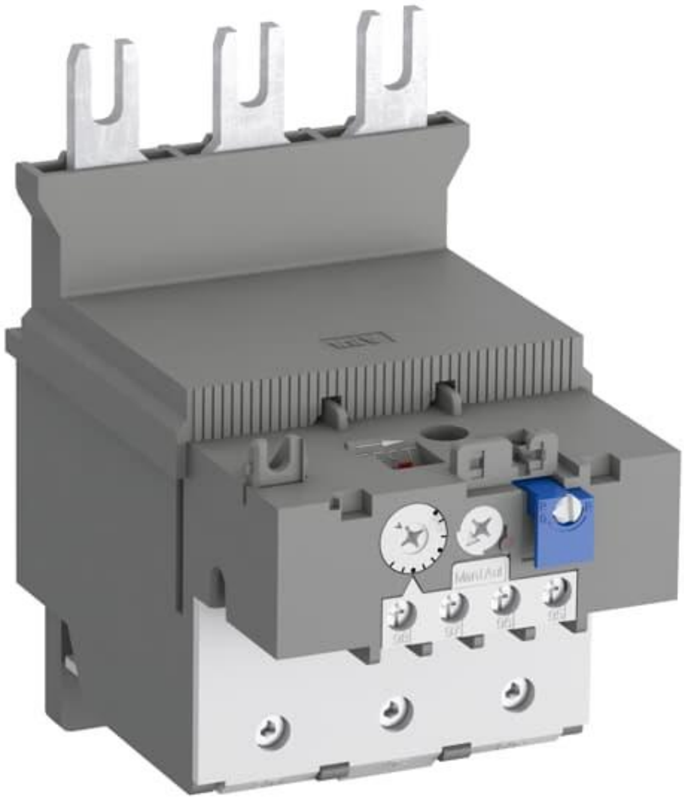
PRODUCT ENVIRONMENTAL PROFILE

Environmental Product Declaration

TF140DU Thermal Overload Relays



TF140DU-142

REGISTRATION NUMBER ABBG-00196-V02.01-EN	IN COMPLIANCE WITH PCR-ED4-EN-2021 09 06 SUPPLEMENTED BY PSR-0005-ED3-EN-2023 06 06
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EPD Owner	ABB STOTZ-KONTAKT GmbH, Eppelheimer Strasse 82 69123 Heidelberg, Germany www.abb.com
Manufacturer name and address	ABB Bulgaria EOOD - Petrich branch 1, Varna str., 2850 Petrich
Company contacts	EPD_ELSP@in.abb.com
Reference product	TF140DU-142 Thermal Overload Relay
Description of the product	The thermal overload relay is an economic electromechanical protection device for the main circuit. It offers reliable and fast protection for motors in the event of overload or phase failure. The device has trip class 10A. The overload relays are connected directly to the block contactors. Single mounting kits are available as accessory.
Functional unit	The functional unit to this study is a single Thermal Overload Relay (Other switchgear and control gear solutions mentioned in the scope e.g. fuses TC32, all-or-nothing relays TC94, measuring relays and protection equipment TC95), on which the general rules of PCR apply and this product is considered a 'Passive product' with non-continuous operation scenario with a reference lifetime of 20 years.
Other products covered	TF140DU-* TF140DU-*-V1000 where * denotes the rated current (e.g. TF140DU-90, TF140DU-90-V1000, …..)
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 (2023), and the corresponding low voltage electricity countries mix
Geographical representativeness	Raw materials & Manufacturing: [Global] Assembly: [Bulgaria] Distribution / Use: [Global] specific sales mix EoL: [Global]
Technological representativeness	Materials and processes data are specific for the production of Thermal Overload Relays
LCA Study	This study is based on the LCA study described in the LCA report 1SAC200271H0001
EPD type	Representative product
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 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’s production unit in Petrich is built in 1996 and the factory has expanded ever since. The city is located in Southwestern Bulgaria. ABB's newest production unit in Petrich built in 2019 manufactures low voltage products. The factory represents ABB's third greenfield investment in Bulgaria and is the company's fifth production unit in the country.

ABB Bulgaria EOOD - Petrich branch have implemented and maintain Quality Management System (QMS), Environmental Management Systems (EMS), Health & Safety Management System (HSMS) and Energy Management System (EnMS), according to the international standards ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 and ISO 50001:2018.

The main activity of the ABB production unit in Petrich focuses on acting as an outsourcing producer for electro-mechanical assemblies, including welding/winding/pressing/ assembling of sub-assemblies for low voltage control products and DIN rail mounted products. Customers of the factory are ABB companies in Western Europe, such as Germany, Switzerland, Czech Republic etc.

TF140DU Product cluster

The TF140DU thermal overload relay is an economic electromechanical protection device for the main circuit. It offers reliable and fast protection for motors in the event of overload or phase failure. The device has trip class 10A. Further features are the temperature compensation, trip contact (NC), signal contact (NO), automatic or manual reset selectable, trip-free mechanism, STOP and Test function and a trip indication. The overload relays are connected directly to the block contactors. Single mounting kits are available as accessory.

Product cluster declared in this PEP includes the following Thermal Overload Relays across a range namely TF140DU and covers variants of this product range.

Thermal Overload Relay	Variants	Rated voltage U_e [V]	Rated current I_e [A]	Number of poles
TF140DU	TF140DU-90	690	90	3
	TF140DU-110	690	110	3
	TF140DU-135	690	135	3
	TF140DU-142	690	142	3
	TF140DU-90-V1000	690	90	3
	TF140DU-110-V1000	690	110	3
	TF140DU-135-V1000	690	135	3
	TF140DU-142-V1000	690	142	3

Table 1: Technical characteristics of TF140DU Thermal Overload Relays
(Refer Technical catalogue for complete details).

Constituent Materials

TF140DU-142

The representative products, TF140DU-142 weighs about 0.95kg including its, paper documentation and packaging.

Materials	Name	IEC 62474 MC	[g]	Weight %
Metals	Cu and CU alloys	M-121	319.96	33.6%
	Steel	M-119	69.63	7.3%
	Stainless Steel	M-100	61.53	6.5%
Plastics	Unsaturated Polyester	M-301	309.02	32.5%
	Polyamide (PA)	M-258	92.00	9.7%
	Polycarbonate (PC)	M-254	11.46	1.2%
	Polyethylene (PE)	M-251	2.77	0.3%
Others	Paper	M-341	84.99	8.9%
	Ceramics	M-160	0.34	<0.1%
Total			**951.69**	**100.0%**

Table 2: Weight of materials TF140DU-142

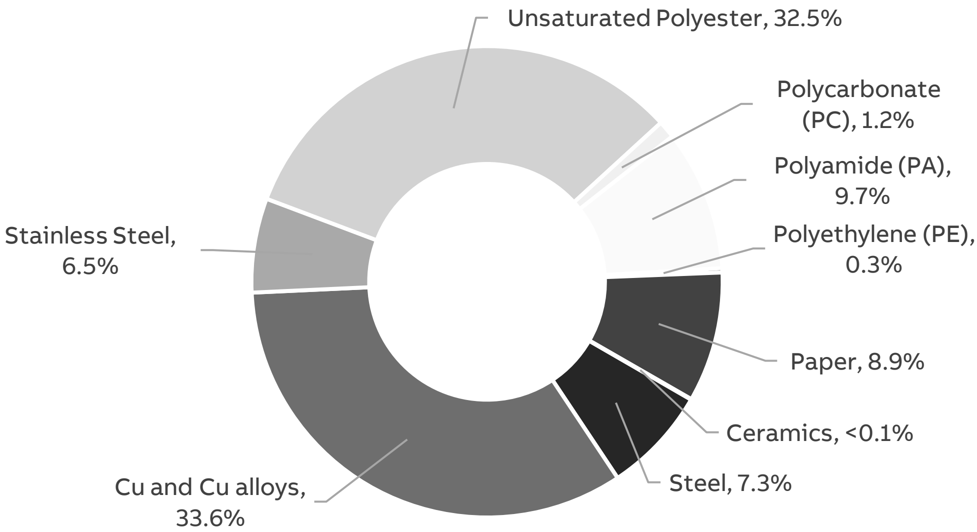

Figure 1: Composition of TF140DU-142

Packaging for TF140DU-142 weight the following substance composition.

Materials	Unit	TF140DU-142
Corrugated Cardboard	g	63.8

Table 3: Weight of materials for TF140DU-142 Packaging

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.

The functional unit to this study is a single Thermal Overload Relay (Other switchgear and control gear solutions mentioned in the scope e.g. fuses TC32, all-or-nothing relays TC94, measuring relays and protection equipment TC95), on which the general rules of PCR apply and this product is considered a ‘Passive product’ with non-continuous operation scenario for a reference lifetime of 20 years.

The Reference Flow of the study is a single Thermal Overload Relay (including its packaging and accessories) with mass described in table 3.

System boundaries and life cycle stages

The life cycle of the Thermal 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.

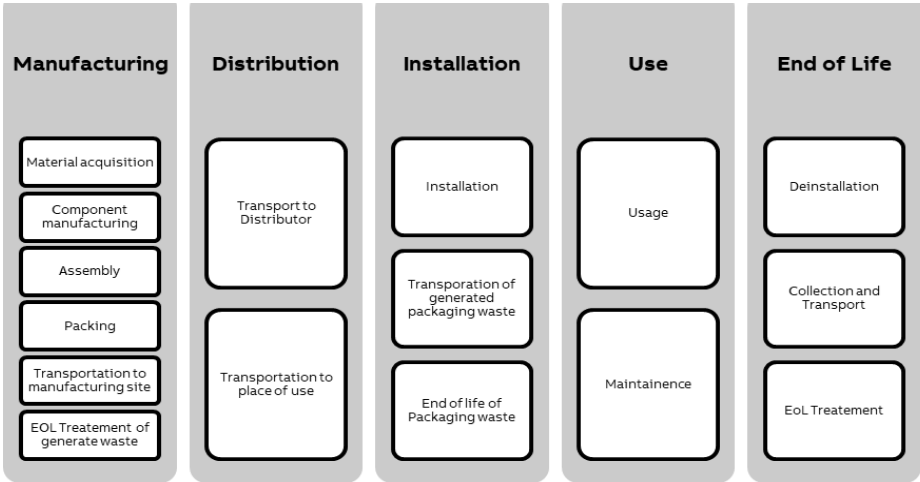

Table 4: Phases for the evaluation of construction products according to EN50693:2019 [3].

Temporal and geographical boundaries

The ABB component suppliers are sourced all over the world. All primary data collected from ABB 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 PEP, 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

An allocation key is used for consumptions related to the manufacturing process in the production site, as well for company waste. Since the factory produces several products (different Fusegear and Contactor products) only a part of the environmental impact has been allocated to the Thermal Overload Relay production line.

All these flows have been allocated and divided by the total number of Thermal Overload Relays produced in 2023.

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 assuming no specific data available (PCR-ed4-EN-2021_09_06, ch 2.5.3). 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, {RoW}| market group for | Cut-off Electricity, {GLO}| market group for | Cut-off	Based on materials and supplier's locations
Manufacturing	A3	ABB Green Mix Low Voltage	Specific Energy model for ABB 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

Inventory analysis

In this PEP, 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 and Windchill ERP were used. They are a list of all the components and assemblies that constitute the finished product, organized by hierarchy level. Each item is matched with its code, quantity, weight and supplier. The BOMs were then processed, adding material, surface area, volume and weight data, taken from technical drawings/datasheets. 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 cut-off by classification system processes [6] are used to represent the LCA model
To improve both the inventory and modelling phase of the product, a specific modular dataset framework has been adopted. Raw materials and Manufacturing processes datasets from Ecoinvent database [6] have been clustered and listed inside two distinct mater data tables ABB Raw Materials and ABB Materials & Processes. Data used in the analysis is not older than 10 years.

Manufacturing stage

The Thermal Overload 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 Thermal Overload Relay 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 unpackaged product from supplier, sorts, packs and delivers to the customer according to the orders.

Most of the inputs to the products' manufacturing stage are already produced component parts from the supply chain.

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 facility have been calculated.

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

The complete energy mix has been modelled considering the documents on energy 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 TF/TA product cluster (SAP ERP sales data as a source).

The other parameter affecting the environmental impact for this LCA stage is the total mass of the product (including its packaging). Different mass values for each specific configuration covered by this study have been considered in the model.

As per PSR, additional distance of 1000km is considered to account for the last mile delivery distance

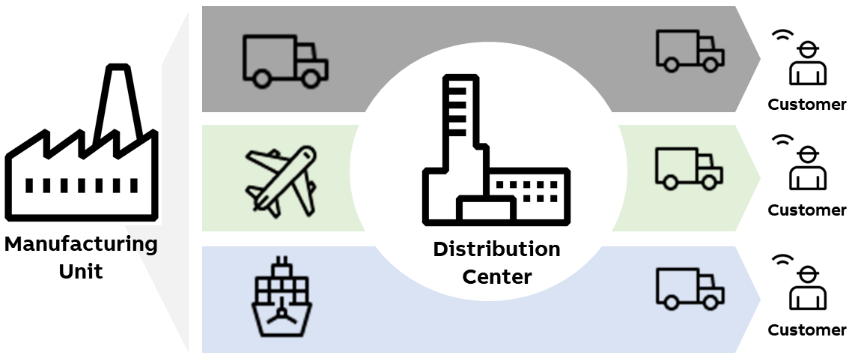

Figure 2: Distribution methodology.

Installation

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

For the disposal of the packaging after installation of the product 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 the Eurostat data available.

Use

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

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

Parameters		
Iu	[A]	200
Load Rate	[%]	30
h/year	[h]	8760
RSL	[years]	20
Time operating coefficient	[%]	30

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:

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

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 was built based on the 2023 actual sales mix data for the specific Thermal Overload Relay product (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

TF140DU-142

The following table show the environmental impact indicators of the life cycle of a TA140DU-142 Thermal 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	Manufac-turing	Distribu-tion	Installa-tion	Use	End of Life
GWP-total	kg CO2 eq	4.94E+01	6.89E+00	2.74E+00	5.56E-02	3.93E+01	3.99E-01
GWP-fossil	kg CO2 eq	4.85E+01	6.87E+00	2.73E+00	1.52E-02	3.84E+01	3.87E-01
GWP-biogenic	kg CO2 eq	9.18E-01	1.83E-02	8.42E-04	4.03E-02	8.46E-01	1.22E-02
GWP-luluc	kg CO2 eq	6.60E-02	8.96E-03	3.94E-04	4.32E-06	5.63E-02	3.27E-04
ODP	kg CFC11-eq	9.31E-07	2.93E-07	4.47E-08	2.37E-09	5.70E-07	2.00E-08
AP	mol H+ eq	3.57E-01	1.78E-01	1.20E-02	5.96E-05	1.65E-01	1.95E-03
EP-freshwater	kg P eq	3.15E-02	1.39E-02	6.24E-05	9.12E-07	1.74E-02	9.22E-05
EP-marine	kg N eq	4.73E-02	1.39E-02	4.74E-03	3.83E-05	2.76E-02	1.02E-03
EP-terrestrial	mol N eq	4.95E-01	1.65E-01	5.08E-02	2.23E-04	2.75E-01	4.08E-03
POCP	kg NMVOC eq	1.72E-01	4.88E-02	1.64E-02	6.97E-05	1.05E-01	1.22E-03
ADP-m&m	kg Sb eq	4.91E-03	4.61E-03	1.63E-06	2.54E-08	3.03E-04	2.66E-07
ADP-fossil	MJ	7.41E+02	1.01E+02	3.61E+01	1.68E-01	6.00E+02	3.79E+00
WDP	m3 of equiv. depriv.	1.34E+01	3.52E+00	8.02E-02	1.18E-03	9.81E+00	3.48E-02
PENRE	MJ	7.32E+02	9.25E+01	3.61E+01	1.68E-01	6.00E+02	3.79E+00
PENRM	MJ	8.45E+00	8.45E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	7.41E+02	1.01E+02	3.61E+01	1.68E-01	6.00E+02	3.79E+00
PERE	MJ	1.10E+02	1.76E+01	1.90E-01	2.09E-03	9.21E+01	3.51E-01
PERM	MJ	7.53E-01	7.53E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.11E+02	1.83E+01	1.90E-01	2.09E-03	9.21E+01	3.51E-01
SM	kg	1.95E-01	1.95E-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	8.52E+02	1.19E+02	3.63E+01	1.70E-01	6.92E+02	4.14E+00
FW	m3	4.34E-01	1.25E-01	2.79E-03	3.84E-05	3.05E-01	1.33E-03
HWD	kg	2.62E-03	4.83E-04	2.41E-04	4.33E-07	1.89E-03	6.83E-06
N-HWD	kg	5.35E+00	2.07E+00	5.73E-01	3.18E-02	2.22E+00	4.53E-01
RWD	kg	1.98E-03	1.88E-04	3.99E-06	1.06E-06	1.78E-03	1.30E-05
CfR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MfR	kg	7.56E-01	1.33E-01	0.00E+00	7.75E-02	0.00E+00	5.45E-01
MfER	kg	3.58E-02	0.00E+00	0.00E+00	1.71E-02	0.00E+00	1.86E-02
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.	1.65E-06	6.24E-07	6.57E-08	1.29E-09	9.23E-07	3.20E-08
IrHH	kBq U-235 eq	8.28E+00	6.87E-01	1.74E-02	7.71E-04	7.55E+00	2.45E-02
ETX FW	CTUe	2.99E+02	1.90E+02	1.86E+01	1.88E-01	8.75E+01	1.79E+00
HTX CE	CTUh	4.93E-08	3.55E-08	4.29E-10	5.04E-12	1.28E-08	4.64E-10
HTX N-CE	CTUh	4.17E-06	3.61E-06	3.37E-08	2.25E-10	5.00E-07	2.89E-08
IrLS	Pt	1.95E+02	8.35E+01	8.28E+00	1.91E-01	1.01E+02	2.66E+00

Table 7: Impact indicators for TF140DU-142

Impact category	Unit	TF140DU-142
Biogenic Carbon content of the product	kg	5.36E-03
Biogenic Carbon content of the associated packaging	kg	1.28E-02

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

PERE	Use of renewable primary energy excluding 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)
PENRE	Use of non-renewable primary energy excluding non-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)
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
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

Other 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

This LCA covers different build configurations in addition to the representative product. All the analyzed configurations have the same main functionality, product standards and manufacturing technology. A sensitivity analysis has been conducted to identify the influential parameters that affect the environmental footprint of the product.

As the variants have almost similar construction as compared to the reference product, their weights are equal to the Reference product weights. Hence the Manufacturing, Distribution, Installation & End of Life impacts can be considered to be same as that of the Reference product (Results in Table 7). The Use phase extrapolation factors are mentioned below:

Use

Product	Current In [A]	LCA Stage	Factor
TF140DU-90	90	Use Phase	0.85
TF140DU-110	110		0.89
TF140DU-135	135		1.13
TF140DU-142	142		1.00
TF140DU-90-V1000	90		0.85
TF140DU-110-V1000	110		0.89
TF140DU-135-V1000	135		1.13
TF140DU-142-V1000	142		1.00

Table 9: Extrapolation factors for TF140DU -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).

	TF140DU-142
Recyclability potential	61.1%

Table 10: Recyclability potential of TF140DU-142

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-EN-2023 06 06" - SPECIFIC RULES FOR Electrical switchgear and control gear Solutions (Circuit breakers)

[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