# PRODUCT ENVIRONMENTAL PROFILE

## Environmental Product Declaration

### ABB MCCB Tmax XT7 IEC 1600A (CN)

Production site: Xiamen, China

June 2023


| | |
|---|---|
| REGISTRATION NUMBER<br>ABBG-00079-V01.01-EN | IN COMPLIANCE WITH PCR-ED4-EN-2021 09 06<br>SUPPLEMENTED BY PSR-0005-ED2-EN-2016 03 29 |
| VERIFIER ACCREDITATION NUMBER<br>VH42 | INFORMATION AND REFERENCE DOCUMENTS<br>www.pep-ecopassport.org |
| DATE OF ISSUE<br>06-2023 | VALIDITY PERIOD<br>5 years |
| INDEPENDENT VERIFICATION OF THE DECLARATION AND DATA, IN COMPLIANCE WITH ISO 14025: 2006 | |
| INTERNAL ☐ | EXTERNAL ☒ |
| THE PCR REVIEW WAS CONDUCTED BY A PANEL OF EXPERTS CHAIRED BY JULIE ORGELET (DDEMAIN) | PEP eco PASS PORT® |
| PEP ARE COMPLIANT WITH XP C08-100-1 :2016 OR EN 50693:2019<br>THE ELEMENTS OF THE PRESENT PEP CANNOT BE COMPARED WITH ELEMENTS FROM ANOTHER PROGRAM. | |
| DOCUMENT IN COMPLIANCE WITH ISO 14025: 2006 « ENVIRONMENTAL LABELS AND DECLARATIONS. TYPE III ENVIRONMENTAL DECLARATIONS » | |

| | |
|---|---|
| **EPD Owner** | ABB S.p.A.<br>Via Luciano Lama, 33, 20099 Sesto San Giovanni (MI) – Italy<br>www.abb.com |
| **Manufacturer name and address** | ABB Xiamen Low Voltage Equipment Co. Ltd.<br>Xiamen, Fujian, China, 361006 |
| **Company contacts** | EPD_ELSP@in.abb.com |
| **Reference product** | XT7 1600 Ekip Dip LS/I In=1600A - 3 Pole |
| **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. XT7 is suitable for applications from 800 A to 1600 A. It enables a direct communication to the new energy management cloud-computing platform ABB Ability™ Energy and Asset Manager |
| **Functional unit** | The functional unit to protect during 20 years the installation against overloads and short-circuits in circuit with assigned voltage U and rated current In. This protection is ensured in accordance with the following parameters<br>IEC Type<br>Rated voltage [V]: 690<br>Rated current [A]: 1600<br>Rated breaking capacity [kA]: 50<br>Number of poles: 3/4<br>Tripping Curve: L, S, I, G |
| **Other products covered** | XT7 Circuit Breakers of types L/S/H/D of IEC type and ratings 800A to 1600A / 3poles /4poles |
| **Reference lifetime** | 20 years |
| **Product category** | Electrical, Electronic and HVAC-R Products |
| **Use Scenario** | The use phase has been modeled based on the sales mix data (2021), and the corresponding low voltage electricity countries mix |
| **Geographical representativeness** | Raw materials & Manufacturing: [China / Global]<br>Assembly: [China]<br>Distribution / Use: [Global] specific sales mix<br>EoL: [Global] |
| **Technological representativeness** | Materials and processes data are specific for the production of XT7 circuit breaker |
| **LCA Study** | This study is based on the LCA study described in the LCA report 2TFP990013A1011 |
| **EPD type** | Products family declaration |
| **EPD scope** | "Cradle to grave" |
| **Year of reported primary data** | 2021 |
| **LCA software** | SimaPro 9.3.0.3 (2022) |
| **LCI database** | Ecoinvent v3.8 (2021) |
| **LCIA methodology** | EN 15804:2012+A2:2019 |

# Contents

# ABB Purpose & Embedding Sustainability

ABB is a leading global technology company that energizes the transformation of society and industry to achieve a more productive, sustainable future. By connecting software to its electrification, robotics, automation and motion portfolio, ABB pushes the boundaries of technology to drive performance to new levels. With a history of excellence stretching back more than 130 years, ABB's success is driven by about 105 thousand talented employees in over 100 countries.
ABB's Electrification business offers a wide-ranging portfolio of products, digital solutions and services, from substation to socket, enabling safe, smart and sustainable electrification. Offerings encompass digital and connected innovations for low voltage and medium voltage, including EV infrastructure, solar inverters, modular substations, distribution automation, power protection, wiring accessories, switchgear, enclosures, cabling, sensing and control.
ABB is committed to continually promoting and embedding sustainability across its operations and value chain, aspiring to become a role model for others to follow. With its ABB Purpose, ABB is focusing on reducing harmful emissions, preserving natural resources and championing ethical and humane behavior.

# General Information

Located in Xiang‘an Torch Industrial Park of Xiamen, ABB Xiamen Hub, with an investment of 2 billion yuan (approximate $300 million) and covering an area of ~ 430000 square meters, officially came into service on Nov. 2018. It integrated eight ABB companies in Xiamen to create smarter production workshop and workplace with higher efficiency through optimized resource allocation and unified management. ABB in Xiamen, with nearly 3,500 employees in total, has a full range of businesses including R&D, manufacturing, engineering, sales and services, as well as ABB China's supply chain management and corporate functions.

The ABB Xiamen Hub is ABB's biggest manufacturing centre for middle & low voltage switchgears and air circuit breakers. With powerful R&D and innovation capability, it is home to:

- One of ABB's largest R&D centres for NeoGear and MNS low-voltage systems
- ABB's first digitally connected remote service centre in China
- ABB Technology Experience Centre covering full ABB solution & focusing on user experience

As a modernized large industrial park, ABB Xiamen Hub widely implements environment friendly materials, energy - saving technique and intelligent solutions. They include BMS system for centralized control and monitoring of equipment, PMCS solution for comprehensive management of energy consumption, i-Bus® intelligent building control system for lighting control, rainwater recovery system, and electric vehicle charging facility. With all these solutions, ABB Xiamen Hub has set an example for building a green, low - carbon and intelligent industrial park

# XT7 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 analyzed in this LCA is XT7 IEC type which is a lever type mechanism. The following table shows the product characteristics.

| Circuit breaker | XT7 IEC Type |
|---|---|
| Max Rated voltage U [V] | 690 |
| Max Rated current In [A] | 1600 |
| Max Rated short circuit breaking capacity Icu [kA] | 200 |
| Number of poles | 3/4 |

Table 1: Technical characteristics of XT7 circuit breakers (Refer Technical catalogue for details).

Along the whole XT7 product cluster a set of different build configurations have been covered by this analysis. Main differences consist of the number of poles, trip unit type, and short circuit breaking capacity. The LCA SimaPro model has been fully parametrized to fulfill each different configuration.

Official declarations LB-DT 17-21D [12] and 1SDL000282R1265 [13] states compliance of ABB molded case circuit breakers and air circuit breakers respectively to RoHS II and REACH regulations; annex 1SDL000571R0 [14] provides exemptions considered for RoHS II while annex 1SDL000572R0 [15] lists REACH substances present in a concentration above 0,1% adding reference to products where involved parts are mounted.

# Constituent Materials

**XT7**

The representative product is XT7 1600A L - 3P IEC Circuit Breaker which weighs 16.6 kg including its installed accessories, paper documentation and packaging.

| Materials | Name | IEC 62474 MC | [g] | Weight % |
|---|---|---|---|---|
| Metals | Cu and CU alloys | M-121 | 4565 | 27.6% |
| | Steel | M-119 | 3278 | 19.8% |
| | Precious metals | M-159 | 76 | 0.5% |
| | Stainless Steel | M-100 | 73 | 0.5% |
| Plastics | Unsaturated polyester (UP) | M-301 | 3633 | 21.9% |
| | PolyEthylene (PE) | M-251 | 554 | 3.3% |
| | Polycarbonate (PC) | M-254 | 673 | 4.1% |
| | Polyamide (PA) | M-258 | 314 | 1.9% |
| | PolyPropylene (PP) | M-252 | 123 | 0.7% |
| | PolyEthylene Terephthalate (PET) | M-259 | 93 | 0.6% |
| | Other Polymers | NA | 228 | 1.4% |
| Others | Paper | M-341 | 1674 | 10.1% |
| | Wood | M-340 | 1200 | 7.2% |
| | Other | NA | 74 | 0.4% |
| **Total** | | | 16558 | 100% |

Table 2: Weight of materials XT7 1600A L - 3P IEC

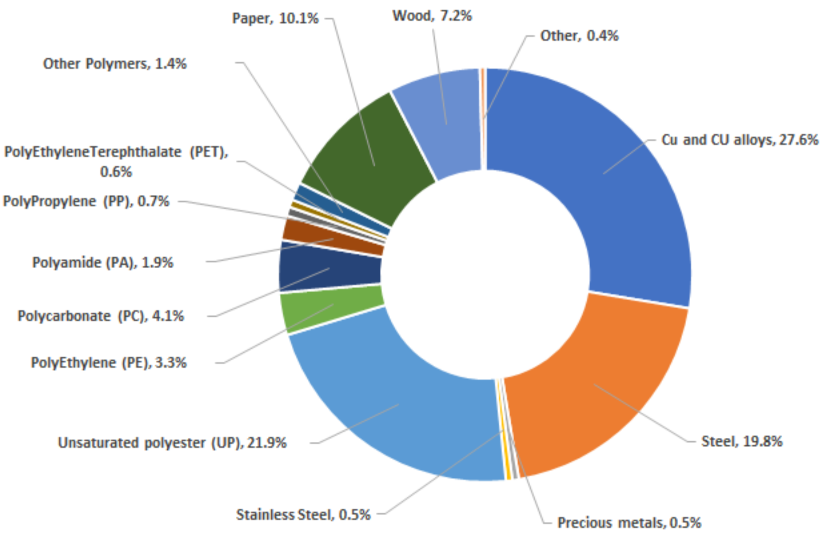


Figure 1: Composition of XT7 1600A L - 3P IEC

Packaging weight for XT7 and its composition is tabulated below.

| Material | XT7- 3P Weight(g) |
|---|---|
| Corrugated Cardboard | 1350 |
| Polyethylene | 480 |
| Plywood | 1200 |
| **Total** | **3030** |

Table 3: Weight of materials XT7 - 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 protect during 20 years the installation against overloads and short-circuits in circuit with assigned voltage U and rated current In (see tables 1, p 5.). This protection is ensured in accordance with the following parameters

| | |
|---|---|
| **Number of poles** | 3/4 |
| **Rated breaking capacity [kA]** | 50 |
| **Tripping Curve** | L, S, I, G |

The Reference Flow of the study is a single circuit breaker (including its packaging and accessories) with mass described in page 6 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<br>Transport to manufacturing site<br>Components/parts manufacturing<br>Assembly<br>Packaging<br>EoL treatment of generated waste | Transport to distributor/ logistic center<br>Transport to place of use | Installation<br>EoL treatment of generated waste (packaging) | Usage<br>Maintenance | Deinstallation<br>Collection and transport<br>EoL treatment |

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

# Temporal and geographical boundaries

The ABB component suppliers are sourced all over the world. All primary data collected are from 2021, which is a representative production year. Secondary data are also representative for this year, as provided by ecoinvent [6].

The selected ecoinvent [6] processes in the LCA model have a global representativeness, due to the unclear origin of each component. In this way, a conservative approach has been adopted.

# Boundaries in the life cycle

As indicated in the PCR capital goods such as buildings, machinery, tools and infrastructure, the packaging for internal transport which cannot be allocated directly to the production of the reference product, may be excluded from the system boundary.

Infrastructures, when present, such as processes deriving from the ecoinvent [6] database have not been excluded.

# Data quality

In this LCA, both primary and secondary data are used. Site specific foreground data have been provided by ABB. Main data sources are the bill of materials & drawings which are available on the ERP (SAP) & Windchill. For all processes for which primary are not available, generic data originating from the ecoinvent database [6], allocation cut-off by classification, are used. The ecoinvent database available in the SimaPro software [7] is used for the calculations.

The data quality characterized by quantitative and qualitative aspects, is presented in Appendix 1. Each data quality parameter has been rated according to DQR tables from Chapter 7.19.2.2 of the Product Environmental Footprint Guide v.6.3 to give an indication of geography, technology and temporal representativeness.

# Environmental impact indicators

The information obtained from the inventory analysis is aggregated according to the effects related to the various environmental issues. According to "PCR-ed4-EN-2021 09 06" and EN 50693:2019 [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 E1.2 & XT7-XT7M production line occupancy area for electricity consumption and waste generated as both the product are made on same production line.

The total number of operators working on the production line was considered for water consumption. All these flows have been allocated and divided by the total number of E1.2 and XT7-XT7M circuit breakers produced in 2021.

## 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].

Printed circuit boards (PCB) have been modelled with a representative cluster dataset including: every single component, the unpopulated board as well as the surface mounting technology (SMD) process.

## 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<br>Electricity, {RoW}\| market group for \| Cut-off | Based on materials and supplier's locations |
| Manufacturing | A3 | ABB Green Mix Low Voltage | Specific Energy model for ABB Xiamen, manufacturing plant, 100% renewable |
| Installation (Packaging EoL) | A5 | Electricity, {GLO}\| market group for \| Cut-off | |
| Use Stage | B1 | Electricity, [country]x \| market for \| Cut-off, S | Low voltage, based on 2021 country sales mix |
| EoL | C1-C4 | Electricity, {GLO}\| market group for \| Cut-off | |

Table 5: Energy models used in each LCA stage

# 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 (Separates).

All primary data collected from ABB are from 2021, which was a representative production year. The ecoinvent cut-off by classification system processes [6] are used to represent the LCA model.

Due to the large amounts of components in the Circuit Breaker, raw material inputs have been modelled with data from ecoinvent [6] representing either Global [GLO] or Rest of World [RoW] market coverage based on the supplier's location. These datasets are assumed to be representative.

## 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.

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

The entire supplier's network has been modelled with the calculation of each transportation stage, from the first manufacturing supplier to the next.

All the distances from the last subassembly suppliers' factories to the ABB manufacturing facility have been calculated.
In the ABB factory, the different components and subassemblies are assembled into the circuit breaker. 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 production site and includes renewable energy only.

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

## Distribution

The transport distances from ABB manufacturing plant to the distribution centers (regional distribution centers / local sales organizations) have been calculated considering the specific reference products sales mix data from 2022 (SAP ERP sales data as a source).
Reference product distribution is representative of the entire size and equivalent to distribution of other products listed in the extrapolation tables.

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 10% distance by road has been considered to cover the last distribution stage to the end customer (usage location).

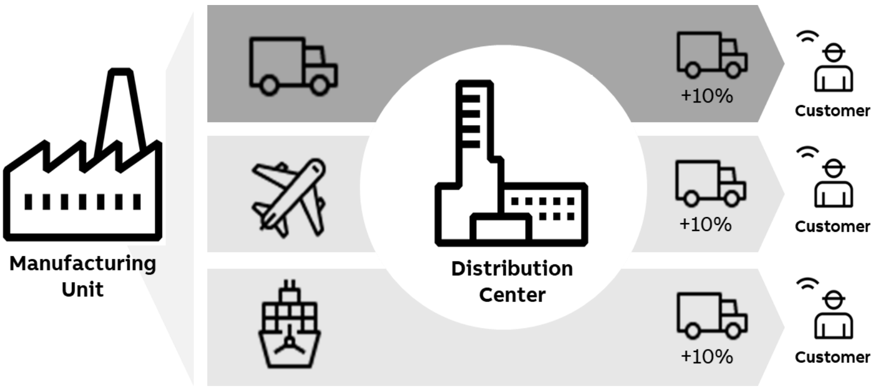


Figure 2: Distribution methodology

## Installation

The installation phase only implies manual activities, and no energy is consumed. This phase also includes the disposal of the packaging of the Low Voltage Circuit Breaker.

All the components needed to install the product (e.g. IP30 flange, lifting plates, etc.) have been included in the analysis.

For the disposal of the packaging after installation of the circuit breaker 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 China urban domestic waste treatment data available.

## Use

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

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

| **Parameters** | | |
|---|---|---|
| Iu | [A] | 1600 |
| Iu | [%] | 50 |
| 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 breaker 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 has been modeled based on the 2021 actual sales mix data (SAP ERP sales data as a source). From Ecoinvent [6] database, the low voltage electricity country mix for each country$_{(x)}$ has been selected with its respective percentage on the total sales mix (Electricity, low voltage [country]$_x$ | market for | Cut-off, S).

Since no maintenance happens during the use phase, the environmental impacts linked to this procedure have been considered as null in the analysis.

## End of life

The end-of-life stage is modelled according to PCR [1] and IEC/TR 62635 [9]. The percentages for end-of-life treatments of materials are taken from IEC/TR 62635 [9].

Since no specific data is available, the transport distances from the place of use to the place of disposal are assumed to be 1000 km (local/domestic transport by lorry, according to PCR [1]).

Disassembly manuals can be provided to the customer to support product disposal.
All circuit moving and fixed parts are labelled with WEEE logo.

# Environmental impacts

The following table show the environmental impact indicators of the life cycle of a XT7 1600A L - 3P IEC Circuit Breaker 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 | 4.23E+03 | 1.12E+02 | 1.41E+00 | 3.53E+00 | 4.11E+03 | 5.94E+00 |
| GWP-fossil | kg CO2 eq | 4.21E+03 | 1.13E+02 | 1.41E+00 | 8.11E-01 | 4.09E+03 | 5.86E+00 |
| GWP-biogenic | kg CO2 eq | 2.19E+01 | -1.51E+00 | 7.52E-04 | 2.72E+00 | 2.06E+01 | 7.20E-02 |
| GWP-luluc | kg CO2 eq | 1.74E+00 | 1.22E+00 | 6.68E-04 | 1.22E-04 | 5.17E-01 | 4.12E-03 |
| ODP | kg CFC11 eq | 3.54E-05 | 1.32E-05 | 3.09E-07 | 6.79E-08 | 2.14E-05 | 3.92E-07 |
| AP | mol H+ eq | 2.41E+01 | 2.53E+00 | 1.79E-02 | 1.88E-03 | 2.15E+01 | 2.98E-02 |
| EP-freshwater | kg P eq | 9.95E-01 | 2.31E-01 | 8.69E-05 | 3.19E-05 | 7.63E-01 | 1.41E-03 |
| EP-marine | kg N eq | 4.81E+00 | 2.48E-01 | 4.88E-03 | 7.91E-04 | 4.54E+00 | 1.43E-02 |
| EP-terrestrial | mol N eq | 5.15E+01 | 2.93E+00 | 5.39E-02 | 7.43E-03 | 4.84E+01 | 6.19E-02 |
| POCP | kg NMVOC eq | 1.35E+01 | 8.82E-01 | 1.47E-02 | 2.11E-03 | 1.26E+01 | 1.78E-02 |
| ADP-m&m | kg Sb eq | 1.04E-01 | 9.12E-02 | 2.88E-06 | 7.67E-07 | 1.23E-02 | 4.70E-06 |
| ADP-fossil | MJ | 3.78E+04 | 1.63E+03 | 2.07E+01 | 4.73E+00 | 3.61E+04 | 5.75E+01 |
| WDP | m3 | 4.85E+02 | 6.26E+01 | 6.96E-02 | 2.85E-02 | 4.22E+02 | 4.96E-01 |
| PENRE | MJ | 3.76E+04 | 1.41E+03 | 2.07E+01 | 4.73E+00 | 3.61E+04 | 5.75E+01 |
| PENRM | MJ | 2.14E+02 | 2.14E+02 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PENRT | MJ | 3.78E+04 | 1.63E+03 | 2.07E+01 | 4.73E+00 | 3.61E+04 | 5.75E+01 |
| PERE | MJ | 3.90E+03 | 1.99E+02 | 2.07E-01 | 5.92E-02 | 3.70E+03 | 5.06E+00 |
| PERM | MJ | 4.72E+01 | 4.72E+01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| PERT | MJ | 3.95E+03 | 2.46E+02 | 2.07E-01 | 5.92E-02 | 3.70E+03 | 5.06E+00 |
| SM | kg | 4.27E+00 | 4.27E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| RSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| NRSF | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| FW | m3 | 1.20E+01 | 1.73E+00 | 2.26E-03 | 1.14E-03 | 1.03E+01 | 2.05E-02 |
| HWD | kg | 1.97E-02 | 1.28E-02 | 4.32E-05 | 1.19E-05 | 6.79E-03 | 6.07E-05 |
| N-HWD | kg | 3.65E+02 | 2.32E+01 | 1.46E+00 | 6.12E-01 | 3.33E+02 | 6.35E+00 |
| RWD | kg | 2.66E-02 | 5.51E-03 | 1.38E-04 | 2.97E-05 | 2.07E-02 | 2.27E-04 |
| MfR | kg | 1.17E+01 | 2.02E+00 | 0.00E+00 | 8.91E-01 | 0.00E+00 | 8.83E+00 |
| MfER | kg | 2.23E+00 | 0.00E+00 | 0.00E+00 | 1.96E+00 | 0.00E+00 | 2.68E-01 |
| Efp | disease inc. | 3.13E-04 | 1.05E-05 | 1.32E-07 | 3.73E-08 | 3.01E-04 | 4.80E-07 |
| IrHH | kBq U-235 eq | 8.39E+01 | 1.47E+01 | 9.63E-02 | 2.15E-02 | 6.87E+01 | 3.75E-01 |
| ETX FW | CTUe | 1.31E+05 | 2.55E+04 | 1.62E+01 | 5.28E+00 | 1.06E+05 | 1.12E+02 |
| HTX CE | CTUh | 1.55E-06 | 5.20E-07 | 5.77E-10 | 2.21E-10 | 1.03E-06 | 6.75E-09 |
| HTX N-CE | CTUh | 7.76E-05 | 3.23E-05 | 1.56E-08 | 9.22E-09 | 4.49E-05 | 4.20E-07 |
| IrLS | Pt | 9.68E+03 | 1.51E+03 | 1.84E+01 | 5.13E+00 | 8.10E+03 | 4.04E+01 |

Table 7: Impact indicators for XT7 1600A L - 3P IEC

| Impact category | Unit | XT7 1600A L - 3P IEC |
|---|---|---|
| Biogenic Carbon content of the product | kg | 3.43E-02 |
| Biogenic Carbon content of the associated packaging | kg | 1.48E+00 |

Table 8: Inventory flow other indicators

### Environmental impact indicators

| | |
|---|---|
| GWP-total | Global Warming Potential total (Climate change) |
| GWP-fossil | Global Warming Potential fossil |
| GWP-biogenic | Global Warming Potential biogenic |
| GWP-luluc | Global Warming Potential land use and land use change |
| ODP | Depletion potential of the stratospheric ozone layer |
| AP | Acidification potential |
| EP-freshwater | Eutrophication potential - freshwater compartment |
| EP-marine | Eutrophication potential - fraction of nutrients reaching marine end compartment |
| EP-terrestrial | Eutrophication potential -Accumulated Exceedance |
| POCP | Formation potential of tropospheric ozone |
| ADP-m&m | Abiotic Depletion for non-fossil resources potential |
| ADP-fossil | Abiotic Depletion for fossil resources potential, WDP |
| WDP | Water deprivation potential. |

### Resource use indicators

| | |
|---|---|
| PENRE | Use of non-renewable primary energy excluding renewable primary energy resources used as raw material |
| PENRM | Use of non-renewable primary energy resources used as raw material |
| PENRT | Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) |
| PERE | Use of renewable primary energy excluding non-renewable primary energy resources used as raw material |
| PERM | Use of renewable primary energy resources used as raw material |
| PERT | Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) |

### Secondary materials, water and energy resources

| | |
|---|---|
| SM | Use of secondary materials |
| RSF | Use of renewable secondary fuels |
| NRSF | Use of non-renewable secondary fuels |
| FW | FW: Net use of fresh water |

### Waste category indicators

| | |
|---|---|
| HWD | Hazardous waste disposed |
| N-HWD | Non-hazardous waste disposed |
| RWD | Radioactive waste disposed |

### Output flow indicators

| | |
|---|---|
| MfR | Materials for recycling |
| MfER | Materials for energy recovery |

### 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 than the representative product. All the analyzed configurations have the same main functionality, product standards and manufacturing technology.

The different life cycle stages can be extrapolated to other products of the same homogeneous environmental family by applying a rule of proportionality to the parameters in the following tables, divided by different life cycle stages.

**XT7 IEC Extrapolation:**

| Circuit Breaker | GWP-total | GWP-fossil | GWP-biogenic | GWP-luluc | ODP | AP | EP-freshwater | EP-marine | EP-terrestrial | POCP | ADP-m&m | ADP-fossil | WDP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IEC - 3P - 800-1600 L | 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 - 3P - 800-1600 S/H | 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 - 3P - 1000-1600 D | 0.89 | 0.89 | 1.11 | 0.98 | 0.74 | 0.92 | 0.92 | 0.91 | 0.92 | 0.93 | 0.94 | 0.90 | 0.92 |
| IEC - 4P - 800-1600 L | 1.33 | 1.33 | 1.43 | 1.33 | 1.32 | 1.33 | 1.32 | 1.33 | 1.34 | 1.33 | 1.32 | 1.31 | 1.31 |
| IEC - 4P - 800-1600 S/H | 1.33 | 1.33 | 1.43 | 1.33 | 1.32 | 1.33 | 1.32 | 1.33 | 1.34 | 1.33 | 1.32 | 1.31 | 1.31 |
| IEC - 4P - 1000-1600 D | 1.20 | 1.20 | 1.57 | 1.31 | 1.03 | 1.22 | 1.23 | 1.22 | 1.25 | 1.25 | 1.25 | 1.20 | 1.21 |

Table 9a: Manufacturing phase Extrapolation factors for XT7
Reference product: XT7 1600A L - 3P IEC

| Circuit Breaker | LCA Phase | All |
|---|---|---|
| IEC - 3P - 800-1600 L | Distribution | 1.00 |
| IEC - 3P - 800-1600 S/H | | 1.00 |
| IEC - 3P - 1000-1600 D | | 0.94 |
| IEC - 4P - 800-1600 L | | 1.28 |
| IEC - 4P - 800-1600 S/H | | 1.28 |
| IEC - 4P - 1000-1600 D | | 1.20 |

Table 9b: Distribution phase Extrapolation factors for XT7
Reference product: XT7 1600A L - 3P IEC

| Type | In [A] | LCA Phase | Factor |
|---|---|---|---|
| IEC | 800 | Use | 0.26 |
| | 1000 | | 0.39 |
| | 1250 | | 0.61 |
| | 1600 | | 1 |

Table 9c: Use phase Extrapolation factors for XT7
Reference product: XT7 1600A L - 3P IEC

| Circuit Breaker | GWP-total | GWP-fossil | GWP-biogenic | GWP-luluc | ODP | AP | EP-freshwater | EP-marine | EP-terrestrial | POCP | ADP-m&m | ADP-fossil | WDP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IEC - 3P - 800-1600 L | 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 - 3P - 800-1600 S/H | 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 - 3P - 1000-1600 D | 0.94 | 0.94 | 0.96 | 0.94 | 0.93 | 0.94 | 0.94 | 0.96 | 0.94 | 0.94 | 0.93 | 0.94 | 0.94 |
| IEC - 4P - 800-1600 L | 1.31 | 1.31 | 1.23 | 1.32 | 1.29 | 1.32 | 1.33 | 1.32 | 1.31 | 1.31 | 1.30 | 1.31 | 1.32 |
| IEC - 4P - 800-1600 S/H | 1.31 | 1.31 | 1.23 | 1.32 | 1.29 | 1.32 | 1.33 | 1.32 | 1.31 | 1.31 | 1.30 | 1.31 | 1.32 |
| IEC - 4P - 1000-1600 D | 1.23 | 1.23 | 1.18 | 1.25 | 1.20 | 1.24 | 1.25 | 1.26 | 1.23 | 1.23 | 1.21 | 1.23 | 1.25 |

Table 9d: End of Life phase Extrapolation factors for XT7
Reference product: XT7 1600A L - 3P IEC

# 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).

| | XT7 1600A L - 3P IEC |
|---|---|
| Recyclability potential | 66.3% |

Table 10: Recyclability potential of XT7

# References


[1] PCR "PEP-PCR-ed4-EN-2021_09_06" - Product Category Rules for Electrical, Electronic and HVAC-R Products (published: 6th September 2021)

[2] PSR "PSR-0005-ed2-EN-2016 03 29" - SPECIFIC RULES FOR Electrical switchgear and control gear Solutions (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 v3.8 (2021). ecoinvent database version 3.8 - (https://ecoinvent.org/)

[7] SimaPro Software version 9.3.0.3 - PRé Sustainability

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

[9] IEC/TR 62635 - Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment - Edition 1.0 2012-10

[10] 2TFP990013A1013– Annex LCA BOM / Processes

[11] 2TFP990013A1012 – Annex LCA Data Details

[12] LB-DT 17-21D - RoHS II (MCCBs and ACBs)

[13] 1SDL000282R1265 - REACH (MCCBs and ACBs)

[14] 1SDL000571R0 Ver 01 - RoHS Exemptions (MCCBs and ACBs)

[15] 1SDL000572R0 Ver 01 - SVHC present in excess of 0.1% (MCCBs and ACBs)