EPD

Environmental Product Declaration

VD4 Vacuum Circuit Breakers p.135 and p.150 families with PT1 pole

Production site: Dalmine, Italy

DOCUMENT KIND	IN COMPLIANCE WITH			
Environmental Product Declaration	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 S.p.A. Via Friuli, 4, 24044 Dalmine, Italy		
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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	VD4 Vacuum Circuit Breaker p.135-150 adopting PT1 pole in all its versions.		
Product description	The VD4 is a medium voltage tripolar circuit breaker. It is an automatically operated electrical device that is used to control and protect an electrical circuit from damage caused by overload or short circuit. It can be equipped with three embedded poles (PT1), that are used to provide dielectric strength and protection of the vacuum interrupter (VG4-S or VGE4).		
Functional unit	To manage and protect the electrical continuity of the circuit to which it is applied, at use rate of 30% and load factor of 50% during a service life of 20 years.		
Reference flow	A single average withdrawable VD4 p.135-150 with PT1 pole and 630A nominal current.		
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 1VCD601891R0001		
EPD type	Average product		
EPD scope	Cradle-to-grave		
Product RSL	20 years		
Geographical representativeness	Manufacturing (suppliers): Global	Manufacturing (ABB): Italy	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.		

Contents

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.

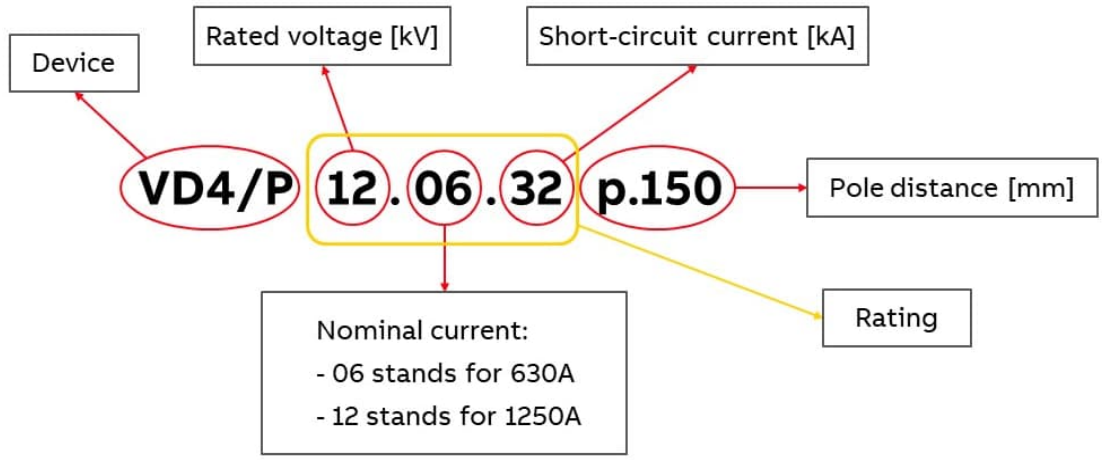
General Information

The products declared in this Environmental Product Declaration include the following devices of the Vacuum Circuit Breaker VD4 family with the related accessories and packaging:

- VD4
- VD4evo
- VD4/GT
- VD4/P
- VD4/GT/P
- VD4/P K
- VD4/P PK

In particular, the VD4 and VD4/GT stand for fixed configurations, that will be here analyzed as sensitivity analysis, while all the other ones stand for withdrawable product configuration. The reference flow is composed by the withdrawable version complete of all the available accessories. The analysis will be mainly referred to the products with nominal current of 630A, while 1250A ones will be studied in Extrapolation rules chapter.

The presented devices are available in a variety of ratings, each one with its own construction and peculiarity. The following scheme reports how to derive the rating from the product's name. "Rating of a device" is defined as the combination of rated voltage, nominal current and short-circuit current.



General technical specifications of the available products are presented below.

	VD4 family
Rated voltage [kV]	12 to 17.5
Rated current [A]	630 or 1250
Rated short circuit breaking current [kA]	16 to 31.5

It can be equipped with three embedded poles PT1, that are used to provide dielectric strength and protection of the vacuum interrupter (VG4-S or VGE4).

The VD4 devices are manufactured by the ABB site located in Dalmine, Italy.

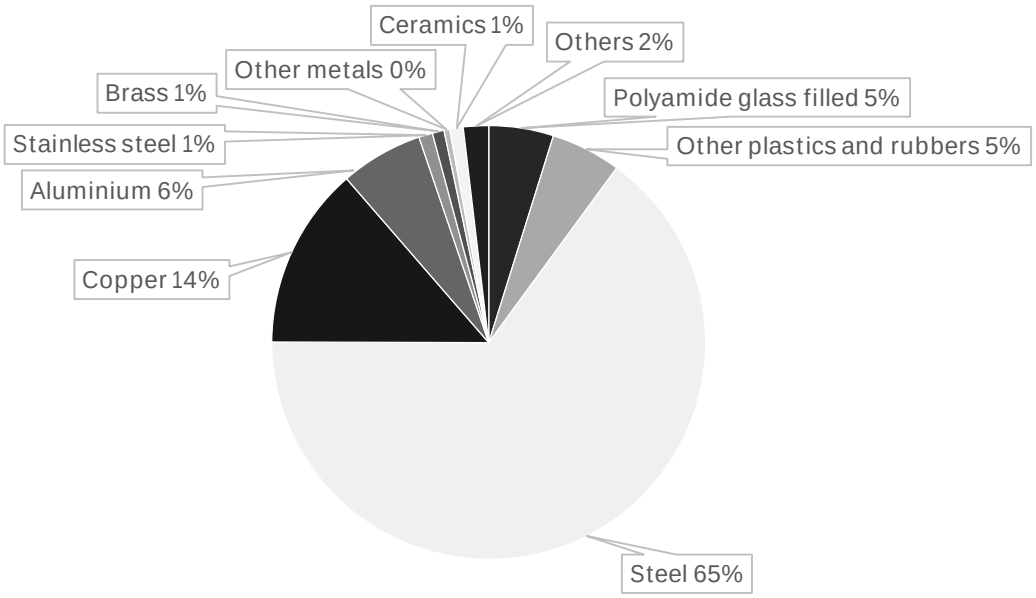
The manufacturing site is certified according to the following standards:

- 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 systems

Constituent Materials

The average withdrawable version of VD4 p.135-150 with PT1 pole average weighs 89.01 kg, and the constituent materials and average weight are presented below.

Type	Material	Weight [kg]	Weight %
Plastics	Polyamide glass filled	4.30	4.83%
	Other plastics and rubbers	4.67	5.24%
Metals	Steel	57.81	64.95%
	Copper	12.08	13.57%
	Aluminum	5.50	6.18%
	Stainless steel	0.93	1.04%
	Brass	0.76	0.85%
	Other metals	0.39	0.43%
Others	Ceramics	0.90	1.01%
	Others	1.68	1.88%
Total		89.01	100%



The packaging is the same for all the devices, the materials and accessories weighs 27.57 kg, and the constituent materials are presented below.

Description	Material	Weight [kg]	Weight %
Screw, bush, nut, bracket	Steel	1.47	5%
Packaging box	Cardboard	4.00	15%
Bags, straps, belt	Plastic	0.60	2%
Pallet, lid	Wood	21.50	78%
Total		27.57	100%

LCA Background Information

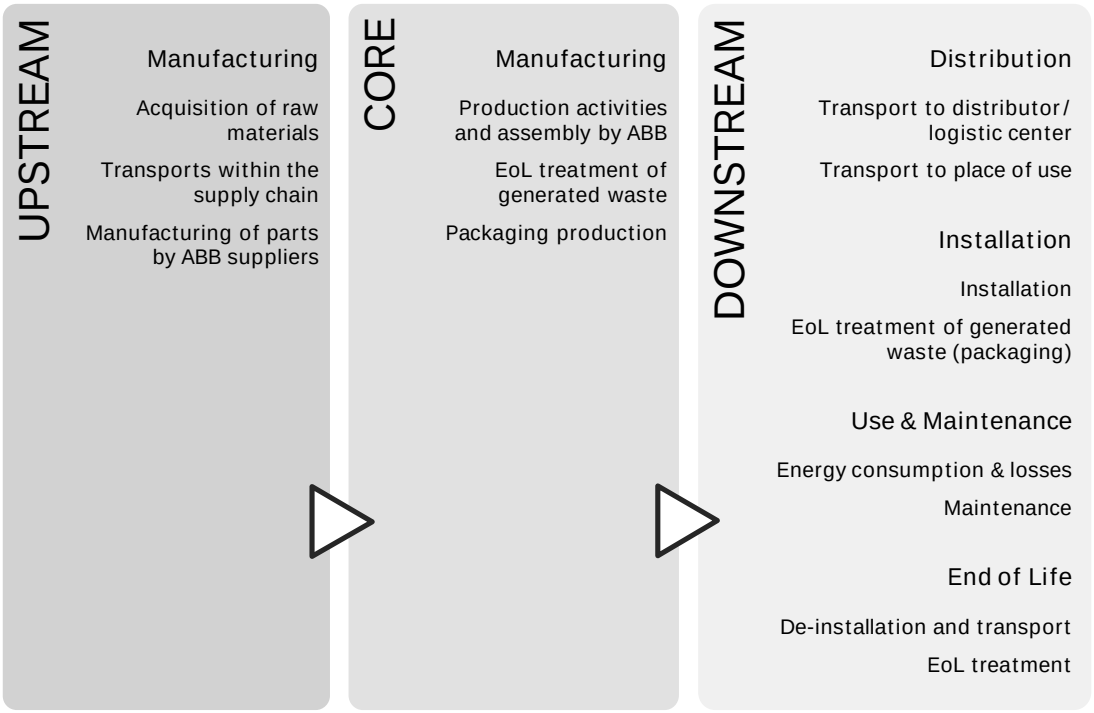
Functional Unit

The functional unit of this study is to manage and protect the electrical continuity of the circuit to which it is applied, during a service life of 20 years, with a use rate of 30% and a load factor of 50%. The reference flow is a single average withdrawable version VD4 p.135-150 with PT1 pole device in withdrawable version, 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 a withdrawable VD4 p.135-150 with PT1 pole, 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 Standard/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 average withdrawable VD4 p.135-150 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 are obtained from EPD of the PT2 VGE4-S pole (Report No. 3XAA019290, rev. A).

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.

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 average withdrawable VD4 p.135-p.150 with PT1 pole by using allocation rules. This is done by allocating electricity to surface area and production volume, heating, and waste to surface area. Water is allocated directly to employees of the line involved in the study.

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 EPDItaly007 “Electronic and electrical products and systems”, the cut-off criteria can be set to a maximum of 2% of the overall environmental impacts. In this LCA, components like stickers, glue and grease have been excluded as their weights are negligible. The same allies to packaging, where small parts such as sticking labels are even smaller fraction of the total mass.
Burnishing, oiling, black oxide and phosphate surface treatments have also been excluded due to the low amount of surface involved.

Inventory Analysis

Manufacturing stage

As presented in chapter Constituent Materials, low-alloyed steel and copper are the most frequently used materials, followed by polyamide and aluminum alloy.

Using the ecoinvent database, the steels are mainly modelled with *Steel, low-alloyed {GLO}| market for* and the copper is mainly modelled with *Copper, cathode {GLO}| market for*. 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 *Zinc coat, pieces {GLO}| market for.*

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 average withdrawable VD4 p.135-150 with PT1 pole 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 PCR EPDItaly012, as the actual customer's distance is unknown. The selected ecoinvent process is *transport, freight, lorry 16-32 metric ton, EURO4 {RER}*.

Installation

The installation phase implies manual activities as well as the support of a lifting machinery, whose energy consumption is negligible. 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 with the ecoinvent process *transport, freight, lorry 16-32 metric ton, EURO4 {RER}*, as actual location of disposal is unknown.

Use

The use stage considers the reference power consumption over the reference service life of 20 years as defined in the functional unit. This is calculated using the following formula, according to PCR/standard:

$$P_{use} = R_{int} * (I_{nom} * LF)^2 * n_{poles}$$

$$E_{use}[kWh] = \frac{P_{use} * 8760 * RSL * \alpha}{1000} = 414.61\ kWh$$

Where:

- E_{use} = Total energy use over the reference service life
- P_{use} = Reference power consumption in watts
- I_{nom} = Nominal current, 630A in this reference case
- R_{int} = Internal resistance
- LF = Load Factor
- n_{poles} = Number of poles
- 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

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
European energy mix; *Electricity, medium voltage {RER}| market group for | Cut-off, S*	Ecoinvent v3.9.1	0.368	kg CO_2-eq./kWh

Maintenance was not considered because it does not imply any relevant use of material or energy.

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. 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

Average Withdrawable VD4 p.135-150 with PT1 pole

The environmental indicators for the average withdrawable VD4 p.135-150 with PT1 pole family with a reference current of 630A results are presented.

			Cradle-to-gate					
			Cradle-to-grave					
Impact category	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
GWP – total	kg CO_2 eq.	8.32E+02	6.42E+02	-2.84E+00	6.75E+00	1.27E+01	1.60E+02	1.35E+01
GWP – fossil	kg CO_2 eq.	8.36E+02	6.35E+02	2.82E+01	6.74E+00	1.51E+00	1.54E+02	1.10E+01
GWP – biogenic	kg CO_2 eq.	-6.11E+00	5.66E+00	-3.12E+01	6.13E-03	1.12E+01	5.67E+00	2.55E+00
GWP – luluc	kg CO_2 eq.	1.37E+00	8.39E-01	1.33E-01	3.29E-03	4.55E-04	3.85E-01	1.21E-02
ODP	kg CFC-11 eq.	2.91E-05	2.53E-05	8.29E-07	1.48E-07	1.75E-08	2.76E-06	1.15E-07
AP	mol H+ eq.	1.33E+01	1.23E+01	2.04E-01	2.79E-02	4.56E-03	7.72E-01	4.58E-02
EP – freshwater	kg P eq.	1.12E+00	9.68E-01	1.10E-02	4.75E-04	1.25E-04	1.40E-01	3.09E-03
EP – marine	kg N eq.	1.32E+00	1.08E+00	5.72E-02	1.06E-02	5.78E-03	1.37E-01	3.17E-02
EP – terrestrial	mol N eq.	1.65E+01	1.43E+01	7.38E-01	1.14E-01	1.91E-02	1.21E+00	1.23E-01
POCP	kg NMVOC eq.	4.55E+00	3.90E+00	1.78E-01	4.08E-02	6.57E-03	3.90E-01	3.89E-02
ADP – minerals and metals	kg Sb eq.	1.72E-01	1.72E-01	3.03E-04	2.18E-05	2.90E-06	3.06E-04	8.04E-05
ADP – fossil	MJ, net calorific value	1.18E+04	7.61E+03	4.61E+02	9.61E+01	1.19E+01	3.54E+03	1.15E+02
WDP	m^3 eq.	2.66E+02	2.11E+02	1.67E+01	3.90E-01	8.69E-02	3.62E+01	1.45E+00

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	1.16E+04	7.45E+03	4.37E+02	9.61E+01	1.19E+01	3.54E+03	1.15E+02
PERE	MJ, low cal. value	2.56E+03	1.06E+03	8.05E+02	1.49E+00	2.66E-01	6.79E+02	1.06E+01
PENRM	MJ, low cal. value	1.82E+02	1.58E+02	2.39E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, low cal. value	1.27E+01	1.27E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, low cal. value	1.18E+04	7.61E+03	4.61E+02	9.61E+01	1.19E+01	3.54E+03	1.15E+02
PERT	MJ, low cal. value	2.57E+03	1.08E+03	8.05E+02	1.49E+00	2.66E-01	6.79E+02	1.06E+01
FW	m^3	9.61E+00	6.17E+00	5.95E-01	1.37E-02	3.17E-03	2.77E+00	5.41E-02
MS	kg	3.19E+01	2.77E+01	4.18E+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	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	1.34E-01	1.26E-01	2.74E-03	6.12E-04	6.87E-05	4.48E-03	4.35E-04
NHWD	kg	2.26E+02	1.76E+02	7.08E+00	4.70E+00	9.82E+00	9.71E+00	1.93E+01
RWD	kg	3.73E-02	1.03E-02	9.58E-04	3.12E-05	5.19E-06	2.58E-02	2.13E-04
MER	kg	1.01E+01	2.39E+00	4.57E-01	0.00E+00	6.83E+00	0.00E+00	4.39E-01
MFR	kg	1.14E+02	1.93E+01	6.72E+00	0.00E+00	1.15E+01	0.00E+00	7.67E+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	4.59E+01	1.12E+01	2.20E+00	0.00E+00	2.91E+01	0.00E+00	3.37E+00
EEE	MJ	2.49E+01	5.68E+00	1.22E+00	0.00E+00	1.62E+01	0.00E+00	1.80E+00

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.

Extrapolation rules

Despite similarities from the constructive point of view, the total environmental impact indicators differ from the products with nominal current of 1250A more than 10% due to large differences in the use phase. Therefore, to determine their impact indicators value, extrapolation rules are adopted.
Those values can be obtained from the results for the reference average withdrawable VD4 p.135-150 with PT1 pole and 630A of nominal current, multiplying them for the correspondent conversion factor as shown in the following formula:

$$Value_{1250A} = Value_{630A} * ConversionFactor$$

Where:

- $Value_{630A}$ can be found in the tables in the previous chapter;
- $ConversionFactor$ is constant and can be found in the following tables.

The conversion factors were calculated by dividing the results obtained in the LCA analysis of the other configurations (1250A nominal current) for the ones related to the withdrawable products with 630A nominal current.
In the following table are presented the average values obtained for the withdrawable VD4 p.135-150 with 1250A nominal current.

			Cradle-to-gate					
			Cradle-to-grave					
Impact category	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
GWP – total	kg CO_2 eq.	1.58	1.02	1.00	1.01	1.00	3.94	1.02
GWP – fossil	kg CO_2 eq.	1.56	1.02	1.00	1.01	1.00	3.94	1.02
GWP – biogenic	kg CO_2 eq.	-1.77	1.03	1.00	1.01	1.00	3.94	1.02
GWP – luluc	kg CO_2 eq.	1.85	1.04	1.00	1.01	1.00	3.94	1.02
ODP	kg CFC-11 eq.	1.28	1.00	1.00	1.01	1.00	3.94	1.02
AP	mol H+ eq.	1.17	1.00	1.00	1.01	1.00	3.94	1.02
EP – freshwater	kg P eq.	1.36	0.99	1.00	1.01	1.00	3.94	1.02
EP – marine	kg N eq.	1.31	1.00	1.00	1.01	1.00	3.94	1.01
EP – terrestrial	mol N eq.	1.22	1.00	1.00	1.01	1.00	3.94	1.02
POCP	kg NMVOC eq.	1.26	1.01	1.00	1.01	1.00	3.94	1.02
ADP – minerals and metals	kg Sb eq.	0.97	0.96	1.00	1.01	1.00	3.94	1.02
ADP – fossil	MJ. net calorific value	1.89	1.02	1.00	1.01	1.00	3.94	1.02
WDP	m^3 eq.	1.38	0.97	1.00	1.01	1.00	3.94	1.02

Sensitivity analysis

A sensitivity analysis is conducted to understand how the environmental impacts vary considering operative condition variations. Changing the accessories of the withdrawable VD4 p.135-150 with PT1 pole, a fixed configuration can be obtained, and then, by considering a nominal current increase from 630A to 1250A (along with fundamental components change), another type of configuration is obtained. Both are similar to the reference flow, since the basic circuit breaker is the same, as well as most of the accessories, but the environmental impact indicators change.

In the first analyzed case, the circuit breaker is produced without bushing, tulips, and truck to obtain a fixed configuration with 630A nominal current. This strong material reduction, along with a lower internal resistance, causes a relevant decrease in impact indicator values. In the second case the same approach was adopted, but also increasing the nominal current at 1250A. Also in this case, a lower amount of material used and lower internal resistance causes a decrease in impact indicators values, but a higher nominal current value results in a strong increase in the Use-phase consumption, causing higher impact indicators values.

Average fixed VD4 p.135-150 with PT1 pole and 630A nominal current Impact indicators

			Cradle-to-gate					
			Cradle-to-grave					
Impact category	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
GWP – total	kg CO_2 eq.	5.82E+02	4.75E+02	-2.84E+00	5.29E+00	1.27E+01	8.20E+01	9.76E+00
GWP – fossil	kg CO_2 eq.	5.94E+02	4.72E+02	2.82E+01	5.29E+00	1.51E+00	7.89E+01	7.96E+00
GWP – biogenic	kg CO_2 eq.	-1.28E+01	2.45E+00	-3.12E+01	4.81E-03	1.12E+01	2.91E+00	1.80E+00
GWP – luluc	kg CO_2 eq.	9.39E-01	5.97E-01	1.33E-01	2.58E-03	4.55E-04	1.97E-01	8.40E-03
ODP	kg CFC-11 eq.	2.55E-05	2.30E-05	8.29E-07	1.16E-07	1.75E-08	1.42E-06	8.35E-08
AP	mol H+ eq.	9.16E+00	8.50E+00	2.04E-01	2.19E-02	4.56E-03	3.96E-01	3.22E-02
EP – freshwater	kg P eq.	7.77E-01	6.91E-01	1.10E-02	3.72E-04	1.25E-04	7.20E-02	2.17E-03
EP – marine	kg N eq.	9.42E-01	7.78E-01	5.72E-02	8.35E-03	5.78E-03	7.04E-02	2.17E-02
EP – terrestrial	mol N eq.	1.14E+01	9.80E+00	7.38E-01	8.91E-02	1.91E-02	6.21E-01	8.64E-02
POCP	kg NMVOC eq.	3.27E+00	2.83E+00	1.78E-01	3.20E-02	6.57E-03	2.00E-01	2.75E-02
ADP – minerals and metals	kg Sb eq.	1.28E-01	1.27E-01	3.03E-04	1.71E-05	2.90E-06	1.57E-04	5.64E-05
ADP – fossil	MJ. net calorific value	8.12E+03	5.67E+03	4.61E+02	7.54E+01	1.19E+01	1.82E+03	8.14E+01
WDP	m^3 eq.	1.85E+02	1.48E+02	1.67E+01	3.06E-01	8.69E-02	1.86E+01	1.06E+00

Average fixed VD4 p.135-150 with PT1 pole and 1250A nominal current Impact indicators

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.	8.23E+02	4.75E+02	-2.84E+00	5.29E+00	1.27E+01	3.23E+02	9.76E+00
GWP – fossil	kg CO_2 eq.	8.26E+02	4.72E+02	2.82E+01	5.29E+00	1.51E+00	3.11E+02	7.96E+00
GWP – biogenic	kg CO_2 eq.	-4.28E+00	2.45E+00	-3.12E+01	4.81E-03	1.12E+01	1.15E+01	1.80E+00
GWP – luluc	kg CO_2 eq.	1.52E+00	5.97E-01	1.33E-01	2.58E-03	4.55E-04	7.77E-01	8.40E-03
ODP	kg CFC-11 eq.	2.97E-05	2.30E-05	8.29E-07	1.16E-07	1.75E-08	5.58E-06	8.35E-08
AP	mol H+ eq.	1.03E+01	8.50E+00	2.04E-01	2.19E-02	4.56E-03	1.56E+00	3.22E-02
EP – freshwater	kg P eq.	9.88E-01	6.91E-01	1.10E-02	3.72E-04	1.25E-04	2.84E-01	2.17E-03
EP – marine	kg N eq.	1.15E+00	7.78E-01	5.72E-02	8.35E-03	5.78E-03	2.77E-01	2.17E-02
EP – terrestrial	mol N eq.	1.32E+01	9.80E+00	7.38E-01	8.91E-02	1.91E-02	2.45E+00	8.64E-02
POCP	kg NMVOC eq.	3.86E+00	2.83E+00	1.78E-01	3.20E-02	6.57E-03	7.88E-01	2.75E-02
ADP – minerals and metals	kg Sb eq.	1.28E-01	1.27E-01	3.03E-04	1.71E-05	2.90E-06	6.18E-04	5.64E-05
ADP – fossil	MJ. net calorific value	1.35E+04	5.67E+03	4.61E+02	7.54E+01	1.19E+01	7.15E+03	8.14E+01
WDP	m^3 eq.	2.39E+02	1.48E+02	1.67E+01	3.06E-01	8.69E-02	7.31E+01	1.06E+00

Additional Environmental Information

Recyclability potential

The recyclability potential of the average VD4 p.135-150 with PT1 pole is calculated by dividing “MFR: material for recycling” in the end-of-life stage with the total weight of the product. As a result, the average recyclability potential of the VD4 P.135-150 is equal to 81.37%.

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 Dalmine factory {IT}_Bio37%-Solar37%-Hydro23%-Other2%_2022	Ecoinvent v3.9.1	0.169	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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