighting also apply:

Name	Value	Unit
Power Input Standby	4,80	W
Power Input Operation	57,8	W

Base materials/Ancillary materials
For the main product components: One automatic revolving door, consisting of four (4) door leaves and with a diameter of 3000mm and a height of 2200mm, the product composition of the KTV A is as follows:

Name	Value	Unit
Glass	46.6	%
Aluminium	32.3	%
Steel	12.9	%
Particle board	3.2	%
Electronics	1.7	%
Plastic	1.6	%
Zinc	1.5	%
Others	<0.3	%

The KTV A includes partial articles which contain substances listed in the Candidate List of *REACH Regulation 1907/2006/EC* (date: 08.07.2021) exceeding 0.1 percentage by mass: yes

- Lead (Pb): 7439-92-1 (CAS-No.) is used in some of the alloys. The concentration of lead

in each individual alloy does not exceed 4.0% (by mass).

The Candidate List can be found on the *ECHA* website address: https:echa.europa.eu/de/home

Reference service life
The reference service life of dormakaba's automatic revolving doors is about 20 years, depending on the application and frequency of use. This is consistent with approximately 10 million cycles over the door's service life.

LCA: Calculation rules

Declared Unit
The declared unit is 1 piece of the product: 876.16 kg

Declared unit

Name	Value	Unit
Declared unit for revolving door system*	6.6	m^2
Mass of the entire system (excl. packaging)	876	kg
Conversion factor to 1 kg	876	-
Grammage of the components	133	kg/m^2
Dimensions for revolving door, diameter	3000	mm
Dimensions for revolving door, height	2200	mm

* Area represents the cross-sectional area of the door, which is designed to fit in an opening of 3000-mm wide by 2200-mm high.

System boundary
The type of EPD is: cradle to gate with options, modules C1–C4, and module D (A1–A3 + C + D and additional modules: A4 + A5 + B6)

Production - Module A1-A3
The product stage includes:
— A1, raw material extraction, processing and mechanical treatments, processing of secondarymaterial input (e.g. recycling processes),
— A2, transport to the manufacturer,
— A3, manufacturing and assemblyincluding provision of all materials, products and energy, as well as waste processing up to the end-of waste state.

Construction stage - Modules A4-A5

The construction process stage includes:
— A4, transport to the building site;
— A5, installation into the building;
including provision of all materials, products and energy, as well as waste processing up to the end-ofwaste
state or disposal of final residues during the construction process stage.

Use stage - Module B6
The use stage related to the operation of the buildingincludes:
— B6, operational energy use

End-of-life stage– Modules C1-C4 and D
The end-of-life stage includes:
— C1, de-construction, demolition:
— C2, transport to waste processing;
— C3, waste processing for reuse, recovery and/orrecycling;
— C4, disposal;
including provision and all transport, provision of all materials, products and related energy and water use.Module D (Benefits and loads beyond the system boundary) includes:
— D, recycling potentials, expressed as net impactsand benefits.

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.

Background database: GaBi ts, SP40, CUP 2020.1

LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic Carbon

Information on describing the Biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic Carbon Content in product	13.55	kg C
Biogenic Carbon Content in	12.52	kg C

accompanying packaging		

The following technical scenario information is required for the declared modules

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel (per 1 kg)	0.00276	l/100km

Transport distance	100	km
Capacity utilisation (including empty runs)	55	%

Transport distance is declared for a distance of 100km by truck in order to allow scaling to a specific point of installation.

Installation into the building (A5)

Name	Value	Unit
Waste packaging (paper and plastic)	35.7	kg

Reference service life

Name	Value	Unit
Life Span according to the manufacturer	20	a

Operational energy use (B6)
The use stage is declared for 20 years.

Name	Value	Unit
Electricity consumption (per year)	177.05	kWh
Days per year in use	365	days
On mode per day	2,5	h
Idle mode per day	10,5	h
Off mode per day	11	h
On mode power	31,49	W
Idle mode power	18,9	W
Off mode power	18,9	W

End of life (C1-C4)
C1: The product dismantling from the building is done manually without environmental burden.

Name	Value	Unit
Collected separately waste type	876	kg
Recycling	442	kg
Energy recovery	13.6	kg
Landfilling	420	kg
Transport to waste management	50	km

The product is disassembled in a recycling process. Material recycling is then assumed for the metals, electronic and electromechanics. The plastic components are assumed to be incinerated with energy recovery. Minor proportions of residues arising from the recycling process, glass/inert materials are landfilled.
Region for the End of Life is: Global.

Reuse, recovery and/or recycling potentials (D), relevant scenario information
Collection rate is 100%.

LCA: Results

Disclaimer:

EP-freshwater: This indicator has been calculated as "kg P eq" as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml).

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

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	ND	ND	MNR	MNR	MNR	X	ND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: Automatic Revolving Door KTV A

Core Indicator	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	[kg CO₂-Eq.]	4.08E+3	7.97E+0	5.25E+1	1.43E+3	0.00E+0	3.81E+0	8.63E+1	6.42E+0	-2.06E+3
GWP-fossil	[kg CO₂-Eq.]	4.17E+3	7.62E+0	5.53E+0	1.43E+3	0.00E+0	3.64E+0	3.54E+1	6.38E+0	-2.05E+3
GWP-biogenic	[kg CO₂-Eq.]	-9.68E+1	3.52E-1	4.70E+1	4.75E+0	0.00E+0	1.68E-1	5.09E+1	2.18E-2	-4.76E+0
GWP-luluc	[kg CO₂-Eq.]	2.33E+0	1.81E-4	1.04E-3	2.07E+0	0.00E+0	8.67E-5	2.45E-3	1.84E-2	-7.08E-1
ODP	[kg CFC11-Eq.]	7.29E-9	8.05E-16	1.09E-14	3.14E-11	0.00E+0	3.85E-16	2.37E-14	2.37E-14	-1.39E-8
AP	[mol H⁺-Eq.]	2.23E+1	7.63E-3	1.43E-2	3.15E+0	0.00E+0	3.65E-3	1.36E-2	4.58E-2	-7.87E+0
EP-freshwater	[kg P-Eq.]	4.26E-3	1.63E-6	2.05E-6	4.00E-3	0.00E+0	7.80E-7	3.72E-6	1.10E-5	-1.23E-3
EP-marine	[kg N-Eq.]	3.55E+0	2.43E-3	5.05E-3	6.99E-1	0.00E+0	1.16E-3	3.80E-3	1.18E-2	-1.06E+0
EP-terrestrial	[mol N-Eq.]	3.93E+1	2.70E-2	6.43E-2	7.34E+0	0.00E+0	1.29E-2	6.30E-2	1.29E-1	-1.15E+1
POCP	[kg NMVOC-Eq.]	9.75E+0	6.86E-3	1.34E-2	1.92E+0	0.00E+0	3.28E-3	1.04E-2	3.57E-2	-3.36E+0
ADPE	[kg Sb-Eq.]	7.73E-2	2.29E-7	1.67E-7	4.13E-4	0.00E+0	1.09E-7	3.39E-7	5.73E-7	-2.69E-2
ADPF	[MJ]	5.37E+4	1.08E+2	1.72E+1	2.51E+4	0.00E+0	5.17E+1	2.71E+1	8.37E+1	-2.86E+4
WDP	[m³ world-Eq deprived]	1.30E+3	1.49E-2	6.42E+0	3.11E+2	0.00E+0	7.14E-3	8.87E+0	6.69E-1	-1.77E+2

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; WDP = Water (user) deprivation potential

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: Automatic Revolving Door KTV A

Indicator	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	[MJ]	1.88E+4	3.41E-1	4.11E+2	1.11E+4	0.00E+0	1.63E-1	5.17E+2	1.10E+1	-1.25E+4
PERM	[MJ]	9.19E+2	0.00E+0	-4.08E+2	0.00E+0	0.00E+0	0.00E+0	-5.11E+2	0.00E+0	0.00E+0
PERT	[MJ]	1.97E+4	3.41E-1	3.29E+0	1.11E+4	0.00E+0	1.63E-1	6.24E+0	1.10E+1	-1.25E+4
PENRE	[MJ]	5.32E+4	1.08E+2	9.03E+1	2.51E+4	0.00E+0	5.17E+1	5.34E+2	8.37E+1	-2.87E+4
PENRM	[MJ]	5.80E+2	0.00E+0	-7.31E+1	0.00E+0	0.00E+0	0.00E+0	-5.07E+2	0.00E+0	0.00E+0
PENRT	[MJ]	5.37E+4	1.08E+2	1.72E+1	2.51E+4	0.00E+0	5.17E+1	2.71E+1	8.37E+1	-2.87E+4
SM	[kg]	3.69E+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
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
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
FW	[m³]	5.92E+1	6.11E-4	1.51E-1	1.28E+1	0.00E+0	2.92E-4	2.10E-1	2.11E-2	-2.44E+1

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 – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: Automatic Revolving Door KTV A

Indicator	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	[kg]	1.07E-4	1.05E-8	3.01E-8	1.04E-5	0.00E+0	5.02E-9	6.89E-8	1.28E-6	-1.31E-4
NHWD	[kg]	8.44E+2	1.11E-2	1.96E+0	1.78E+1	0.00E+0	5.29E-3	3.96E+0	4.21E+2	-4.74E+2
RWD	[kg]	2.52E+0	1.16E-4	8.74E-4	3.80E+0	0.00E+0	5.55E-5	1.23E-3	9.53E-4	-2.88E+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
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.09E+2	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
EEE	[MJ]	5.15E+0	0.00E+0	8.09E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	9.34E+0	0.00E+0	1.51E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+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; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: Automatic Revolving Door KTV A

Indicator	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
PM	[Disease Incidence]	2.24E-4	4.01E-8	8.46E-8	1.39E-5	0.00E+0	1.92E-8	1.16E-7	5.66E-7	-1.30E-4
IRP	[kBq U235-Eq.]	4.70E+2	1.66E-2	1.30E-1	3.28E+2	0.00E+0	7.93E-3	1.54E-1	9.80E-2	-5.77E+2
ETP-fw	[CTUe]	3.11E+4	7.66E+1	7.98E+0	5.64E+3	0.00E+0	3.66E+1	1.09E+1	4.78E+1	-1.10E+4
HTP-c	[CTUh]	7.35E-5	1.44E-9	4.47E-10	1.56E-7	0.00E+0	6.89E-10	8.42E-10	7.09E-9	-6.96E-7
HTP-nc	[CTUh]	5.58E-5	6.16E-8	2.31E-8	5.74E-6	0.00E+0	2.95E-8	6.40E-8	7.81E-7	4.97E-6
SQP	[-]	1.62E+4	2.78E-1	4.64E+0	4.20E+3	0.00E+0	1.33E-1	7.89E+0	1.74E+1	-1.15E+3
Caption	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 IRP
This impact category deals mainly with the eventual impact of low dose ionizing
radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible
nuclear accidents, occupational exposure nor radioactive waste disposal in underground
facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not
measured by this indicator.

Disclaimer 2 – for the indicators ADPE, ADPF, WDP, ETP-fw, HTP-c, HTP-nc, SQP
The results of this environmental impact indicator shall be used with care as the
uncertainties on these results are high or as there is limited experience with the indicator.

References

DIN 18650-1
DIN 18650-1/: Powered pedestrian doors. Part 1: Product requirements and test methods.

DIN 18650-2
DIN 18650-2/: Powered pedestrian doors. Part 2: Safety at powered pedestrian doors

DIN EN 16005
DIN EN 16005: Power operated pedestrian doorsets - Safety in use - Requirements and test methods.

DIN EN 55022
DIN EN 55022: Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement.

DIN EN 60335
DIN EN 60335 - 1: Safety of household and similar electrical appliances. Part 1: General requirements.

EN 60335-2-103
EN 60335-2-103: Household and similar electrical appliances. Safety. Particular requirements for drives for gates, doors and windows.

DIN EN 61000-3-2
DIN EN 61000-3-2: Electromagnetic compatibility-3-2: Limits - Limits for harmonic current emissions.

DIN EN 61000-3-3
DIN EN 61000-3-3: Electromagnetic compatibility-3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

DIN EN 61000-6-2
DIN EN 61000-6-2: Electromagnetic compatibility (EMC). Part 6-2: Generic standards: Interference resistance for industrial environments.

DIN EN 61000-6-3
DIN EN 61000-6-3: Electromagnetic compatibility (EMC). Part 6-3: Generic standards: Emission standard for residential, commercial and light-industrial environments.

DIN EN ISO 9001
DIN EN ISO 9001: Quality management systems.

DIN EN ISO 12100
DIN EN ISO 12100: Safety of machinery - Basic concepts - Risk assessment and risk reduction.

DIN EN ISO 13849-1
DIN EN ISO 13849-1: Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design.

IEC 60335-2-103
IEC 60335-2-103: Household and similar electrical appliances. Safety. Part 2-103: Particular requirements for drives for gates, doors and windows.

REACH Regulation
REACH Regulation (EC) No 1907/2006 of the European
Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals.

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RoHS 2011/65/EU
RoHS 2011/65/EU, Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

European Chemicals Agency (ECHA)
https:echa.europa.eu/de/home

Further References

IBU 2021
General Instructions for the EPD programme of Institut Bauen und Umwelt e.V. Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021. www.ibu-epd.com

GaBi ts software
Sphera Solutions GmbH
Gabi Software System and Database for Life Cycle Engineering 1992-2020
Version 10.0.0.71
University of Stuttgart

Leinfelden-Echterdingen

GaBi ts documentation
GaBi life cycle inventory data documentation (https://www.gabisoftware.com/support/gabi/gabidatabase-2020-lci-documentation/).

LCA-tool dormakaba
LCA tool, version 1.0. ENS (doors)
Developed by Sphera Solutions GmbH.

PCR Part A
PCR – Part A: Calculation Rules for the Life Cycle Assessment
and Requirements on the Project Re-port
according to EN 15804+A2:2019, Version 1.0, Institut Bauen und Umwelt e.V., www.ibu-epd.com.

PCR Part B
PCR – Part B: Requirements on the EPD for Building Hardware product, version 1.2, Institut Bauen und Umwelt e.V., www.ibu-epd.com, 2020.