PRODUCT ENVIRONMENTAL PROFILE

Environmental Product Declaration

EF146-150/ EF65-56, EF65-70/ EF96-56, EF96-100
Electronic Overload Relay

EF146-150

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PEP ARE COMPLIANT WITH XP C08-100-1 :2016 OR EN 50693:2019 THE ELEMENTS OF THE PRESENT PEP CANNOT BE COMPARED WITH ELEMENTS FROM ANOTHER PROGRAM.	
DOCUMENT IN COMPLIANCE WITH ISO 14025: 2006 « ENVIRONMENTAL LABELS AND DECLARATIONS. TYPE III ENVIRONMENTAL DECLARATIONS »	

EPD Owner	ABB STOTZ-KONTAKT GmbH Eppelheimer Str. 82, 69123 Heidelberg, Germany. www.abb.com
Manufacturer name and address	ABB Xinhui Low Voltage Switchgear Co., Ltd. Xinhui district, Jiangmen city, Guangdong Province, 529100, P.R. China.
Company contacts	EPD_ELSP@in.abb.com
Reference product	EF146-150 Electronic Overload Relay.
Description of the product	Electronic overload relays offer reliable protection in case of overload and phase-failure. EOL relays are the alternative to thermal overload relays. Motor starters are combinations of overload relays and contactors.
Functional unit	Switch on and off during 20 years electrical power supply of a downstream installation with an electrical control. The functional unit is characterized by a type 3P, control circuit voltage Uc = 24V. Rated voltage of 1000V and rated current of 150A. U = Rated voltage [V]: 1000 In = Rated current [A]: 150 Number of poles: 3 Uc = 24V
Other products covered	Electronic Overload Relays EF65-56, EF65-70, EF96-56, EF96-100
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 (2021), and the corresponding low voltage electricity countries mix
Geographical representativeness	Raw materials & Manufacturing: [Global] Assembly: [China] Distribution / Use: [Global] specific sales mix EoL: [Global]
Technological representa-tiveness	Materials and processes data are specific for the production of EF146-150 Electronic overload relay.
LCA Study	This study is based on the LCA study described in the LCA report 1SAC200231H0001
EPD type	Product Family Declaration
EPD scope	“Cradle to grave”
Year of reported primary data	2021
LCA software	SimaPro 9.3.0.3 (2022)
LCI database	Ecoinvent v3.8 (2021)
LCIA methodology	EN 15804:2012+A2:2019

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 105 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

ABB Xinhui Low Voltage Switchgear Co., Ltd, located in Xinhui District, Jiangmen City, Guangdong Province, the hometown of overseas Chinese. It is a joint venture company of ABB specializing in the production of low-voltage electrical appliances in China. The company mainly produces low voltage molded case circuit breakers (Tmax XT, Tmax and Formula) for power distribution protection and control, ATS automatic transfer switch appliances, Compact/Modular series indicating devices, OT isolating switches, OS isolating switch fuses, PSR/ PSTX series soft starters, EOL electronic overload relays, TOL thermal overload relays, A/AS/AF/AX series contactors, MMS motor protection circuit breakers, etc. In addition to meeting the needs of domestic customers, the products are also exported to markets such as Europe and Asia.

Adhering to the business philosophy of "in China, for China and the world", the company has achieved sustained and rapid development through innovations in product design, production technology and business operations.

The current analysis is performed on the Electronic Overload relays which are a part of Contactors. The main function of the relay is to switch on and off during the service life of 20 years. The contact is used to control the load contactor. The electronic overload relay is self-supplied, which mean no external supply is needed.

EF146-150 Electronic Overload relay product cluster

Electronic overload relays offer reliable protection in case of overload and phase-failure. They are the alternative to thermal overload relays. Motor starters are combinations of overload relays and contactors.

The self-supplied electronic overload relays are three pole electronic/mechanical devices. The motor current flows through build-in current transformers and an evaluation circuit will recognize an overload (over current). This will lead to a release of the relay and a change of the contacts switching position. The contact is used to control the load contactor. The electronic overload relay is self-supplied, which mean no external supply is needed.

Product declared in this LCA includes the following electronic overload relays.

Electronic Overload Relay	EF146-150	EF65-56	EF65-70	EF96-56	EF96-100
Rated voltage [V] (AC)	1000	1000	1000	1000	1000
Rated current [A]	54-150	25-56	25-70	20-56	36-100
Number of Poles	3	3	3	3	3

Table 1: Technical characteristics of Electronic Overload relay.

Reference Product:

The reference product for the LCA of the selected range of Electronic Overload relays is EF146-150A.

Constituent Materials

EF146-150 Electronic Overload Relay

The representative product is EF146-150A which weighs 1010.21g including paper documentation and packaging.

Materials	Name	IEC 62474 MC	[g]	Weight %
Metals	Cu and CU alloys	M-121	379.89	37.6%
	Steel	M-119	189.88	18.8%
	Stainless Steel	M-100	61.67	6.1%
Plastics	Polyamide (PA)	M-258	237.58	23.5%
	Unsaturated polyester (UP)	M-301	4.3	0.4%
	PolyVinylChloride (PVC)	M-200	2.87	0.3%
Others	Paper/ Cardboard	M-341	109.01	10.8%
	Others	N/A	25.01	2.5%
	Total		1010.21	100%

Table 2: Weight of materials EF146-150A

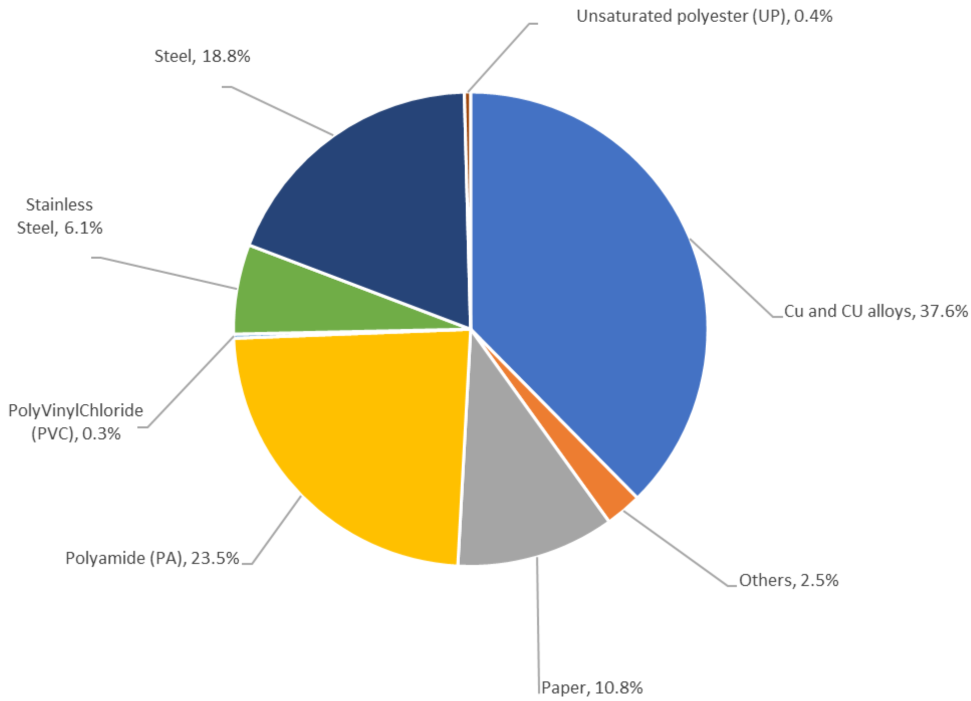

Figure 1: Composition of EF146-150.

Packaging weighs 109g with the following substance composition:

Material	Unit	Total	%
Corrugated Cardboard	g	109	10.7%

Table 3: Weight of packing materials for EF146-150

No cut-off criteria have been applied to the analysis of the product and its packaging. Additional packaging for semifinished products along the supply chain haven't been considered.

LCA background information

Functional unit and Reference Flow

The functional unit is the reference unit used to quantify the performance of the service delivered by a product to the user. The main purpose of the functional unit is to provide a reference to which inputs and outputs are related in the LCA.

Switch on and off during 20 years electrical power supply of a downstream installation with an electrical control.
The functional unit is characterized by a type 3P, control circuit voltage Uc = 24V. Rated voltage of 1000V and rated current of 150A. (refer table 1)

System boundaries and life cycle stages

The life cycle of the Electronic Overload relay, 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
Raw-Material acquisition	Transport to Distributor / Logistic center	Installation	Usage	Deinstallation
Component manufacturing	Transportation to place of use	Transporation of generated packaging waste	Maintainence	Collection and Transport
Assembly		End of life of Packaging waste		EoL Treatement
Packing				
Transportation to manufacturing site				
EOL Treatement of generate 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 2021, 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 climate change: Climate change (total) which includes all greenhouse gases; Climate change (fossil fuels); Climate change (biogenic) which includes the emissions and absorption of biogenic carbon dioxide and biogenic carbon stored in the product; Climate change (land use) - land use and land use transformation. Other indicators as per the PCR[1].

Allocation rules

Allocation coefficients are based on the total labor hours at the facility for electricity, water and total waste generated by the production line.

The total number of hours was considered along with total water, electricity consumption and waste generation for the year (2021) and divided by the labour hours required to produce single EOL relay.

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 the 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.

Application of grease lubricant has been excluded since it is negligible. 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].

Printed circuit boards (PCB) have been modelled with a representative cluster dataset including: every single component, the unpopulated board as well as the surface mounting technology (SMD) process. For some components with no equivalent on ecoinvent database[6], the dataset “Electronic component, passive, unspecified {GLO}| market for | Cut-off, S” was used.

Energy Models

LCA Stage	EN 15804:2012 +A2:2019 module	Energy model	Notes
Raw material extraction and processing	A1-A2	Electricity, {GLO}| market group for | Cut-off	Based on materials and suppliers' locations
Manufacturing	A3	ABB Green Mix	Specific Energy model for ABB Xinhui 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 2021 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 14 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 2021, which was a representative production year. The ecoinvent cut-off by classification system processes [6] are used to represent the LCA model

Due to the large amounts of components in the Relay, raw material inputs have been modelled with data from ecoinvent[6] representing either a Rest of the World [RoW] or Global [GLO] market coverage based on the supplier's location. These datasets are assumed to be representative. Data used in the analysis is not older than 10 years.

Manufacturing stage

The Relays 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.

All the relay's components have been modelled according to their specific raw materials and manufacturing processes.

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 relays 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 EOL Relays. All the semi-finished and ancillary products are produced by ABB's suppliers.

The entire supplier's 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.
In the ABB factory, the different components and subassemblies are assembled into the Electronic Overload Relay. 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 Xinhui production site and includes renewable energy only (Hydroelectric + Solar).

The complete energy mix has been modeled considering the IREC Certificate on energy origins provided to ABB for the year 2021.

Distribution

The transport distances from ABB manufacturing plant to the distribution centers (regional distribution centers / local sales organizations) have been calculated considering the specific 2021 sales mix data for Electronic Overload Relay product cluster (SAP ERP sales data as a source). Additional 1000km has been assumed to cover the last distribution stage to the end customer (usage location).

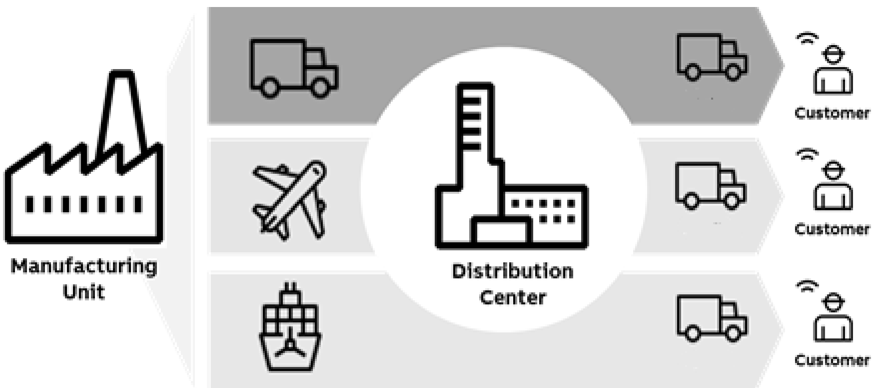

Figure 2: Distribution methodology.

Installation

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

For the disposal of the packaging after installation of the relay at the end of its life, a transport distance of 1000 km (according to PCR [1]) was assumed.
The actual disposal site is unknown and is managed by the customer. The disposal scenario of the packaging was calculated based on Eurostat data.

Use

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

During the use phase, EF146 Electronic Overload relay dissipate some electricity due to power losses. They are calculated according to the data provided in the catalogue of the relay and following the PCR [1] & PSR [2] rules:

Parameters		
Iu	[A]	150
Iu	[%]	50
h/year	[h]	8760
RSL	[years]	20
Time operating coefficient	[%]	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 switch at a given value of current:

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

The above calculations have been performed according to the number of poles (3) on which relevant current flows during use phase.

The Energy model used for this phase has been modeled based on the 2021 actual sales mix data (SAP ERP sales data as a source). From 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]).

Environmental impacts

The following table show the environmental impact indicators of the life cycle of a single EF146-150A Electronic Overload Relay, as indicated by PCR [1] and EN 50693:2019 [3]. The indicators are divided into the contribution of the processes to the different stages (manufacturing, distribution, installation, use and end-of-life).

Impact category	Unit	Total	Manuf	Distr	Install	Use	EoL
GWP-total	kg CO2 eq	7.49E+01	8.16E+00	6.06E+00	5.86E-02	6.02E+01	4.12E-01
GWP-fossil	kg CO2 eq	7.38E+01	8.04E+00	6.06E+00	2.12E-02	5.93E+01	4.06E-01
GWP-biogenic	kg CO2 eq	9.79E-01	1.10E-01	2.04E-03	3.74E-02	8.24E-01	5.38E-03
GWP-luluc	kg CO2 eq	8.49E-02	1.03E-02	3.84E-04	8.15E-06	7.39E-02	3.17E-04
ODP	kg CFC11 eq	4.58E-06	4.24E-07	1.38E-06	4.75E-09	2.75E-06	2.66E-08
AP	mol H+ eq	5.28E-01	2.53E-01	3.13E-02	1.10E-04	2.41E-01	2.30E-03
EP-freshwater	kg P eq	5.87E-02	1.57E-02	8.47E-05	1.60E-06	4.29E-02	1.11E-04
EP-marine	kg N eq	7.51E-02	1.75E-02	1.14E-02	5.40E-05	4.57E-02	4.70E-04
EP-terrestrial	mol N eq	7.45E-01	1.97E-01	1.25E-01	4.07E-04	4.17E-01	4.57E-03
POCP	kg NMVOC eq	2.10E-01	6.03E-02	3.26E-02	1.26E-04	1.16E-01	1.30E-03
ADP-m&m	kg Sb eq	5.14E-03	4.78E-03	1.78E-06	4.91E-08	3.59E-04	3.21E-07
ADP-fossil	MJ	1.11E+03	1.04E+02	8.51E+01	3.24E-01	9.13E+02	4.28E+00
WDP	m3	1.63E+01	5.73E+00	6.95E-02	1.72E-03	1.05E+01	3.44E-02
PENRE	MJ	1.10E+03	9.70E+01	8.51E+01	3.24E-01	9.12E+02	4.28E+00
PENRM	MJ	7.40E+00	7.40E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	1.11E+03	1.04E+02	8.51E+01	3.24E-01	9.12E+02	4.28E+00
PERE	MJ	1.31E+02	1.49E+01	2.84E-01	3.80E-03	1.15E+02	4.04E-01
PERM	MJ	1.87E+00	1.87E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.33E+02	1.68E+01	2.84E-01	3.80E-03	1.15E+02	4.04E-01
SM	kg	3.03E-01	3.03E-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
FW	m3	7.65E-01	1.48E-01	2.63E-03	5.59E-05	6.13E-01	1.50E-03
HWD	kg	1.22E-03	4.04E-04	2.26E-04	7.91E-07	5.88E-04	4.11E-06
N-HWD	kg	6.01E+00	2.14E+00	1.98E-01	3.89E-02	3.46E+00	1.83E-01
RWD	kg	4.47E-03	2.62E-04	6.03E-04	2.13E-06	3.59E-03	1.60E-05
MfR	kg	1.20E+00	1.68E-01	0.00E+00	1.99E-01	0.00E+00	8.33E-01
MfER	kg	3.39E-02	9.90E-03	0.00E+00	1.04E-02	0.00E+00	1.37E-02
Efp	disease inc.	2.11E-06	7.81E-07	7.12E-08	2.48E-09	1.22E-06	3.66E-08
IrHH	kBq U-235 eq	1.55E+01	6.23E-01	3.81E-01	1.53E-03	1.45E+01	2.82E-02
ETX FW	CTUe	2.64E+03	1.78E+03	4.59E+01	3.29E-01	8.11E+02	8.81E+00
HTX CE	CTUh	6.58E-08	4.60E-08	5.79E-10	8.06E-12	1.86E-08	5.50E-10
HTX N-CE	CTUh	3.06E-06	2.38E-06	7.47E-08	3.47E-10	5.75E-07	3.49E-08
IrLS	Pt	2.60E+02	8.37E+01	1.24E+01	3.66E-01	1.61E+02	2.81E+00

Table 7: Impact indicators for EF146-150A Electronic Overload Relay

Impact category	Unit	Total IEC
Biogenic Carbon content of the product	kg	0.00201
Biogenic Carbon content of the associated packaging	kg	0.0197

Table 8: Inventory flow other indicators

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)

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

MfR	Materials for recycling
MfER	Materials for energy recovery

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
IrLS	Impact related to Land use / soil quality

Extrapolation for Homogeneous environmental family

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

EOL RELAY	LCA Phase	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-m&m	ADP-fossil	WDP
EF146-150	Manuf	1	1	1	1	1	1	1	1	1	1	1	1	1
	EoL	1	1	1	1	1	1	1	1	1	1	1	1	1
EF96-100	Manuf	0.93	0.93	0.96	0.91	0.92	0.90	0.89	0.92	0.92	0.92	0.92	0.93	0.91
	EoL	0.86	0.86	0.86	0.83	0.90	0.84	0.82	0.95	0.86	0.86	0.88	0.85	0.84
EF96-56	Manuf	0.98	0.98	1.05	0.98	0.97	1.01	1.03	1.00	1.01	1.01	1.06	0.98	0.98
	EoL	0.97	0.97	0.96	0.96	0.97	0.96	0.96	1.05	0.97	0.97	0.97	0.96	0.96
EF65-56	Manuf	0.97	0.97	1.05	0.97	0.96	1.01	1.02	0.99	1.01	1.00	1.05	0.97	0.97
	EoL	0.97	0.97	0.97	0.96	0.97	0.96	0.96	1.05	0.97	0.97	0.97	0.97	0.96
EF65-70	Manuf	0.98	0.98	1.05	0.97	0.97	1.01	1.03	1.00	1.01	1.01	1.06	0.98	0.98
	EoL	0.97	0.97	0.97	0.96	0.97	0.96	0.96	1.05	0.97	0.97	0.97	0.97	0.96

Table 9: Extrapolation factors for Electronic Overload Relays Reference product: EF146 EOL Relay -Manufacturing / End of Life

EOL Relay	LCA Phase	All
EF65-70	Distr	1.19
EF65-56		1.01
EF96-56		0.92
EF96-100		1.09
EF146-150		1.00

Table 10: Extrapolation factors for Electronic Overload Relays Reference product: EF146 EOL Relay - Distribution Phase.

EOL Relay	LCA Phase	All
EF65-70	USE	0.28
EF65-56		0.20
EF96-56		0.19
EF96-100		0.62
EF146-150		1.00

Table 11: Extrapolation factors for Electronic Overload Relays
Reference product: EF146 EOL Relay – Use Phase

Additional environmental information

According to the waste treatment scenario calculation in SimaPro [7], 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).

	EF146-150A
Recyclability potential	90.6%

Table 12: Recyclability potential of EF146-150A

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-ed2-EN-2016 03 29” - SPECIFIC RULES FOR Electrical switchgear and control gear Solutions (Relays)

[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 v3.8 (2021). ecoinvent database version 3.8 - (https://ecoinvent.org/)

[7] SimaPro Software version 9.3.0.3 - 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