EPD

Environmental Product Declaration

VD4/P 12/17.12.32 p.150

Production site: ABB Dalmine

DOCUMENT KIND		IN COMPLIANCE WITH			
Environmental Product Declaration		ISO 14025 and EN50693			
PROGRAM OPERATOR The Norwegian EPD Foundation		PUBLISHER The Norwegian EPD Foundation			
REGISTRATION NUMBER OF THE PROGRAM OPERATOR NEPD-4066-3093-EN		ISSUE DATE 2022-12-22			
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OWNING ORGANIZATION ABB Switzerland Ltd	DECLARATION NUMBER 2RDA045355	REV. 001	LANG. en	PAGE 1/23	

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EPD Owner	ABB Swizerland Ltd, Group Technology Management
Manufacturer name and address	ABB S.p.A. Via Friuli, 4, 24044 Dalmine (BG)
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Program operator	The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo, Norway Ph.:+47 23 08 80 00 email: post@epd-norge.no
Declared product & **Functional unit or declared unit**	VD4/P 12/17.12.32 p.150 FU: single circuit breaker, which establishes or interrupts the electrical continuity of the circuit to which it is applied, during a service of 20 years, including related accessories and packaging.
Product description	VD4/P breakers are used in electrical distribution for control and protection of cables, overhead lines, transformer and distribution substations, motors, transformers, generators and capacitor banks. The Scope of the Medium voltage circuit breakers is to interrupt an electric current with a mechanical actuator.
CPC code	46211 - Electrical apparatus for switching or protecting electrical circuits, or for making connexions to or in electrical circuits, for a voltage exceeding 1000 V
Independent verification	Independent verification of the declaration and data carried out according to ISO 14025: 2010. ☐ INTERNAL ☒ EXTERNAL Third party verification carried out by: EPD Norway: Vito D'Incognito
Approved By	Håkon Hauan, CEO EPD-Norge
Reference PCR and version number	Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev. 2, 2020/01/20. Sub PCR: EPDItaly012 - Electronic and electrical products and systems – Switches, Rev. 0, 2020/03/16.
Other reference documents	General Programme Instructions for The Norwegian EPD Foundation/EPD-Norge (www.epd-norge.no) version 5:2019
Product RSL description	20 years

Markets of applicability	World (raw materials) Italy (production, use and end-of-life) Europe (use and end-of-life)
LCA study	This EPD is based on the LCA study described in the LCA report 2RDA045354
EPD type	Product specific
EPD scope	“Cradle to grave”
Year of reported primary data	2021
LCA software	SimaPro 9.3.0.3
LCI database	ecoinvent v3.8 (2021)
LCIA methodology	EN 50693:2019
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	EPD-norge declines any responsibility regarding the manufacturer's information, data and results of the life cycle assessment.

Contents

ABB Purpose & Embedding Sustainability

ABB is a leading global technology company that energizes the transformation of society and industry to achieve a more productive, sustainable future. By connecting software to its electrification, robotics, automation and motion portfolio, ABB pushes the boundaries of technology to drive performance to new levels. With a history of excellence stretching back more than 130 years, ABB’s success is driven by about 110 thousand talented employees in over 100 countries.

ABB's Electrification business offers a wide-ranging portfolio of products, digital solutions and services, from substation to socket, enabling safe, smart and sustainable electrification. Offerings encompass digital and connected innovations for low and medium voltage, including EV infrastructure, solar inverters, modular substations, distribution automation, power protection, wiring accessories, switchgear, enclosures, cabling, sensing and control.

ABB is committed to continually promoting and embedding sustainability across its operations and value chain, aspiring to become a role model for others to follow. With its ABB Purpose, ABB is focusing on reducing harmful emissions, preserving natural resources and championing ethical and humane behavior.

General Information

The ABB Dalmine facility produces medium voltage switches, disconnectors, and contactors, medium voltage switchboards for primary and secondary distribution, low voltage switchboards, complete packages and services for substations. Smart systems and technologies for electrical distribution are supplied to utilities, industrial, and tertiary sector customers. Dalmine exports 85% of the volumes produced.
ABB IT-ELDS adopts and implements for its own activities an integrated Quality/Environmental/Health Management System in compliance with the following standards:

- UNI EN ISO 9001/2015 - Quality Management Systems- Requirements
- UNI EN ISO 14001/2015 - Environmental management systems — Requirements with guidance for use
- ISO 45001:2018- Occupational health and safety management systems

The manufacturing of the medium voltage circuit breakers (VD4/P) is located in ABB apparatus factory, where circuit breakers are assembled in the so called One Primary Line. All components and subassemblies are produced by ABB's suppliers and are then assembled in the factory.

Figure 1: ABB Dalmine

The product declared in this Life Cycle Assessment includes the following device:

Table 1: Device ratings (VD4/P 12/17.12.32)

VD4/P	1VCR020985
Rated voltage [kV]	12/17
Rated current [A]	1250
Rated short circuit breaking current [kA]	31.5

The accessories associated with these products are also included in the study.

The VD4/P is a medium voltage circuit breaker. It is an automatically operated electrical device that is used to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to interrupt a high momentary current flow. Unlike a fuse, which operates once and then must be replaced, a medium voltage circuit breaker can be reset to resume normal operation.

The VD4/P circuit-breakers are used in power distribution for control and protection of cables, overhead lines, transformer and distribution substations, motors, transformers, generators and capacitor banks.

The VD4/P are a synthesis of the renowned technology in designing and constructing vacuum interrupters embedded in the poles, and of excellency in design, engineering and production of medium voltage circuit-breakers. The vacuum circuit-breaker does not require an interrupting and insulating medium.

The special geometry of the contacts and the material used, as well as the limited duration and low voltage of the arc, guarantee minimum contact wear and long life. Furthermore, the vacuum prevents their oxidation and contamination.

The low speed of the contacts, together with the reduced run and low mass, limit the energy required for the operation and therefore guarantee extremely limited wear of the system. The circuit breaker therefore only requires limited maintenance.

The VD4/P circuit-breakers use a mechanical operating mechanism, with stored energy and free trip. These characteristics allow opening and closing operations independent of the operator.

The operating mechanism and the poles are fixed to a metal frame. The compact structure ensures sturdiness and mechanical reliability.

Apart from the isolating contacts and the cord with plug for connection of the auxiliary circuits, the withdrawable version is completed with the truck for racking it into and out of the switchgear or enclosure with the door closed.

Constituent materials

The VD4/P weights about 99.1 kg. Some small parts were excluded because of lack of data, as their mass is estimated to be well below 2% of the total weight, according to the EPDItaly012 cut-off criteria.

Table 2: Weights of materials of VD4/P 12/17.12.32

Materials	Name	CAS Number	Product Weight [kg]	%
Plastics	ABS	9003-56-9	1.86	2%
	Polyamide	63428-84-2	5.91	6%
	Polycarbonate	25037-45-0	0.57	<1%
	Polyethylene	9002-88-4	0.7	<1%
	Polyoxymethylene	9002-81-7	0.0006	<1%
	Polyurethane	9009-54-5	0.03	<1%
	Polypropylene	9003-07-0	0.05	<1%
	PTFE	9002-84-0.	0.003	<1%
	PVC	9002-86-2	0.27	<1%
	Rubber	9006-04-6	0.39	<1%
	Polybutylene	9003-28-5	0.1	<1%
Metals	Steel	68316-05-2	70.42	71%
	Copper	7440-50-8	9.46	10%
	Aluminium	7429-90-5	3.11	3%
	Brass	63338-02-3	0.95	1%
	Bronze	158113-12-3	0.22	<1%
	Stainless Steel	12597-68-1	1.25	1%
	Silver	7440-22-4	0.01	<1%
	Chromium	7440-47-3	0.3	<1%
Other	Cables		3.47	4%
Total			99.1	100%

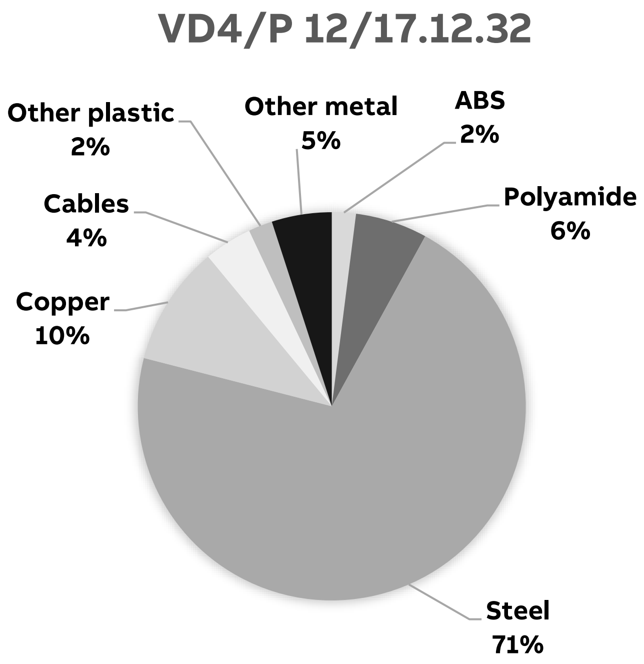

Figure 2 Composition of VD4/P 12/17.12.32

LCA background information

Goal and scope of the LCA study

The goal of the present LCA is the evaluation of the environmental impacts of the single circuit breaker in order to publish an EPD. The LCA is done for eco-design purposes, identifying environmental hotspots enabling process optimization, and environmental communication of potential impacts of VD4/P circuit breakers to the stakeholders such as utilities for electrical distribution.

Functional Unit

The functional unit is the reference unit used to quantify the performance of the service delivered by a product to the user. The main purpose of the functional unit is to provide a reference to which inputs and outputs are related in the LCA. As a result, the reference flow can be determined, which refers to the measure of outputs from processes required to fulfill the function expressed by the functional unit.

The functional unit of this study is to establish or interrupt the electrical continuity of the circuit to which it is applied, during a service of 20 years. The reference flow is a single VD4/P 12/17.12.17 circuit breaker that support 12 and 17 kV of rated voltage, 1250 A of nominal current and 31500 A of short circuit current. Accessories and packaging are included in this study.

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 of the VD4/P, an EEPS (Electronic and Electrical Products and Systems), is a “from cradle to grave” analysis and covers the following main life cycle stages: manufacturing, including the relevant upstream process (e.g. acquisition of raw material, preparation of semi-finished goods, etc.) and the main manufacturing and processing steps; distribution; installation, including the relevant steps for the preparation of the product for use; use including the required maintenance steps within the RSL (reference service life of the product) associated to the reference product; end-of-life stage, including the necessary steps until final disposal or recovery of the product system.

The following table shows the stages of the product life cycle and the information stages according to PCR EPDItaly007 for the evaluation of electronic and electrical products and systems.

The stages of the product life cycle and the information considered for the evaluation of VD4/P are:

- Manufacturing upstream includes raw materials, and production activities of ABB suppliers, including transport of semi-finished items and subassemblies to ABB Dalmine.
- The core part of the manufacturing stage includes local consumptions (ABBDalmine) the relevant assembling and waste due to manufacturing. This includes also the packaging production.
- The distribution stage includes the impacts related to the distribution of the product at the installation site.
- The installation stage includes the end of life of the packaging.
- The use and maintenance stages include the impact related to energy consumption during the service life of the product. End of life includes the operations for the disposal of the product at the end of its service life.

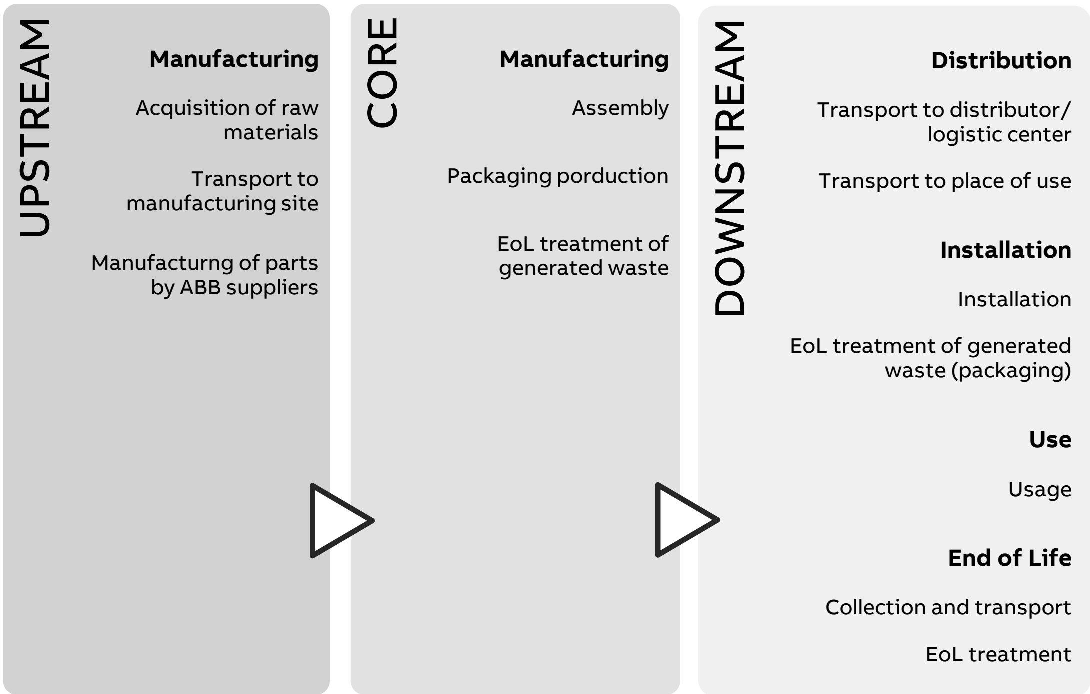

Figure 3: Phases in the LCA methodology

Temporal and geographical boundaries

The ABB component suppliers are sourced all over the world: Asia and Europe. All primary data collected from ABB are from 2021, which is a representative production year. Secondary data are also representative for this year, as provided by ecoinvent v3.8.

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

Boundaries in the life cycle

As indicated in the PCR EPDItaly012, capital goods, such as buildings, machinery, tools and infrastructure, the packaging for internal transport which cannot be allocated directly to the production of the reference product, may be excluded from the system boundary.

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

Data quality

In this EPD, both primary and secondary data are used. Site specific foreground data have been provided by ABB. Main data sources are the bill of materials available on the enterprise resource planning. For all processes for which primary are not available, generic data originating from the ecoinvent v3.8 database, allocation cut-off by classification, are used. The ecoinvent database is available in the SimaPro 9.3.0.3 software used for the calculations.

Information and data obtained from third parties are integrated into this report. the documents used are the LCA and EPD of the pole PT1 VG4-S (ABB document ID 3XAA008725), and the LCA and EPD of the Vacuum interrupter VG4-S (ABB document ID 3XAA008728).

Environmental impact indicators

The information obtained from the inventory analysis is aggregated according to the effects related to the various environmental issues. According to PCR EPDItaly012 and EN 50693 the environmental impact indicators must be determined using the characterization factors and impact assessment methods specified in EN 15804:2012+A2:2019.

PCR EPDItaly012 and the EN 50693 standard establish four indicators for climate impact (GWP-GHG): GWP (total) which includes all greenhouse gases; GWP (fossil fuels); GWP (biogenic carbon) which includes the emissions and absorption of biogenic carbon dioxide and biogenic carbon stored in the product; GWP (land use and land use change).

Allocation rules

An allocation key is used for consumptions related to the manufacturing process in the production site, as well for company waste and product distribution. Since the factory produces several products (apparatus and switchgears), only a part of the environmental impact has been allocated to the production line.

Allocation coefficients are based on installed power for electricity and on the line’s surface area for methane and water consumption. Company consumption is allocated to the OPL (One Primary Line) and divided by the total number of circuit breakers produced in 2021.

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.

Limitation and simplifications

The raw material life cycle stage includes the extraction of raw materials but neglects the production of various components at ABB’s suppliers (glue, grease and adhesive), as their mass represents less than 2% of that of the whole circuit breaker, as stated in the paragraph of cut-off criteria of EPDItaly-012: “Materials making up the switch itself whose total mass does not exceed 2% of the total weight of the device”.

This same applies to packaging, where small parts such as sticking labels and grease are even a smaller fraction of the total mass.

Surface treatments like tin plating, silver plating, copper plating and painting have been considered in the LCA model. Burnishing, galvanizing surface and phosphated and oiled treatments have been excluded by operational choice.

Scraps for metalworking and plastic processes are included when already defined in ecoinvent.

Inventory analysis

In this LCA, both primary and secondary data are used. Site specific foreground data have been provided by ABB. For data collection, Bills of Material (BOM) extracted from ABB's internal SAP and PLM Smarteam software were used. They are a list of all the components and assemblies that constitute the finished product, organized by level. Each item is matched with its code, quantity, weight and supplier. The BOMs were then processed, adding material, surface area and other weight data, taken from technical drawings. Finally, the manufacturing process and surface treatment were assigned, according to information provided by R&D personnel. Road distances between the suppliers and ABB were calculated using Google Maps, and marine distances using Searates - Distances & Time.

As operational choice we decided to aggregate by material and production process the import of data into SimaPro software's for the manufacturing phase.

All primary data collected from ABB are from 2021 which was a representative production year. The ecoinvent v3.8 cut-off by classification system processes are used to model the background system of the processes. In addition, polyoxymethylene was taken from the database Industry Data 2.0, available in SimaPro libraries, as it is not present in ecoinvent database.

The ecoinvent v3.8 cut-off by classification system processes are used to model the background system of the processes.

Due to the large amounts of components in the medium voltage circuit breaker, raw material inputs are modelled with data from ecoinvent representing a global market coverage. These datasets are assumed to be representative.

Manufacturing stage

The circuit breaker is composed of a multitude of components, all of which are made from of numerous materials. Most of the inputs to the products' manufacturing stage are already produced components.

The single use packaging is also included in the analysis, in the manufacturing core stage. The packaging is common for all the version of VD4/P, it is composed of steel fixing brackets (1.5 kg), a cardboard box (4 kg), a wooden pallet (9 kg) and plastic material, polypropylene, polyethylene and polyamide (0.56 kg) resulting in a total weight of 15.06 kg.

ABB receives packaging components from outside suppliers and packages the circuit breakers before shipping them.

Steel is the most frequently used material, followed by copper. All steel components (hot rolled, cold rolled, low-alloyed steel) are modelled with the same kind of steel: "*Steel, low-*

alloyed {GLO}| market for", as it is representative for the large majority of the steel parts. Then, when present, the surface treatment is also considered.

The distance from subassembly manufacturing factory to ABB facility is calculated.

The product between the weight of the subassembly and the distance of the supplier according to the transport is considered. The following data is obtained:

Table 3 Sub-assembly distance x weight

Transport type	Weight*distance (kg*km)
Market for transport, freight, lorry >32 metric ton, EURO 4, RoW, Cut-off, S	1063.65
Market for transport, freight, lorry >32 metric ton, EURO 4, RER, Cut-off, S	84776,51
Market for transport, freight, lorry 16-32 metric ton, EURO 4, RER, Cut-off, S	2824.95
Market for transport, freight, lorry 16-32 metric ton, EURO 4, RoW, Cut-off, S	3291.99
Market for transport, freight, sea, Container ship (GLO), Cut-off, S	326325.91

The manufacturing of the medium voltage circuit breakers is located in ABB facility of Dalmine, Italy. In the factory, the different components and subassemblies are assembled into the circuit breaker. All the components are produced by ABB's suppliers. The energy mix used for the production phase is representative for Dalmine production site and includes green energy only (hydroelectric 62%, wind 16%, photovoltaic 6% and internal production photovoltaic 16%).

Table 4 Dalmine green mix

Data source	Amount	Unit
ABB green mix	0.03	kg CO_2-eq/kWh

Allocation coefficients are based on the line's surface area for electricity, methane, water consumption and waste generated. Company consumption is allocated to the OPL (One Primary Line) and divided by the total number of circuit breakers produced in 2021, corresponding to 32284 units. Electricity consumption and waste are obtained by dividing the consumption of apparatus building by total product.

Table 5 Allocation criteria

Utility	OPL allocation coefficient	Allocation criterium	Total 2021 consumptions	OPL 2021 consumptions
Water	9.4%	Surface area of site	9937 m^3 (Site)	936.94 m^3
Methane	9.4%	Surface area of site	686713 m^3 (Site)	64748.8 m3

Utility	Allocation criterium	Total 2021 consumptions	OPL 2021 consumptions
Electricity	Apparatus building total consumption	1782403 kWh (Factory)	29 kWh/apparatus
Waste	Apparatus building total consumption	460148 kg (Factory)	3.66 kg/apparatus

The waste generated by the production and assembly processes is included in the calculation. Wastes generated during production are collected by a disposer located in Lombardy, according to 2022 MUD document. Their final destination is defined by the disposal certificate on waste management.

Distribution

The transport distances from ABB plant to the place of use is based on the allocation rules, which are taken from the average distance of the major clients of the ABB Apparatus factory. It is calculated as approximately 800 km.

Installation

The installation phase only implies manual activities and no energy is consumed. This phase also includes the disposal of the packaging of the medium voltage circuit breaker.

For the disposal of the packaging after installation and of the circuit breaker at the end of its life, a transport distance of 100 km was assumed. The actual disposal site is unknown and is managed by the customer.

Table 6 End of life scenario for packaging materials, according from Eurostat

Material	Weight kg	Recycling %	Incineration %	Landfill %
Cardboard	4	81.6	9.1	9.3
Plastics	0.56	37.7	38.2	24.1
Steel	1.5	75.5	1.8	22.7
Wood	9	32.4	29.4	38.2

Use

Use and maintenance are modelled according to the PCR EPDItaly012 – Switches, for the circuit breaker. Instead for the Monitoring and Diagnostic system, they are modelled according to the PCR EPDItaly007.

For the use phase, the general European medium voltage electricity mix from ecoinvent v3.8 is used.

Table 7 GHG emissions connected to electricity production for the manufacturing of ABB's products

Data source	Amount	Unit
Ecoinvent 3.8 Europe without Switzerland mix	0.40	kg CO_2-eq/kWh

Since no maintenance happens during the use phase, the environmental impacts linked this procedure have been omitted from the analysis.

During the use phase, the VD4/P dissipates some electricity due to ohmic losses. Electricity consumption was calculated with the following formula:

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

$$P_{use} = 3 * R * (0.5 * I)^2$$

$$\alpha = 0.3$$

The current and internal resistance values, reference tests, and results obtained are given in Table 8. The internal resistance values of circuit breaker can be considered unchanged for the version with the monitoring and diagnostic system.

Table 8 Test report, internal resistance, current, power and energy for use phase modelling

	VD4/P 12.12.32 Motorized truck version
Test report	1VLR020016
Internal resistance [μΩ]	23.8
Nominal current [A]	1250
P_{use} [W]	27.89
E_{use} [kWh]	1465.93

The RSL is adopted from the circuit breaker rules, the operational time and power are assumed to be 100% for all of the service life.

Since no maintenance happens during the use phase, the environmental impacts linked to this procedure are omitted from the analysis.

End of life

The transport distances from the place of use to the place of disposal are assumed to be 100 km.

The end-of-life stage is modelled according to PCR EPDItaly012 and IEC/TR 62635. The percentages for end-of-life treatments of circuit breakers are taken from IEC/TR 62635, while the data for packaging waste scenarios are provided by Eurostat. The percentages are reported in Table 6 and Table 9.

Table 9 End of life Eurostat and IEC/TR 62636 percentage

Material	Weight	Recycling %	Incineration %	Landfill %
Plastics	8.9	0	5	95
Steel	70.41	94	0	6
Aluminium, Nickel, Zinc	1.61	91	0	9
Copper	9.49	85	0	15

Environmental indicators

The following tables show the environmental impact indicators of the life cycle of a single circuit breaker, as indicated by PCR EPDItaly007, sub-PCR EPDItaly012 and EN 50693:2019.

The indicators are divided into the contribution of the processes to the different modules (upstream, core and downstream) and stages (manufacturing, distribution, installation, use and end-of-life).

Table 10 Environmental impact indicators of VD4/P 12/17.12.32 Motorized truck version

Impact category	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use	End of life
GWP - total	kg CO_2 eq.	1.28E+03	6.45E+02	7.70E+00	1.51E+01	6.74E+00	5.95E+02	1.37E+01
GWP - fossil	kg CO_2 eq.	1.25E+03	6.28E+02	2.03E+01	1.50E+01	1.03E+00	5.75E+02	1.08E+01
GWP - biogenic	kg CO_2 eq.	3.08E+01	1.62E+01	-1.26E+01	1.37E-02	5.71E+00	1.87E+01	2.88E+00
GWP - luluc	kg CO_2 eq.	2.14E+00	7.27E-01	4.49E-02	5.96E-03	2.52E-04	1.36E+00	9.56E-03
ODP	kg CFC-11 eq.	8.63E-05	5.13E-05	2.09E-06	3.51E-06	8.60E-08	2.85E-05	7.75E-07
AP	mol H^+ eq.	1.44E+01	1.11E+01	8.21E-02	7.62E-02	2.77E-03	3.10E+00	4.28E-02
EP - freshwater	kg PO_4 eq.	1.47E+00	8.81E-01	6.33E-03	9.78E-04	7.01E-05	5.75E-01	2.77E-03
POCP	kg NMVOC eq.	4.95E+00	3.49E+00	6.96E-02	8.19E-02	3.25E-03	1.27E+00	3.09E-02
ADP – minerals and metals	kg Sb eq.	2.42E-01	2.41E-01	2.82E-04	5.28E-05	2.46E-06	1.35E-03	1.22E-04
ADP – fossil	MJ, net calorific value	2.04E+04	7.48E+03	3.13E+02	2.29E+02	6.58E+00	1.22E+04	9.95E+01
WDP	m^3 eq.	4.21E+02	2.65E+02	2.14E+01	6.91E-01	8.71E-02	1.33E+02	1,20E+00

Table 11 Resource use parameters of VD4/P 12/17.12.32 Motorized truck version

Resource use parameters	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use	End of life
PENRE	MJ, low cal. value	1.98E+04	7.00E+03	2.74E+02	2.29E+02	6.58E+00	1.22E+04	9.95E+01
PERE	MJ, low cal. value	3.12E+03	8.60E+02	1.39E+02	3.23E+00	1.68E-01	2.11E+03	8.97E+00
PENRM	MJ, low cal. value	5.13E+02	4.74E+02	3.89E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, low cal. value	2.30E+02	1.82E+01	2.11E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, low cal. value	2.03E+04	7.48E+03	3.13E+02	2.29E+02	6.58E+00	1.22E+04	9.95E+01
PERT	MJ, low cal. value	3.35E+03	8.79E+02	3.50E+02	3.23E+00	1.68E-01	2.11E+03	8.97E+00
FW	m^3	1.82E+01	7.41E+00	5.53E-01	2.56E-02	2.90E-03	1.02E+01	4.99E-02
MS	kg	3.08E+01	2.66E+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.

Table 12 Waste indicators of VD4/P 12/17 .12.32 Motorized truck version

Waste production indicators	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use	End of life
HWD	kg	1.35E-01	1.28E-01	1.45E-03	5.99E-04	1.51E-05	4.34E-03	1.67E-04
NHWD	kg	2.58E+02	1.78E+02	4.44E+00	1.18E+01	4.61E+00	4.05E+01	1.83E+01
RWD	kg	1.11E-01	1.87E-02	6.85E-04	1.55E-03	3.83E-05	8.97E-02	4.76E-04
MER	kg	6.68E+00	2.50E+00	1.70E-01	0.00E+00	3.27E+00	0.00E+00	7.47E-01
MFR	kg	1.18E+02	3.00E+01	3.83E+00	0.00E+00	7.52E+00	0.00E+00	7.64E+01
CRU	kg	2.91E+01	1.13E+01	0.00E+00	0.00E+00	1.24E+01	0.00E+00	5.31E+00
ETE	MJ	1.47E+01	5.71E+00	0.00E+00	0.00E+00	6.23E+00	0.00E+00	2.71E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+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.

Additional environmental information

Recyclability potential

According to the waste treatment scenario calculation in Simapro, based on the recycling rate in technical report IEC/TR 62635 Edition 1.0, the following recyclability potentials were calculated.

Table 13 Recyclability potential of VD4/P

	Recyclability potential
VD4/P 12/17.12.32	88%

Additional Norwegian requirements

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

Production mix from green energy purchasing certificate medium voltage (production of transmission line, in addition to direct emissions and losses in grid) applied electricity for the manufacturing process.

Data source	Amount	Unit
ABB green mix	0.03	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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