


PRODUCT ENVIRONMENTAL PROFILE

Environmental Product Declaration

AF(S)09/12/16(Z)(B) Contactors & NF(Z)(B)22E,31E,40E,44E,53E,62E,71E,80E & NF(Z)33/11, NF(Z)51/11 Contactors Relays



REGISTRATION NUMBER ABBG-000204-V01.01-EN	DRAFTING RULES: PCR-ED4-EN-2021 09 06 SUPPLEMENTED BY PSR-0005-ED3-EN-2023 06 06	
VERIFIER ACCREDITATION NUMBER VH50	INFORMATION AND REFERENCE DOCUMENTS WWW.PEP-ECOPASSPORT.ORG	
DATE OF ISSUE 02-2024	VALIDITY PERIOD 5 YEARS	
INDEPENDENT VERIFICATION OF THE DECLARATION AND DATA, IN COMPLIANCE WITH ISO 14025: 2006		
INTERNAL <input type="checkbox"/>	EXTERNAL <input checked="" type="checkbox"/>	
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 »		
© Copyright 2023 ABB. All rights reserved.		

EPD Owner	ABB France, 11 rue D'Arsonval, Chassieu, France www.abb.com
Manufacturer name and address	ABB France, 11 rue D'Arsonval, Chassieu, France
Company contact	EPD_ELSP@in.abb.com
Reference product	AF09-30-10 Contactor
Description of the product	The AF09-30-10 is a 3 pole - 690 V IEC or 600 UL contactor with 1 built-in auxiliary contact and screw terminals, controlling motors up to 4 kW / 400 V AC (AC-3) or 5 hp / 480 V UL and switching power circuits up to 25 A (AC-1) or 25 A UL general use. Thanks to the AF technology, the contactor has a wide control voltage range (100-250 V 50/60 Hz and DC), managing large control voltage variations, reducing panel energy consumptions, and ensuring distinct operations in unstable networks. Furthermore, surge protection is built-in, offering a compact solution.
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: 2/2, 3/0, 3/1, 4/0, 4/4, 5/1, 6/2, 7/1, 8/0, 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 Power Circuit Voltage U_p [V]: 690V Maximum allowed intensity by the power circuit I_p [A]: 9.5A/12.5A/18A Rated Control Circuit Voltage U_c [V]: 24-500V Number of poles: 3/4/8
Other products covered	The PEP covers offerings for: - 3-pole contactors AF09, AF12, AF16: AF09/12/16/(Z)(B)-30-10(K)(RT); AF09/12/16/(Z)(B)-30-01(K)(RT), AF(S)09/12/16(Z)-30-22; - 4-pole contactors AF09, AF16: AF09/16(Z)(B)-40-00(K)(RT); AF09/16(Z)(B)-22-00(K)(RT) - 4-pole contactor relays NF(Z)(B)22E,31E,44E(K)(RT) - 8-pole contactor relays NF(Z)(B)44E,53E,62E,71E,80E(K)(RT), NF(Z)33/11, NF(Z)51/11
Reference lifetime	20 years
Product category	Electrical, Electronic and HVAC-R Products
Use Scenario	The use phase has been modeled based on the sales mix data (2022), and the corresponding low voltage electricity countries mix
Geographical representativeness	Raw materials & Manufacturing: [Europe / Global] Assembly: [France] Distribution / Use: [Global] specific sales mix EoL: [Global]
Technological representativeness	Materials and processes data are specific for the production of AF09-30-10 Contactor
LCA Study	This study is based on the LCA study described in the LCA report 1SBD250584E0004
EPD type	Product Family Declaration
EPD scope	"Cradle to grave"
Year of reported primary data	2022
LCA software	SimaPro 9.5.0.1 (2023)
LCI database	ecoinvent v3.9 (2023)
LCIA methodology	EN 50693:2019

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	2/19

Contents

ABB Purpose & Embedding Sustainability	4
General Information	4
AF Contactors product cluster	5
Constituent Materials	5
Functional unit and Reference Flow	6
System boundaries and life cycle stages.....	7
Temporal and geographical boundaries	7
Boundaries in the life cycle.....	7
Data quality	8
Environmental impact indicators	8
Allocation rules	8
Limitations and simplifications	8
Energy Models.....	9
Inventory analysis.....	9
Manufacturing stage.....	10
Distribution	10
Installation.....	11
Use.....	11
End of life.....	12
Environmental impacts	13
Additional environmental information.....	18
References	19

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	3/19



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 facility located in Chassieu, is for the Smart Power Division, the competence center for Contactors <100A and >9A.

All the products are produced in an automated system with precision and accuracy. These are supplied to utilities, industrial, and tertiary sector customers.

ABB adopts and implements for its own activities an integrated Quality/Environmental/Health Management System in compliance with the following standards:

SS-EN ISO 9001: 2015 - Quality Management Systems- Requirements

SS-EN ISO 14001: 2015 - Environmental management systems - Requirements with guidance for use

AF contactors are most commonly used for controlling electric motors and switch various non-motor loads. Contactors can break current over a wide range of currents, from a few amperes to thousands of amperes, and voltages up to 1000V AC.

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	4/19

AF Contactors Product cluster

Product cluster declared in this PEP includes the following AF(S)09/12/16(Z)(B) Contactors NF(Z)(B)22E, 31E, 40E, 44E, 53E, 62E, 71E, 80E Contactor relays:

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)}]	Rated Current of Aux. poles [I _p]	Rated Control Voltage [U _c]
AF(S)09/12/16 (B/Z/ZB) & NF(B/Z/ZB)22 /31/40/44/53 /62/71/80	AF09/12/16/(Z)(B)-30-10(K)(RT)	3	1	690V	9.5A/12.5A/18A	6A	24-500V
	AF09/12/16/(Z)(B)-30-01(K)(RT)						
	AF09/12/16(Z)-30-22	3	4	690V	9.5A/12.5A/18A	6A	24-500V
	AFS09/12/16(Z)-30-22(K)	3	4	690V	9.5A/12.5A/18A	6A	24-250V
	AF09/16(Z)(B)-40-00(K)(RT)	4	0	690V	9.5A/18A		24-500V
	AF09/16(Z)(B)-22-00(K)(RT)						
	NF(Z)(B)22E,31E,44E(K)(RT)	0	4	690V	0A	6A	24-500V
	NF(Z)(B)44E,53E,62E,71E,80E(K)(RT)	0	8	690V	0A	6A	24-500V
NF(Z)33/11, NF(Z)51/11							

Table 1: Technical characteristics of AF(S)09/12/16(Z)(B) Contactors & NF(Z)(B)22E,31E,40E,44E,62E,80E Contactor Relays.

The accessories associated with these products are also included in the study.

Reference Product:

The reference product for the LCA of the complete range of AF(S)09/12/16(Z)(B) & NF(Z)(B)22E,31E,40E,44E,62E,80E) is AF09-30-10 (3-pole).



Constituent Materials

The AF09-30-10 weights about 0.292 kg including its installed accessories, packaging, and paper documentation.

AF09-30-10				
Materials	Name	IEC 62474 MC	[g]	%
Metals	Steel	M-119	111.61	38.1%
	Cu and Cu Alloys	M-121	56.74	19.4%
	Stainless Steel	M-100	2.54	0.9%
	Precious Metals	M-159	0.57	0.2%
Plastics	Polyamide	M-258	103.92	35.5%
	Elastomer	M-320	0.12	<0.1
Other	Paper/Cardboard	M-341	10.21	3.5%
	Others	N/A	7.06	2.4%
Total			292.79	100.0%

Table 2: Weight of materials AF09-30-10

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	5/19

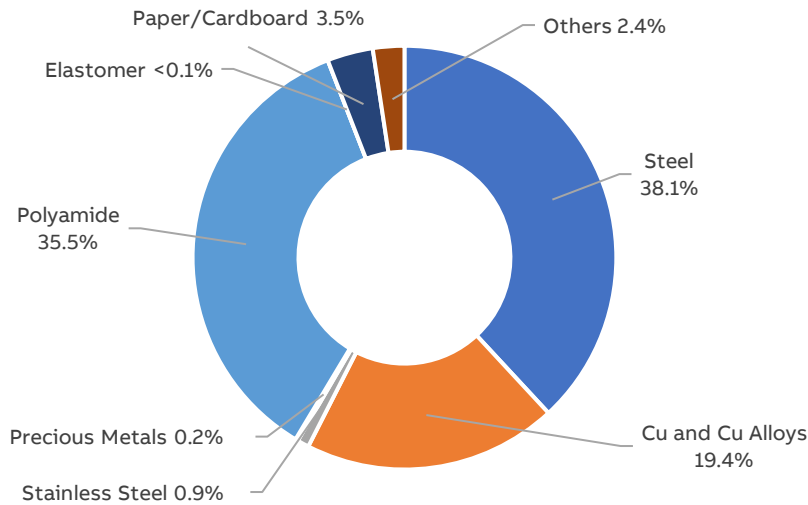


Figure 1: Composition of AF65-30-00

Along the whole AF(S)09/12/16(Z)(B) & NF(Z)(B)22E,31E,40E,44E,62E,80E product cluster, a set of different build configurations have been covered by this analysis.

Packaging weighs 10.21g, with the following substance composition:

Material	Unit	Total	%
Corrugated Cardboard	g	9.97	3.4%
Cardboard and Paper	g	0.24	<0.1%
Total		10.21	3.5%

Table 3: Weight of Packaging for AF09-30-10

Official declarations 2CMT2021-006277 [10] and 2CMT2021-006202 [11] states compliance of ABB AF Contactors respectively to RoHS and REACH regulations; 2CMT2021-006277 [10] provides exemptions considered for RoHS while 2CMT2021-006202 [11] lists REACH substances present in a concentration above 0.1% adding reference to products where involved parts are mounted.

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: 2/2, 3/0, 3/1, 4/0, 4/4, 5/1, 6/2, 7/1, 8/0, 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, table 2.

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	6/19

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		Installation		Deinstallation
Transport to manufacturing site				
Components/parts manufacturing	Transport to distributor/ logistic center	EoL treatment of generated waste (packaging)	Usage	Collection and transport
Assembly	Transport to place of use		Maintenance	
Packaging				EoL treatment
EoL treatment of generated waste				

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 2022, 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.

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	7/19

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 AF(S)09(Z)(B) 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.

Production, use and disposal of the packaging of components and semi-finished intermediates from raw materials extraction up to the factory gate has been included with the assumption as per PSR-0005-ed3-EN- 2023 06 06 “Product Specific Rules for Electrical Switchgear and Control gear Solutions” Section 3.1.5.1.3. Packaging of raw materials and components. An average packaging content of 5% of the mass

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	8/19

of the reference equipment (equipment + packaging) has been considered, broken down as follows: Wood 50%, Cardboard 40%, Low-density polyethylene 10%.

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, {FR} market for Cut-off	Specific Energy model for ABB Chassieu 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 2022 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).

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	9/19

All primary data collected from ABB are from 2022, 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 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 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 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 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 Chassieu production site and includes renewable energy only (Hydroelectric +Solar +Wind +Biogas).

The complete energy mix has been modeled considering the certificate on Guarantee of origins provided to ABB for the year 2022.

Distribution

The transport distances from ABB manufacturing plant to the distribution centers (regional distribution centers / local sales organizations) have been calculated considering the specific 2022 sales mix data for 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]).

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	10/19

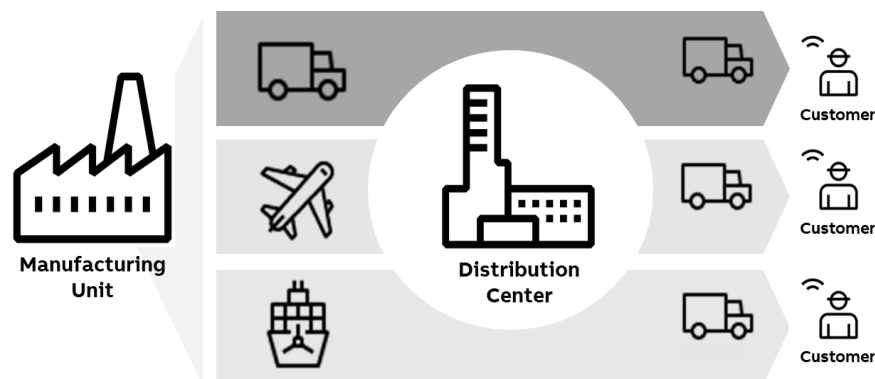


Figure 2: Distribution Methodology

Installation

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

For the disposal of the packaging after installation of the AF Contactor at the end of its life, a transport distance of 1000 km (according to PCR[1]) was assumed. The chosen transportation datasets from Ecoinvent [6].

The actual disposal site is unknown and is managed by the customer.

Use

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

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

Parameters		
I_u	[A]	9-18A
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:

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

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	11/19

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 2022 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.

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	12/19



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).

AF09-30-10

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of Life
GWP-total	kg CO2 eq	1.10E+02	2.74E+00	4.02E-01	2.20E-02	1.07E+02	8.57E-02
GWP-fossil	kg CO2 eq	1.06E+02	2.71E+00	4.02E-01	2.86E-03	1.03E+02	8.47E-02
GWP-biogenic	kg CO2 eq	3.15E+00	2.08E-02	1.15E-04	1.91E-02	3.11E+00	9.48E-04
GWP-luluc	kg CO2 eq	4.77E-01	3.39E-03	5.58E-05	1.31E-06	4.73E-01	6.86E-05
ODP	kg CFC11 eq	1.16E-06	3.61E-08	6.49E-09	6.08E-11	1.11E-06	8.48E-10
AP	mol H+ eq	5.32E-01	4.20E-02	1.86E-03	1.25E-05	4.87E-01	3.99E-04
EP-freshwater	kg P eq	9.30E-02	4.98E-03	8.57E-06	2.41E-07	8.80E-02	1.79E-05
EP-marine	kg N eq	9.83E-02	5.34E-03	7.20E-04	8.17E-06	9.22E-02	1.03E-04
EP-terrestrial	mol N eq	9.19E-01	5.58E-02	7.73E-03	5.10E-05	8.55E-01	9.64E-04
POCP	kg NMVOC eq	2.85E-01	1.60E-02	2.46E-03	1.91E-05	2.66E-01	3.24E-04
ADP-m&m	kg Sb eq	2.21E-03	1.43E-03	2.13E-07	7.34E-09	7.83E-04	9.28E-08
ADP-fossil	MJ	1.53E+03	3.70E+01	5.29E+00	3.96E-02	1.49E+03	8.87E-01
WDP	m3	2.49E+01	1.61E+00	1.12E-02	1.96E-04	2.33E+01	7.03E-03
PENRE	MJ	1.53E+03	3.44E+01	5.29E+00	3.96E-02	1.49E+03	8.87E-01
PENRM	MJ	2.54E+00	2.54E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	1.53E+03	3.70E+01	5.29E+00	3.96E-02	1.49E+03	8.87E-01
PERE	MJ	3.08E+02	4.05E+00	2.61E-02	6.23E-04	3.04E+02	6.78E-02
PERM	MJ	1.74E-01	1.74E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	3.09E+02	4.22E+00	2.61E-02	6.23E-04	3.04E+02	6.78E-02
SM	kg	8.98E-02	8.98E-02	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	1.84E+03	4.12E+01	5.31E+00	4.02E-02	1.79E+03	9.55E-01
FW	m3	1.07E+00	4.46E-02	3.92E-04	7.31E-06	1.03E+00	2.70E-04
HWD	kg	3.59E-03	2.97E-04	3.52E-05	2.43E-07	3.25E-03	3.34E-06
N-HWD	kg	7.98E+00	4.81E-01	6.93E-02	5.83E-03	7.37E+00	5.36E-02
RWD	kg	5.37E-03	6.48E-05	5.46E-07	1.26E-08	5.30E-03	9.78E-07
CfR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MfR	kg	3.19E-01	4.26E-02	0.00E+00	1.49E-02	0.00E+00	2.62E-01
MfER	kg	1.24E-02	8.19E-04	0.00E+00	7.46E-03	0.00E+00	4.08E-03
EN	MJ by energy vector	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Efp	disease inc.	2.59E-06	1.93E-07	8.62E-09	2.84E-10	2.38E-06	7.06E-09
IrHH	kBq U-235 eq	2.12E+01	2.53E-01	2.39E-03	5.22E-05	2.09E+01	3.97E-03
ETX FW	CTUe	2.83E+02	9.17E+01	2.72E+00	3.05E-02	1.88E+02	3.46E-01
HTX CE	CTUh	4.14E-08	7.06E-09	6.03E-11	1.54E-12	3.42E-08	9.08E-11
HTX N-CE	CTUh	1.98E-06	4.41E-07	4.91E-09	5.97E-11	1.53E-06	5.53E-09
IrLS	Pt	2.89E+02	2.26E+01	1.05E+00	4.00E-02	2.65E+02	6.29E-01

Table 7: Impact indicators for AF09-30-10

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	13/19

Impact Category	Unit	Total
Biogenic carbon content of the product	kg	3.0E-03
Biogenic carbon content of the associated packaging	kg	2.9E-02

Table 8: Inventory Flow indicators of AF09-30-10

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 lifecycle

Secondary materials, water and energy resources

SM	Use of secondary materials
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	14/19

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

Others indicators

Efp	Emissions of Fine particles
IrHH	Ionizing radiation, human health
ETX FW	Ecotoxicity, freshwater
HTX CE	Human toxicity, carcinogenic effects
HTX N-CE	Human toxicity, non-carcinogenic effects

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	15/19

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
AF09/12/16(Z)(B)-30-01; AF09/12/16(Z)(B)-30-10; AF09/16(Z)-40-00; AF09/16(Z)-22-00; NF(Z)22E,31E,40E(K)	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
NFZB44E,62E,80E(RT)	0.88	0.88	0.91	0.85	0.53	0.93	0.82	0.81	0.78	0.82	0.73	0.88	0.99
NF(Z)44E,53E,62E,71E,80E	0.93	0.93	0.88	0.93	0.74	1.19	0.98	0.91	0.91	0.94	0.81	0.93	1.06
NF(Z)44E,53E,62E,71E,80EK	1.15	1.16	0.95	1.15	1.06	1.11	1.11	1.15	1.13	1.14	1.13	1.16	1.19
AF09/12/16(Z)BRT; NF(Z)B22E,31E,40E(RT)	1.11	1.11	0.93	1.09	1.04	1.09	1.06	1.09	1.08	1.08	1.05	1.12	1.17
AF09/12/16(Z)-30-22	1.08	1.08	0.86	1.07	1.02	1.05	1.03	1.06	1.04	1.05	1.03	1.08	1.12
AF09(Z)(B)-30-10K; AF09(Z)(B)-30-01K;	0.91	0.91	0.85	0.81	0.66	0.84	0.76	0.81	0.77	0.81	0.67	0.92	0.97
AFS09/12/16(Z)-30-22	0.93	0.93	0.80	0.91	0.72	1.17	0.94	0.88	0.87	0.92	0.76	0.94	1.09

Table 9: Extrapolation factors for AF(S)09/12/16(Z)(B) & NF(Z)(B)22E,31E,40E,44E,62E,80E

Reference product AF09-30-10 –Manufacturing

Contactor	LCA Stage	Factor
AF09/12/16(Z)(B)-30-01; AF09/12/16(Z)(B)-30-10; AF09/16(Z)-40-00; AF09/16(Z)-22-00; NF(Z)22E,31E,40E(K)	Distribution	1.00
NFZB44E,62E,80E(RT)		1.37
NF(Z)44E,53E,62E,71E,80E		1.22
NF(Z)44E,53E,62E,71E,80EK		1.23
AF09/12/16(Z)BRT; NF(Z)B22E,31E,40E(RT)		1.13
AF09/12/16(Z)-30-22		1.19
AF09(Z)(B)-30-10K; AF09(Z)(B)-30-01K;		1.04
AFS09/12/16(Z)-30-22		1.20

Table10: Extrapolation factors AF(S)09/12/16(Z)(B) & NF(Z)(B)22E,31E,40E,44E,62E,80E

Reference product: AF09-30-10 -Distribution.

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	16/19

Product	Main Current [I _{AC-3}]	Number of main poles	Aux Current [I _{AC-15}]	Number of aux poles	Factor
AF09(B)-30-10(RT) AF09(B)-30-01(RT) AF09(B)-40-00(RT) AF09(B)-22-00(RT) NF(B)22E,31E,40E(K)(RT)	9	3	6	1	1.00
AF09Z(B)-30-10(RT) AF09Z(B)-30-01(RT) AF09Z(B)-40-00(RT) AF09Z(B)-22-00(RT) NFZ(B)22E,31E,40E(K)(RT)	9	3	6	1	0.76
AF09Z(B)-30-10(K) AF09Z(B)-30-01(K)	9	3	6	1	0.78
AF12Z(B)-30-10(RT) AF12Z(B)-30-01(RT)	12	3	6	1	0.80
NFZ(B)44E,53E,62E, 71E,80E(K)(RT)	9	0	6	8	0.81
AF12Z(B)-30-10(K) AF12Z(B)-30-01(K)	12	3	6	1	0.82
AF16Z(B)-30-10(RT) AF16Z(B)-30-01(RT)	18	3	6	1	0.85
AF16Z(B)-40-00(RT) AF16Z(B)-22-00(RT)	18	4	6	0	0.88
AF16Z(B)-30-10(K) AF16Z(B)-30-01(K)	18	3	6	1	0.94
AF09(B)-30-10(K) AF09(B)-30-01(K)	9	3	6	1	1.02
AF09(S)-30-22	9	3	6	4	1.04
AF12(B)-30-10(RT) AF12(B)-30-01(RT)	12	3	6	1	1.04
NF(B)44E,53E,62E, 71E,80E(K)(RT)	9	0	6	8	1.05
AF12(B)-30-10(K) AF12(B)-30-01(K)	12	3	6	1	1.06
AF12(S)-30-22	12	3	6	4	1.07
AF16(B)-30-10(RT) AF16(B)-30-01(RT)	18	3	6	1	1.09
AF16(B)-40-00(RT) AF16(B)-22-00(RT)	18	4	6	0	1.12
AF16(S)-30-22	18	3	6	4	1.13
AF16(B)-30-10(K) AF16(B)-30-01(K)	18	3	6	1	1.18

Table 11: Extrapolation factors AF(S)09/12/16(Z)(B) & NF(Z)(B)22E,31E,40E,44E,62E,80E

Reference product: AF09-30-10-Use Phase

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	17/19

EoL

Product	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-minerals &	ADP-fossil	WDP
AF09/12/16(Z)(B)-30-01; AF09/12/16(Z)(B)-30-10 ; AF09/16(Z)-40-00; AF09/16(Z)-22-00; NF(Z)22E,31E,40E(K)	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
NFZB44E,62E,80E(RT)	1.56	1.55	2.87	1.73	1.46	1.68	1.77	1.53	1.56	1.54	1.42	1.59	1.65
NF(Z)44E,53E,62E,71E,80E	1.18	1.17	2.17	1.19	1.20	1.17	1.17	1.20	1.18	1.19	1.21	1.19	1.19
NF(Z)44E,53E,62E,71E,80EK	1.27	1.25	2.35	1.30	1.24	1.28	1.30	1.28	1.25	1.25	1.23	1.27	1.28
AF09/12/16(Z)BRT; NF(Z)B22E,31E,40E(RT)	1.39	1.39	1.69	1.57	1.26	1.51	1.62	1.34	1.38	1.35	1.21	1.41	1.49
AF09/12/16(Z)-30-22	1.14	1.13	2.11	1.13	1.17	1.12	1.11	1.16	1.14	1.15	1.18	1.14	1.14
AF09(Z)(B)-30-10K; AF09(Z)(B)-30-01K;	1.35	1.12	22.09	1.13	1.13	1.14	1.14	1.17	1.13	1.14	1.13	1.13	1.13
AFS09/12/16(Z)-30-22	1.14	1.13	2.14	1.13	1.17	1.13	1.12	1.17	1.15	1.15	1.18	1.15	1.13

Table 12: Extrapolation factors for AF(S)09/12/16(Z)(B) & NF(Z)(B)22E,31E,40E,44E,62E,80E

Reference product: AF09-30-10- 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).

	AF09-30-10
Recyclability potential	92.7%

Table 12: Recyclability potential of AF09-30-10

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	18/19

References

- [1] PEP Ecopassport PCR-ed4-EN-2021 09 06 “Product Category Rules for Electrical, Electronic and HVAC-R Products”
(published: 6th September 2021)
- [2] PEP Ecopassport PSR-0005-ed3-EN-2023 06 06 “Product Specific Rules for Electrical Switchgear and Control gear Solutions” (published: May 2016)
- [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 version 3.9. Swiss, Centre for Life Cycle Inventories, Dübendorf, Switzerland
- [7] PRé Consultants, 2023. Software SimaPro version 9.5.0.1 (www.pre.nl).
- [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
- [10] 2CMT2021-006277- RoHS
- [11] 2CMT2021-006202- REACH
- [12] 1SBD250584E0004-LCA Report

STATUS	SECURITY LEVEL	PEP ECOPASSPORT REG. NUMBER	DOCUMENT ID.	REV.	LANG.	PAGE
Approved	Public	ABBG-00204-V01.01-EN	1SBD250584E3000	A.002	en	19/19