EPD

Environmental Product Declaration

REX640 Protection and Control Relay

Production site: Vaasa, Finland

DOCUMENT KIND Environmental Product Declaration	IN COMPLIANCE WITH ISO 14025 and EN 50693			
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EPD Owner	ABB Swizerland Ltd, Group Technology Management
Organisation no	CHE-101.538.426
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Declared product, functional unit (FU), and reference flow (RF)	REX640 Protection and Control Relay FU: To protect a power system against faults such as short circuit and overload, during a service life of 10 years and with a use rate of 100 %. RF: A single protection and control relay, including related accessories and packaging.
Product description	The REX640 relay is used in utility, industrial, and transport and infrastructure applications for protection, control, measurement, and super-vision of power distribution systems. REX640 is based on an application package concept, that offer a variety of ready-made application packages to choose from. The available application packages provide feeder protection, power transformer protection, machine protection, shunt capacitor protection, busbar protection, automatic synchronization, Petersen coil control, Arc protection with supervised sensors.
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-Norway: Elisabet Amat Guasch Signature: 
Approved by	Håkon Hauan, CEO EPD-Norge Signature: 
Reference PCR and version number	EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev. 2, 2020/10/21.
Core PCR	EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems
Product RSL description	10 years (this is a theoretical period selected for calculation purposes only and it is not representative for the minimum, average, nor actual service life of the product)
Markets of applicability	Global: Manufacturing and distribution Europe: Use and end-of-life
LCA study	This EPD is based on the LCA study described in the LCA report 2RCA057422
EPD type	A specific product by a specific manufacturer

EPD scope	“Cradle to grave”
Year of reported primary data	2021
LCA software	SimaPro 9.3.0.3 (2022)
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	The owner of the declaration shall be liable for the underlying information and evidence. EPD-Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

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

REX640 is an all-in-one protection and control relay use in advanced power distribution and generation applications with unmatched flexibility available during the complete life cycle of the device. The relay has a modular design for both hardware and software, which allows customization and modification flexibility, and adaptation to changing protection requirements. REX640 relays are used in utility, industrial, and transport and infrastructure applications for protection, control, measurement, and super-vision of power distribution systems. REX640 is based on an application package concept, that offer a variety of ready-made application packages to choose from. The available application packages provide feeder protection, power transformer protection, machine protection, shunt capacitor protection, busbar protection, automatic synchronization, Petersen coil control, and Arc protection with supervised sensors throughout the relay life cycle.

The products declared in this Environmental Product Declaration includes the configurations of the REX640 protection and control relays.

General technical specifications for the REX640 are as follows:

Description		Value
Width		304,0 mm
Height		264,8 mm
Depth	With compression type CT/VT connectors	242,2 mm
	With ring lug type CT/VT connectors	254,1 mm
	With grounding bar	274,0 mm
Weight (exc. packaging		6,9…9,3 kg

	Power Supply Module 1001	Power Supply Module 1002	Power Supply Module 1003
Nominal auxiliary voltage U_n	24, 30, 48, 60 V DC	100, 110, 120, 220, 240 V AC, 50 and 60 Hz 48, 60, 110, 125, 220, 250 V DC	110, 125 V DC
Burden of auxiliary voltage supply under quiescent (P_q) / operating condition	DC < 18,0 W (nominal) / < 25,0 W (max.)	AC < 20,0 W (nominal) / < 25,0 W (max.) DC < 20,0 W (nominal) / < 25,0 W (max.)	DC < 17,0 W (nominal) / < 25,0 W (max.)

The REX640 protection and control relays are produced in Vaasa, Finland, and the relays are sold globally.

The manufacturing site in Vaasa, Finland, uses 100 % renewable energy for the electricity, more specifically, a 50/50 mix of wind and hydro. 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

Note, 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. Most of the parts are purchased as sub-assemblies or ready modules.

The relay has mandatory and optional slots. A mandatory slot always contains a module, but an optional slot may be empty, depending on the configration ordered. The module slots are shown in table 3.

Module	Slot A1	Slot A2	Slot B	Slot C	Slot D	Slot E	Slot F	Slot G
ARC1001	o							
COM1001		•						
COM1002		•						
COM1003		•						
COM1004		•						
COM1005		•						
BIO1001			•	o	o			
BIO1002			•	o	o			
BIO1003						o		
BIO1004						o		
RTD1001				o	o			
AIM1001						o	•	
AIM1002						o	•	
SIM1001						o	•	
PSM1001								•
PSM1002								•
PSM1003								•

• = Mandatory to have one of the allocated modules in the slot
o = Optional to have one of the allocated modules in the slot. The population (order) of the modules in the optional slots depends on the composition variant ordered.

Due to the modular nature of the product, there is a significant variation within the REX640 in terms of environmental impacts. A representative relay is therefore selected as reference product and declared in this EPD. The configuration of the reference product has all module slots but one filled. The results of the study can be extrapolated for other relay configurations according to EN 50693. The extrapolation rules are provided together with the results.

Slot	Description	Module
	Base functionality	REX640B10NN
A1	-	-
A2	Communication module	COM1002
B	Binary input/output module	BI01001
C	Binary input/output module	BI01001
D	Binary input/output module	BI01001
E	Analogue input module 1	AIM1001
F	Analogue input module 2	AIM1002
G	Power supply module	PSM1002
Product		REX640
Average nominal power		16,5 W
Weight (excl. packaging)		9,16 kg
Ordering code		REX640_11Z9

The ordering code is generated based on selected configuration in the ABB's product selection tool.

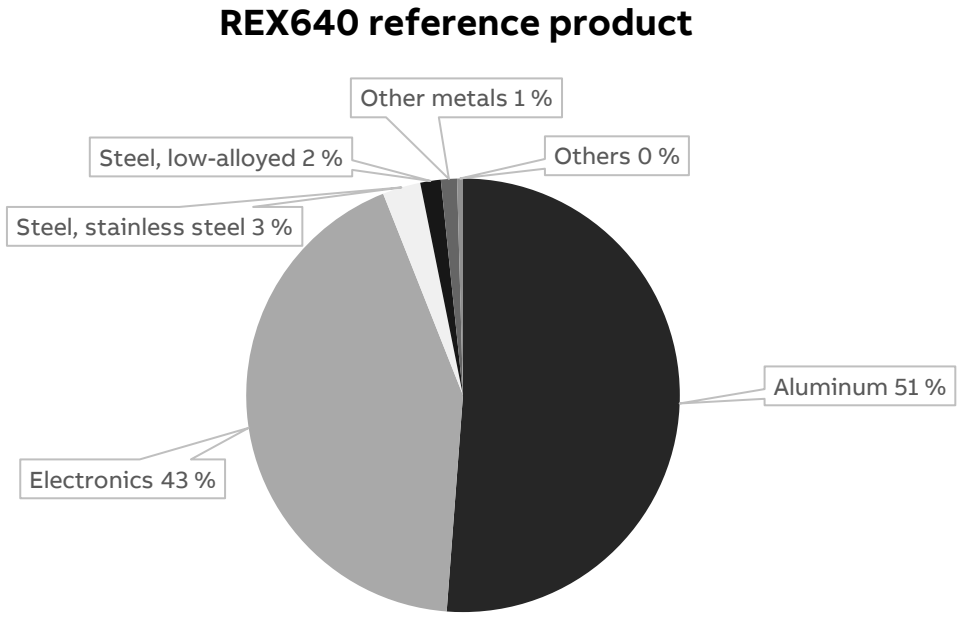
Packaging materials and manuals associated with these products are also included in the study.

Description	Material and weight
Manuals	Printed paper, 43 g
Packaging box	Cardboard,471 g
Box interior	Moulded recycled fibre pulp, 384 g
Pallet (6 pcs / pallet)	Wooden pallet, 1767 g

Constituent materials

The reference product weighs ca 9,16 kg, including 7 slots of maximum 8 in terms of hardware. Stickers and glue used in PSM base plate assembly have been excluded as they are considered negligible to the overall environmental impacts. Due to the complex nature of the electronics, these are presented as a separate category, which includes printed wiring boards, electronic components, connectors, and cables. Electronics are typically composed of various plastics, copper, and precious metals.

REX640 reference product (excl. packaging)				
Materials	**Name**	**CAS Number**	**Weight [kg]**	**%**
Metals	Aluminium	7429-90-5	4,69	51
	Steel, stainless steel	12597-68-1	0,26	3
	Steel, low-alloyed	12597-69-2	0,14	2
	Other metals		0,11	1
Others	Electronics (PWBs, components, connectors, cables)	-	3,92	43
	Others	-	0,04	0
			9,16	100



LCA background information

Functional Unit and Reference Flow

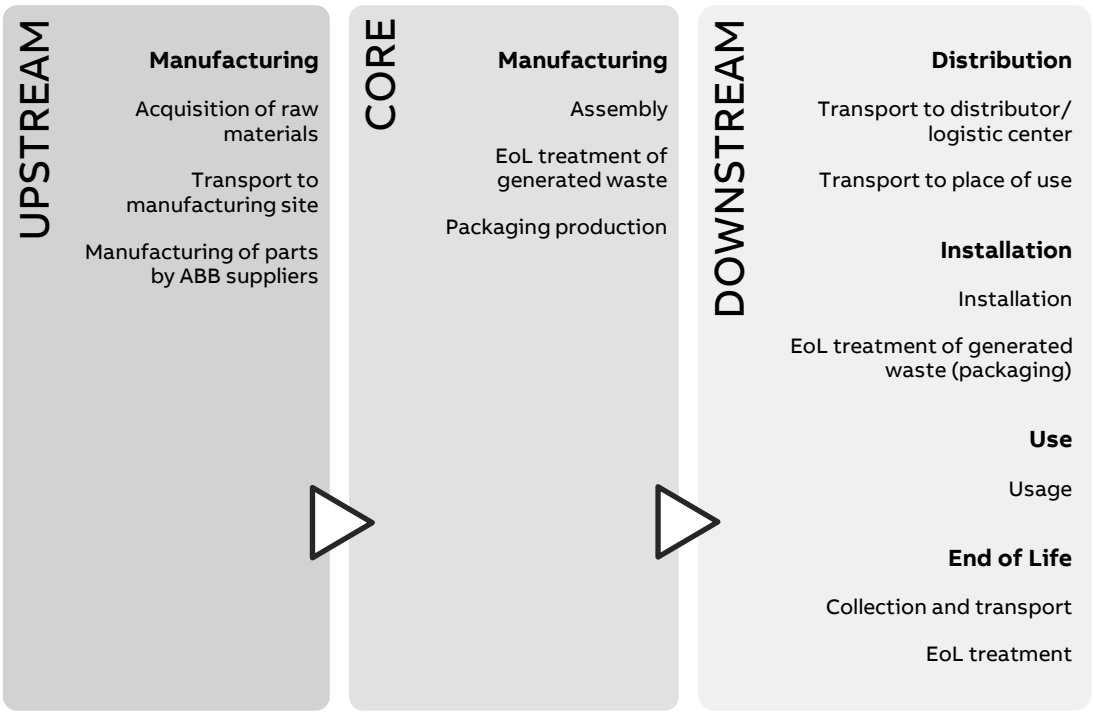
The functional unit of this study is to protect a power system against faults such as short circuit and overload, during a service life of 10 years and with a use rate of 100 %. The reference flow is a single protection and control relay, including related accessories and packaging.

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 analysis of the REX640, an EEPS (Electronic and Electrical Products and Systems), is a “from cradle to grave” analysis and covers the following main life cycle stages according to EN 50693: Manufacturing stage, 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 stage; installation stage, including the relevant steps for the preparation of the product for use; use stage, including the re-quired maintenance steps within the RSL (reference service life) associated to the reference product; end-of-life stage, including the necessary steps until and for the final disposal or recovery of the product system.

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



More specifically, the stages of the product life cycle and the information considered for the evaluation of the REX640 are the following:

- The upstream manufacturing stage: This includes the acquisition of raw materials as well as production and transportation of semi-finished parts, components, and sub-assemblies from both direct and indirect suppliers to ABB. Production losses are also included.
- The core manufacturing stage: This includes the final assembling and testing at the local manufacturing site in Finland. It also includes the utility consumptions and the waste generated at the sites as well as the production and use of packaging materials.
- The distribution stage: This includes all activities related to the distribution and transportation of the final product to the site of installation.
- The installation stage: This includes the end of life of the packaging materials.
- The use stage: This includes the power consumption throughout the reference service life of the product.
- The end-of-life stage: This includes all activities related to waste treatment and disposal of the product at the end of its service life.

Temporal and geographical boundaries

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

Due to the unclear origin of each material, ecoinvent processes with a global representativeness have been used. Thus, a conservative approach has been adopted.

Boundaries in the life cycle

In terms of boundaries, the PCR EPDitaly007 requires to refer to chapter 4.2.3.1 in the standard EN 50693 for products that can be easily replaced or recovered. In accordance with EN 50693:2019, 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 processes deriving from the ecoinvent database have not been excluded.

Data quality

Both primary and secondary data are used. The main sources for primary data are the bill of materials as well as technical drawings and documents. Site specific foreground data have been provided by ABB. 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 SimaPro 9.3.0.3 which is the LCA software used for the calculations.

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.

Note, the PCR EPDItaly007 uses four different indicators for climate change (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).

Allocation rules

The utility consumption and waste generation of the ABB's production plant 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 2021 are simply divided by the total output of relays during the same year. 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.

Limitations and simplifications

The PCR EPDItaly007 does not provide any details about cut-off criteria; it refers to chapter 4.2.3.3 in the standard EN 50693. According to EN 50693, the cut-off criteria can be set to a maximum of 5 % of the overall environmental impacts given by the LCIA results.

In this study, stickers and glue used in PSM base plate assembly have been excluded as they are considered negligible to the overall environmental impacts.

Inventory analysis

In this study, both primary and secondary data are used. The main sources for primary data are the bill of materials as well as technical drawings and documents. Site specific foreground data have been provided by ABB. The ecoinvent v3.8 cut-off by classification system processes are used to model the background system of the processes.

Due to the complex supply chain of the REX640, ecoinvent processes are selected with a global representativeness.

Manufacturing stage

Aluminium and electronics are the most frequently used materials, followed by stainless and low-alloyed steel.

To account for the production efforts of metal parts, “metal working, average”-processes are most commonly used.

The printed wiring boards (PWB) are modelled on a component level. Thus, every single component that is mounted on the PWBs is categorized and grouped into the most corresponding component found in ecoinvent. Furthermore, due to the high impacts of gold, primary data are used to model the specific amounts of gold used in each connector.

The transport distances of raw materials to the manufacturing site of the first known supplier in the supply chain are assumed to be included in ecoinvent’s “market for”-processes. Additional transports of semi-finished parts, components, and sub-assemblies between indirect suppliers, direct suppliers, and ABB’s production plant are added separately. Intercontinental transports are assumed to be by air. Thus, a conservative approach is adopted.

The core manufacturing stage of the REX640 takes place in ABB manufacturing site in Finland. The utility consumption and waste generation of the ABB’s production plant are allocated to the production of one relay according to the provided allocation rules.

Packaging materials and manuals are also included in the analysis, in the core manufacturing stage.

Distribution

The relays are in general delivered directly to the customer, and the most common type of transport is by road and air. ABB does not have any additional distribution centres. The relays are neither repacked throughout the distribution stage.

A distribution scenario is developed based on primary data. A weighted average is calculated for air, sea, and road transports based on delivery statistics from 2021.

Installation

The installation phase only implies manual activities, and no energy is consumed. Thus, in the LCA, this phase only includes the end-of-life of the packaging materials and manuals that are discarded after installation. Statistical data are adopted from Eurostat (2018) to create a scenario which is representative for Europe. A transport distance of 100 km is assumed because the actual location of disposal is unknown.

Use

The use phase considers the power consumption over the reference service life of 10 years as defined in the functional unit. A use rate of 100 % is assumed because under normal operational circumstances, the relay is always powered on in a stand-by mode. Variations in power consumption from other modes are therefore considered negligible, including power losses from input and output signals. Because this product is sold globally and is not limited to any specific country, the latest energy mix for the European Union is adopted as suggested by the standard EN 50693. The emission factor is derived from GWP - total from the selected impact assessment method. For reference, the following table shows the greenhouse gas emissions per kWh (EN 15804:2012+A2:2019 method, GWP indicator):

Electricity mix	Data source	Amount	Unit
European electricity mix: Electricity, medium voltage {RER}| market group for | Cut-off, S	Ecoinvent v3.8	0,40	kg CO_2-eq/kWh

End of life

The end-of-life stage is modelled according to the PCR EPDItaly007 and IEC/TR 62635. The percentages for end-of-life treatments of the product are adopted from IEC/TR 62635 (Annex D, example 2), which is representative for Europe. The scenario is based on the rates given for materials that go through a separation process and thus, a conservative approach is adopted. A transport distance of 100 km is assumed because the distance to the actual location of disposal is unknown.

Environmental indicators

This chapter presents the environmental impact indicators for the selected reference product of REX640, according to the PCR EPDItaly007. Extrapolation rules are thereafter provided, based on a sensitivity analysis, which allows for estimating more precise impacts of other relay configurations.

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).

REX640 reference product

Product: REX640
Ordering code: REX640_11Z9
Hardware: 7 of 8 slots filled
Nominal power: 16,5 W (measured, average)

Impact category	Unit	Total	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use	End-of-life
GWP - total	kg CO_2 eq.	8,63E+02	2,35E+02	1,35E+00	4,13E+01	1,46E+00	5,77E+02	5,91E+00
GWP - fossil	kg CO_2 eq.	8,41E+02	2,33E+02	3,56E+00	4,13E+01	7,43E-02	5,58E+02	5,73E+00
GWP - biogenic	kg CO_2 eq.	1,97E+01	1,81E+00	-2,30E+00	1,46E-02	1,39E+00	1,86E+01	1,79E-01
GWP - luluc	kg CO_2 eq.	1,82E+00	4,25E-01	7,87E-02	3,00E-03	2,60E-05	1,31E+00	8,04E-04
ODP	kg CFC-11 eq.	5,27E-05	1,52E-05	3,15E-07	9,40E-06	1,18E-08	2,76E-05	7,25E-08
AP	mol H^+ eq.	5,49E+00	2,24E+00	2,26E-02	2,15E-01	4,00E-04	3,00E+00	4,69E-03
EP - freshwater	kg P eq.	8,42E-01	2,82E-01	1,53E-03	6,24E-04	1,00E-05	5,57E-01	2,52E-04
POCP	kg NMVOC eq.	2,52E+00	1,04E+00	1,60E-02	2,23E-01	4,54E-04	1,24E+00	4,07E-03
ADP – minerals and metals	kg Sb eq.	8,62E-02	8,48E-02	4,55E-05	1,64E-05	2,20E-07	1,32E-03	8,29E-06
ADP – fossil	MJ, net calorific value	1,54E+04	2,87E+03	4,91E+01	5,80E+02	8,60E-01	1,19E+04	8,98E+00
WDP	m^3 eq.	2,18E+02	8,58E+01	2,36E+00	4,99E-01	-6,37E-03	1,29E+02	1,73E-01

GWP-fossil: Global Warming Potential fossil; GWP-biogenic: Global Warming Potential biogenic; GWP-luluc: Global Warming Potential land use and land use change; ODP: Depletion potential of the stratospheric ozone layer; AP: Acidification potential; EP-freshwater: Eutrophication potential-freshwater compartment; 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	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use	End-of-life
PENRE	MJ, low cal. value	1,54E+04	2,81E+03	4,90E+01	5,80E+02	8,60E-01	1,19E+04	8,98E+00
PERE	MJ, low cal. value	2,54E+03	3,23E+02	9,09E+01	2,14E+00	1,54E-02	2,12E+03	7,14E-01
PENRM	MJ, low cal. value	5,66E+01	5,66E+01	0,00E+00	0	0	0	0
PERM	MJ, low cal. value	4,32E+01	0	4,32E+01	0	0	0	0
PENRT	MJ, low cal. value	1,54E+04	2,87E+03	4,90E+01	5,80E+02	8,60E-01	1,19E+04	8,98E+00
PERT	MJ, low cal. value	2,58E+03	3,23E+02	1,34E+02	2,14E+00	1,54E-02	2,12E+03	7,14E-01
FW	m^3	1,33E+01	2,96E+00	1,54E-01	1,91E-02	-5,89E-05	1,01E+01	6,42E-03
MS	kg	3,73E+00	3,37E+00	3,60E-01	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0

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	UPSTREAM	CORE	DOWNSTREAM			
			Manufacturing		Distribution	Installation	Use	End-of-life
HWD	kg	3,89E-02	3,30E-02	1,19E-04	1,54E-03	2,15E-06	4,23E-03	1,71E-05
NHWD	kg	7,64E+01	3,32E+01	9,58E-01	1,66E+00	1,39E-01	3,95E+01	9,32E-01
RWD	kg	1,00E-01	8,13E-03	1,91E-04	4,11E-03	5,03E-06	8,80E-02	4,00E-05
MER	kg	3,09E+00	0	5,45E-01	0	8,79E-01	0	1,67E+00
MFR	kg	9,92E+00	1,23E+00	1,58E+00	0	1,72E+00	0	5,40E+00
CRU	kg	0	0	0	0	0	0	0
ETE	MJ	1,92E+01	0	1,63E+00	0	3,09E+00	0	1,45E+01
EEE	MJ	9,82E+00	0	7,99E-01	0	1,54E+00	00	7,49E+00

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

Extrapolation rules

Due to the large variations in environmental impacts present within the REX640, extrapolation rules are established according to EN 50693. The rules are based on a sensitivity analysis and the changes in percentages are presented in tables in the following pages, in relation to the reference product. This allows for estimating more precise impacts of other relay configurations. The following rules are established:

1. The upstream manufacturing stage, distribution stage, and end-of-life stage can be extrapolated based on the number of hardware modules.
   - Range of variation: 0–4 empty slots
   - Reference product: 1 empty slot
   - Formula for 2-4 empty slots: $Value_{\mathrm{refproduct}} * (1 - change\% * (n_{\mathrm{emptyslots}} - 1))$
   - Formula for 0 empty slots: $Value_{\mathrm{refproduct}} * (1 + change\% * 0{,}31)$

2. The use stage can be extrapolated based on the actual, measured nominal power consumption.
   - Formula: $Value_{refproduct} * (1 - change\% * (16{,}5 - \mathrm{P}_{\mathrm{nominal}}))$
   - Range of variation: 12–20 W

Example 1: A REX640 relay that have 3 hardware module slots empty, and a measured nominal power consumption at 15 W.

- GWP-total in upstream stage = 235,0 kg CO_2-eq * (1 – 9 % * (3 – 1) = 192,5 kg CO_2-eq
- GWP-total in use stage = 577,5 kg CO_2-eq * (1 – 16,5% * (16,5–15)) = 525,0 kg CO_2-eq

Example 2: REX640 relay that have 0 hardware module slots empty, and a measured nominal power consumption at 18 W.

- GWP-fossil in distribution = 41,3 kg CO_2-eq * (1 + 6 % * 0,31) = 42,0 kg CO_2-eq
- GWP-fossil in use stage = 557,5 kg CO_2-eq * (1 – 6,1 ,5% * (16,5-18)) = 608,2 kg CO_2-eq

An REX640 extrapolation tool with changeable parameters is provided in:
https://search.abb.com/library/Download.aspx?DocumentID=2RCA057534&LanguageCode=en&DocumentPartId=&Action=Launch

Impact category	Change per hardware module						Change per Watt
	Upstream manufacturing	Core manufacturing	Distribution	Installation	Use	End-of-life	Use
GWP - total	9,0 %	-	6,0 %	-	-	15,3 %	6,1 %
GWP - fossil	9,1 %	-	6,0 %	-	-	15,7 %	6,1 %
GWP - biogenic	3,3 %	-	5,9 %	-	-	0,6 %	6,1 %
GWP - luluc	7,9 %	-	6,2 %	-	-	4,9 %	6,1 %
ODP	9,2 %	-	6,0 %	-	-	6,8 %	6,1 %
AP	10,9 %	-	6,1 %	-	-	8,0 %	6,1 %
EP - freshwater	10,4 %	-	6,0 %	-	-	5,7 %	6,1 %
POCP	9,7 %	-	6,1 %	-	-	9,7 %	6,1 %
ADP – minerals and metals	11,1 %	-	6,0 %	-	-	2,2 %	6,1 %
ADP – fossil	9,6 %	-	6,0 %	-	-	6,0 %	6,1 %
WDP	9,8 %	-	6,0 %	-	-	10,7 %	6,1 %

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; 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	Change per hardware module						Change per Watt
	Upstream manufacturing	Core manufacturing	Distribution	Installation	Use	End-of-life	Use
PENRE	9,4 %	-	6,0 %	-	-	6,0 %	6,1 %
PERE	9,3 %	-	6,0 %	-	-	4,4 %	6,1 %
PENRM	19,2 %	-	-	-	-	-	-
PERM	-	-	-	-	-	-	-
PENRT	9,6 %	-	6,0 %	-	-	6,0 %	6,1 %
PERT	9,3 %	-	6,0 %	-	-	4,4 %	6,1 %
FW	9,0 %	-	6,0 %	-	-	9,7 %	6,1 %
MS	0,4 %	-	-	-	-	-	-
RSF	-	-	-	-	-	-	-
NRSF	-	-	-	-	-	-	-

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	Change per hardware module						Change per Watt
	Upstream manufacturing	Core manufacturing	Distribution	Installation	Use	End-of-life	Use
HWD	8,4 %	-	5,9 %	-	-	8,2 %	6,1 %
NHWD	8,9 %	-	6,0 %	-	-	4,4 %	6,1 %
RWD	9,3 %	-	6,0 %	-	-	5,4 %	6,1 %
MER	-	-	-	-	-	17,1 %	-
MFR	1,0 %	-	-	-	-	2,6 %	-
CRU	-	-	-	-	-	-	-
ETE	-	-	-	-	-	17,1 %	-
EEE	-	-	-	-	-	17,1 %	-

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

The recyclability potential of the reference product is calculated by dividing “MFR: material for recycling” with the total weight of the relay. This is based on the end-of-life scenario adopted from IEC/TR 62635 (Annex D, example 2) which is representative for Europe. The scenario is based on the rates given for materials that go through a separation process, and the production losses in the recycling processes have also been considered; thus, a conservative approach is adopted. Recyclability potentials for other relay configurations are also provided, which is based on a sensitivity analysis and extrapolation procedures.

Product	Recyclability potential
REX640, full relay (extrapolated)	**58,5 %**
REX640, 1 slot empty (reference product)	**58,9 %**
REX640, 2 slots empty (extrapolated)	**62,8 %**
REX640, 3 slots empty (extrapolated)	**66,7 %**
REX640, 4 slots empty (extrapolated)	**70,6 %**

REACH and RoHS compliance of REX640

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 REX640 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.

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 lines, in addition to direct emissions and losses in grid) applied electricity for the manufacturing process.

Electricity mix	Data source	Amount	Unit
ABB FI – custom: 50 % wind + 50 % hydro	Ecoinvent v3.8	0,0259	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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