EPD

Environmental Product Declaration

Current Transformer LZZBJ9-36/285W3b

Production site: Xiamen, China

DOCUMENT KIND Environmental Product Declaration	IN COMPLIANCE WITH ISO 14025 and EN 50693			
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EPD Owner	ABB Switzerland Ltd, Group Technology Management
Organization No.	CHE-101.538.426
Manufacturer name and address	ABB Electrical Equipment (Xiamen) Co., Ltd 1st Floor, No.885, Fang Shan Xi Er Road, Xiang'An Industrial Area, Torch Hi-Tech Industrial Development Zone, Xiamen, Fujian, China
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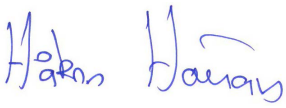
Declared product	LZZBJ9-36/285W3b current transformer
Product description	The LZZBJ9-36/285W3b current transformer are casted in epoxy resin and designed mostly for insulation voltage of 3.6 kV to 40.5 kV.
Functional unit	The functional unit of this LZZBJ9-36/285W3b current transformer is to measure and protect an energy distribution system (the system voltage 3.6 kV to 40.5 kV), use rate and load rate of 100 %, during a service life of 20 years in China.
Reference flow	The reference flow is a single current transformer device, including related accessories and packaging.
CPC code	46121 - Electrical transformers
Independent verification	Independent verification of the declaration and data, according to ISO 14025:2010 ☐ INTERNAL ☒ EXTERNAL Independent verifier approved by EPD-Norge: Elisabet Amat Signature: 
Approved by	Håkon Hauan, CEO EPD-Norge Signature: 
Reference PCR	EN 50693:2019 – Product Category Rules for Life Cycle Assessments of Electronic and Electrical Products and Systems. EPDItaly007 – Electronic and Electrical Products and Systems, Rev. 3.0, 2023/01/13.
Program instructions	The Norwegian EPD Foundation/EPD-Norge, General Programme Instructions 2019, Version 3.0, 2019/04/24.
LCA study	This EPD is based on the LCA study described in the LCA report 3XAA019315.
EPD type	Specific product
EPD scope	Cradle-to-grave
Product RSL	20 years
Geographical representativeness	Manufacturing (suppliers): Global / Manufacturing (ABB): Xiamen / Downstream: Asia
Reference year	2022
LCA software	SimaPro 9.5 (2023)
LCI database	Ecoinvent v3.9.1 (2022)
Comparability	EPDs published within the same product category, though originating from different programs, may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible.
Liability	The owner of the declaration shall be liable for the underlying information and evidence. EPD-Norge shall not be liable with respect to manufacturer, life cycle assessment data, and evidence.

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Sustainability at ABB

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At ABB, we actively contribute to a more sustainable world, leading by example in our own operations and partnering with customers and suppliers to enable a low-carbon society, preserve resources, and promote social progress.

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General Information

The product declared in this Environmental Product Declaration is the LZZBJ9-36/285W3b current transformer, including related accessories and packaging.

The LZZBJ9-36/285W3b is an epoxy resin casted insulating current transformer which is used to measure and protect an energy distribution system (the system voltage 3.6 kV to 40.5 kV).

General technical specifications of the product are presented below.

	Unit	LZZBJ9-36/285W3b
Outer height/width/length	mm	480/285/465
Highest voltage	kV	40.5
Insulation level	kV	95/185
Rated primary current	A	1250
Rated secondary current	A	5
Accuracy class	/	0.2S/0.5/5P30/5P30
Rated output	VA	20/20/20/20
Frequency	Hz	50
Rated short-time thermal current and time	kA/s	50/3

The LZZBJ9-36/285W3b is manufactured by the ABB Electrical Equipment (Xiamen) Co., Ltd located in ABB Industry Center Xiamen, China, the instrument transformer factory is in the northwest of ABB Industry Center.

The manufacturing site is certified according to the following standards:

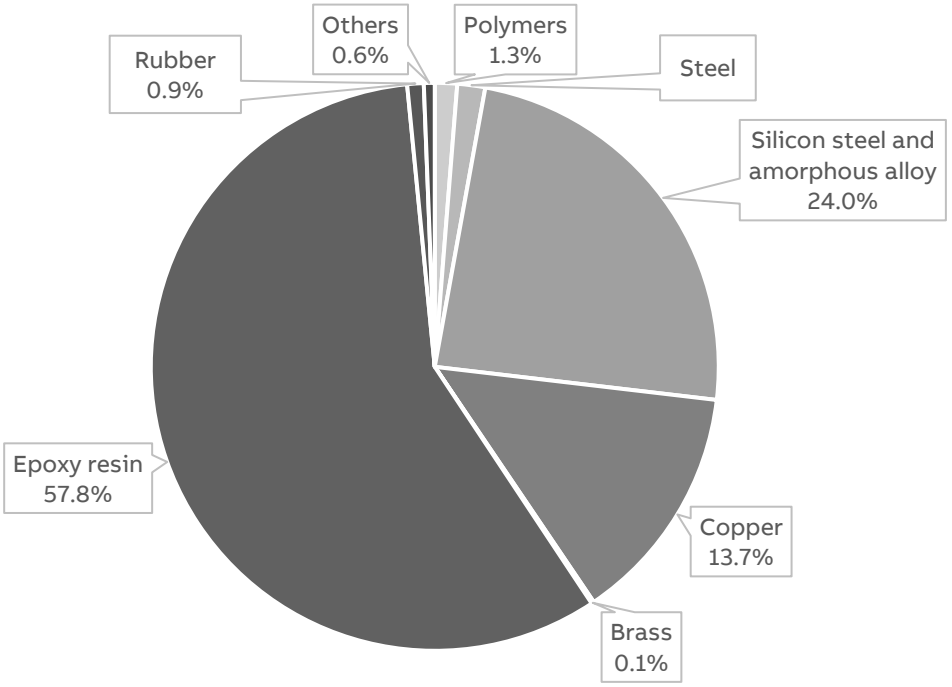
- ISO 9001:2015 – Quality Management Systems
- ISO 14001:2015 – Environmental Management Systems
- ISO 45001:2018 – Occupational Health and Safety Management Systems
- ISO 50001:2018 – Energy management

Constituent Materials

The LZZBJ9-36/285W3b current transformer weights 64.1 kg, and the constituent materials are presented below.

Materials	Name	Weight [kg]	Weight %
Plastics	Polymers	0.8	1.3
Metals	Steel	1.0	1.6
	Silicon steel and amorphous alloy	15.4	24.0
	Copper	8.8	13.7
	Brass	0.1	0.1
Other	Epoxy resin	37.0	57.8
	Rubber	0.6	0.9
	Others	0.4	0.6
Total		**64.1**	100.0

LZZBJ9-36/285W3b



The packaging materials and accessories weighs 7.033 kg, and the constituent materials are presented below.

Description	Material	Weight [kg]	Weight %
Pallet	Wood	13.2/6=2.2	31
Angle iron	Steel galvanized	3.4/6=0.567	8
Plywood	Plywood	25.6/6=4.267	61
Total		**42.2/6=7.033**	**100**

LCA Background Information

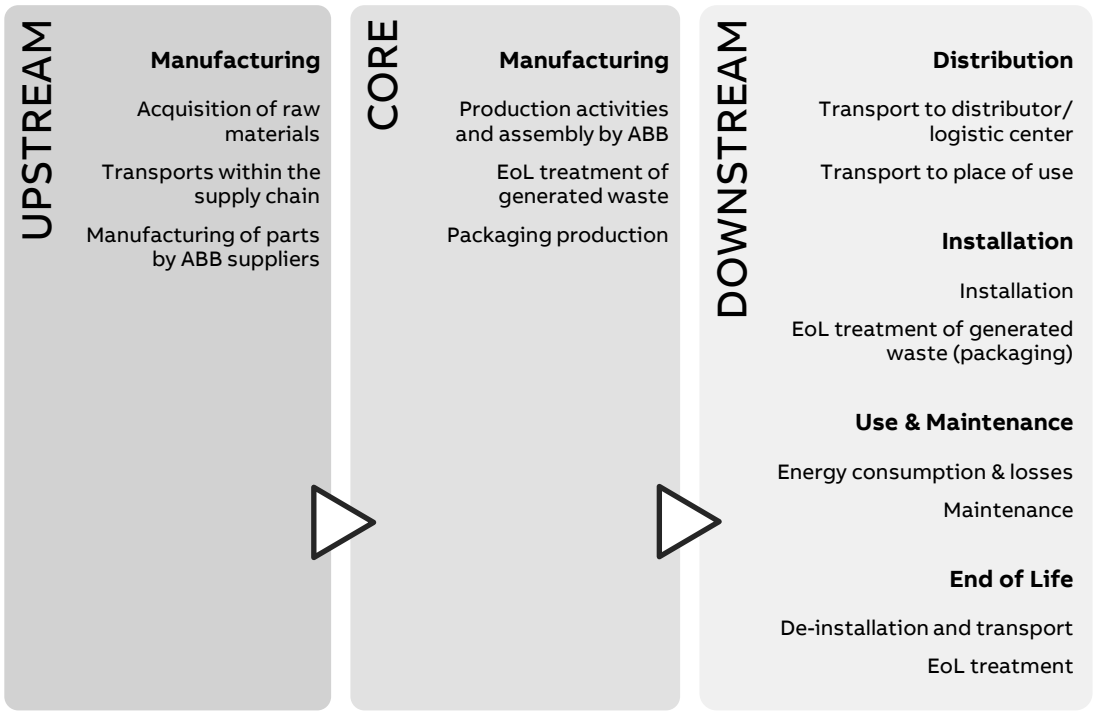
Functional Unit

The functional unit of this study is to measure and protect an energy distribution system (the system voltage 3.6 kV to 40.5 kV), during a service life of 20 years and use rate and load rate of 100 %. The reference flow is a single current transformer device, including related accessories and packaging.

Note, the reference service life (RSL) of 20 years is a theoretical period selected for calculation purposes only – this is not representative for the minimum, average, nor actual service life of the product.

System Boundaries

The life cycle assessment of the LZZBJ9-36/285W3b current transformer, an EEPS (Electronic and Electrical Products and Systems), is a “cradle-to-grave” analysis. The figure below shows the product life cycle stages and the information considered in the LCA.



In terms of exclusions from the system boundary, according to the PCR, capital goods such as machinery, tools, buildings, infrastructure, packaging for internal transports, and administrative activities, which cannot be allocated directly to the production of the reference product, are excluded.

Infrastructures, when present, such as in processes deriving from the ecoinvent database, have not been excluded. Scraps for metal working and plastic processes are also included when already defined in ecoinvent.

Temporal and geographical boundaries

In terms of temporal boundaries, all primary data collected from ABB are from 2022, which is considered a representative production year. Secondary data are provided by ecoinvent v3.9.1 which was released in 2022.

In terms of geographical boundaries, the materials and components used in the production of the LZZBJ9-36/285W3b current transformer are globally sourced. The supply chains are often complex and can extend across multiple countries and continents. Therefore, materials or background processes with global representativeness are selected from ecoinvent. Thus, a conservative approach is adopted.

Data quality

Both primary and secondary data are used. The main sources for primary data are the bill of materials and technical drawings, while site specific foreground data are provided by ABB.

For all processes for which primary data are not available, generic data originating from the ecoinvent v3.9.1 database, “allocation, cut-off by classification”, are used. In addition, chemical substance is taken from the database Industry Data 2.0. The LCA software used for the calculations is SimaPro 9.5.

Environmental impact indicators

The information obtained from the inventory analysis is aggregated according to the effects related to the various environmental issues. In accordance with the PCR EPDItaly007, the environmental impact indicators are determined by using the characterization factors and impact assessment methods specified in EN 15804:2012+A2:2019.

Allocation rules

The utility consumption and waste generation at the ABB manufacturing site is allocated to the production of one LZZBJ9-36/285W3b current transformer by using allocation rules. This is done by surface area of factory and volume production.

For the end-of-life allocation, the “Polluter Pays” principle is adopted according to what is defined in the CEN/TR 16970 standard, as required by the PCR EPDItaly007. This means, waste treatment processes are allocated to the product system that generates the waste until the end-of-waste state is reached. The environmental burdens of recycling and energy recovery processes are therefore allocated to the product system that generates the waste, while the product system that uses the exported energy and recycled materials receives it burden-free. However, the potential benefits and avoided loads from recovery and recycling processes are not considered because it is not required by EPDItaly007.

Cut-off criteria

According to PCR or Standard, the cut-off criteria can be set to a maximum of 2 % of the overall environmental impacts. In this LCA, stickers have been excluded as their weights are negligible. natural gas for cooking has also been excluded due to the complexity of modelling.

Inventory Analysis

Manufacturing stage

As presented in chapter Constituent Materials, epoxy resin is the most frequently used material, followed by silicon steel and amorphous alloy, and copper.

Using the ecoinvent database, the epoxy resin is mainly modelled with custom processes, the silicon steel and amorphous alloy is a special steel for the magnetic core of the transformer, it mainly modelled with *Steel, low-alloyed {GLO}| market for steel, low-alloyed* and additional process for annealing and metal working. To account for the production activities of copper parts, *Copper, cathode {GLO}| market for copper, cathode | Cut-off, Sand Metal working, average for copper product manufacturing {GLO}| market for metal working, average for copper product manufacturing | Cut-off, S, S* is the most frequently used processes.

Supply chain transports are added as far as data is available between ABB, the suppliers, and sub-suppliers. Only primary suppliers are considered. The rest of the transports are assumed to already be included in ecoinvent's "market for"-processes.

For the ABB manufacturing site, which is considered in the core manufacturing stage, utility consumption and waste generation are allocated to the production of one LZZBJ9-36/285W3b current transformer according to the defined allocation rules. The packaging materials and accessories associated with the product are also considered in the core manufacturing stage.

Distribution

The transport distance from the ABB manufacturing site to the site of installation is assumed to be 300 km over land, as suggested by the EPDItaly015, as the actual distance is unknown. The selected ecoinvent process is *transport, freight, lorry 16-32 metric ton, EURO4 {ROW}*.

Installation

The installation phase only implies manual activities, and no energy is consumed. Therefore, this phase only considers the end-of-life of the packaging materials used.

The end-of-life scenario for packaging materials is based on literature which comes from the reports of government and association representative for China. The data taken into consideration is assumed to be representative of an Asian scenario.

Use

The use stage considers the reference power losses over the reference service life of 20 years as defined in the functional unit. This is calculated using the formula explained below.
During the use phase of the LZZBJ9-36/285W3b current transformer, electricity induction transformer (transformers with magnetic core), dissipate some energy losses of two types: losses in the magnetic core (magnetic core) and joule losses in the resistance of the primary and secondary coils.

$$\Delta P[W] = \Delta P_F + \Delta P_J$$

Where:

- ΔP = Total losses of the transformer
- ΔP_F = Losses in the magnetic core (C-core-)
- ΔP_J = Joule losses in the primary and secondary coils

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

Where:

- E_{use} = Total energy use over the reference service life
- ΔP_{use} = Reference power consumption in watts
- RSL = Reference Service Life in years
- 8760 is the number of hours in a year.
- 1000 is the conversion factor from W to kW.

LZZBJ9-36/285W3b, 1250//5/5/5/5A	
ΔP_F [W]	0.12
ΔP_J [W]	84.62
ΔP [W]	84.74
E_{use} [kWh]	14846.83

Because this product is sold globally and is not limited to any specific country, the latest energy mix of Asia is used. The emission factor of the energy mix is presented below.

Energy mix	Source	Amount	Unit
Electricity, medium voltage {RAS}| market group for electricity, me-dium voltage | Cut-off, S	Ecoinvent v3.9.1	0.9207	kg CO_2-eq./kWh

Maintenance is not considered because all parts have been casted in solid epoxy resin, do not need maintenance.

End of life

Decommissioning of the product only implies manual activities, and no energy is consumed. Therefore, this phase only considers the end-of-life of the product.

The end-of-life scenario for the product is based on IEC/TR 62635 (Annex D.3), which is representative for Europe due to the lack of data for an Asian scenario. The IEC/TR 62635 (Annex D.3) scenario is the most representative for Electronic and Electrical Products and Systems (EEPS).
A conservative approach is adopted by using the rates given for materials that go through a separation process, except for electronics for which selective treatment is assumed, and this includes the losses in the separation processes. A transport distance of 100 km by lorry is assumed as actual location of disposal is unknown.

Environmental Indicators

LZZBJ9-36/285W3b current transformer

Impact category	Unit	Total	Cradle-to-gate		Cradle-to-grave			
			UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
GWP – total	kg CO_2 eq.	1.39E+04	2.19E+02	-4.16E+00	3.16E+00	9.71E+00	1.37E+04	3.84E+00
GWP – fossil	kg CO_2 eq.	1.39E+04	2.16E+02	4.80E+00	3.15E+00	2.49E-01	1.37E+04	3.05E+00
GWP – biogenic	kg CO_2 eq.	-1.99E+01	3.04E+00	-8.99E+00	1.10E-03	9.46E+00	-2.42E+01	7.81E-01
GWP – luluc	kg CO_2 eq.	1.14E+01	3.23E-01	1.66E-02	1.65E-03	1.22E-04	1.10E+01	3.63E-03
ODP	kg CFC-11 eq.	7.53E-05	7.18E-06	1.24E-07	5.00E-08	4.06E-09	6.79E-05	3.34E-08
AP	mol H+ eq.	7.56E+01	6.22E+00	3.39E-02	1.39E-02	1.81E-03	6.94E+01	1.35E-02
EP – freshwater	kg P eq.	5.50E+00	4.83E-01	2.30E-03	2.56E-04	6.35E-05	5.02E+00	9.15E-04
EP – marine	kg N eq.	1.48E+01	4.27E-01	1.24E-02	5.08E-03	8.14E-04	1.44E+01	7.13E-03
EP – terrestrial	mol N eq.	1.53E+02	5.28E+00	1.16E-01	5.44E-02	8.12E-03	1.48E+02	3.61E-02
POCP	kg NMVOC eq.	4.31E+01	1.69E+00	3.74E-02	1.87E-02	2.29E-03	4.13E+01	1.14E-02
ADP – minerals and metals	kg Sb eq.	8.27E-02	7.31E-02	5.16E-05	1.01E-05	1.51E-06	9.51E-03	2.44E-05
ADP – fossil	MJ, net calorific value	1.52E+05	3.24E+03	5.82E+02	4.46E+01	2.95E+00	1.48E+05	3.31E+01
WDP	m^3 eq.	1.85E+03	1.17E+02	8.97E+00	1.97E-01	-6.44E-02	1.73E+03	4.97E-01

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-marine compartment; EP-terrestrial: Eutrophication potential-accumulated exceedance; POCP: Formation potential of tropospheric ozone; ADP-minerals & metals: Abiotic Depletion for non-fossil resources potential; ADP-fossil: Abiotic Depletion for fossil resources potential; WDP: Water deprivation potential.

Resource use parameters	Unit	Total	Cradle-to-gate		Cradle-to-grave			
			UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
PENRE	MJ, low cal. value	1.52E+05	3.21E+03	5.82E+02	4.46E+01	2.95E+00	1.48E+05	3.31E+01
PERE	MJ, low cal. value	1.34E+04	3.79E+02	1.36E+02	5.68E-01	7.32E-02	1.28E+04	3.21E+00
PENRM	MJ, low cal. value	2.98E+01	2.98E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, low cal. value	9.43E+01	4.23E+00	9.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, low cal. value	1.52E+05	3.24E+03	5.82E+02	4.46E+01	2.95E+00	1.48E+05	3.31E+01
PERT	MJ, low cal. value	1.34E+04	3.83E+02	2.26E+02	5.68E-01	7.32E-02	1.28E+04	3.21E+00
FW	m^3	4.90E+01	3.15E+00	2.38E-01	6.36E-03	-1.07E-03	4.56E+01	1.83E-02
MS	kg	7.22E+00	7.04E+00	1.81E-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	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PENRE: Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material; PERE: Use of renewable primary energy excluding renewable primary energy resources used as raw material; PENRM: Use of non-renewable primary energy resources used as raw material; PERM: Use of 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); PERT: Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); FW: Net use of fresh water; MS: Use of secondary materials; RFS: Use of renewable secondary fuels; NRSF: Use of non-renewable secondary fuels.

Waste production indicators	Unit	Total	Cradle-to-gate		Cradle-to-grave			
			UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
HWD	kg	2.52E-01	6.91E-02	3.74E-04	2.89E-04	1.76E-05	1.82E-01	1.26E-04
NHWD	kg	9.18E+02	6.46E+01	1.51E+00	2.17E+00	1.75E-01	8.44E+02	5.45E+00
RWD	kg	1.78E-01	4.34E-03	6.84E-03	9.02E-06	8.07E-07	1.67E-01	6.47E-05
MER	kg	7.06E+00	0.00E+00	5.12E-01	0.00E+00	6.47E+00	0.00E+00	8.29E-02
MFR	kg	2.51E+01	1.51E+00	7.97E-02	0.00E+00	5.67E-01	0.00E+00	2.29E+01
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	2.83E+01	0.00E+00	1.87E+00	0.00E+00	2.58E+01	0.00E+00	6.11E-01
EEE	MJ	1.57E+01	0.00E+00	1.04E+00	0.00E+00	1.43E+01	0.00E+00	3.39E-01

HWD: hazardous waste disposed; NHWD: non-hazardous waste disposed; RWD: radioactive waste disposed; MER: materials for energy recovery; MFR: material for recycling; CRU: components for reuse; ETE: exported thermal energy; EEE: exported electricity energy.

Sensitivity analysis

This chapter presents the results of a sensitivity analysis in different scenarios, to understand how the impact category “GWP – total” varies for LZZBJ9-36/285W3b current transformer sold in different geographical locations. Distribution scenario has been fixed to 300 km in both scenarios although real distances are different, only use and maintenance stage has been modified according to different geographical regions.

Scenario	Total [kg CO_2 eq.]	UPSTREAM	CORE	DOWNSTREAM			
		Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
Declared scenario Manufacturing site: China Distribution: 300 km by lorry Use stage: Asia	1.39E+04	2.19E+02	-4.16E+00	3.16E+00	9.71E+00	1.37E+04	3.84E+00
Europe Manufacturing site: China Distribution: 300 km by lorry Use stage: Europe	5.60E+03	2.19E+02	-4.16E+00	3.16E+00	9.71E+00	5.37E+03	3.84E+00

Additional Environmental Information

Recyclability potential

The recyclability potential of the LZZBJ9-36/285W3b current transformer is calculated by dividing “MFR: material for recycling” in the end-of-life stage by the total weight of the product. As a result, the recyclability potential of the product is 35.73 %.

Greenhouse gas emissions from the use of electricity in the manufacturing phase

Production mix from import, medium voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process.

Energy mix	Data source	Amount	Unit
ABB_Electricity mix Xiamen Factory {CN}_Nuclear96%-Solar4%_2022 | PseudoS	Ecoinvent v3.9.1	0.0193	kg CO_2-eq/kWh

Dangerous substances

The product contains no substances given by the REACH Candidate list.

Indoor environment

The product meets the requirements for low emissions.

Carbon footprint

Carbon footprint has not been worked out for the product.

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EPDItaly015 – *Electronic and Electrical Products and Systems – Switchboards,* Rev. 1.5, 2022/02/23.

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