PRODUCT ENVIRONMENTAL PROFILE

Environmental Product Declaration

ABB Thermal Overload Relays TF42

REGISTRATION NUMBER ABBG-00393-V01.03-EN	IN COMPLIANCE WITH PCR-ED4-EN-2021 09 06 SUPPLEMENTED BY PSR-0005-ED3-EN-2023 06 06
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INTERNAL ☐	EXTERNAL ☒
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PEP ARE COMPLIANT WITH XP C08-100-1 :2016 OR EN 50693:2019 THE ELEMENTS OF THE PRESENT PEP MAY NOT BE COMPARED WITH ELEMENTS FROM ANY ANOTHER 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 contacts	EPD_ELSP@in.abb.com
Reference product	ABB Thermal Overload Relays TF42-4.2
Description of the product	Thermal overload relays are economic electromechanical protection devices for the main circuit. They are used mainly to protect motors against overload and phase failures. Starter combinations are setup together with contactors
Functional unit	The function unit is to protect against over current and phase failures with bimetal tripping element characterised by the composition of the poles Np, a rated voltage of Ue and a rated current Ie for industrial application during the reference service life of the product of 20 years.
Other products covered	**TF42** followed by **-*** or **-*B** with ***** equal to the rated current (e.g. TF42-16, TF42-16B, ...)
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: [Germany] Distribution / Use: [Global] specific sales mix EoL: [Global]
Technological representativeness	Materials and processes data are specific to the production of TF42 Thermal Overload Relays
LCA Study	This study is based on the LCA study described in the LCA report 1SAC200374H0001
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 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

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 Manual Motor Starters, Overload relays, Mini Contactors, Installation Contactors, Time Relays, Monitoring Relays, Motor Controller, Power Supplies, Interface Products and Safety Products.

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

The current analysis is performed on the Thermal 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. In case of an overload or phase failure, the contact is used to control the load contactor.

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.

TF42 Thermal overload relays product cluster

Thermal overload relays are economical electromechanical protection devices for the main circuit. They offer reliable protection for motors in the event of overload or phase failure. Motor starters are combinations of overload relays and contactors.
The thermal overload relays are three pole relays with bimetal tripping elements. The motor current flows through the bimetal tripping elements and heats them directly and indirectly. In case of an overload (overcurrent), the bimetal element bend because of the heating. This leads to a release of the relay and a change of the contacts switching position.

Reference Product:

The reference product for the LCA of the complete range of TF42 Thermal overload Relays is TF42-4.2

TF42 product rating:

TF42 Thermal overload Relays	Rated operating current [I_e]	Number of poles [N_p]	Rated operating voltage [U_e]
TF42-0.13/TF-0.13B	0.10-0.13A	3	690 V AC 600 V DC
TF42-0.17/TF-0.17B	0.13-0.17A		
TF42-0.23/TF-0.23B	0.17-0.23A		
TF42-0.31/TF-0.31B	0.23-0.31A		
TF42-0.41/TF-0.41B	0.31-0.41A		
TF42-0.55/TF-0.55B	0.41-0.55A		
TF42-0.74/TF-0.74B	0.55-0.74A		
TF42-1.0/TF-1.0B	0.74-1.00A		
TF42-1.3/TF-1.3B	1.00-1.30A		
TF42-1.7/TF-1.7B	1.30-1.70A		
TF42-2.3/TF-2.3B	1.70-2.30A		
TF42-3.1/TF-3.1B	2.30-3.10A		
TF42-4.2/TF-4.2B	3.10-4.20A		
TF42-5.7/TF-5.7B	4.20-5.70A		
TF42-7.6/TF-7.6B	5.70-7.60A		
TF42-10/TF-10B	7.60-10.00A		
TF42-13/TF-13B	10.00-13.00A		
TF42-16/TF-16B	13.00-16.00A		
TF42-20/TF-20B	16.00-20.00A		
TF42-24/TF-24B	20.00-24.00A		
TF42-29/TF-29B	24.00-29.00A		
TF42-35/TF-35B	29.00-35.00A		
TF42-38/TF-38B	35.00-40.00A		

Table 1: Technical characteristics of Thermal overload relays
(Refer Technical catalogue for complete details)

Constituent Materials

TF42-4.2 Thermal Overload Relays

TF42-4.2 Thermal Overload relays weighs 166g including its paper documentation and packaging.

TF42-4.2 Thermal overload relays				
Materials	**Name**	**IEC 62474 MC**	**[g]**	**Weight %**
Metals	Steel	M-119	41.2	24.8%
	Cu and Cu Alloys	M-121	26.3	15.8%
	Stainless Steel	M-100	0.5	0.3%
Plastics	Polybutylene Terephthalate	M-258	44.1	26.5%
	Polyamide	M-251	25.1	15.1%
	Polycarbonate	M-254	0.6	0.4%
	Unsaturated Polyester	M-252	0.3	0.2%
	Polyethylene	M-251	0.2	0.1%
	Polypropylene	M-252	0.2	0.1%
Others	Cardboard/Paper		27.6	16.6%
Total			**166.2**	**100%**

Table 2: Weight of materials TF42-4.2 Thermal overload relays

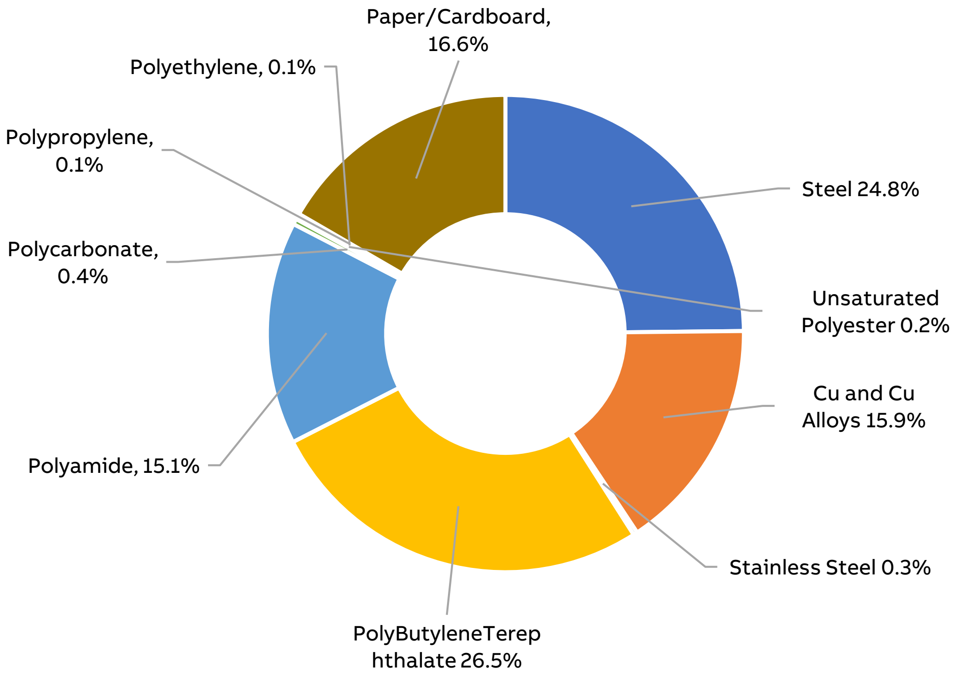

Figure 1: Composition of TF42-4.2 Thermal Overload Relays

The following tables shows the packaging weights for Thermal Overload Relay

Material weight (g)	TF42-4.2
Corrugated Cardboard	19.3

Table 3: Weight of materials TF42-4.2 – Packaging

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.

The function unit is to protect against over current and phase failures with bimetal tripping element characterised by the composition of the poles Np, a rated voltage of Ue and a rated current Ie for industrial application during the reference service life of the product of 20 years.

The Reference Flow of the study is a Thermal overload relays (including its packaging and accessories).

System boundaries and life cycle stages

The life cycle of the Thermal overload relays, 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.

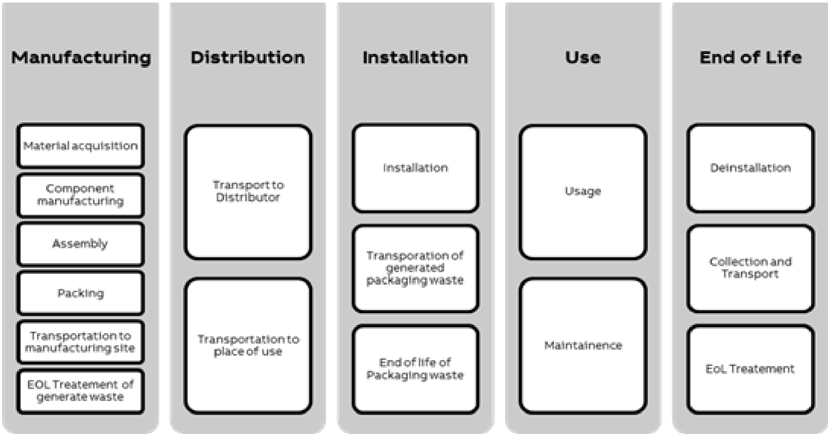

Table 4: Phases for the evaluation of construction products according to EN50693:2019 [3].

Temporal and geographical boundaries

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

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 Thermal overload relays line's occupancy area for electricity apart from assembly processes, the whole production line is temperature-regulated throughout the year. The allocation of the total amount of waste generated and water used by the production line is also based on the same criterion.

All these flows have been allocated and divided by the total number of Thermal Overload relays produced in 2022.

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, because 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's locations
Manufacturing	A3	ABB Heidelberg Electricity Mix	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 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 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 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 2022, 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. All the Thermal overload 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 product 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 Thermal overload 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 specific distances from the last subassembly suppliers' factories up to the ABB manufacturing facility have been calculated.

In the ABB factory, the different components and subassemblies are assembled into the Manual Motor Starter. 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 Vaasa production site and includes renewable energy only (Hydro + Solar).
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 total products sales mix data from 2022 (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.

An additional 1000 km distance by road has been considered to cover the last distribution stage to the end customer (usage location).

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

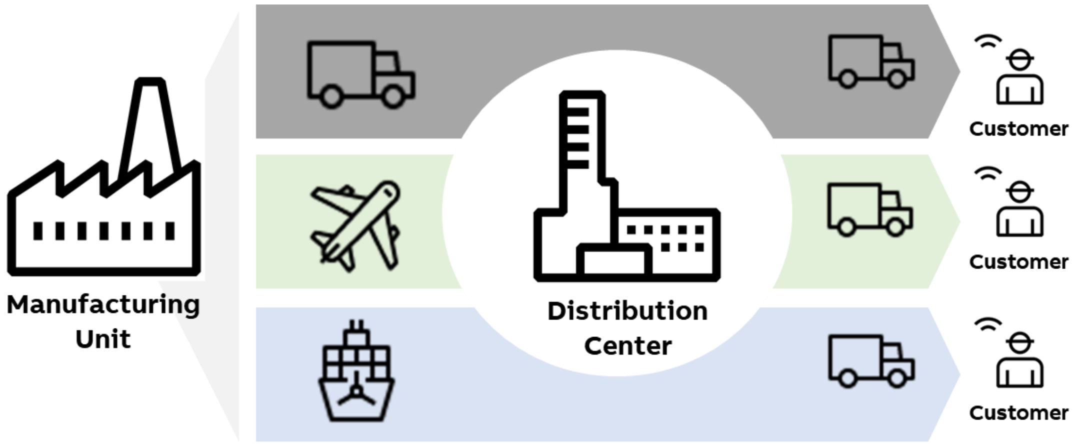

Figure 2: Distribution methodology.

Installation

The installation phase only implies manual activities, and no energy is consumed. This phase also includes the disposal of the packaging of 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 latest Eurostat data (EU-27) available.

Use

During the use phase, Thermal overload relays dissipate some electricity due to power losses. The respective energy for each specific configuration of the entire product family has been calculated according to the data provided in the catalogue of the Thermal overload relays and following the PCR [1] & PSR [2] rules

Parameters		TF42-4.2
Iu	[A]	4.2
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 thermal overload relay 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 2022 actual sales mix data for the entire TF42-4.2 product range (SAP ERP sales data as a source). This approach has been taken since this list of countries will be the most representative also for the other products listed in the extrapolation tables.

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 Thermal overload relays, 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	Manufacturing	Distribution	Installation	Use	End of Life
GWP-total	kg CO2 eq	1.46E+01	8.85E-01	5.55E-01	3.11E-02	1.31E+01	4.91E-02
GWP-fossil	kg CO2 eq	1.42E+01	8.79E-01	5.55E-01	2.92E-03	1.28E+01	4.59E-02
GWP-biogenic	kg CO2 eq	3.07E-01	-1.68E-03	1.31E-04	2.82E-02	2.78E-01	3.19E-03
GWP-luluc	kg CO2 eq	4.53E-02	7.17E-03	5.56E-05	1.37E-06	3.81E-02	3.21E-05
ODP	kg CFC11 eq	8.11E-07	6.23E-07	8.69E-09	6.35E-11	1.79E-07	4.41E-10
AP	mol H+ eq	6.38E-02	1.20E-02	2.43E-03	1.23E-05	4.91E-02	1.94E-04
EP-freshwater	kg P eq	8.05E-03	9.38E-04	9.17E-06	2.14E-07	7.09E-03	8.30E-06
EP-marine	kg N eq	1.14E-02	1.34E-03	9.72E-04	7.47E-06	8.94E-03	1.40E-04
EP-terrestrial	mol N eq	1.10E-01	1.33E-02	1.04E-02	4.93E-05	8.62E-02	4.83E-04
POCP	kg NMVOC eq	3.98E-02	4.28E-03	3.29E-03	1.90E-05	3.20E-02	1.65E-04
ADP-m&m	kg Sb eq	2.27E-04	1.23E-04	1.78E-07	7.69E-09	1.04E-04	4.84E-08
ADP-fossil	MJ	2.20E+02	1.31E+01	7.25E+00	4.15E-02	1.99E+02	4.41E-01
WDP	m3	3.52E+00	4.55E-01	1.34E-02	2.76E-04	3.05E+00	3.90E-03
PENRE	MJ	2.19E+02	1.24E+01	7.25E+00	4.15E-02	1.99E+02	4.41E-01
PENRM	MJ	6.53E-01	6.53E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.20E+02	1.31E+01	7.25E+00	4.15E-02	1.99E+02	4.41E-01
PERE	MJ	3.65E+01	2.21E+00	2.81E-02	6.43E-04	3.43E+01	3.14E-02
PERM	MJ	2.28E-01	2.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	3.68E+01	2.44E+00	2.81E-02	6.43E-04	3.43E+01	3.14E-02
SM	kg	3.23E-02	3.23E-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	2.56E+02	1.55E+01	7.28E+00	4.21E-02	2.33E+02	4.72E-01
FW	m3	1.33E-01	1.48E-02	4.74E-04	9.05E-06	1.18E-01	1.42E-04
HWD	kg	6.82E-04	6.34E-05	4.88E-05	2.56E-07	5.68E-04	1.74E-06
N-HWD	kg	1.18E+00	2.56E-01	3.85E-02	5.16E-03	8.14E-01	6.86E-02
RWD	kg	6.97E-04	2.35E-05	5.94E-07	1.32E-08	6.72E-04	4.51E-07
CfR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MfR	kg	1.49E-01	1.76E-02	0.00E+00	3.52E-02	0.00E+00	9.60E-02
MfER	kg	5.16E-03	0.00E+00	0.00E+00	1.83E-03	0.00E+00	3.32E-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.	3.43E-07	5.78E-08	7.62E-09	2.92E-10	2.74E-07	3.49E-09
IrHH	kBq U-235 eq	2.88E+00	8.99E-02	2.65E-03	5.45E-05	2.79E+00	1.83E-03
ETX FW	CTUe	3.77E+01	1.12E+01	3.73E+00	3.14E-02	2.25E+01	1.87E-01
HTX CE	CTUh	7.54E-09	3.39E-09	6.69E-11	1.39E-12	4.03E-09	4.31E-11
HTX N-CE	CTUh	3.13E-07	1.31E-07	6.76E-09	5.04E-11	1.73E-07	2.52E-09
IrLS	Pt	4.11E+01	7.62E+00	8.23E-01	4.22E-02	3.23E+01	3.40E-01

Table 7: Impact indicators for TF42-4.2 Thermal Overload Relay

Impact category	Unit	TF42-4.2
Biogenic Carbon content of the product	kg	4.20E-03
Biogenic Carbon content of the associated packaging	kg	3.84E-03

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

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

Table 8: Inventory flow other indicators

Extrapolation for Homogeneous environmental family

All the analyzed configurations have the same main functionality, product standards and manufacturing technology.
As a result, the impacts of 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 TF42 only use phase impacts are different between the products. In the following table, use phase factor has been shown for TF42 variants.

Product	LCA Phase	Factor
TF42-0.13/TF-0.13B, TF42-0.17/TF- 0.17B, TF42-1.3/TF-1.3B, TF42-1.7/TF-1.7B, TF42-2.3/TF-2.3B, TF42-3.1/TF-3.1B, TF42-4.2/TF- 4.2B, TF42-7.6/TF-7.6B	Use	1.0
TF42-0.41/TF-0.41B, TF42-0.55/TF-0.55B, TF42-1.0/TF-1.0B, TF42-5.7/TF-5.7B, TF42-10/TF-10B		1.06
TF42-0.23/TF-0.23B, TF42-0.31/TF-0.31 B, TF42-0.74/TF-0.74 B, TF42-16/TF- 16B		1.11
TF42-13/TF- 13B		1.22
TF42-20/TF-20B		1.39
TF42-24/TF-24B, TF42-29/TF-29B		1.44
TF42-35/TF- 35B, TF42-38/TF- 38B		1.56

Table 9 Extrapolation factors for Thermal Overload Relays

Reference product: TF42-4.2 Thermal overload 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).

Product	Recyclability potential
TF42-4.2	65%

Table 10: Recyclability potential of Thermal overload relays

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

[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