EPD

Environmental Product Declaration

Self-Powered Feeder Protection REJ603 v1.5 from Relion 605 series

Production site: Vadodara, India

DOCUMENT KIND Environmental Product Declaration	IN COMPLIANCE WITH ISO 14025 and EN 50693			
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EPD Owner	ABB Switzerland Ltd, Group Technology Management		
Organization No.	CHE-101.538.426		
Manufacturer name and address	ABB India Limited, Digital Substation Products, Electrification, Distribution Solution Maneja Works, Maneja, Vadodara, Gujarat, India 390 013		
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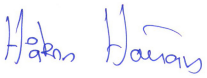
Program operator	The Norwegian EPD Foundation Post Box 5250 Majorstuen, 0303 Oslo, Norway phone: +47 23 08 80 00, email: post@epd-norge.no		
Declared product	REJ603 v1.5 from Relion 605 series		
Product description	REJ603 v1.5 is a self-powered protection relay and primarily used in Ring Main Units (RMU) and secondary distribution switchgears within distribution network for utility, industrial, and transport and infrastructure applications for selective short-circuit and earth fault protection of feeders. Specific applications include feeder and transformer protection. The relays are available in ready-made standard configurations for fast and easy setup but can also be tailored to meet customer-specific requirements with front panel DIP switches settings.		
Functional unit	To protect a power system against faults such as short-circuit and earth fault of feeder, by drawing current from the external current transformer in the feeder resulting in a power consumption of approximately 1 W, during a service life of 10 years and with a use rate of 100 % in Europe.		
Reference flow	A single REJ603 v1.5 self-powered protection relay, including related connectors, accessories, and packaging.		
CPC code	4621 - Electricity distribution or control apparatus		
Independent verification	Independent verification of the declaration and data, according to ISO 14025:2010 ☐ INTERNAL ☒ EXTERNAL Independent verifier approved by EPD-Norge: Elisabet Amat Signature: 		
Approved by	Håkon Hauan, CEO EPD-Norge Signature: 		
Reference PCR	EN 50693:2019 – Product Category Rules for Life Cycle Assessments of Electronic and Electrical Products and Systems. EPDItaly007 – Electronic and Electrical Products and Systems, Rev. 3.0, 2023/01/13.		
Program instructions	The Norwegian EPD Foundation/EPD-Norge, General Programme Instructions 2019, Version 3.0, 2019/04/24.		
LCA study	This EPD is based on the LCA study described in the LCA report 2REA071429.		
EPD type	Specific product		
EPD scope	Cradle-to-grave		
Product RSL	10 years		
Geographical representativeness	Manufacturing (suppliers): Global	Manufacturing (ABB): India	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 includes the following devices of the Relion 605 series of relays:

- REJ603 v1.5 – Self powered Feeder protection without HMI hardware variant. (Reference product)
- REJ603 v1.5 – Self powered Feeder protection with HMI hardware variant (Covered separately in sensitivity analysis)

REJ603 v1.5 is primarily used in Ring Main Units (RMU) and secondary distribution switchgears within distribution network for utility, industrial, and transport and infrastructure ap-plications for selective short-circuit and earth fault protection of feeders. Specific applications include feeder and transformer protection. The relays are available in ready-made standard configurations for fast and easy setup but can also be tailored to meet customer-specific requirements with front panel DIP switches settings.

General technical specifications of the product REJ603 v1.5 are presented below.

	Description	Value
Width	Frame	96 mm
Height	Frame	160 mm
Depth	Case	150 mm

	Power supply		
Self-powered relay	The REJ603v1.5 relay derives power from below listed external CTs mounted in the feeder.		
	CT Type:	Min. Current required one Phase	Min. Current required Three Phase
	REJ603-CT1:8A-28A	7.2A	3.2A
	REJ603-CT2:16A-56A	14.4A	6.4A
	REJ603-CT3:32A-112A	28.8A	12.8A
	REJ603-CT4:64A-224A	57.6A	25.6A
	REJ603-CT5:128A-448A	115.2A	51.2A
Relay Burden	< 1.0 VA		

Slot	Module	REJ603 v1.5 without HMI (reference product)
L1:X1(4,3) **L2:X2(8,7)** **L3:X2(4,3)**	Self-Powered	From External CT
X1(10,9) X1(8,7)	Binary Output	BO
X1, X2	Analogue input	External CT
XCPU	CPU	CPU
XDIS	Display	-
Product ID		REJ603
Product Version		1.5
Weight (excl. packaging)		0.85 kg
Ordering code		REJ603BB401NN3XE

The REJ603 v1.5 is a self-powered protection relay manufactured by ABB India. The manufacturing site is located in Vadodara, India, and the product is sold globally.

The ABB manufacturing site in Vadodara is located in a cluster with other ABB plants. On average, the ABB plants in this location use ca 3.1 % renewable energy from own roof-mounted solar panels and ca 0.6 % from backup diesel generators. For the rest of the electricity, the national energy mix is used. The plant is also 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

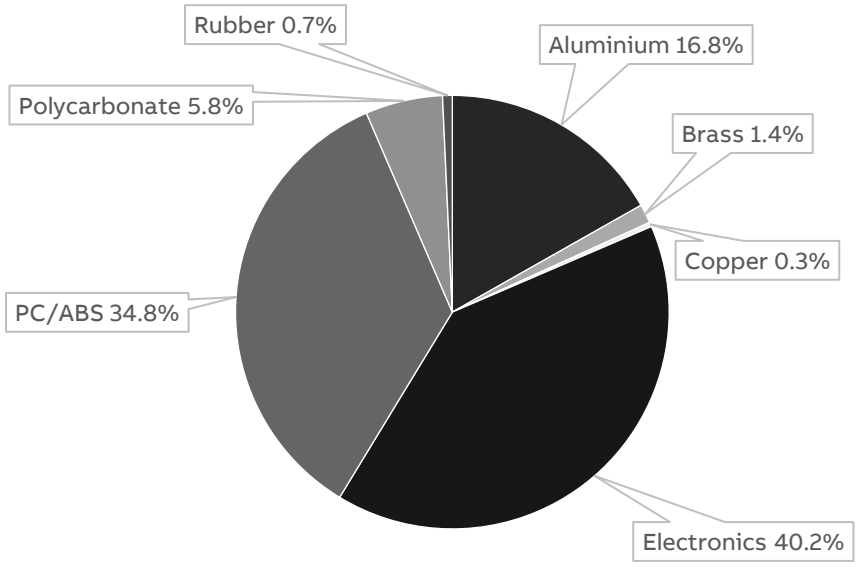
ABB only performs final assembling and testing of the relays. ABB does not manufacture any parts or components themselves. Instead, this is outsourced and purchased from various suppliers globally. Most of the parts are purchased as sub-assemblies or ready modules.

Constituent Materials

The REJ603 v1.5 without HMI weighs 0.845 kg, and the constituent materials are presented below.

Type	Material	Weight [kg]	Weight %
Plastics	PC/ABS	0.292	34.6
	Polycarbonate	0.048	5.7
Metals	Steel	0.005	0.6
	Aluminum	0.141	16.7
	Brass	0.012	1.4
	Copper	0.003	0.4
Others	Rubber	0.006	0.7
	Electronics	0.338	40
Total		**0.845**	**100**

REJ603 v1.5 without HMI



The packaging materials and accessories weighs 0.63 kg, and the constituent materials are presented below. Bulk packaging is also included considering 120 relays per pallet.

	Description	Material	Weight [kg]	Weight %
Relay	Packaging box	Cardboard	0.17	27.1
	Box interior	Cardboard	0.21	33.3
	Subtotal		**0.38**	**60.4**
Pallet (1/120)	Packaging box bulk	Cardboard	0.07	11.1
	Plastic straps	PET	0.05	7.9
	Wooden pallet	Wood	0.13	20.6
	Subtotal		**0.29**	**39.6**
Total			**0.63**	**100**

LCA Background Information

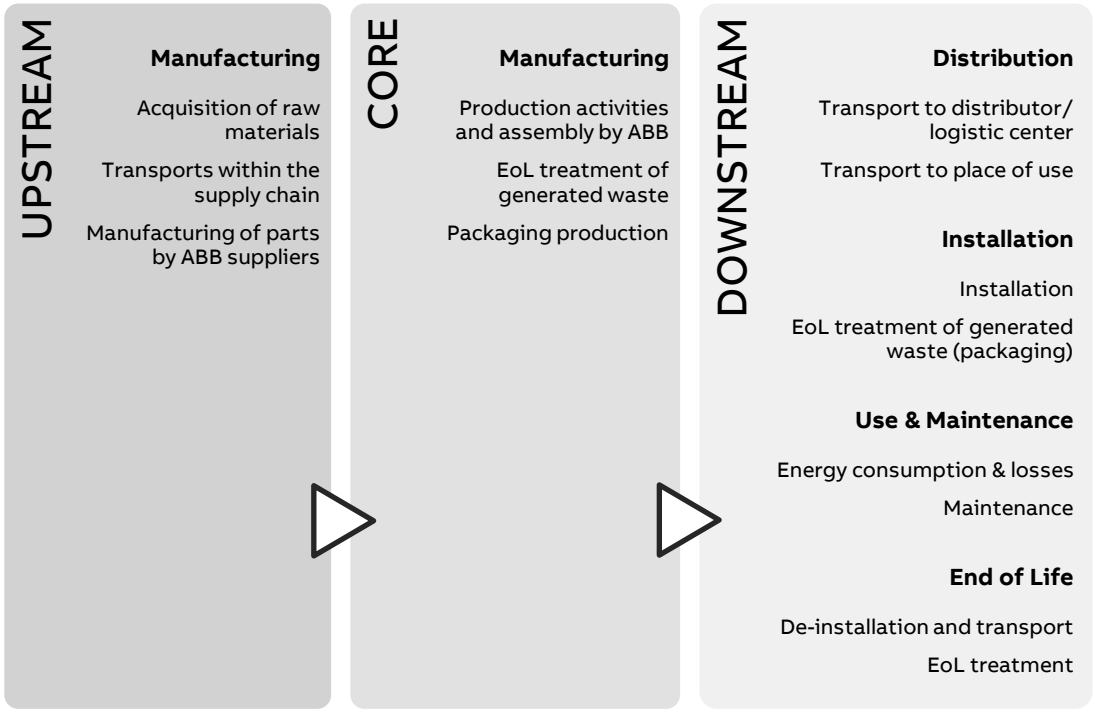
Functional Unit

The functional unit of this study is to protect a power system against faults such as short-circuit and earth fault of feeder, by drawing current from the external current transformer in the feeder resulting in a power consumption of approximately 1 W, during a service life of 10 years and with a use rate of 100 % in Europe. The reference flow is a single REJ603 v1.5 protection relay, including related connectors, accessories, and packaging.

Note, the reference service life (RSL) of 10 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 REJ603 v1.5, 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, 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 REJ603 v1.5 relays are globally sourced. The supply chains are often complex and can extend across multiple countries and continents. Therefore, materials 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. Site specific foreground data are provided by ABB.

For all processes for which primary data are not available, generic data originating from the ecoinvent v3.9.1 database, “allocation, cut-off by classification”, are used. 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 of ABB’s manufacturing site are allocated to the production of one relay by using allocation rules. Because the plant is focused on relay production, the total utility consumption and waste generation for 2022 is simply divided by the total output of relays during the same year. However, utility consumption and waste generation deriving from offices and administrative activities are not excluded because it is not possible to accurately allocate the inventory only for the production. Thus, a conservative approach is adopted.

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 EN 50693, the cut-off criteria can be set to a maximum of 5 % of the overall environmental impacts. In this LCA, stickers, labels, tape, and staples used in the packaging have been excluded as their weights are negligible. Thermal paste used in the electronics is also excluded due to the unavailability of data.

Inventory Analysis

Manufacturing stage

As presented in chapter Constituent Materials, electronics and PC/ABS are the most frequently used materials, followed by aluminum and polycarbonate.

Using the ecoinvent database, PC/ABS is modelled with *Acrylonitrile-butadiene-styrene copolymer {GLO}| market for* and *Polycarbonate {GLO}| market* for. Aluminum is modelled with *Aluminium, cast alloy {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.

The printed wiring boards (PWB) are modelled on a component level. Empty PWB's are first modelled as *printed wiring board, for surface mounting, PB free surface {GLO}| market for*. Every single component, such as resistors, transistors, etc., is then categorized and grouped into the most corresponding processes found in ecoinvent. Finally, the production efforts are accounted for by using the process *Mounting, surface mount technology, Pb-free solder {GLO}| market for*".

For modelling the connectors, the following process is used: *Electric connector, peripheral component interconnect buss {GLO}| market for*. Due to the high impacts of gold, primary data are used to model the specific amounts of gold used in the connectors.

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 REJ603 v1.5 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 the actual distance is unknown. The environmental impacts can be multiplied accordingly if the actual distance is known. 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 nominal power consumption over the reference service life of 10 years as defined in the functional unit. This is calculated using the following formula:

$$E_{use}[kWh] = \frac{P_{use} * 8760 * RSL * \alpha}{1000} = \frac{1\ \text{W} * 8760\ \text{hours} * 10\ \text{years} * 100\ \%}{1000} = 87.6\ kWh$$

Where:

- E_{use} = Total energy use over the reference service life
- P_{use} = 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

A use rate of 100 % is assumed because the relay is constantly drawing current from the CT's during normal operational circumstances. Additional power consumption for active inputs and outputs, e.g., during trip conditions, is considered negligible. Finally, 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	0.36	kg CO_2-eq./kWh

Maintenance is not included because the REJ603 v1.5 without HMI does not have any required maintenance within its service life. The only maintenance that is performed is corrective maintenance if, for example, something breaks or stops working. However, corrective maintenance is unusual, and thus considered negligible.

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 and cables 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

REJ603 v1.5 without HMI

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.	6.61E+01	2.59E+01	7.67E+00	6.83E-02	1.06E-02	3.17E+01	7.55E-01
GWP – fossil	kg CO_2 eq.	6.50E+01	2.57E+01	7.98E+00	6.82E-02	1.06E-02	3.05E+01	7.50E-01
GWP – biogenic	kg CO_2 eq.	9.30E-01	1.23E-01	-3.22E-01	6.21E-05	9.65E-06	1.12E+00	4.90E-03
GWP – luluc	kg CO_2 eq.	1.43E-01	4.80E-02	1.89E-02	3.33E-05	5.18E-06	7.62E-02	1.05E-04
ODP	kg CFC-11 eq.	1.40E-06	8.03E-07	4.82E-08	1.49E-09	2.32E-10	5.48E-07	1.20E-09
AP	mol H+ eq.	4.07E-01	2.15E-01	3.85E-02	2.82E-04	4.39E-05	1.53E-01	5.42E-04
EP – freshwater	kg P eq.	5.88E-02	2.39E-02	7.13E-03	4.80E-06	7.47E-07	2.78E-02	2.85E-05
EP – marine	kg N eq.	7.18E-02	3.41E-02	9.52E-03	1.08E-04	1.67E-05	2.72E-02	8.77E-04
EP – terrestrial	mol N eq.	6.89E-01	3.61E-01	8.46E-02	1.15E-03	1.79E-04	2.40E-01	1.89E-03
POCP	kg NMVOC eq.	2.18E-01	1.17E-01	2.31E-02	4.13E-04	6.42E-05	7.73E-02	5.24E-04
ADP – minerals and metals	kg Sb eq.	4.84E-03	4.77E-03	6.82E-06	2.20E-07	3.43E-08	6.06E-05	5.64E-07
ADP – fossil	MJ, net calorific value	1.14E+03	3.42E+02	9.14E+01	9.72E-01	1.51E-01	7.01E+02	1.03E+00
WDP	m^3 eq.	1.43E+01	6.89E+00	2.53E-01	3.95E-03	6.14E-04	7.17E+00	2.52E-02

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	1.12E+03	3.28E+02	9.14E+01	9.72E-01	1.51E-01	7.01E+02	1.03E+00
PERE	MJ, low cal. value	1.79E+02	3.70E+01	7.65E+00	1.51E-02	2.35E-03	1.35E+02	9.20E-02
PENRM	MJ, low cal. value	1.39E+01	1.39E+01	9.80E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM	MJ, low cal. value	7.35E+00	0.00E+00	7.35E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ, low cal. value	1.14E+03	3.42E+02	9.14E+01	9.72E-01	1.51E-01	7.01E+02	1.03E+00
PERT	MJ, low cal. value	1.87E+02	3.70E+01	1.50E+01	1.51E-02	2.35E-03	1.35E+02	9.20E-02
FW	m^3	8.00E-01	2.44E-01	7.40E-03	1.39E-04	2.16E-05	5.48E-01	8.47E-04
MS	kg	4.72E-01	1.11E-01	3.61E-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	2.94E-03	1.96E-03	8.08E-05	6.19E-06	9.63E-07	8.88E-04	4.35E-06
NHWD	kg	5.59E+00	2.63E+00	5.27E-01	4.75E-02	7.39E-03	1.92E+00	4.50E-01
RWD	kg	5.88E-03	6.82E-04	8.82E-05	3.16E-07	4.91E-08	5.11E-03	1.63E-06
MER	kg	2.61E-01	0.00E+00	4.34E-02	0.00E+00	0.00E+00	0.00E+00	2.18E-01
MFR	kg	1.53E+00	3.98E-02	7.17E-01	0.00E+00	5.66E-01	0.00E+00	2.03E-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	8.54E-01	0.00E+00	1.51E-01	0.00E+00	0.00E+00	0.00E+00	7.03E-01
EEE	MJ	4.66E-01	0.00E+00	7.55E-02	0.00E+00	0.00E+00	0.00E+00	3.90E-01

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

Sensitivity analysis

A sensitivity analysis is conducted to understand the environmental impacts for the other REJ603 v1.5 hardware variant (with HMI). In addition to the HMI, it also includes a Li-Ion battery in the upstream manufacturing stage, as well as one replacement of HMI with battery during the use stage. Packaging and transportation of the replacement HMI and battery are included, but transportation for the technician is excluded since this is typically done at the same time as doing other service or it is replaced by the customer. The results are presented below.

REJ603 v1.5 with HMI

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.	7.39E+01	2.97E+01	7.67E+00	7.63E-02	1.21E-02	3.55E+01	9.90E-01
GWP – fossil	kg CO_2 eq.	7.28E+01	2.95E+01	7.98E+00	7.62E-02	1.21E-02	3.43E+01	9.81E-01
GWP – biogenic	kg CO_2 eq.	9.02E-01	1.33E-01	-3.22E-01	6.94E-05	1.10E-05	1.08E+00	8.59E-03
GWP – luluc	kg CO_2 eq.	1.57E-01	5.45E-02	1.89E-02	3.73E-05	5.90E-06	8.37E-02	2.25E-04
ODP	kg CFC-11 eq.	1.73E-06	9.64E-07	4.82E-08	1.67E-09	2.64E-10	7.11E-07	8.47E-09
AP	mol H+ eq.	4.73E-01	2.47E-01	3.85E-02	3.16E-04	5.00E-05	1.85E-01	1.09E-03
EP – freshwater	kg P eq.	6.68E-02	2.79E-02	7.13E-03	5.37E-06	8.50E-07	3.18E-02	5.78E-05
EP – marine	kg N eq.	8.63E-02	4.12E-02	9.52E-03	1.20E-04	1.91E-05	3.44E-02	1.03E-03
EP – terrestrial	mol N eq.	8.13E-01	4.22E-01	8.46E-02	1.28E-03	2.03E-04	3.02E-01	2.94E-03
POCP	kg NMVOC eq.	2.53E-01	1.34E-01	2.31E-02	4.62E-04	7.31E-05	9.47E-02	8.29E-04
ADP – minerals and metals	kg Sb eq.	6.78E-03	5.75E-03	6.82E-06	2.46E-07	3.90E-08	1.02E-03	1.41E-06
ADP – fossil	MJ, net calorific value	1.23E+03	3.89E+02	9.14E+01	1.09E+00	1.72E-01	7.50E+02	1.88E+00
WDP	m^3 eq.	1.51E+01	7.24E+00	2.53E-01	4.41E-03	6.99E-04	7.54E+00	5.66E-02

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	1.22E+03	3.75E+02	9.14E+01	1.09E+00	1.72E-01	7.49E+02	1.88E+00
PERE	MJ, low cal. value	1.90E+02	4.22E+01	7.65E+00	1.69E-02	2.67E-03	1.40E+02	2.64E-01
PENRM	MJ, low cal. value	1.55E+01	1.47E+01	9.80E-03	0.00E+00	0.00E+00	7.58E-01	0.00E+00
PERM	MJ, low cal. value	8.36E+00	0.00E+00	7.35E+00	0.00E+00	0.00E+00	1.01E+00	0.00E+00
PENRT	MJ, low cal. value	1.23E+03	3.89E+02	9.14E+01	1.09E+00	1.72E-01	7.49E+02	1.88E+00
PERT	MJ, low cal. value	1.98E+02	4.22E+01	1.50E+01	1.69E-02	2.67E-03	1.41E+02	2.64E-01
FW	m^3	8.41E-01	2.63E-01	7.40E-03	1.55E-04	2.45E-05	5.69E-01	1.77E-03
MS	kg	5.35E-01	1.11E-01	3.61E-01	0.00E+00	0.00E+00	6.36E-02	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	3.47E-03	2.23E-03	8.08E-05	6.92E-06	1.10E-06	1.15E-03	7.20E-06
NHWD	kg	6.63E+00	3.11E+00	5.27E-01	5.31E-02	8.41E-03	2.41E+00	5.22E-01
RWD	kg	6.07E-03	7.76E-04	8.82E-05	3.53E-07	5.60E-08	5.20E-03	3.52E-06
MER	kg	3.14E-01	0.00E+00	4.34E-02	0.00E+00	0.00E+00	0.00E+00	2.71E-01
MFR	kg	1.64E+00	3.99E-02	7.17E-01	0.00E+00	6.45E-01	5.22E-05	2.41E-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	1.01E+00	0.00E+00	1.51E-01	0.00E+00	0.00E+00	0.00E+00	8.54E-01
EEE	MJ	5.50E-01	0.00E+00	7.55E-02	0.00E+00	0.00E+00	0.00E+00	4.74E-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.

A sensitivity analysis is also conducted to understand how the impact category “GWP – total” varies for REJ603 v1.5 relays without HMI that are used in different geographical locations. The results are presented below.

REJ603 v1.5 without HMI

Scenario	GWP – total [kg CO_2 eq.]	UPSTREAM	CORE	DOWNSTREAM			
		Manufacturing		Distribution	Installation	Use and maintenance	End-of-life
Declared scenario (Europe) Manufacturing site: India Distribution: 300 km by lorry Use stage: Europe	6.61E+01	2.59E+01	7.67E+00	6.83E-02	1.06E-02	3.17E+01	7.55E-01
India Manufacturing site: India Distribution: 300 km by lorry Use stage: India	1.51E+02	2.59E+01	7.67E+00	6.83E-02	1.06E-02	1.17E+02	7.55E-01
China Manufacturing site: India Distribution: 300 km by lorry Use stage: China	1.17E+02	2.59E+01	7.67E+00	6.83E-02	1.06E-02	8.30E+01	7.55E-01

Additional Environmental Information

Recyclability potential

The recyclability potential of the REJ603 v1.5 is calculated by dividing “MFR: material for recycling” in the end-of-life stage by the total weight of the product. The results are presented below.

	Recyclability potential
REJ603 v1.5 without HMI	24 %
REJ603 v1.5 with HMI	27 %

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 IN energy mix; 96.3% National Energy Mix + 3.1% Solar generation + 0.6% Diesel backup generator	Ecoinvent v3.9.1	1.29	kg CO_2-eq/kWh

Dangerous substances

As part of ABB’s values, and in alignment with the Supplier Code of Conduct, we seek to work with companies who contribute to a sustainable development and are ethically, socially, environmentally, and economically responsible.

ABB is responsible for ensuring that our products comply with legal requirements. There are also other sets of environmental requirements not necessarily originating from legislation, but which are of great importance as ABB customers are demanding compliance with them.

ABB Distribution Solutions has contacted suppliers of the REJ603 v1.5 to collect component and material information. This information includes, but is not limited to:

- Full Material Disclosure
- RoHS compliance certificate
- REACH compliance certificate
- Component lifecycle status

Thus, the purpose is to avoid chemicals, materials, and substances that

- may represent hazards to the environment, or
- the health of workers, customers, consumers, and other stakeholders, or
- could negatively influence end-of-life properties.

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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