PRODUCT ENVIRONMENTAL PROFILE

Environmental Product Declaration

VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 Reversing Mini Contactors

REGISTRATION NUMBER ABBG-00399-V01.01-EN		DRAFTING RULES: PCR-ED4-EN-2021 09 06 SUPPLEMENTED BY PSR-0005-ED3.1-EN-2023 12 08
VERIFIER ACCREDITATION NUMBER VH51		INFORMATION AND REFERENCE DOCUMENTS WWW.PEP-ECOPASSPORT.ORG
DATE OF ISSUE 08-2024		VALIDITY PERIOD 5 YEARS
INDEPENDENT VERIFICATION OF THE DECLARATION AND DATA, IN COMPLIANCE WITH ISO 14025: 2006		
INTERNAL ☐	EXTERNAL ☒	
THE PCR REVIEW WAS CONDUCTED BY A PANEL OF EXPERTS CHAIRED BY JULIE ORGELET (DDEMAIN)		
PEP ARE COMPLIANT WITH XP C08-100-1 :2016 OR EN 50693:2019 THE COMPONENTS OF THE PRESENT PEP MAY NOT BE COMPARED WITH COMPONENTS FROM ANY OTHER PROGRAM.		
DOCUMENT IN COMPLIANCE WITH ISO 14025: 2006 « ENVIRONMENTAL LABELS AND DECLARATIONS. TYPE III ENVIRONMENTAL DECLARATIONS »		

EPD Owner	ABB STOTZ-KONTAKT GmbH, 69123 Heidelberg, Germany www.abb.com
Manufacturer name and address	ABB STOTZ-KONTAKT GmbH - Site Heidelberg, 78132, Heidelberg Baden-Württemberg Germany
Company contact	EPD_ELSP@in.abb.com
Reference product	ABB VBC6-30-10 Reversing Mini Contactor
Description of the product	The VBC6-30-10 mini reversing contactor is a compact 3 pole contactor with 1 auxiliary contact, screw terminals and normal mechanical interlock. They are ideally suited for applications where reliability is a must and space is at a premium. Mini reversing contactors are used in residential buldings, commercial buildings and industrial applications for the control of three-phase motor loads up to 4 kW (AC-3). Further features are the noiseless and hum-free coil, a switch position indication and the integrated possibility for rail or wall mounting.
Functional unit	The Functional Unit is to establish and cut off the supply of a downstream installation from an electrical characterized by the composition of the poles or type of contacts NO/NC, a rated voltage of U_e, a rated current I_e, a control circuit voltage U_c, with N_p poles, and Industrial application areas, according to the appropriate use scenario, and during the reference service life of the product of 20 years. Maximum Rated Operating Voltage U_e [V]: 690V AC, 220V DC Maximum Rated Operating Current I_e [A]: 9-12A (AC3/AC3e @400V) Maximum Control Circuit Voltage U_c [V]: 12-260V DC, 12-415V AC Number of poles N_p: 3/4
Other products covered	The PEP covers offerings for: VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 Reversing Mini Contactors
Reference lifetime	20 years
Product category	Electrical, Electronic and HVAC-R Products (Contactors)
Use Scenario	The use phase has been modeled based on the sales mix data (2023), and the corresponding low voltage electricity countries mix
Geographical representativeness	Raw materials & Manufacturing: [Europe / Global] Assembly: [Germany] Distribution / Use: [Global] specific sales mix EoL: [Global]
Technological representativeness	Materials and processes data are specific for the production of VBC6-30-10 Mini Contactor
LCA Study	This study is based on the LCA study described in the LCA report 1SAC200406H0001
EPD type	Product Family Declaration
EPD scope	“Cradle to grave”
Year of reported primary data	2023
LCA software	SimaPro 9.5.0.1 (2023)
LCI database	Ecoinvent v3.9 (2023)
LCIA methodology	EN 50693:2019

Contents

ABB Purpose & Embedding Sustainability

ABB is a leading global technology company that energizes the transformation of society and industry to achieve a more productive, sustainable future. By connecting software to its electrification, robotics, automation and motion portfolio, ABB pushes the boundaries of technology to drive performance to new levels. With a history of excellence stretching back more than 130 years, ABB's success is driven by about 110 thousand talented employees in over 100 countries.
ABB's Electrification business offers a wide-ranging portfolio of products, digital solutions and services, from substation to socket, enabling safe, smart and sustainable electrification. Offerings encompass digital and connected innovations for low voltage and medium voltage, including EV infrastructure, solar inverters, modular substations, distribution automation, power protection, wiring accessories, switchgear, enclosures, cabling, sensing and control.
ABB is committed to continually promoting and embedding sustainability across its operations and value chain, aspiring to become a role model for others to follow. With its ABB Purpose, ABB is focusing on reducing harmful emissions, preserving natural resources and championing ethical and humane behavior.

General Information

The ABB STOTZ-KONTAKT GmbH company was founded in 1891 and develops, manufactures, and sells products for the electrical installation and automation of buildings, machines and plants.
For the Smart Power, the company is the competence centre for Installation Contactors, Overload relays, Mini Contactors, Manual Motor Starters, Time Relays, Monitoring Relays, Motor Controller, Power Supplies, Interface Products and Safety Products.

- Heidelberg Workshop Smart Power is about 5000 sq. m.
- Hornberg Workshop is around 6500 sq.m.
- Employees 1000 person.
- Global R&D and product management are located at the factory.

ISO 9001:2015 - Quality Management Systems Heidelberg & Hornberg
ISO 45001:2018- Occupational Health and Safety Assessment Series- Heidelberg
ISO 50001:2018- Energy management systems- Heidelberg & Hornberg
ISO 14001:2015- Environmental management systems – Heidelberg

In the factory, the different components and subassemblies are assembled on the manufacturing line. All components and subassemblies are produced by ABB's suppliers. These are assembled and tested as per the standards within the factory premises.

Reversing Mini Contactors product cluster

Product cluster declared in this PEP includes the following VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 Reversing Mini Contactors:

Product Range	Product	Number of Main poles [N_p]	Number of Auxiliary poles	Max. Rated Operating Voltage [U_e]	Max. Rated Current of Main poles [$I_{e\ \{AC3\}}$] at 400V	Rated Current of Aux. poles [$I_{p\ \{AC15\}}$] at 240V	Rated Control Circuit Voltage [U_c]
VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 Reversing Mini Contactors	VB(C)6(A)-30-01-_, VB(C)6(A)-30-10-_,	3	1	690V	9A	4A	12-260V DC 12-415V AC
	VB(C)7(A)-30-01-_, VB(C)7(A)-30-10-_, VTBC7-30-01	3	1	690V	12A	4A	12-260V DC 12-415V AC
	VB(C)6(A)-40-00-_	4	0	690V	9A	-	12-260V DC 12-415V AC
	VB(C)7(A)-40-00-_	4	0	690V	12A	-	12-260V DC 12-415V AC

Table 1: Technical characteristics of VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 Reversing Mini Contactors.

Reference Product:

The reference product for the LCA of the complete range of VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 is VBC6-30-10.

Constituent Materials

The VBC6-30-10 weights about 0.387kg including its installed accessories, packaging, and paper documentation.

VBC6-30-10				
Materials	**Name**	**IEC 62474 MC**	**[g]**	**%**
Metals	Steel	M-119	173.2	44.7%
	Cu and Cu Alloys	M-121	96.8	25.0%
	Precious Metals	M-159	1.1	0.3%
	Stainless Steel	M-100	0.2	<0.1%
Plastics	Polyamide	M-258	87.4	22.6%
	Unsaturated Polyester	M-301	10.3	2.7%
Other	Paper/Cardboard	M-341	18.2	4.7%
Total			**387.2**	**100.0%**

Table 2: Weight of materials VBC6-30-10

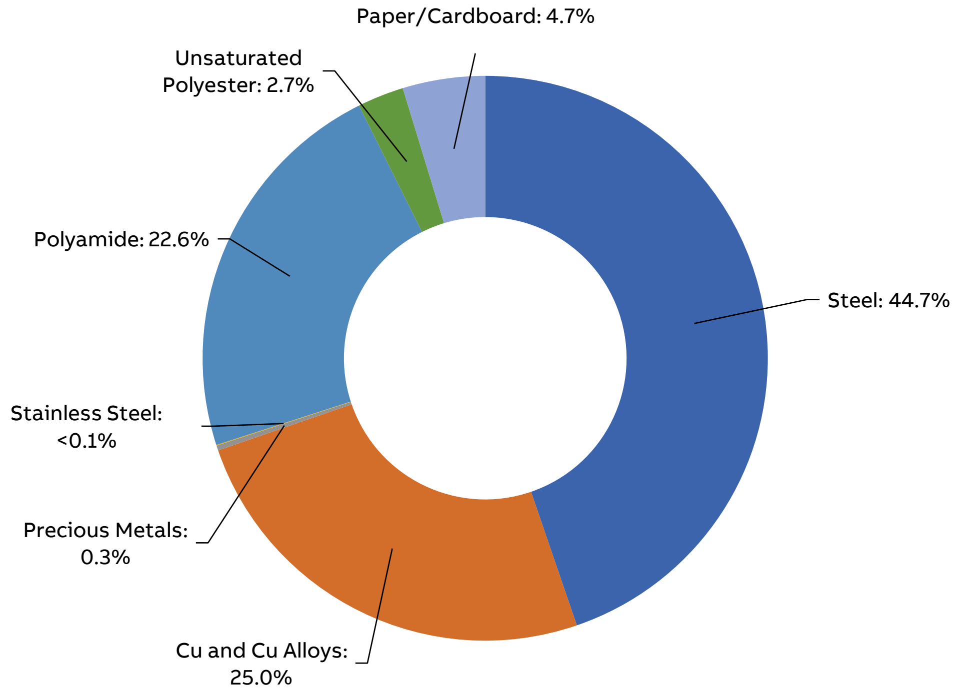

Figure 1: Composition of VBC6-30-10

Along the whole VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 product cluster, a set of different build configurations have been covered by this analysis.

Packaging weighs 13.73g, with the following substance composition:

Material	Unit	Total	%
Corrugated Cardboard	g	13.71	3.5%
Paper	g	0.02	<0.1%
Total		**13.73**	**3.5%**

Table 3: Weight of Packaging for VBC6-30-10

Functional unit and Reference Flow

The Functional Unit is to establish and cut off the supply of a downstream installation from an electrical characterized by the composition of the poles or type of contacts NO/NC, a rated voltage of U_e, a rated current I_e, a control circuit voltage U_c, with N_p poles, and Industrial application areas, according to the appropriate use scenario, and during the reference service life of the product of 20 years.
(table 1)

The Reference Flow of the study is a single Contactor (including its packaging and accessories) with mass described in table 2.

System boundaries and life cycle stages

The life cycle of the Contactor, an EEPS (Electronic and Electrical Products and Systems), is a “from cradle to grave” analysis and covers the following main life cycle stages: manufacturing, including the relevant acquisition of raw material, preparation of semi-finished goods, etc. and processing steps; distribution; installation, including the relevant steps for the preparation of the product for use; use including the required maintenance steps within the RSL (reference service life of the product) associated to the reference product; end-of-life stage, including the necessary steps until final disposal or recovery of the product system.

The following table shows the stages of the product life cycle and the information stages according to EN 50693:2019 [3] for the evaluation of electronic and electrical products and systems.

Manufacturing	Distribution	Installation	Use	End-of-Life (EoL)
Acquisition of raw materials Transport to manufacturing site Components/parts manufacturing Assembly Packaging EoL treatment of generated waste	Transport to distributor/ logistic center Transport to place of use	Installation EoL treatment of generated waste (packaging)	Usage Maintenance	Deinstallation Collection and transport EoL treatment

Table 4: Phases for the evaluation of construction products according to EN50693:2019 [3].

Temporal and geographical boundaries

The ABB component suppliers are sourced all over the world. All primary data collected are from 2023, which is a representative production year. Secondary data are also representative for this year, as provided by ecoinvent [6].

The selected ecoinvent [6] processes in the LCA model have a global representativeness, due to the unclear origin of each component. In this way, a conservative approach has been adopted.

Boundaries in the life cycle

As indicated in the PCR capital goods such as buildings, machinery, tools and infrastructure, the packaging for internal transport which cannot be allocated directly to the production of the reference product, may be excluded from the system boundary.

Infrastructures, when present, such as processes deriving from the ecoinvent [6] database have not been excluded.

Data quality

In this LCA, both primary and secondary data are used. Site specific foreground data have been provided by ABB. Main data sources are the bill of materials & drawings which are available on the ERP (SAP) & Windchill. For all processes for which primary are not available, generic data originating from the ecoinvent database [6], allocation cut-off by classification, are used. The ecoinvent database available in the SimaPro software [7] is used for the calculations.

The data quality characterized by quantitative and qualitative aspects, is presented in Appendix 1. Each data quality parameter has been rated according to DQR tables from Chapter 7.19.2.2 of the Product Environmental Footprint Guide v.6.3 to give an indication of geography, technology and temporal representativeness.

Environmental impact indicators

The information obtained from the inventory analysis is aggregated according to the effects related to the various environmental issues. According to “PCR-ed4-EN-2021 09 06” and EN 50693 [3] the environmental impact indicators must be determined using the characterization factors and impact assessment methods specified in EN 15804:2012+A2:2019 [8].

PCR-ed4-EN-2021 09 06 and the EN 50693:2019 [3] standard establish four indicators for GWP: GWP (total) which includes all greenhouse gases; GWP (fossil fuels); GWP (biogenic) which includes the emissions and absorption of biogenic carbon dioxide and biogenic carbon stored in the product; GWP (land use) - land use and land use transformation. Other indicators as per the PCR[1].

Allocation rules

Allocation coefficients are based on the B6 line’s occupancy area for electricity consumption since, apart from assembly processes, the whole production line is temperature-regulated throughout the year. The allocation of the total amount of waste generated by the production line and water consumption, has been based on this criterion.

Limitations and simplifications

Raw materials life cycle stage includes the extraction of raw materials as well as the transport distances to the manufacturing suppliers. These distances are assumed to be 1000 km as per PCR. This distance has been added to the one already included in the market processes used for the model, as a result of a conservative choice made by the LCA operators.

Surface treatments like galvanizing, tin and silver plating as well as their related transport processes (back and forth from the finishing suppliers) have been considered in the LCA model.

Scraps for metal working and plastic processes are included when already defined in ecoinvent[6].

Energy Models

LCA Stage	EN 15804:2012 +A2:2019 module	Energy model	Notes
Raw material extraction and processing	A1-A2	Electricity, {RER}| market group for | Cut-off Electricity, {GLO}| market group for | Cut-off	Based on materials and supplier locations
Manufacturing	A3	Electricity, {DE}| market for | Cut-off	Specific Energy model for ABB Heidelberg manufacturing plant, 100% renewable
Installation (Packaging EoL)	A5	Electricity, {GLO}| market group for | Cut-off	
Use Stage	B1	Electricity, [country]x | market for | Cut-off, S **	Low voltage, based on 2023 country sales mix
EoL	C1-C4	Electricity, {GLO}| market group for | Cut-off	

Table 5: Energy models used in each LCA stage

** Please refer the use phase page 11 for further description

Inventory analysis

In this LCA, both primary and secondary data are used. Site specific foreground data have been provided by ABB. For data collection, Bills of Material (BOM) extracted from ABB's internal SAP software were used. They are a list of all the components and assemblies that constitute the finished product, organized by level. Each item is matched with its code, quantity, weight and supplier. The BOMs were then processed, adding material, surface area and other weight data, taken from technical drawings. Finally, the manufacturing process and surface treatment were assigned, according to information provided by R&D

personnel. Road distances between the suppliers and ABB were calculated using Google Maps, and marine distances using Distances & Time (Searates).

All primary data collected from ABB are from 2023, which was a representative production year. The ecoinvent v3.9 cut-off by classification system processes [6] are used to model the background system of the processes.

Due to a lot of components in the Reversing Mini Contactors, raw material inputs have been modelled with data from ecoinvent representing either a European [RER] or Global [RoW] market coverage based on the supplier's location. These datasets are assumed to be representative.

Manufacturing stage

The Reversing Mini Contactors are composed of a multitude of components, all of which are made from of numerous materials. Most of the inputs to the products' manufacturing stage are already produced component parts.

The single use packaging as well as paper documentation are also included in the analysis in the manufacturing stage. ABB receives packaging components from outside suppliers and packages the Reversing Mini Contactors before shipping them.

Most of the inputs to the products' manufacturing stage are already produced component parts from the supply chain. In the ABB manufacturing plant, the different components and subassemblies are assembled into the Contactor. All the semi-finished and ancillary products are produced by ABB's suppliers.

The entire AF Reversing Mini Contactors suppliers' network has been modelled with the calculation of each transportation stage: from the first manufacturing supplier to the next. All the distances from the last subassembly suppliers' factories to the ABB manufacturing facility have been calculated.
All the distances from the last subassembly suppliers' factories to the ABB manufacturing facility have been calculated.
In the ABB factory, the different components and subassemblies are assembled into the Contactor. All the semi-finished and ancillary products are produced by ABB's suppliers.

The energy mix used for the production phase is representative for ABB Heidelberg production site and includes renewable energy only.

The complete energy mix has been modeled considering the certificate on Guarantee of origins provided to ABB for the year 2023.

Distribution

The transport distances from ABB manufacturing plant to the distribution centers (regional distribution centers / local sales organizations) have been calculated considering the specific 2023 sales mix data for VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 Reversing Reversing Mini Contactors product cluster (SAP ERP sales data as a source).

Since no specific data is available for the transport distances from the Distribution Centre to place of actual use (Customer site), distances of 1000 km are assumed (local/domestic transport by lorry, according to PCR [1]).

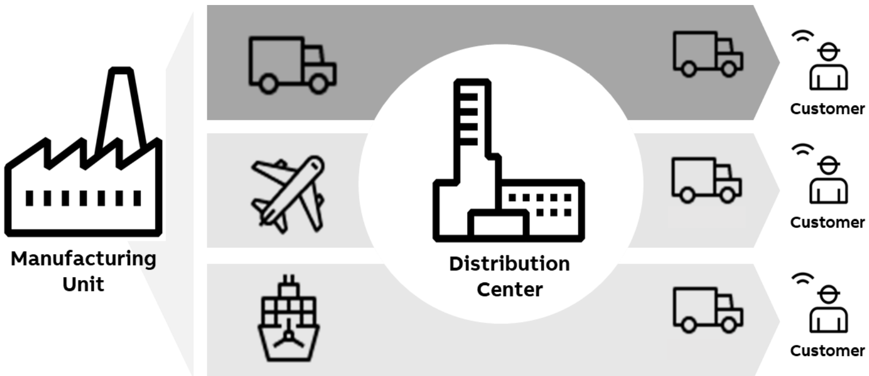

Figure 2: Distribution Methodology

Installation

The installation phase only implies manual activities, and no energy is consumed. This phase also includes the disposal of the packaging of the Mini Contactor.

For the disposal of the packaging after installation of the Mini Contactor at the end of its life, a transport distance of 100 km (according to PSR[2]) was assumed. The chosen transportation datasets from Ecoinvent [6].
The actual disposal site is unknown and is managed by the customer. The waste disposal scenarios are modelled as per PSR[2]. The reference year for disposal dataset for European scope is 2021.

Use

Use and maintenance are modelled according to the PCR [1].

During the use phase, Mini Contactor, dissipates some electricity due to power losses. They are calculated according to the data provided in the catalogue of the Mini Contactor and following the PCR [1] & PSR [2] rules:

Parameters		
Iu	[A]	9-12A
Load Rate	[%]	50
h/year	[h]	8760
RSL	[years]	20
Time operating coefficient α	[%]	50

Table 6: Use phase parameters

The formula for the calculation of the electricity consumed is shown below and it is described as follows, where P_{use} is the power consumed by the Contactor at a given value of current:

$$E_{use}\ [kWh] = \frac{P_{use} * 8760 * RSL * \alpha}{1000}$$

The above calculations have been performed according to the number of poles on which relevant current flows during use phase.

The Energy model used for this phase has been modeled based on the 2023 actual sales mix data (SAP ERP sales data as a source). From the Ecoinvent [6] database, the low voltage electricity country mix for each country(x) has been selected with its respective percentage on the total sales mix (Electricity, low voltage [country]x | market for | Cut-off, S).

Since no maintenance happens during the use phase, the environmental impacts linked to this procedure have been considered as null in the analysis.

End of life

The end-of-life stage is modelled according to PCR [1] and IEC/TR 62635 [9]. The percentages for end-of-life treatments of materials are taken from IEC/TR 62635 [9].

Since no specific data is available, the transport distances from the place of use to the place of disposal are assumed to be 1000 km (local/domestic transport by lorry, according to PCR [1]).

Disassembly manuals can be provided to the customer to support product disposal.

Environmental impacts

The following tables show the environmental impact indicators of the life cycle of a single Contactor, as indicated by PEP Ecopassport PCR and EN 50693:2019 [3]. The indicators are divided into the contribution of the processes to the different modules (upstream, core and downstream) and stages (manufacturing, distribution, installation, use and end-of-life).

VBC6-30-10

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of Life
GWP-total	kg CO2 eq	2.12E+02	3.05E+00	7.41E-01	9.92E-03	2.08E+02	7.42E-02
GWP-fossil	kg CO2 eq	2.02E+02	2.99E+00	7.41E-01	3.29E-04	1.98E+02	7.12E-02
GWP-biogenic	kg CO2 eq	9.64E+00	4.87E-02	1.84E-04	9.59E-03	9.58E+00	2.89E-03
GWP-luluc	kg CO2 eq	2.54E-01	8.48E-03	8.40E-05	1.42E-07	2.45E-01	8.17E-05
ODP	kg CFC11-eq	2.34E-06	4.37E-08	1.17E-08	9.56E-12	2.29E-06	3.48E-10
AP	mol H+ eq	8.58E-01	6.45E-02	3.24E-03	2.13E-06	7.90E-01	4.23E-04
EP-freshwater	kg P eq	1.55E-01	5.91E-03	1.38E-05	3.47E-08	1.49E-01	2.36E-05
EP-marine	kg N eq	1.76E-01	6.59E-03	1.29E-03	2.55E-06	1.68E-01	1.00E-04
EP-terrestrial	mol N eq	1.69E+00	7.40E-02	1.39E-02	8.80E-06	1.60E+00	7.14E-04
POCP	kg NMVOC eq	5.03E-01	2.18E-02	4.40E-03	3.04E-06	4.77E-01	2.17E-04
ADP-m&m	kg Sb eq	3.17E-03	1.59E-03	2.96E-07	7.39E-10	1.59E-03	2.91E-08
ADP-fossil	MJ	2.66E+03	3.99E+01	9.71E+00	3.49E-03	2.61E+03	7.23E-01
WDP	m3 of equiv. depriv.	3.37E+01	1.82E+00	1.90E-02	1.85E-04	3.19E+01	7.40E-03
PENRE	MJ	2.66E+03	3.76E+01	9.71E+00	3.49E-03	2.61E+03	7.23E-01
PENRM	MJ	2.32E+00	2.32E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.66E+03	3.99E+01	9.71E+00	3.49E-03	2.61E+03	7.23E-01
PERE	MJ	5.83E+02	4.99E+00	4.13E-02	9.26E-05	5.78E+02	9.21E-02
PERM	MJ	1.62E-01	1.62E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	5.83E+02	5.15E+00	4.13E-02	9.26E-05	5.78E+02	9.21E-02
SM	kg	1.31E-01	1.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PET	MJ	3.24E+03	4.50E+01	9.75E+00	3.58E-03	3.19E+03	8.15E-01
FW	m3	1.39E+00	4.78E-02	6.69E-04	6.27E-06	1.34E+00	3.00E-04
HWD	kg	6.57E-03	3.22E-04	6.52E-05	1.96E-08	6.18E-03	1.27E-06
N-HWD	kg	1.69E+01	6.96E-01	8.00E-02	1.19E-03	1.61E+01	3.60E-02
RWD	kg	8.40E-03	6.73E-05	8.58E-07	1.53E-09	8.33E-03	1.25E-06
CfR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MfR	kg	4.41E-01	8.81E-02	0.00E+00	8.09E-03	0.00E+00	3.44E-01
MfER	kg	1.63E-02	9.68E-03	0.00E+00	4.74E-03	0.00E+00	1.84E-03
EN	MJ by energy vector	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PM	disease inc.	6.83E-06	2.50E-07	1.24E-08	2.76E-11	6.56E-06	6.29E-09
IRP	kBq U-235 eq	3.09E+01	2.64E-01	3.80E-03	6.19E-06	3.06E+01	5.05E-03
ETP-fw	CTUe	4.80E+02	7.22E+01	5.01E+00	1.34E-02	4.03E+02	1.60E-01
HTP-c	CTUh	7.51E-08	1.16E-08	9.72E-11	4.96E-13	6.33E-08	1.30E-10
HTP-nc	CTUh	3.72E-06	7.39E-07	9.07E-09	2.33E-11	2.96E-06	8.36E-09
SQP	Pt	6.44E+02	3.25E+01	1.42E+00	2.99E-03	6.10E+02	3.55E-01

Table 7: Impact indicators for VBC6-30-10

Impact Category	Unit	Total
Biogenic carbon content of the product	kg	2.26E-03
Biogenic carbon content of the associated packaging	kg	3.01E-03

Table 8: Inventory Flow indicators of VBC6-30-10

Environmental impact indicators

GWP-total	Global Warming Potential total (Climate change)
GWP-fossil	Global Warming Potential fossil
GWP-biogenic	Global Warming Potential biogenic
GWP-luluc	Global Warming Potential land use and land use change
ODP	Depletion potential of the stratospheric ozone layer
AP	Acidification potential
EP-freshwater	Eutrophication potential - freshwater compartment
EP-marine	Eutrophication potential - fraction of nutrients reaching marine end compartment
EP-terrestrial	Eutrophication potential -Accumulated Exceedance
POCP	Formation potential of tropospheric ozone
ADP-m&m	Abiotic Depletion for non-fossil resources potential
ADP-fossil	Abiotic Depletion for fossil resources potential, WDP
WDP	Water deprivation potential.

Resource use indicators

PENRE	Use of non-renewable primary energy excluding renewable primary energy resources used as raw material
PENRM	Use of non-renewable primary energy resources used as raw material
PENRT	Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)
PERE	Use of renewable primary energy excluding non-renewable primary energy resources used as raw material
PERM	Use of renewable primary energy resources used as raw material
PERT	Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)
PET	Total use of primary energy in the lifecyle

Secondary materials, water and energy resources

SM	Use of secondary materials
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	FW: Net use of fresh water

Waste category indicators

HWD	Hazardous waste disposed
N-HWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed

Output flow indicators

CfR	Component for reuse
MfR	Materials for recycling
MfER	Materials for energy recovery
EN	Exported energy

Waste category indicators

HWD	Hazardous waste disposed
N-HWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed

Output flow indicators

MfR	Materials for recycling
MfER	Materials for energy recovery
CfR	Component for reuse
EN	Exported energy

Others indicators

PM	Emissions of Fine particles
IRP	Ionizing radiation, human health
ETP-fw	Ecotoxicity, freshwater
HTP-c	Human toxicity, carcinogenic effects
HTP-nc	Human toxicity, non-carcinogenic effects
SQP	Impact related to Land use / soil quality

Extrapolation for Homogeneous environmental family

This LCA covers different build configurations than the representative product from the IEC and UL types. All the analyzed configurations have the same main functionality, product standards and manufacturing technology. The different life cycle stages can be extrapolated to other products of the same homogeneous environmental family by applying a rule of proportionality to the parameters in the following tables, divided by different life cycle stages.

Product	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-minerals & metals	ADP-fossil	WDP
VB6, VB6S, VBC6(P)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
VB7, VB7S, VB7D, VBC7(P)	1.13	1.13	1.06	1.08	1.13	1.19	1.25	1.22	1.25	1.21	1.40	1.12	1.11
VB6S, VB6SA, VBC6A, VBC6SA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
VB7A, VB7SA, VBC7A	1.13	1.13	1.06	1.08	1.13	1.19	1.25	1.22	1.25	1.21	1.40	1.12	1.11
VTBC7	1.28	1.28	1.12	1.15	1.22	1.27	1.40	1.34	1.42	1.36	1.65	1.24	1.05

Table 9: Extrapolation factors for VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7

Reference product: VBC6-30-10 Manufacturing

Product	Factor
VB6, VB6S, VBC6(P)	1.00
VB7, VB7S, VB7D, VBC7(P)	1.01
VB6S, VB6SA, VBC6A, VBC6SA	1.00
VB7A, VB7SA, VBC7A	1.01
VTBC7	1.02

Table10: Extrapolation factors for VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7

Reference product: VBC6-30-10 Distribution

Product	Number of main poles	Number of aux poles	Factor
VBC6-30-10; VBC6-30-10; VBC6(A)-30-01-(P/F); VBC6(A)-30-10-(P/F);	3	1	1.00
VB6(A)-30-01; VB6-30-01-(P/F); VB6(A)-30-10; VB6-30-10-(P/F); VB6(A)-30-10-P; VB6(A)-30-01-P	3	1	1.20
VB7(A/D)-30-01; VB7-30-01-(P/F); VB7(A/D)-30-10; VB7-30-10-(P/F); VB7(A)-30-10-P; VB7(A)-30-01-P; VB7-30-10; VB7-30-01	3	1	1.27
VBC7(A)-30-01; VBC7-30-01-(P/F); VBC7(A)-30-10; VBC7-30-10-(P/F); VBC7(A)-30-10-P; VBC7(A)-30-01-P; VBC7-30-10; VBC7-30-01	3	1	1.07
VB7(A)-40-00; VB7(A)-40-00-P;	4	0	1.34
VBC7(A)-40-00; VBC7(A)-40-00-P;	4	0	1.14
VB6(A)-40-00;	4	0	1.18
VTBC7-30-01	3	1	1.59

Table 11: Extrapolation factors for VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7 (Reference product: VBC6-30-10) Use Phase

All the product variants have same Installation impacts.

Product	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-minerals & metals	ADP-fossil	WDP
VB6, VB6S, VBC6(P)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
VB7, VB7S, VB7D, VBC7(P)	1.14	1.14	1.08	1.16	1.13	1.15	1.16	1.10	1.14	1.14	1.10	1.15	1.15
VB6S, VB6SA, VBC6A, VBC6SA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
VB7A, VB7SA, VBC7A	1.14	1.14	1.08	1.16	1.13	1.15	1.16	1.10	1.15	1.14	1.10	1.15	1.15
VTBC7	1.19	1.19	1.10	1.20	1.16	1.20	1.20	1.13	1.18	1.18	1.13	1.19	1.19

Table 12: Extrapolation factors for VB6, VBC6, VB6S, VB7, VBC7, VB7D, VB7S, VB6A, VB6SA, VBC6A, VB7A, VBC7A, VB7SA, VTBC7

(Reference product: VBC6-30-10) End of Life

Additional environmental information

According to the waste treatment scenario calculation in Simapro, based on the recycling rate in the technical report IEC/TR 62635 Edition 1.0 [9] Table D.6, the following recyclability potentials were calculated. The recyclability potential is calculated based on the product weight (excluding packaging).

	VBC6-30-10
Recyclability potential	87.8%

Table 12: Recyclability potential of VBC6-30-10

References

[1] PCR "PEP-PCR-ed4-EN-2021_09_06" - Product Category Rules for Electrical, Electronic and HVAC-R Products (published: 6th September 2021)

[2] PSR "PSR-0005-ed3.1-EN-2023 12 08" - SPECIFIC RULES FOR Electrical switchgear and control gear Solutions

[3] EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems

[4] ISO 14040:2006 - Environmental management -Life cycle assessment - Principles and framework

[5] ISO 14044:2006 - Environmental management - Life cycle assessment - Requirements and guidelines

[6] ecoinvent v3.9 (2023). ecoinvent database version 3.9 - (https://ecoinvent.org/)

[7] SimaPro Software version 9.5.0.1 - PRé Sustainability

[8] UNI EN 15804:2012+A2:2019: Sustainability of constructions - Environmental product declarations (September 2019).

[9] IEC/TR 62635 - Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment - Edition 1.0 2012-10