EPD

Environmental Product Declaration

Embedded Pole PT2 VG6 family

Production site: Ratingen, Germany

DOCUMENT KIND Environmental Product Declaration	IN COMPLIANCE WITH ISO 14025 and EN 50693			
PROGRAM OPERATOR The Norwegian EPD Foundation	PUBLISHER The Norwegian EPD Foundation			
REGISTRATION NUMBER OF THE PROGRAM OPERATOR NEPD-5871-5122-EN	ISSUE DATE 2024-01-23			
VALID TO 2029-01-23	STATUS Approved	SECURITY LEVEL Public		
OWNING ORGANIZATION ABB Switzerland Ltd, Group Technology Management	ABB DOCUMENT ID 3XAA019293	REV. A	LANG. EN	PAGE 1/20

EPD Owner	ABB Switzerland Ltd, Group Technology Management		
Organization No.	CHE-101.538.426		
Manufacturer name and address	ABB AG Oberhausener Str. 33, 40472 Ratingen		
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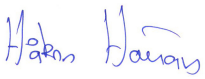
Program operator	The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo, Norway phone: +47 23 08 80 00, email: post@epd-norge.no		
Declared product	Embedded Poles PT2 VG6 family, included PT2 VG6 1600A / 2500A / 3150A		
Product description	The pole part contains a core component, a vacuum interrupter, embedded in a special cast resin. The pole parts protect the vacuum interrupters from impact, dust, moisture, and external damage. At the same time, the pole part facilitates the connection between the vacuum interrupter and the operating mechanism and provides the possibility to connect busbars, for instance, in a switchgear.		
Functional unit	The functional unit of this study is a single pole part, which provides high dielectric strength as well as better protection of the vacuum interrupter against environmental influences, humidity, and mechanical forces, at a reference nominal current of 1600 A and a use rate of 30 %, during a service life of 20 years. The reference flow is a single pole part, including related accessories and packaging.		
Reference flow	A single pole part including related accessories and packaging.		
CPC code	46211 - Electrical apparatus for switching or protecting electrical circuits, or for making connections to or in electrical circuits, for a voltage exceeding 1000 V		
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. EPDItaly012 – Electronic and Electrical Products and Systems – Switches, Rev. 0, 2020/03/16.		
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 3XAA019294.		
EPD type	Average EPD		
EPD scope	Cradle-to-grave		
Product RSL	20 years		
Geographical representativeness	Manufacturing (suppliers): Global	Manufacturing (ABB): Germany	Downstream: Europe
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

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.

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.

Learn more on our website global.abb/group/en/sustainability or scan the QR code.

General Information

The products declared in this Environmental Product Declaration includes the following devices of the pole part PT2 VG6 family, including related accessories and packaging:

- PT2 VG6 1600A
- PT2 VG6 2500A
- PT2 VG6 3150A

The PT2 VG6 family is an embedded pole which are used in different indoor applications to establish or interrupt the electrical continuity of a circuit. This includes certain voltage levels (up to 17.5 kV), specific current levels for rated current (up to 3150 A) and short-circuit current (up to 40 kA).

General technical specifications of the product PT2 VG6 family are presented below.

Technical information			
	PT2 VG6 1600A	**PT2 VG6 2500A**	**PT2 VG6 3150A**
Rated voltage [kV]	… 17.5 kV		
Rated current [A]	… 1600 A	… 2500 A	… 3150 A
Rated short circuit breaking current [kA]	… 40 kA		

The PT2 VG6 family is manufactured by the ABB AG manufacturing site located in Ratingen.

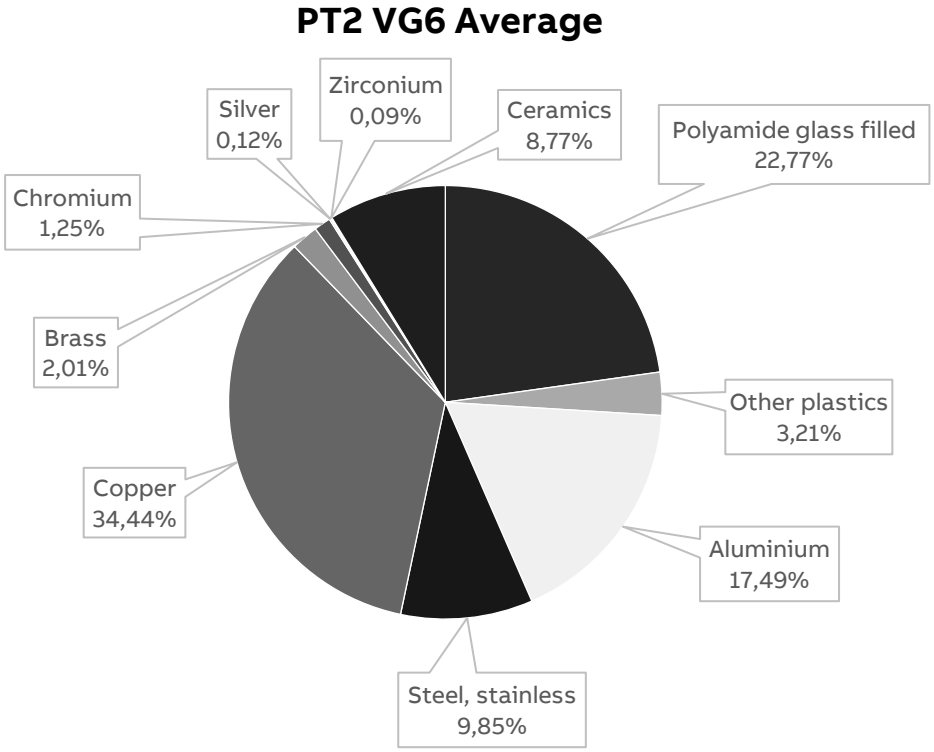
The manufacturing site is certified according to the following standards:

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

Constituent Materials

The PT2 VG6 with a nominal current of 1600A has a average weight of 11.218 kg, and the constituent materials are presented below.

Type	Material	Weight [kg]	Weight %
Plastics	Polyamide glass filled	2.554	22.77
	Other plastics	0.360	3.21
Metals	Aluminium	1.962	17.49
	Steel, stainless	1.105	9.85
	Copper	3.863	34.44
	Brass	0.226	2.01
	Chromium	0.140	1.25
	Silver	0.014	0.12
	Zirconium	0.010	0.09
Others	Ceramics	0.984	8.77
Total		**11.218**	**100**



For PT2 pole parts, two types of boxes are utilized: single-use and reusable. The packaging materials and accessories have a combined weight of 1.377 kg with single-use boxes and 1.761 kg with reusable boxes, calculated per PT2 pole part. The constituent materials are detailed below. These packaging options are evenly distributed, with a 50% utilization rate for both single-use and reusable boxes.

Description	Material	Weight [kg]	Weight %
Single-use box inlc. pallet	Wood	1.04	75.54
Steel Strip	Galvanized steel	0.079	5.76
Polyethylene Ethafoam	Polyethylene foam	0.154	11.15
Packaging Bag	Aluminum film	0.027	1.97
Desiccation Bag	Bentonite	0.018	1.3
Bracket for transport protection	POM	0.059	4.28
Total		**1.377**	**100**

Description	Material	Weight [kg]	Weight %
Reusable box inlc. pallet	Cardboard	1.196	67.92
Steel Strip	Galvanized steel	0.307	17.43
Polyethylene Ethafoam	Polyethylene foam	0.154	8.75
Packaging Bag	Aluminum film	0.027	1.53
Desiccation Bag	Bentonite	0.018	1.02
Bracket for transport protection	POM	0.059	3.35
Total		**1.761**	**100**

LCA Background Information

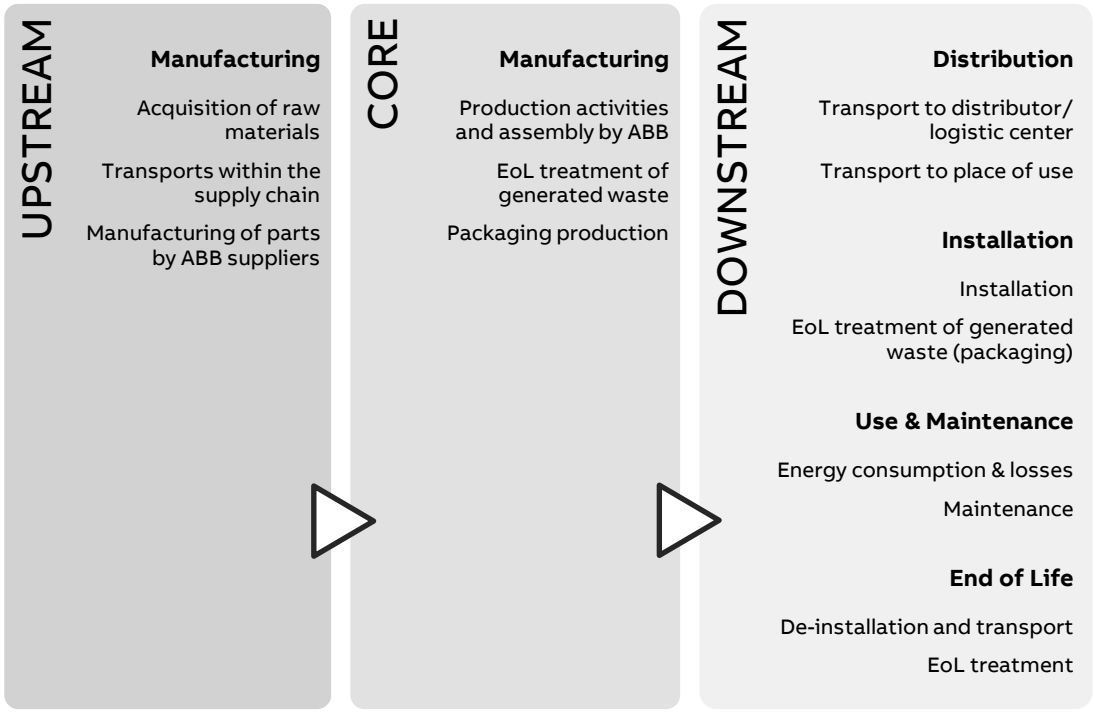
Functional Unit

The functional unit of this study is a single pole part, which provides high dielectric strength as well as better protection of the vacuum interrupter against environmental influences, humidity, and mechanical forces, at a reference nominal current of 1600 A and a use rate of 30 %, during a service life of 20 years. The reference flow is a single pole part, 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 PT2 VG6 family, 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 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 PT2 VG6 family are globally sourced. The supply chains are often complex and can extend across multiple countries and continents. Therefore, materials and 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. Furthermore, information and data obtained from other LCA studies are also used.

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. The database Industry Data 2.0 is also used for the materials POM (Polyoxymethylene) and Steel Electrogalvanized which are not available by ecoinvent. 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 PT2 pole part by using allocation rules. As the factory produces various products, including components, apparatus, and switchgears, only a portion of the environmental impact has been allocated to specific production lines. The values for electricity, heat, pressurized air, and water consumption have been careful measured and recorded using counters distributed throughout the entire factory. These counters are connected to specific areas, machines, or individual workstations. Consequently, the total utility consumption and waste generation for the year 2022 are proportionally allocated based on the total output of PT2 pole parts component during the same period.

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, the cut-off criteria can be set to a maximum of 2 % of the total weight. In this LCA, stickers and grease have been excluded since their weights are negligible. Additionally, the material adhesive Teroson MS 9399 has been excluded due to a lack of available data sets in ecoinvent, and its mass represents less than 2% of the total mass of the entire product.

Inventory Analysis

Manufacturing stage

As presented in chapter Constituent Materials, aluminium is the most frequently used materials in the product, followed by polyamide glass filled and cooper.

Using the ecoinvent database, the aluminium is mainly modelled with *Aluminium, wrought alloy {GLO}| market for* and the polyamide glass filled is mainly modelled with ecoinvent material *Nylon 6-6 {RER}| market for nylon 6-6* and *Glass fibre {GLO}| market for glass fibre*. To account for the production activities of metal and plastic parts, *Metal working, average* and *Injection molding* are the most frequently used processes. Surface treatments are also included, and the most common surface treatment is a *ABB_Electroplating Silver plating (Ratingen)* which is based on primary data.

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 PT2 VG6 family 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 distances from ABB plant to the place of use were exactly defined and allocated based on the delivered quantities of the product. The selected ecoinvent processes are:

- *Transport, freight, lorry 16-32 metric ton, EURO4 {RER}*
- *Transport, freight, sea, container ship {GLO}*
- *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 *Packaging waste by waste management operations* by Eurostat (2020), which is representative for Europe. A transport distance of 100 km by lorry is assumed as actual location of disposal is unknown.

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 following formula, according to PCR:

$$E_{loss}[kWh] = \frac{P_{loss} * 8760 * RSL * \alpha}{1000} = \frac{8.136\ \text{W} * 8760\ \text{hours} * 20\ \text{years} * 30\ \%}{1000} = 427.62\ kWh$$

$$P_{loss} = R_i * (0.5 * I_r)^2 = 8.136\,W$$

Where:

- E_{loss} = Total energy use over the reference service life
- P_{loss} = Reference power consumption in watts
- *RSL* = Reference Service Life in years
- α = Use time rate
- 8760 is the number of hours in a year
- 1000 is the conversion factor from W to kW
- R_i = Internal Resistance (12.71 μΩ)
- I_r = Reference Current (1600 A)

Because this product is sold globally and is not limited to any specific country, the latest energy mix of the European Union is adopted as suggested by the standard EN 50693. The emission factor of the energy mix is presented below.

Energy mix	Source	Amount	Unit
Electricity, medium voltage {Europe without Switzerland}| market group for electricity, medium voltage | Cut-off, S	ecoinvent v3.9.1	0.367	kg CO_2-eq./kWh

Maintenance is not considered because the pole parts are maintenance free products.

End of life

The end-of-life scenario for the product is based on IEC/TR 62635 (Annex D.3), which is representative for Europe (see Table 15). A conservative approach is adopted by mainly using rates given for materials that go through a separation process (table D.8), and this includes the losses in the separation processes. Exceptions exist, particularly with polyamide glass-filled (PA66-GFxx), and ceramics. Polyamide with glass-filled undergoes a dismantling process according to waste management company and recycling is assumed to be 94 % according to IEC/TR 62635 (Annex D.6) and ceramic is assumed to be 100% landfilled. The transportation assumption is a 100 km distance by lorry, reflecting the uncertainty of the actual disposal location.

Percentage data regarding the treatment of pole parts at the end of their life is sourced from IEC/TR 62635, while EUROSTAT contributes information on packaging waste scenarios.

Environmental Indicators

Environmental Impact Indicators of PT2 VG6 family average results with 1600A reference current

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.	3.06E+02	1.16E+02	2.71E+01	2.97E+00	3.14E-01	1.57E+02	2.12E+00
GWP – fossil	kg CO_2 eq.	2.99E+02	1.15E+02	2.73E+01	2.96E+00	5.76E-02	1.51E+02	1.90E+00
GWP – biogenic	kg CO_2 eq.	6.94E+00	1.24E+00	-2.25E-01	4.74E-04	2.57E-01	5.44E+00	2.22E-01
GWP – luluc	kg CO_2 eq.	6.08E-01	2.10E-01	1.54E-02	2.01E-03	1.26E-05	3.79E-01	1.91E-03
ODP	kg CFC-11 eq.	4.92E-06	1.30E-06	8.20E-07	5.14E-08	4.42E-10	2.71E-06	2.72E-08
AP	mol H+ eq.	4.59E+00	3.33E+00	4.24E-01	6.32E-02	1.18E-04	7.59E-01	7.58E-03
EP – freshwater	kg P eq.	4.38E-01	2.66E-01	3.39E-02	1.35E-04	3.50E-06	1.38E-01	5.68E-04
EP – marine	kg N eq.	4.42E-01	2.57E-01	3.18E-02	1.63E-02	1.41E-04	1.35E-01	2.40E-03
EP – terrestrial	mol N eq.	4.90E+00	3.11E+00	4.05E-01	1.80E-01	4.96E-04	1.19E+00	1.92E-02
POCP	kg NMVOC eq.	1.45E+00	8.88E-01	1.25E-01	5.00E-02	1.65E-04	3.84E-01	6.36E-03
ADP – minerals and metals	kg Sb eq.	5.85E-02	5.21E-02	6.17E-03	5.08E-06	8.31E-08	2.97E-04	1.11E-05
ADP – fossil	MJ, net calorific value	5.18E+03	1.39E+03	2.59E+02	3.83E+01	3.14E-01	3.46E+03	2.36E+01
WDP	m^3 eq.	1.06E+02	6.31E+01	7.34E+00	1.12E-01	2.13E-03	3.55E+01	3.68E-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	5.08E+03	1.30E+03	2.57E+02	3.83E+01	3.14E-01	3.46E+03	2.36E+01
PERE	MJ, low cal. value	8.92E+02	2.17E+02	2.75E+01	3.88E-01	7.87E-03	6.46E+02	1.53E+00
PENRM	MJ, low cal. value	9.27E+01	9.09E+01	1.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, low cal. value	7.72E+00	0.00E+00	7.72E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, low cal. value	5.17E+03	1.39E+03	2.59E+02	3.83E+01	3.14E-01	3.46E+03	2.36E+01
PERT	MJ, low cal. value	9.00E+02	2.17E+02	3.52E+01	3.88E-01	7.87E-03	6.46E+02	1.53E+00
FW	m^3	4.55E+00	1.69E+00	2.04E-01	3.95E-03	7.82E-05	2.64E+00	1.14E-02
MS	kg	2.04E+00	1.88E+00	1.55E-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	2.68E-02	2.07E-02	1.36E-03	2.09E-04	1.77E-06	4.41E-03	8.05E-05
NHWD	kg	4.74E+01	3.04E+01	3.95E+00	7.44E-01	2.53E-01	9.48E+00	2.63E+00
RWD	kg	2.73E-02	1.99E-03	2.26E-04	7.18E-06	1.54E-07	2.50E-02	2.90E-05
MER	kg	1.75E+00	0.00E+00	1.55E+00	0.00E+00	1.75E-01	0.00E+00	3.18E-02
MFR	kg	1.22E+01	1.66E+00	1.24E+00	0.00E+00	2.31E-01	0.00E+00	9.12E+00
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	3.37E+00	0.00E+00	2.30E+00	0.00E+00	7.87E-01	0.00E+00	2.81E-01
EEE	MJ	1.84E+00	0.00E+00	1.24E+00	0.00E+00	4.37E-01	0.00E+00	1.56E-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.

Resulting in a variation from the average of ±10%
PT2 VG6 Family w/o UseStage

Impact category	Unit	PT2 VG6 1600A	PT2 VG6 3150A	Average	1600A (MIN)	3150A (MAX)
GWP – total	kg CO_2 eq.	1,41E+02	1,57E+02	1,49E+02	-5%	5%
GWP – fossil	kg CO_2 eq.	1,40E+02	1,55E+02	1,47E+02	-5%	5%
GWP – biogenic	kg CO_2 eq.	1,41E+00	1,59E+00	1,50E+00	-6%	6%
GWP – luluc	kg CO_2 eq.	2,12E-01	2,47E-01	2,29E-01	-8%	8%
ODP	kg CFC-11 eq.	2,12E-06	2,29E-06	2,20E-06	-4%	4%
AP	mol H+ eq.	3,59E+00	4,07E+00	3,83E+00	-6%	6%
EP – freshwater	kg P eq.	2,83E-01	3,18E-01	3,00E-01	-6%	6%
EP – marine	kg N eq.	2,91E-01	3,24E-01	3,07E-01	-5%	5%
EP – terrestrial	mol N eq.	3,51E+00	3,92E+00	3,71E+00	-6%	6%
POCP	kg NMVOC eq.	1,01E+00	1,13E+00	1,07E+00	-6%	6%
ADP – minerals and metals	kg Sb eq.	5,56E-02	6,09E-02	5,83E-02	-5%	5%
ADP – fossil	MJ, net calorific value	1,63E+03	1,80E+03	1,71E+03	-5%	5%
WDP	m^3 eq.	6,75E+01	7,44E+01	7,10E+01	-5%	5%

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.

Resulting in a variation from the average of ±10%
PT2 VG6 Family with UseStage, with 1600A rated current

Impact category	Unit	PT2 VG6 1600A	PT2 VG6 3150A	Average	1600A (MIN)	3150A (MAX)
GWP – total	kg CO_2 eq.	2,99E+02	3,14E+02	3,06E+02	-2%	2%
GWP – fossil	kg CO_2 eq.	2,91E+02	3,06E+02	2,99E+02	-3%	3%
GWP – biogenic	kg CO_2 eq.	6,85E+00	7,02E+00	6,94E+00	-1%	1%
GWP – luluc	kg CO_2 eq.	5,90E-01	6,25E-01	6,08E-01	-3%	3%
ODP	kg CFC-11 eq.	4,83E-06	5,00E-06	4,92E-06	-2%	2%
AP	mol H+ eq.	4,35E+00	4,82E+00	4,59E+00	-5%	5%
EP – freshwater	kg P eq.	4,21E-01	4,56E-01	4,38E-01	-4%	4%
EP – marine	kg N eq.	4,26E-01	4,59E-01	4,42E-01	-4%	4%
EP – terrestrial	mol N eq.	4,70E+00	5,11E+00	4,90E+00	-4%	4%
POCP	kg NMVOC eq.	1,39E+00	1,51E+00	1,45E+00	-4%	4%
ADP – minerals and metals	kg Sb eq.	5,59E-02	6,12E-02	5,85E-02	-4%	4%
ADP – fossil	MJ, net calorific value	5,09E+03	5,26E+03	5,18E+03	-2%	2%
WDP	m^3 eq.	1,03E+02	1,10E+02	1,06E+02	-3%	3%

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.

Extrapolation rules

Due to the possible variations in power consumption within the PT2 VG6 family, extrapolation rules for environmental impacts were established according to EN 50693. Changes in the rated current and, consequently, variations in weights were precisely identified, and results were determined. The extent of variation primarily depended on the nominal current used, with the typical range being 600 - 3150 A. The following extrapolation rule is established:

- The nominal current is a variable value that can be extrapolated to identify a suitable product and, simultaneously, determine the weight of the product.
  - Formula: $Impactvalue_{ref} * \left(I_{new}^2 / I_{ref}^2\right)$
  - Reference nominal current: 1600 A
  - Typical range of new current: 600 – 3150 A

- Example: A PT2 VG6 family average result that has a measured nominal current at 2550 A.
  - "GWP-total" in use stage $= 157.1\ kg\ CO2eq * ((3150\ A)^2/(1600\ A)^2)$
    $= 609\ kg\ CO2eq$

Extrapolation Rules Tool of PT2 VG6 family

Additional Environmental Information

Recyclability potential

The recyclability potential of the PT2 VG6 family 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 81.25 % are presented below:

	Recyclability potential
Average results	81.25 %

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

The manufacturing phase in Ratingen, Germany, uses energy which is generated by a CHP (combined heat and power unit) owned by ABB operated by natural gas for the electricity. The emission factor of the energy mix is presented in the table below.

Energy mix	Data source	Amount	Unit
Electricity, high voltage {Europe without Switzerland}| heat and power cogeneration, natural gas, 1MW electrical, lean burn | Cut-off, S	ecoinvent v3.9.1	0.627	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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