PRODUCT ENVIRONMENTAL PROFILE

Environmental Product Declaration

TMAX XT XT5 THERMOMAGNETIC

Production site: Frosinone, Italy
December 2025

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PEP ARE COMPLIANT WITH XP C08-100-1 :2016 AND EN 50693:2019 THE COMPONENTS OF THE PRESENT PEP MAYNOT BE COMPARED WITH COMPONENTS FROM ANY OTHER PROGRAM.	
DOCUMENT IN COMPLIANCE WITH ISO 14025: 2006 « ENVIRONMENTAL LABELS AND DECLARATIONS. TYPE III ENVIRONMENTAL DECLARATIONS »	

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Manufacturer name and address	ABB S.p.A. Via E. Fermi 40 - 03100 Frosinone (FR) - Italy
Company contacts	EPD_ELSP@in.abb.com
Reference product	XT5 3P 400A circuit breaker IEC fixed version equipped with Thermal magnetic trip unit
Description of the product	ABB's new Tmax XT series of Molded Case circuit-breakers, combine the finest protection that has always characterized ABB's molded case circuit breakers with the most precise metering and connectivity functionalities, providing designers, installers and end-users exclusive solutions for their daily needs. Suitable for applications from 160 A to 1600 A, the Tmax XT offers exceptional breaking capacity for all voltages and applications.
Functional unit	The functional unit is to protect the installation from overloads and short circuits in a circuit with rated voltage 690V, rated current 400A, with 3 poles, a rated breaking capacity Icu 40kA, and the tripping curve L, I in the Industrial application area during the reference service life of the product of 20 years.
Other products covered	XT5 Fixed Circuit Breakers of types N/S/H/L/V/X (both IEC & UL type) and ratings 300A to 630A / 3poles /4poles with Thermal magnetic trip unit with optional LSC accessory.
Reference lifetime	20 years
Product category	Electrical, Electronic and HVAC-R Products (Circuit-breakers family)
Use Scenario	The use phase has been modelled based on the sales mix data (2024), and the corresponding low voltage electricity countries mix.
Geographical representativeness	Raw materials & Manufacturing: [Europe / Global] Assembly: [Italy] Distribution / Use: [Global] specific sales mix EoL: [Global]
Technological representativeness	Materials and processes data are specific to the production of XT5 circuit breaker
LCA Study	This study is based on the LCA study described in the LCA report 1SDH002225A1001.
EPD type	Products family declaration
EPD scope	"Cradle to grave"
Year of reported primary data	2024
LCA software	SimaPro 10.2.0.3 (2025)
LCI database	Ecoinvent v3.10 (2024) and Carbon Minds V2.01 (2024)
LCIA methodology	EN 15804:2019+A2 and EF 3.1

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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 Frosinone factory represents a centre of excellence in ABB for the development and manufacture of low-voltage circuit breakers. The 150,000 square-meter facility with 800 employees is highly automated and produces more than three million circuit breakers every year. A Lighthouse Plant, selected by the Italian government as a model for digital transformation and Industry 4.0 strategies, Frosinone promotes smart, digitalized, and connected operations, increasing efficiency across the full value chain. Achieving zero production waste to landfill was a whole-factory program. Flexibility, lean production processes, capacity to efficiently and rapidly meet market demands, and process innovation are some of the most significant characteristics of this site.

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

- ISO 9001:2015 - Quality Management Systems – Requirements
- ISO 14001:2015 - Environmental management systems – Specification with guidance for use
- ISO 45001:2018 - Occupational Health and Safety Assessment Series – Requirements
- ISO 50001:2018 - Energy Management System
- SA 8000:2014 - Social Accountability 8000 – SA 8000

ABB offers a wide range of low voltage Circuit Breakers for any application, also distribution. The primary scope of Low Voltage Circuit Breakers is to isolate parts of an electrical distribution system in the event of abnormal conditions.

In the factory, the different components and subassemblies are assembled on the manufacturing line. All components and subassemblies are produced by ABB's suppliers and are only assembled in the factory.

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Tmax XT XT5 product cluster

ABB's new Tmax XT series of Molded Case circuit-breakers, combine the finest protection that has always characterized ABB's molded case circuit breakers with the most precise metering and connectivity functionalities, providing designers, installers and end-users exclusive solutions for their daily needs. Suitable for applications from 160 A to 1600 A, the Tmax XT offers exceptional breaking capacity for all voltages and applications. Combined with high-precision electronic relays of the smallest sizes, the new series protects equipment investments and ensures uninterrupted operation and high availability. Product cluster XT5 analyzed in this LCA includes both IEC and UL types

- **XT5 product ratings**

Circuit breaker	XT5 IEC Type	XT5 UL Type
Rated voltage U [V]	690	600
Rated current In [A]	400/630	400/600
Rated short circuit breaking current Icu [kA]	200	200
Number of poles	3/4	3/4

Table 1: Technical characteristics of XT5 circuit breakers
(Refer Technical catalogue for complete details).

Constituent Materials

XT5 Circuit Breaker with Thermal Magnetic Trip Unit

The representative product is XT5 3p IEC N/S/H/L TMA 400A Fixed Circuit Breaker, which weighs 4.92 kg including its installed accessories, paper documentation and packaging.

Materials	Name	IEC 62474 MC	[g]	Weight %
Metals	Steel	M-119	1337.7	27.2%
	Cu and Cu Alloys	M-121	585.5	11.9%
	Stainless Steel	M-100	320.2	6.5%
	Precious Metals	M-159	15.6	0.3%
	Aluminium	M-120	2.1	<0.1%
Plastics	Unsaturated Polyester	M-301	1426.5	29.0%
	Polycarbonate	M-254	355.6	7.2%
	Polyamide	M-258	126.4	2.6%
	Polyethylene	M-251	105.8	2.1%
	Elastomer	M-32	52.4	1.1%
	PBT	M-261	48.8	1.0%
	ABS	M-256	23.0	0.5%
	Polyarylamide	M-272	13.9	0.3%
	PVC	M-250	0.3	<0.1%
	PET	M-259	0.1	<0.1%
Others	Paper/Cardboard	M-341	506.5	10.3%
Total			4920.4	100.0%

Table 2: Weight of materials XT5 3p IEC N/S/H/L TMA 400A

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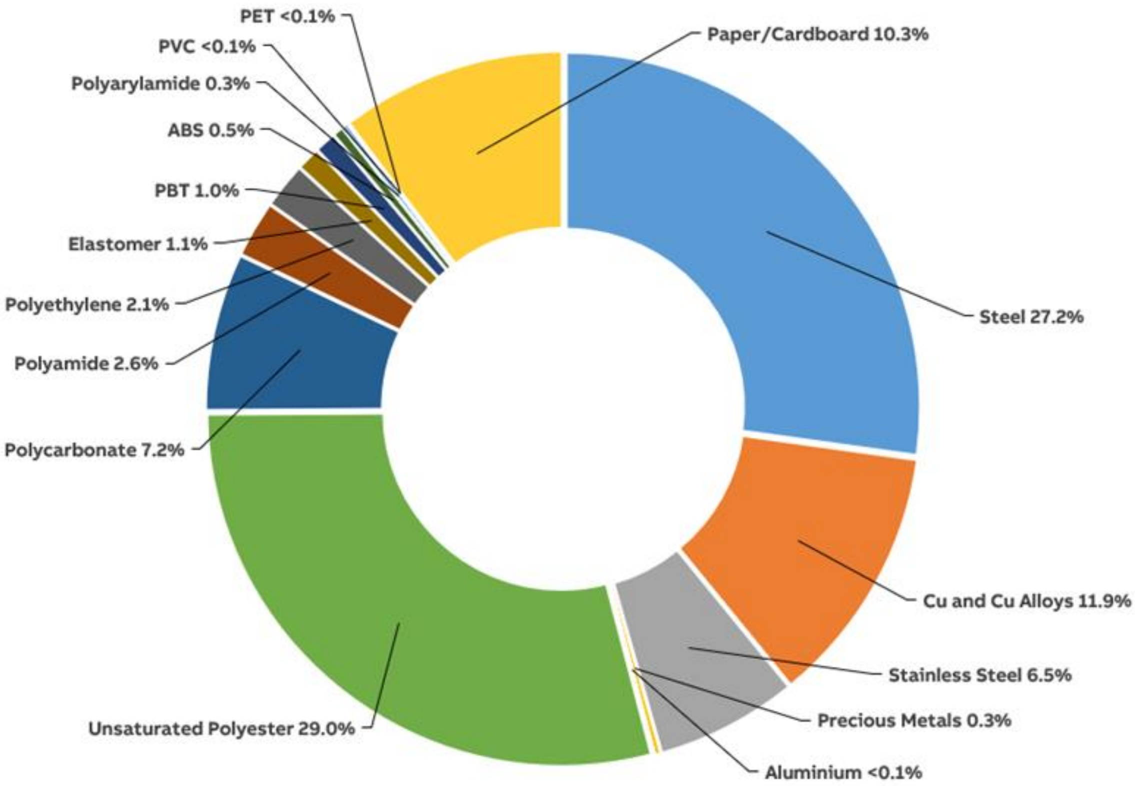

Figure 1: Composition of XT5 3p IEC N/S/H/L TMA 400A

Packaging weight for XT5 3p IEC N/S/H/L TMA 400A circuit breaker and its composition is tabulated below.

Materials	Name	IEC 62474 MC	[g]	Weight %
Others	Cardboard	M-341	381.0	78.3%
Plastics	Polyethylene	M-251	105.8	21.7%
Total			486.8	100.0%

Table 3: Weight of packaging materials XT5 3p IEC N/S/H/L TMA 400A

No cut-off criteria have been applied to the analysis of the product and its packaging.

Official declarations 1SDL000282R1377 [11] and 1SDL000282R1448 [12] states compliance of ABB molded case circuit breakers and air circuit breakers respectively to RoHS II and REACH regulations; annex 1SDL000571R0 [13] provides exemptions considered for RoHS II while annex 1SDL000572R0 [14] lists REACH substances present in a concentration above 0.1% adding reference to products where involved parts are mounted.

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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 is to protect the installation from overloads and short circuits in a circuit with rated voltage 690V, rated current 400A, with 3 poles, a rated breaking capacity Icu 40kA, and the tripping curve L, I in the Industrial application area during the reference service life of the product of 20 years.

The Reference Flow of the study is a single circuit breaker (including its packaging and accessories) with mass described in table 2 & 3

System boundaries and life cycle stages

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

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

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

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

The "point of substitution" principle is applied in the end-of-life allocation, in accordance with the EN 50693:2019 [3] standard.

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Temporal and geographical boundaries

The ABB component suppliers are sourced all over the world. All primary data collected is from 2024, which is a representative production year for production technology of XT5 circuit breaker at ABB S.p.A. Via E. Fermi 40 - 03100 Frosinone (FR) – Italy facility. The geographical representativeness for the other life stages is global. The technological representativeness for the secondary data is ecoinvent [6].

The selected ecoinvent [6] and Carbon Mind [7] processes in the LCA model have a regional representativeness, absence of regional dataset, global representativeness of datasets has been chosen. 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 is not available, generic data originating from the Ecoinvent [6] and/or Carbon Minds [7] dataset, are used.

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 [9].

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].

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Allocation rules

Allocation coefficients are based on occupancy area. Based on this criterion, only a portion of the factory's total water, waste, thermal energy and electricity energy consumption for the year 2024 is designated for XT5 circuit breaker.

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 [1]. 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 on the circuit breakers operating mechanism has been excluded since it is negligible. Surface treatments have been considered in the LCA model. Default scraps for metal working, plastic and packaging processes are included as per PSR [2].

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 Electricity, {RER}| market group for | Cut-off	Based on materials and supplier's locations
Manufacturing	A3	Electricity, low voltage {IT}| market for electricity, low voltage | Cut-off, S	-
Installation (Packaging EoL)	A5	Electricity, {GLO}| market group for | Cut-off	-
Use Stage	B1	Electricity, [country]x | market for | Cut-off	Low voltage, based on 2024 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 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 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 Frosinone plant are from 2024. In cases where primary data was not available, secondary data sources such as Ecoinvent [6] and Carbon Mind [7] were utilized.

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Manufacturing stage

The Circuit Breakers 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 product before shipping them. An average raw material packaging content of 5% of the reference equipment has been considered as per PSR [2].

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 circuit breaker. All the semi-finished and ancillary products are produced by ABB's suppliers.

The electricity used for the production phase is drawn from Italian network. This has been modelled using "Electricity, low voltage {IT}| market for electricity, low voltage | Cut-off, S" dataset from ecoinvent [6].

Distribution

The transport distances from ABB manufacturing plant to the distribution centers (regional distribution centers / local sales organizations) have been calculated considering the specific 2024 sales mix data for XT5 product cluster (SAP ERP sales data as a source).
Since no specific data is available for the transport distances from the Distribution Centre to place of actual use (Customer site), distances of 1000 km are assumed (local/domestic transport by lorry, according to PCR [1]).

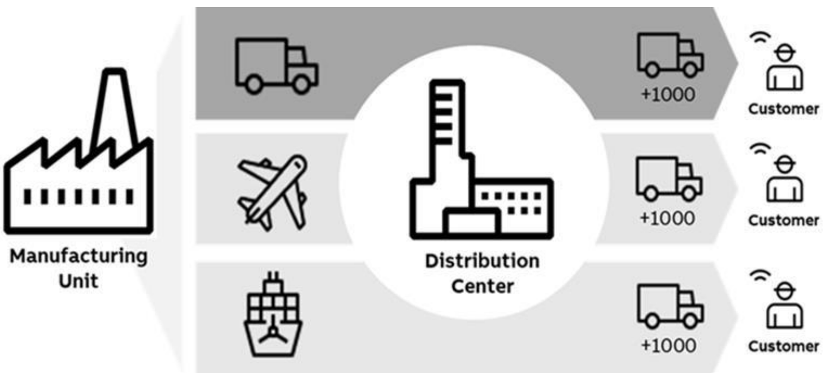

Figure 2: Distribution methodology.

Installation

The installation phase only implies manual activities, and no energy is consumed. This phase also includes the disposal of the packaging of the Circuit Breaker.
All the components needed to install the product (mounting hardware, phase barriers etc) have been included in the analysis.

For the disposal of the packaging after installation at the end of its life, a transport distance of 100 km (according to PSR [2]) was assumed as the actual disposal site is unknown. The chosen transportation dataset is from Ecoinvent [4].

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The disposal scenario of the packaging was calculated based on actual sales mix. For European countries Eurostat data (2021) and for non-European countries default scenario from PSR [2] is used.

Use

During the use phase, XT5 circuit breakers dissipate some electricity due to power losses. The respective energy for each specific configuration of the entire XT5 product family has been calculated according to the data provided in the catalogue of the circuit breaker and following the PCR [1] & PSR [2] rules:

Parameters		
Rated current,In	[A]	400
Load rate	[%]	50
h/year	[h]	8760
RSL	[years]	20
Use rate, α	[%]	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 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 2024 actual sales mix data for the entire XT5 product range (SAP ERP sales data as a source). This approach has been taken since this list of countries is the most representative.

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 IEC/TR 62635 [10]. The percentages for end-of-life treatments of materials are taken from IEC/TR 62635 [10].
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]).

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Environmental impacts

The following table show the environmental impact indicators of the life cycle of a single circuit breaker XT5 3p IEC N/S/H/L 400A with TMA trip unit, 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	5.61E+02	3.25E+01	8.89E+00	7.78E-01	5.17E+02	2.10E+00
GWP-fossil	kg CO2 eq	5.50E+02	3.20E+01	8.89E+00	3.52E-01	5.07E+02	1.98E+00
GWP-biogenic	kg CO2 eq	9.50E+00	4.09E-01	1.17E-03	4.27E-01	8.55E+00	1.17E-01
GWP-luluc	kg CO2 eq	1.57E+00	4.07E-02	9.06E-04	1.34E-04	1.53E+00	1.91E-03
ODP	kg CFC11-eq	7.53E-06	4.92E-07	1.39E-07	4.45E-09	6.86E-06	3.02E-08
AP	mol H+ eq	3.31E+00	4.97E-01	3.92E-02	4.17E-04	2.77E+00	6.87E-03
EP-freshwater	kg P eq	3.50E-01	4.87E-02	1.88E-04	2.81E-05	3.00E-01	7.55E-04
EP-marine	kg N eq	5.44E-01	5.65E-02	1.52E-02	1.71E-04	4.67E-01	5.46E-03
EP-terrestrial	mol N eq	5.49E+00	6.84E-01	1.66E-01	1.34E-03	4.62E+00	1.81E-02
POCP	kg NMVOC eq	1.76E+00	1.99E-01	5.40E-02	4.08E-04	1.50E+00	6.34E-03
ADP-m&m	kg Sb eq	1.91E-02	1.51E-02	4.37E-06	2.68E-07	3.98E-03	8.41E-06
ADP-fossil	MJ	8.12E+03	4.71E+02	1.19E+02	2.07E+00	7.50E+03	2.77E+01
WDP	m3 of equiv. depriv.	1.45E+02	1.25E+01	2.18E-01	6.69E-02	1.32E+02	3.80E-01
PENRE	MJ	8.07E+03	4.21E+02	1.19E+02	2.07E+00	7.50E+03	2.77E+01
PENRM	MJ	4.48E+01	4.48E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	8.12E+03	4.71E+02	1.19E+02	2.07E+00	7.50E+03	2.77E+01
PERE	MJ	1.74E+03	6.68E+01	5.67E-01	1.82E-01	1.67E+03	3.06E+00
PERM	MJ	6.67E+00	6.67E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.75E+03	7.27E+01	5.67E-01	1.82E-01	1.67E+03	3.06E+00
SM	kg	6.12E-01	6.12E-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	9.86E+03	5.44E+02	1.20E+02	2.25E+00	9.17E+03	3.07E+01
FW	m3	4.81E+00	3.57E-01	7.04E-03	2.37E-03	4.43E+00	1.66E-02
HWD	kg	3.95E-02	1.82E-02	8.18E-04	1.02E-05	2.03E-02	2.08E-04
N-HWD	kg	3.30E+01	4.16E+00	1.26E+00	1.74E-01	2.25E+01	4.91E+00
RWD	kg	2.08E-02	8.52E-04	1.10E-05	3.94E-06	1.99E-02	8.39E-05
CfR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MfR	kg	3.31E+00	7.40E-01	0.00E+00	1.33E-01	0.00E+00	2.44E+00
MfER	kg	3.79E-01	1.23E-01	0.00E+00	2.64E-02	0.00E+00	2.30E-01
EN	MJ by energy vector	2.04E-01	2.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PM	disease inc.	1.50E-05	2.31E-06	1.76E-07	3.37E-09	1.24E-05	1.36E-07
IRP	kBq U-235 eq	8.66E+01	3.26E+00	4.51E-02	1.54E-02	8.29E+01	3.28E-01
ETP-fw	CTUe	2.65E+03	1.16E+03	1.04E+01	1.59E+00	1.46E+03	1.52E+01
HTP-c	CTUh	1.39E-06	5.62E-07	1.29E-08	5.05E-10	7.97E-07	1.40E-08
HTP-nc	CTUh	9.75E-06	4.01E-06	8.86E-08	2.04E-09	5.62E-06	2.77E-08
SQP	Pt	1.78E+03	3.01E+02	2.13E+01	5.62E-01	1.44E+03	1.38E+01

Table 7: Impact indicators for **XT5 3P IEC N/S/H/L TMA 400A**

Impact category	Unit	XT5 3P IEC N/S/H/L TMA 400A
Biogenic C of Product	kg	2.98E-02
Biogenic C of Packaging	kg	1.62E-01

Table 8: Inventory flow other indicators

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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	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
PNERM	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	Components for reuse
MfR	Materials for recycling
MfER	Materials for energy recovery
EN	Exported energy

Other indicators

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

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Extrapolation for homogeneous environmental family

This LCA covers different build configurations than the representative product. All the analyzed configurations have the same main functionality, product standards and manufacturing technology. The LCA SimaPro model has been fully parametrized to fulfil each different configuration.

For other products than the reference product covered by this PEP, the environmental impacts for each phase of the lifecycle are obtained by multiplying the values of the reference product by the following factor in listed table.

* If the factor is "1", the impacts of the phase of the life cycle are same in comparison to the Reference product.

LCA Phase: Manufacturing

Type	Poles	Rating	Breaking Capacity	Trip Unit	LSC accessory	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-m&m	ADP-fossil	WDP
IEC	3	400	N/S/H/L	TMA/TMG	-	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
IEC	3	400	N/S/H/L	TMA/TMG	Y	1.37	1.36	1.46	1.52	1.37	1.87	1.73	1.50	1.53	1.53	1.44	1.33	1.59
IEC	4	400	N/S/H/L	TMA/TMG	-	1.28	1.28	1.30	1.24	1.26	1.32	1.32	1.30	1.31	1.30	1.32	1.28	1.29
IEC	4	400	N/S/H/L	TMA/TMG	Y	1.78	1.77	1.90	1.88	1.76	2.53	2.34	1.98	2.04	2.04	1.92	1.73	2.12
IEC	3	630	N/S/H/L	TMA/TMG	-	1.16	1.17	1.10	1.17	1.13	1.31	1.37	1.30	1.33	1.28	1.45	1.15	1.21
IEC	3	630	N/S/H/L	TMA/TMG	Y	1.53	1.53	1.56	1.69	1.49	2.17	2.10	1.80	1.86	1.81	1.89	1.48	1.80
IEC	4	630	N/S/H/L	TMA/TMG	-	1.51	1.51	1.47	1.48	1.44	1.73	1.82	1.71	1.76	1.68	1.92	1.48	1.58
IEC	4	630	N/S/H/L	TMA/TMG	Y	2.01	2.00	2.06	2.11	1.93	2.94	2.84	2.39	2.49	2.41	2.52	1.94	2.40
IEC	3	400-630	V/X	TMA/TMG	-	1.16	1.16	1.11	1.18	1.13	1.30	1.37	1.30	1.33	1.28	1.45	1.14	1.21
IEC	3	400-630	V/X	TMA/TMG	Y	1.52	1.52	1.57	1.70	1.50	2.17	2.10	1.80	1.86	1.81	1.89	1.48	1.80
IEC	4	400-630	V/X	TMA/TMG	-	1.50	1.50	1.48	1.49	1.44	1.73	1.82	1.71	1.76	1.68	1.92	1.48	1.58
IEC	4	400-630	V/X	TMA/TMG	Y	2.00	2.00	2.07	2.12	1.94	2.94	2.84	2.39	2.49	2.41	2.52	1.93	2.41
IEC	3	400-630	-	D	-	1.12	1.12	1.07	1.14	1.08	1.28	1.35	1.27	1.30	1.25	1.44	1.11	1.17
IEC	4	400-630	-	D	-	1.45	1.45	1.41	1.44	1.37	1.69	1.80	1.67	1.72	1.64	1.91	1.42	1.53
UL	3	400-600	N/S/H/L	TMA/TMG	-	1.14	1.14	1.06	1.15	1.10	1.26	1.31	1.26	1.29	1.24	1.39	1.12	1.19
UL	4	400-600	N/S/H/L	TMA/TMG	-	1.49	1.49	1.42	1.46	1.42	1.68	1.74	1.67	1.71	1.64	1.84	1.46	1.56
UL	3	400-600	V/X	TMA/TMG	-	1.14	1.14	1.07	1.16	1.11	1.26	1.31	1.26	1.29	1.24	1.40	1.12	1.19
UL	4	400-600	V/X	TMA/TMG	-	1.48	1.48	1.43	1.46	1.42	1.67	1.74	1.67	1.71	1.64	1.84	1.45	1.56
UL	3	400-600	N/S/H/L	D	-	1.13	1.13	1.05	1.14	1.09	1.28	1.35	1.28	1.31	1.25	1.44	1.11	1.17
UL	4	400-600	N/S/H/L	D	-	1.47	1.47	1.39	1.44	1.40	1.70	1.80	1.68	1.73	1.65	1.91	1.44	1.53
UL	3	400-600	V	D	-	1.13	1.13	1.05	1.14	1.09	1.28	1.35	1.28	1.31	1.25	1.44	1.11	1.17

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Type	Poles	Rating	Breaking Capacity	Trip Unit	LSC accessory	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-m&m	ADP-fossil	WDP
UL	4	400-600	V	D	-	1.47	1.47	1.39	1.44	1.40	1.70	1.80	1.68	1.73	1.65	1.91	1.44	1.53
IEC	3	400	N/S/H/L	MA	-	1.01	1.01	1.01	1.02	1.01	1.08	1.07	1.03	1.03	1.03	1.03	1.01	1.05
IEC	3	400	N/S/H/L	MA	Y	1.37	1.37	1.47	1.54	1.37	1.95	1.80	1.53	1.57	1.57	1.46	1.34	1.64
IEC	3	630	N/S/H/L	MA	-	1.15	1.16	1.09	1.16	1.12	1.29	1.36	1.29	1.32	1.27	1.44	1.14	1.20
IEC	3	630	N/S/H/L	MA	Y	1.52	1.52	1.55	1.68	1.49	2.16	2.09	1.79	1.85	1.80	1.88	1.47	1.79
IEC	3	400-630	V/X	MA	-	1.15	1.15	1.09	1.17	1.12	1.29	1.36	1.29	1.32	1.26	1.45	1.14	1.20
IEC	3	400-630	V/X	MA	Y	1.52	1.51	1.55	1.69	1.49	2.16	2.09	1.79	1.85	1.80	1.88	1.47	1.79
UL	3	400-600	N/S/H/L	MA	-	1.15	1.15	1.06	1.16	1.11	1.29	1.36	1.29	1.32	1.27	1.44	1.13	1.19
UL	3	400-600	V/X	MA	-	1.15	1.15	1.07	1.17	1.11	1.29	1.36	1.29	1.32	1.27	1.45	1.13	1.19

Table 9: Extrapolation factors XT5 Circuit Breaker with Thermal magnetic trip units
Reference product: **XT5 3P IEC N/S/H/L TMA 400A**

LCA Phase: Distribution

Type	Poles	Rating	Breaking Capacity	Trip Unit	LSC accessory	Factor
IEC	3	400	N/S/H/L	TMA/TMG	-	1.00
IEC	3	400	N/S/H/L	TMA/TMG	Y	1.36
IEC	4	400	N/S/H/L	TMA/TMG	-	1.26
IEC	4	400	N/S/H/L	TMA/TMG	Y	1.71
IEC	3	630	N/S/H/L	TMA/TMG	-	1.04
IEC	3	630	N/S/H/L	TMA/TMG	Y	1.41
IEC	4	630	N/S/H/L	TMA/TMG	-	1.33
IEC	4	630	N/S/H/L	TMA/TMG	Y	1.78
IEC	3	400-630	V/X	TMA/TMG	-	1.06
IEC	3	400-630	V/X	TMA/TMG	Y	1.42
IEC	4	400-630	V/X	TMA/TMG	-	1.34
IEC	4	400-630	V/X	TMA/TMG	Y	1.79
IEC	3	400-630	-	D	-	1.00
IEC	4	400-630	-	D	-	1.27
UL	3	400-600	N/S/H/L	TMA/TMG	-	1.02
UL	4	400-600	N/S/H/L	TMA/TMG	-	1.30
UL	3	400-600	V/X	TMA/TMG	-	1.03
UL	4	400-600	V/X	TMA/TMG	-	1.32
UL	3	400-600	N/S/H/L	D	-	0.99
UL	4	400-600	N/S/H/L	D	-	1.26
UL	3	400-600	V	D	-	0.99
UL	4	400-600	V	D	-	1.26
IEC	3	400	N/S/H/L	MA	-	1.01
IEC	3	400	N/S/H/L	MA	Y	1.37

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Type	Poles	Rating	Breaking Capacity	Trip Unit	LSC accessory	Factor
IEC	3	630	N/S/H/L	MA	-	1.04
IEC	3	630	N/S/H/L	MA	Y	1.40
IEC	3	400-630	V/X	MA	-	1.05
IEC	3	400-630	V/X	MA	Y	1.41
UL	3	400-600	N/S/H/L	MA	-	1.03
UL	3	400-600	V/X	MA	-	1.04

Table 10: Extrapolation factors XT5 Circuit Breaker with Thermal magnetic trip units
Reference product: **XT5 3P IEC N/S/H/L TMA 400A**

LCA Phase: Installation

Type	LSC accessory	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-m&m	ADP-fossil	WDP
XT5	No	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
XT5	Yes	1.34	0.53	2.01	1.74	1.79	1.61	1.61	1.64	1.58	1.57	1.55	1.77	1.92

Table 11: Extrapolation factors XT5 Circuit Breaker with Thermal magnetic trip units
Reference product: **XT5 3P IEC N/S/H/L TMA 400A**

LCA Phase: Use

Type	Breaking Capacity	In [A]	Factor
IEC	N/S/H/L	320	0.70
	N/S/H/L	**400**	**1.00**
	N/S/H/L	500	1.39
	N/S/H/L/V/X	630	1.98
UL	N/S/H/L	300	0.64
	N/S/H/L	400	1.00
	N/S/H/L	500	1.39
	N/S/H/L/V/X	600	1.91

Table 12: Extrapolation factors for XT5 Circuit Breaker with Thermal magnetic trip units
Reference product: **XT5 3P IEC N/S/H/L TMA 400A**

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LCA Phase: End of Life

Type	Poles	Rating	Breaking Capacity	Trip Unit	LSC accessory	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-m&m	ADP-fossil	WDP
IEC	3	400	N/S/H/L	TMA/TMG	-	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
IEC	3	400	N/S/H/L	TMA/TMG	Y	1.33	1.34	1.19	1.40	1.42	1.42	1.53	1.25	1.39	1.39	1.70	1.48	1.54
IEC	4	400	N/S/H/L	TMA/TMG	-	1.27	1.27	1.18	1.26	1.25	1.27	1.27	1.29	1.27	1.27	1.30	1.27	1.20
IEC	4	400	N/S/H/L	TMA/TMG	Y	1.69	1.71	1.40	1.76	1.80	1.81	1.97	1.64	1.77	1.78	2.24	1.90	1.85
IEC	3	630	N/S/H/L	TMA/TMG	-	1.05	1.05	1.02	1.08	1.09	1.08	1.11	1.02	1.06	1.06	1.17	1.10	1.11
IEC	3	630	N/S/H/L	TMA/TMG	Y	1.38	1.39	1.21	1.48	1.51	1.50	1.65	1.28	1.46	1.46	1.87	1.58	1.64
IEC	4	630	N/S/H/L	TMA/TMG	-	1.35	1.36	1.23	1.38	1.39	1.39	1.44	1.33	1.38	1.38	1.53	1.41	1.38
IEC	4	630	N/S/H/L	TMA/TMG	Y	1.77	1.79	1.45	1.88	1.93	1.93	2.14	1.67	1.88	1.88	2.48	2.04	2.02
IEC	3	400-630	V/X	TMA/TMG	-	1.06	1.07	1.04	1.10	1.11	1.09	1.13	1.03	1.08	1.08	1.18	1.11	1.14
IEC	3	400-630	V/X	TMA/TMG	Y	1.40	1.41	1.23	1.50	1.52	1.52	1.67	1.28	1.47	1.47	1.88	1.59	1.68
IEC	4	400-630	V/X	TMA/TMG	-	1.37	1.38	1.26	1.41	1.40	1.41	1.47	1.33	1.40	1.40	1.54	1.43	1.42
IEC	4	400-630	V/X	TMA/TMG	Y	1.79	1.81	1.47	1.91	1.95	1.95	2.16	1.68	1.90	1.90	2.49	2.06	2.07
IEC	3	400-630	-	D	-	0.98	0.99	0.92	1.00	1.02	1.00	1.04	0.99	1.00	1.00	1.11	1.03	0.99
IEC	4	400-630	-	D	-	1.26	1.27	1.11	1.27	1.29	1.30	1.35	1.29	1.29	1.29	1.45	1.32	1.23
UL	3	400-600	N/S/H/L	TMA/TMG	-	1.02	1.02	0.99	1.04	1.04	1.04	1.07	1.01	1.04	1.04	1.12	1.06	1.07
UL	4	400-600	N/S/H/L	TMA/TMG	-	1.32	1.32	1.20	1.34	1.32	1.35	1.39	1.32	1.34	1.34	1.47	1.37	1.34
UL	3	400-600	V/X	TMA/TMG	-	1.04	1.04	1.01	1.06	1.05	1.06	1.09	1.02	1.05	1.05	1.13	1.08	1.11
UL	4	400-600	V/X	TMA/TMG	-	1.34	1.34	1.22	1.36	1.34	1.37	1.41	1.32	1.37	1.37	1.48	1.39	1.38
UL	3	400-600	N/S/H/L	D	-	0.97	0.98	0.91	0.98	1.00	0.99	1.03	0.99	0.99	0.99	1.10	1.02	0.99
UL	4	400-600	N/S/H/L	D	-	1.26	1.27	1.10	1.26	1.28	1.29	1.34	1.29	1.28	1.29	1.44	1.32	1.22
UL	3	400-600	V	D	-	0.97	0.98	0.91	0.98	1.00	0.99	1.03	0.99	0.99	0.99	1.10	1.02	0.99
UL	4	400-600	V	D	-	1.26	1.27	1.10	1.26	1.28	1.29	1.34	1.29	1.28	1.29	1.44	1.32	1.22
IEC	3	400	N/S/H/L	MA	-	1.01	1.01	1.00	1.01	1.02	1.02	1.03	1.00	1.01	1.01	1.05	1.03	1.03
IEC	3	400	N/S/H/L	MA	Y	1.34	1.35	1.19	1.41	1.44	1.44	1.57	1.26	1.40	1.41	1.75	1.51	1.57
IEC	3	630	N/S/H/L	MA	-	1.04	1.04	1.02	1.06	1.08	1.06	1.09	1.02	1.05	1.05	1.14	1.08	1.09
IEC	3	630	N/S/H/L	MA	Y	1.37	1.38	1.21	1.46	1.50	1.48	1.63	1.27	1.44	1.44	1.84	1.56	1.63
IEC	3	400-630	V/X	MA	-	1.05	1.05	1.04	1.08	1.09	1.08	1.11	1.02	1.07	1.07	1.15	1.10	1.13
IEC	3	400-630	V/X	MA	Y	1.38	1.39	1.23	1.48	1.51	1.50	1.65	1.28	1.46	1.46	1.85	1.58	1.66
UL	3	400-600	N/S/H/L	MA	-	1.02	1.02	0.99	1.03	1.04	1.04	1.07	1.01	1.04	1.04	1.13	1.07	1.08
UL	3	400-600	V/X	MA	-	1.03	1.04	1.01	1.05	1.06	1.06	1.09	1.02	1.05	1.05	1.14	1.08	1.12

Table 13: Extrapolation factors for IEC XT5 Circuit Breaker with Thermal magnetic trip units
Reference product: **XT5 3P IEC N/S/H/L TMA 400A**

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Additional environmental information

According to the waste treatment scenario calculation in Simapro[8], based on the recycling rate in the technical report IEC/TR 62635 Edition 1.0 [10] Table D.6, the following recyclability potentials were calculated. The recyclability potential is calculated based on the product weight (excluding packaging).

	XT5 3P IEC N/S/H/L TMA 400A
Recyclability potential	**61.4 %**

Table 14: Recyclability potential

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References

[1] PCR "PEP-PCR-ed4-EN-2021 09 06" - Product Category Rules for Electrical, Electronic and HVAC-R Products (published: 6th September 2021)

[2] PSR "PSR-0005-ed3.1-EN-2023 12 08" - Specific rules for Electrical switchgear and control gear Solutions (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 v3.10 (2024)- (https://ecoinvent.org/)

[7] Carbon Minds V2.01 (2024) – (https://www.carbon-minds.com/)

[8] SimaPro 10.2.0.3 (2025)- PRé Sustainability

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

[10] 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

[11] 1SDL000282R1377- RoHS II (MCCBs and ACBs)

[12] 1SDL000282R1448- REACH (MCCBs and ACBs)

[13] 1SDL000571R0- RoHS Exemptions (MCCBs and ACBs)

[14] 1SDL000572R0- SVHC present in excess of 0.1% (MCCBs and ACBs)

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