



EPD

# Environmental Product Declaration


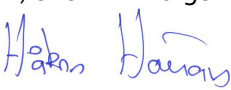
Circuit breaker VD4/HPA 12.06-08-12.25-32 P185

Retrofit solution for HPA circuit Breaker in Safesix enclosures

Production site: ABB Dalmine, Italy



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-5629-4926 -EN	ISSUE DATE 2023-12-15			
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OWNING ORGANIZATION ABB Switzerland Ltd, Group Technology Management	ABB DOCUMENT ID 1VCD900059R0001	REV. A	LANG. EN	PAGE 1/18

<b>EPD Owner</b>	ABB Switzerland Ltd, Group Technology Management		
<b>Organization No.</b>	CHE-101.538.426		
<b>Manufacturer name and address</b>	ABB S.p.A. Via Friuli, 4, 24044 Dalmine, Italy		
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<b>Program operator</b>	The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo, Norway phone: +47 23 08 80 00, email: post@epd-norge.no		
<b>Declared product</b>	VD4/HPA 12.06-08-12.25-32 P185		
<b>Product description</b>	VD4 circuit breakers are used in power distribution systems for controlling and protecting cables, overhead lines, distribution substations, motors, transformers, generators, and capacitor banks.		
<b>Functional unit</b>	The function of the system is to manage and protect the electrical continuity of the circuit to which it is applied, at a use rate of 30% and a load factor of 50%. The functional unit is the production and downstream of the product during a service life of 20 years in Europe		
<b>Reference flow</b>	A single VD4/HPA 12.06-08-12.25-32 P185 circuit breaker that supports 12 kV of rated voltage, 1250 A of nominal current and 32 kA of short circuit current, including related accessories and packaging.		
<b>CPC code</b>	46211 - Electrical apparatus for switching or protecting electrical circuits, or for making connections to or in electrical circuits, for a voltage exceeding 1000 V		
<b>Independent verification</b>	Independent verification of the declaration and data, according to ISO 14025:2010  <input type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL  Independent verifier approved by EPD-Norge: Elisabet Amat Guasch  Signature: 		
<b>Approved by</b>	Håkon Hauan, CEO EPD-Norge  Signature: 		
<b>Reference PCR</b>	EN 50693:2019 – Product Category Rules for Life Cycle Assessments of Electronic and Electrical Products and Systems. EPDIItaly007 – Electronic and Electrical Products and Systems, Rev. 3.0, 2023/01/13. EPDIItaly012 – Electronic and Electrical Products and Systems – Switches, Rev. 0, 2020/03/16.		
<b>Program instructions</b>	The Norwegian EPD Foundation/EPD-Norge, General Programme Instructions 2019, Version 3.0, 2019/04/24.		
<b>LCA study</b>	This EPD is based on the LCA study described in the LCA report 1VCD900060R0001.		
<b>EPD type</b>	Specific product		
<b>EPD scope</b>	Cradle-to-grave		
<b>Product RSL</b>	20 years		
<b>Geographical representativeness</b>	Manufacturing (suppliers): Global	Manufacturing (ABB): Italy	Downstream: Europe
<b>Reference year</b>	2022		
<b>LCA software</b>	SimaPro 9.5 (2023)		
<b>LCI database</b>	Ecoinvent v3.9.1 (2022)		
<b>Comparability</b>	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.		
<b>Liability</b>	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](https://global.abb/group/en/sustainability) or scan the QR code.



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## General Information

The product declared in this Environmental Product Declaration is the VD4/HPA 12.06-08-12.25-32 P185, including related accessories and packaging.

Embedded pole type PT1 is used to provide dielectric strength and protection of the vacuum interrupters type VG4S.

The product VD4/HPA 12.06-08-12.25-32 P185 declared in this Life Cycle Assessment includes different ratings presented below.

VD4/HPA 12.06-08-12.25-32 P185			
Circuit breaker type:	Rated voltage [kV]	Rated current [A]	Rated short circuit breaking current [kA]
VD4/HPA 12.06.25	12	630	25
VD4/HPA 12.06.32	12	630	32
VD4/HPA 12.08.25	12	800	25
VD4/HPA 12.08.32	12	800	32
VD4/HPA 12.12.25	12	1250	25
VD4/HPA 12.12.32	12	1250	32

The VD4/HPA 12.06-08-12.25-32 P185 is manufactured by the ABB Dalmine manufacturing site located in Italy.

The manufacturing site is certified according to the following standards:

- ISO 9001:2015 – Quality Management Systems - Requirements
- ISO 14001:2015 – Environmental Management Systems - Requirements with guidance for use
- ISO 45001:2018 – Occupational Health and Safety Management Systems - Requirements with guidance for use
- ISO 50001:2018 – Energy Management Systems – Requirements with guidance for use

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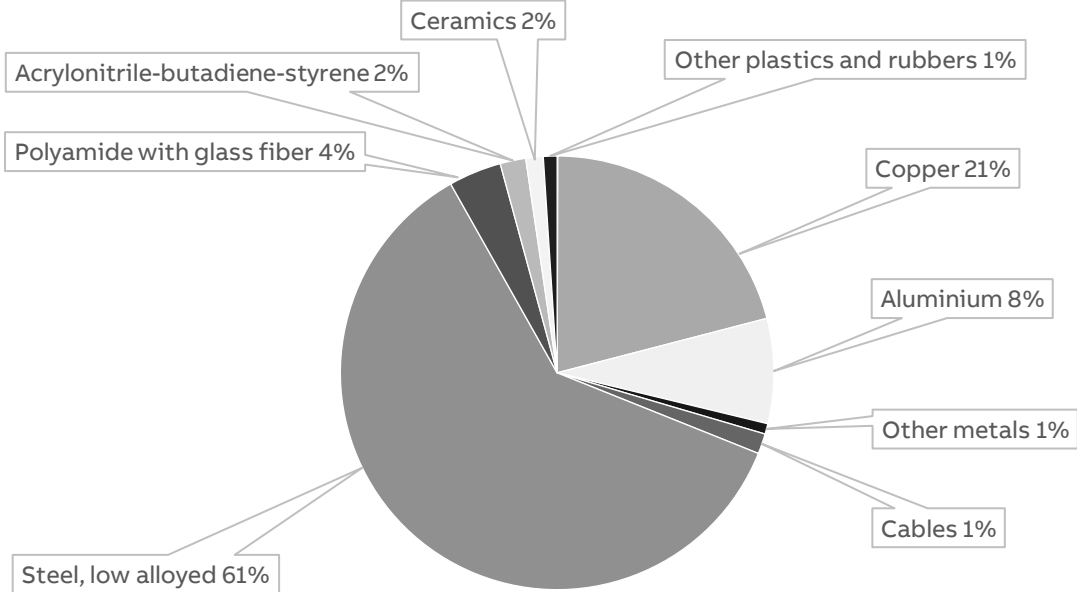


# Constituent Materials

The VD4/HPA 12.06-08-12.25-32 P185 weighs 105.29 kg, and the constituent materials are presented below.

Type	Material	Weight [kg]	Weight %
Plastics	Polycarbonate	0.18	0.17%
	Polyamide with glass fiber	4.08	3.87%
	Acrylonitrile-butadiene-styrene	1.98	1.88%
	Other plastics and rubbers	0.62	0.59%
Metals	Steel, low-alloyed	62.88	60.73%
	Steel, stainless	0.05	0.04%
	Copper	21.64	20.56%
	Aluminum	8.09	7.68%
	Other metals	0.81	0.77%
Others	Cables	1.56	1.48%
	Ceramics	1.34	1.27%
	Others	1.06	0.96%
<b>Total</b>		<b>105.29</b>	<b>100</b>

**VD4/HPA 12.06-08-12.25-32 P185**



The packaging materials and accessories weighs 27.58 kg, and the constituent materials are presented below.

Description	Material	Weight [kg]	Weight %
Screw, bush, nut, bracket	Steel	1.48	5%
Packaging box	Cardboard	4.00	15%
Bags, straps, belt	Plastic	0.60	2%
Pallet, lid	Wood	21.57	78%
<b>Total</b>		<b>27.58</b>	<b>100</b>

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# LCA Background Information

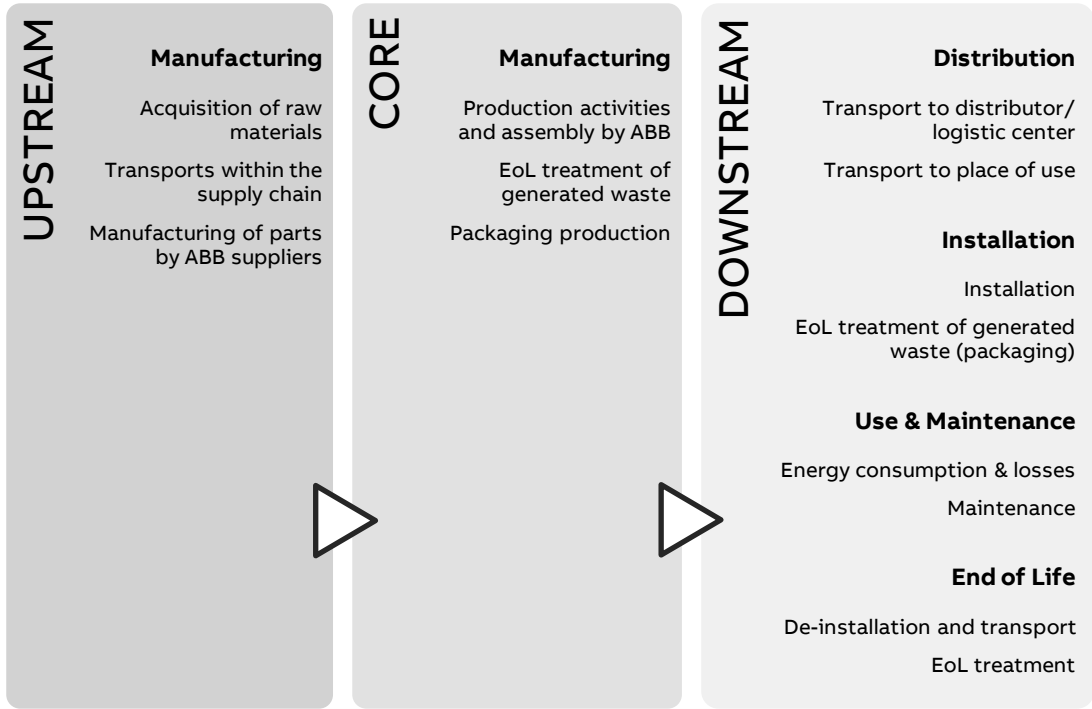
## Functional Unit

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 and with a use rate of 30% and a load factor of 50%. The reference flow is VD4/HPA 12.06-08-12.25-32 P185, 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 VD4/HPA 12.06-08-12.25-32 P185, 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 EN 50693 and Product Category Rules PCR EPDItaly007 “Electronic and electrical products and systems”, 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.

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## 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 VD4/HPA 12.06-08-12.25-32 P185 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. This includes the LCA of Product embedded poles PT1 VG4S.

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 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 VD4/HPA 12.06-08-12.25-32 P185 by using allocation rules. This is done by allocating electricity to surface area and production volume, heating, and waste to sur-face area. Water is allocated directly to the 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 glue, grease and stickers have been excluded as their weights are negligible. Burnishing, oiling, black oxide, and phosphate surface treatments have also been excluded due to the negligible amount of the involved surfaces.

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# Inventory Analysis

## Manufacturing stage

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

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 treatments are **Zinc coat, coils {GLO} market for and 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 VD4/HPA 12.06-08-12.25-32 P185 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 distance is unknown. The selected ecoinvent process is **transport, freight, lorry 16-32 metric ton, EURO4 {RER}**.

## 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 EPDItaly012:

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

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## Product specifications

VD4/HPA 12.12.25-32	
Rated current [A]	1250
$P_{use}$ [W]	32.30
$E_{use}$ [kWh]	1697.61

Where:

- $E_{use}$  = Total energy use over the reference service life
- $P_{use}$  = Reference power consumption in watts
- $RSL$  = Reference Service Life in years
- $\alpha$  = 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; <i>Electricity, medium voltage {RER} market group for   Cut-off, S</i>	Ecoinvent v3.9.1	0.368	kg CO <sub>2</sub> -eq./kWh

Maintenance is not considered because it does not imply any relevant use of materials 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.

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# Environmental Indicators

## VD4/HPA 12.06-08-12.25-32 P185

Impact category	Unit	Total	Cradle-to-gate					
			UPSTREAM	CORE	Cradle-to-grave			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
<b>GWP – total</b>	kg CO <sub>2</sub> eq.	1.48E+03	8.20E+02	6.65E+00	1.37E+01	1.27E+01	6.14E+02	1.38E+01
<b>GWP – fossil</b>	kg CO <sub>2</sub> eq.	1.46E+03	8.42E+02	4.62E+00	1.36E+01	1.51E+00	5.91E+02	1.12E+01
<b>GWP – biogenic</b>	kg CO <sub>2</sub> eq.	1.37E+01	-2.39E+01	2.02E+00	1.24E-02	1.12E+01	2.18E+01	2.62E+00
<b>GWP – luluc</b>	kg CO <sub>2</sub> eq.	3.02E+00	1.52E+00	3.74E-03	6.67E-03	4.55E-04	1.48E+00	1.21E-02
<b>ODP</b>	kg CFC-11 eq.	3.41E-05	2.27E-05	2.81E-07	2.99E-07	1.75E-08	1.06E-05	1.14E-07
<b>AP</b>	mol H+ eq.	2.40E+01	2.09E+01	2.04E-02	5.65E-02	4.56E-03	2.96E+00	4.59E-02
<b>EP – freshwater</b>	kg P eq.	2.12E+00	1.57E+00	7.61E-04	9.61E-04	1.25E-04	5.39E-01	3.08E-03
<b>EP – marine</b>	kg N eq.	2.21E+00	1.62E+00	4.92E-03	2.15E-02	5.78E-03	5.27E-01	3.25E-02
<b>EP – terrestrial</b>	mol N eq.	2.70E+01	2.19E+01	6.60E-02	2.30E-01	1.91E-02	4.65E+00	1.23E-01
<b>POCP</b>	kg NMVOC eq.	7.44E+00	5.80E+00	1.64E-02	8.27E-02	6.57E-03	1.50E+00	3.91E-02
<b>ADP – minerals and metals</b>	kg Sb eq.	2.55E-01	2.54E-01	7.22E-05	4.41E-05	2.90E-06	1.17E-03	8.10E-05
<b>ADP – fossil</b>	MJ, net calorific value	2.41E+04	1.01E+04	6.03E+01	1.95E+02	1.19E+01	1.36E+04	1.14E+02
<b>WDP</b>	m <sup>3</sup> eq.	4.96E+02	3.54E+02	7.39E-01	7.90E-01	8.69E-02	1.39E+02	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.

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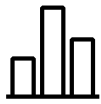
Resource use parameters	Unit	Total	Cradle-to-gate		Cradle-to-grave			
			UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
PENRE	MJ, low cal. value	2.40E+04	1.00E+04	6.03E+01	1.95E+02	1.19E+01	1.36E+04	1.14E+02
PERE	MJ, low cal. value	4.63E+03	1.91E+03	9.56E+01	3.02E+00	2.66E-01	2.61E+03	1.06E+01
PENRM	MJ, low cal. value	9.78E+01	9.78E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, low cal. value	3.36E+02	3.36E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, low cal. value	2.41E+04	1.01E+04	6.03E+01	1.95E+02	1.19E+01	1.36E+04	1.14E+02
PERT	MJ, low cal. value	4.96E+03	2.24E+03	9.56E+01	3.02E+00	2.66E-01	2.61E+03	1.06E+01
FW	m <sup>3</sup>	2.09E+01	9.99E+00	1.59E-01	2.77E-02	3.17E-03	1.06E+01	5.42E-02
MS	kg	3.92E+01	3.92E+01	0.00E+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	1.10E-01	8.99E-02	6.12E-04	1.24E-03	6.87E-05	1.72E-02	4.33E-04
NHWD	kg	3.09E+02	2.30E+02	4.69E-01	9.51E+00	9.82E+00	3.73E+01	2.11E+01
RWD	kg	1.13E-01	1.42E-02	5.38E-05	6.32E-05	5.19E-06	9.89E-02	2.15E-04
MER	kg	1.04E+01	2.96E+00	7.00E-02	0.00E+00	6.83E+00	0.00E+00	5.45E-01
MFR	kg	1.27E+02	3.30E+01	5.87E+00	0.00E+00	1.15E+01	0.00E+00	7.64E+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	4.75E+01	1.36E+01	5.24E-01	0.00E+00	2.91E+01	0.00E+00	4.25E+00
EEE	MJ	2.57E+01	6.99E+00	2.91E-01	0.00E+00	1.62E+01	0.00E+00	2.28E+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.

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## Sensitivity analysis

To provide a complete study, a sensitivity analysis has been performed to evaluate the environmental impact of the product with the rated current in the use phase of 800 A, as specified in the following table.

VD4/HPA 12.08.25-32	
Rated current [A]	800
P <sub>use</sub> [W]	13.23
E <sub>use</sub> [kWh]	695.34

The results of this analysis are presented in the following table.

Impact category	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing	Distribution	Installation	Use and maintenance	End-of-life	
<b>GWP – total</b>	kg CO <sub>2</sub> eq.	1.12E+03	8.20E+02	6.65E+00	1.37E+01	1.27E+01	2.51E+02	1.38E+01
<b>GWP – fossil</b>	kg CO <sub>2</sub> eq.	1.12E+03	8.42E+02	4.62E+00	1.36E+01	1.51E+00	2.42E+02	1.12E+01
<b>GWP – biogenic</b>	kg CO <sub>2</sub> eq.	7.96E-01	-2.39E+01	2.02E+00	1.24E-02	1.12E+01	8.92E+00	2.62E+00
<b>GWP – luluc</b>	kg CO <sub>2</sub> eq.	2.15E+00	1.52E+00	3.74E-03	6.67E-03	4.55E-04	6.05E-01	1.21E-02
<b>ODP</b>	kg CFC-11 eq.	2.78E-05	2.27E-05	2.81E-07	2.99E-07	1.75E-08	4.35E-06	1.14E-07
<b>AP</b>	mol H+ eq.	2.22E+01	2.09E+01	2.04E-02	5.65E-02	4.56E-03	1.21E+00	4.59E-02
<b>EP – freshwater</b>	kg P eq.	1.80E+00	1.57E+00	7.61E-04	9.61E-04	1.25E-04	2.21E-01	3.08E-03
<b>EP – marine</b>	kg N eq.	1.90E+00	1.62E+00	4.92E-03	2.15E-02	5.78E-03	2.16E-01	3.25E-02
<b>EP – terrestrial</b>	mol N eq.	2.43E+01	2.19E+01	6.60E-02	2.30E-01	1.91E-02	1.90E+00	1.23E-01
<b>POCP</b>	kg NMVOC eq.	6.56E+00	5.80E+00	1.64E-02	8.27E-02	6.57E-03	6.14E-01	3.91E-02
<b>ADP – minerals and metals</b>	kg Sb eq.	2.54E-01	2.54E-01	7.22E-05	4.41E-05	2.90E-06	4.81E-04	8.10E-05
<b>ADP – fossil</b>	MJ, net calorific value	1.61E+04	1.01E+04	6.03E+01	1.95E+02	1.19E+01	5.57E+03	1.14E+02
<b>WDP</b>	m <sup>3</sup> eq.	4.14E+02	3.54E+02	7.39E-01	7.90E-01	8.69E-02	5.69E+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.

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To provide a complete study, a sensitivity analysis has been performed to evaluate the environmental impact of the product with the rated current in the use phase of 630 A, as specified in the following table.

VD4/HPA 12.06.25-32	
Rated current [A]	630
P <sub>use</sub> [W]	8.20
E <sub>use</sub> [kWh]	431.22

The results of this analysis are presented in the following table.

Impact category	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing	Distribution	Installation	Use and maintenance	End-of-life	
<b>GWP – total</b>	kg CO <sub>2</sub> eq.	1.02E+03	8.20E+02	6.65E+00	1.37E+01	1.27E+01	1.56E+02	1.38E+01
<b>GWP – fossil</b>	kg CO <sub>2</sub> eq.	1.02E+03	8.42E+02	4.62E+00	1.36E+01	1.51E+00	1.50E+02	1.12E+01
<b>GWP – biogenic</b>	kg CO <sub>2</sub> eq.	-2.59E+00	-2.39E+01	2.02E+00	1.24E-02	1.12E+01	5.53E+00	2.62E+00
<b>GWP – luluc</b>	kg CO <sub>2</sub> eq.	1.92E+00	1.52E+00	3.74E-03	6.67E-03	4.55E-04	3.75E-01	1.21E-02
<b>ODP</b>	kg CFC-11 eq.	2.61E-05	2.27E-05	2.81E-07	2.99E-07	1.75E-08	2.70E-06	1.14E-07
<b>AP</b>	mol H+ eq.	2.18E+01	2.09E+01	2.04E-02	5.65E-02	4.56E-03	7.53E-01	4.59E-02
<b>EP – freshwater</b>	kg P eq.	1.72E+00	1.57E+00	7.61E-04	9.61E-04	1.25E-04	1.37E-01	3.08E-03
<b>EP – marine</b>	kg N eq.	1.82E+00	1.62E+00	4.92E-03	2.15E-02	5.78E-03	1.34E-01	3.25E-02
<b>EP – terrestrial</b>	mol N eq.	2.35E+01	2.19E+01	6.60E-02	2.30E-01	1.91E-02	1.18E+00	1.23E-01
<b>POCP</b>	kg NMVOC eq.	6.33E+00	5.80E+00	1.64E-02	8.27E-02	6.57E-03	3.81E-01	3.91E-02
<b>ADP – minerals and metals</b>	kg Sb eq.	2.54E-01	2.54E-01	7.22E-05	4.41E-05	2.90E-06	2.98E-04	8.10E-05
<b>ADP – fossil</b>	MJ, net calorific value	1.40E+04	1.01E+04	6.03E+01	1.95E+02	1.19E+01	3.45E+03	1.14E+02
<b>WDP</b>	m <sup>3</sup> eq.	3.92E+02	3.54E+02	7.39E-01	7.90E-01	8.69E-02	3.53E+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.

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## Additional Environmental Information

### Extrapolation coefficients

Thanks to the sensitivity analysis it is possible to assess all the ratings of the product. The environmental impacts of the ratings are collected in the following table and expressed as a ratio between the results of the former analysis (rated current 1250 A) and the sensitivity analysis (800A and 630 A).

Product	Climate change - Total	Climate change - Fossil	Climate change - Biogenic	Climate change - Land use and LU change	Ozone depletion	Acidification	Eutrophication aquatic freshwater	Eutrophication aquatic marine	Eutrophication terrestrial	Photochemical ozone formation	Dep of ab res - minerals and metals	Dep of ab res - fossils	Water use
VD4/HPA 12.06.25 P185	1.45	1.43	-5.27	1.57	1.30	1.10	1.23	1.22	1.15	1.18	1.00	1.73	1.26
VD4/HPA 12.06.32 P185	1.45	1.43	-5.27	1.57	1.30	1.10	1.23	1.22	1.15	1.18	1.00	1.73	1.26
VD4/HPA 12.08.25 P185	1.32	1.31	17.17	1.41	1.23	1.08	1.18	1.16	1.11	1.13	1.00	1.50	1.20
VD4/HPA 12.08.32 P185	1.32	1.31	17.17	1.41	1.23	1.08	1.18	1.16	1.11	1.13	1.00	1.50	1.20
VD4/HPA 12.12.25 P185	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
VD4/HPA 12.12.32 P185	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

### Recyclability potential

The recyclability potential of the VD4/HPA 12.06-08-12.25-32 P185 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 72.6 %.

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

The manufacturing site in Dalmine, Italy, uses the national energy mix for the electricity, Guarantee of Origin certified (GO certified). The emission factor of the energy mix is presented in the following table.

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 <sub>2</sub> -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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## References

- ecoinvent. ecoinvent v3.9.1 (2022). <https://ecoinvent.org/the-ecoinvent-database/data-releases/ecoinvent-3-9-1/>
- European Committee for Standardization. (2019). *Product category rules for life cycle assessments of electronic and electrical products and systems* (EN 50693:2019).
- European Committee for Standardization. (2019). *Sustainability of constructions - Environmental product declarations* (EN 15804:2012+A2:2019).
- Eurostat. (2020). *Packaging waste by waste management operations*.  
[https://ec.europa.eu/eurostat/databrowser/view/ENV\\_WASPAC/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/ENV_WASPAC/default/table?lang=en)
- ICMQ S.p.A. (2023). *PCR EPDItaly007-Electronic and electrical products and systems*, rev. 3.0 (2023-01-13). EPDItaly. <https://www.epditaly.it/en/view-pcr/>
- ICMQ S.p.A. (2020a). *PCR EPDItaly012-Electronic and electrical products and systems - switches*, rev. 0 (2020-03-15). EPDItaly. <https://www.epditaly.it/en/view-pcr/>
- ICMQ S.p.A (2020b). *Regulations of the EPDItaly Programme Regulations*, rev. 5.2 (2020-02-16). EPDItaly. [https://www.epditaly.it/en/wp-content/uploads/2016/12/EPDITALY-Regulament\\_rev-5.2\\_EN.pdf](https://www.epditaly.it/en/wp-content/uploads/2016/12/EPDITALY-Regulament_rev-5.2_EN.pdf)
- International Electrotechnical Commission. (2012). *Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment*, Edition 1.0 (2012-10-1) (IEC/TR 62635).
- International Organization for Standardisation. (2006). *Environmental management - Life cycle assessment - Principles and framework* (ISO Standard No. 14040:2006).  
<https://www.iso.org/standard/37456.html>
- International Organization for Standardisation. (2006). *Environmental management - Life cycle assessment - Requirements and guidelines* (ISO Standard No. 14044:2006).  
<https://www.iso.org/standard/38498.html>
- PRé Sustainability. (2023). SimaPro (version 9.5) [computer software]. <https://pre-sustainability.com/solutions/tools/simapro/>
- SeaRates. (2022). *Shipping Distances & Time Calculator*.  
<https://www.searates.com/services/distances-time>
- The Norwegian EPD Foundation/EPD-Norge. (2019). *General Programme Instructions 2019*, Version 3.0 (2019-04-24). <https://www.epd-norge.no/getfile.php/1340010-1685100696/Dokumenter/GPI%20Det%20norske%20EPD%20programmet%20approved%20240419%20-%20ver3%20updated%20250523.pdf>
- Viganò, A.A. (2023). *Life Cycle Assessment: VD4/HPA 12.06-08-12.25-32 P185* (Report No. 1VCD900060R0001, rev. A). ABB Switzerland Ltd, Group Technology Management.



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