ABB F200B RESIDUAL CURRENT CIRCUIT BREAKERS

Product Environmental Profile

Environmental Product Declaration

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VERIFIED
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Document in compliance with ISO 14025: 2010 "Environmental labels and declarations. Type III environmental declarations"

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ABB Purpose & Embedding Sustainability

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 behaviour.

General Information

Reference product	ABB F204B 4 poles 30 mA 25A - code 2CSF204568R1630	
Description of the product	The F200 Type B are universal current-sensitive residual current circuit breakers RCCBs designed for industrial applications where there is increasing use of devices like frequency converters, medical equipment and UPS systems. The RCCB Type B protect faults occurred due to smooth DC residual currents or currents with low residual ripple which are common in the above applications.	
Functional unit	The functional unit is to protect during 20 years the installation against overloads and short-circuits and people and premises at risk of fire or explosion against insulation defects in the circuit with assigned voltage 230 V and rated current 25A. The reference product is F204B 300mA 25A with a weight of 0.3867 kg and its packaging of 0.0726 kg. No installation materials or maintenance components are required in the life cycle of the product. All the materials not found in the reference product, such as waste and scraps generated during the life cycle are also included. The disposal of the packaging during the installation phase and the disposal of all F204B 300mA 25A components during the product's end-of-life are also considered. Waste generated during the production phase is also included in the life cycle.	
Other product covered	**Technical characteristics**	**F200B RCCBs**
	Rated voltage [V]	230
	Rated current [A]	16/25/40/63
	Rated Sensitivity [A]	0.03/0.3/0.5
	Type of differential protection	B, B S
	Number of poles [P]	2-4

Constituent materials

The F204B 300mA 25A and its packaging weight approximately 0.459 kg.

PEP Material Category	Material	Percentage (%)
F204B		
Plastic	PA	22.6%
Metal	Steel	21.5%
Metal	Copper	13.2%
Plastic	Glass fibre	12.2%
Other	PCB	4.4%
Other	Nickel	2.1%
Plastic	PPS	2.0%
Plastic	PET	1.5%
Metal	Ferrous metals	1.5%
Metal	Zinc	0.6%
Plastic	PC	0.6%
Other	Paper	0.5%
Plastic	POM	0.4%
Metal	Brass	0.3%
Other	Miscellaneous	0.7%
Total F204B		84.2%
PACKAGING		
Other	Wood	7.8%
Other	Cardboard	6.5%
Other	Paper	1.3%
Plastic	PE	0.2%
Other	Adhesive	<0.1%
Total packaging		15.8%
TOTAL		100.0%

LCA background information

The aim of this Life Cycle Assessment (LCA) is the evaluation of the life cycle environmental impacts of the products F200B Type B produced by ABB S.p.A. to obtain the PEP declaration from the PEP ecopassport® program and identify environmental hotspots. The specific type of F200B analyzed in this LCA project is the F204B 300mA 25A, article code 2CSF204568R1630. The life cycle environmental impacts of the other F200B included in the family are calculated with the application of the extrapolation rules, following the indication of the PCR-ed4-EN-2021 09 06 standard. The stakeholder involved in this LCA study are: 2B Srl as LCA practitioner and ABB SpA as PEP owner.

LCA approach

The approach used to conduct this LCA is attributional. The LCA attributional model represents the assessment of the actual, average or estimated supply chain of a product or process. The existing or estimated system is placed in a static technological context. The attributional approach is a type of modelling that requires environmentally relevant inputs and outputs for each process involved in the product life cycle to be attributed to the functional unit.

Functional Unit

The functional unit of F204B 300mA 25A is to protect during 20 years the installation against overloads and short-circuits and people and premises at risk of fire or explosion against insulation defects in the circuit with assigned voltage 230 V and rated current 25A. The reference product is F204B 300mA 25A with a weight of 0.3867 kg and its packaging of 0.0726 kg. No installation materials or maintenance components are required in the life cycle of the product. All the materials not found in the reference product, such as waste and scraps generated during the life cycle are also included. The disposal of the packaging during the installation phase and the disposal of all F204B 300mA 25A components during the product's end-of-life are also considered. Waste generated during the production phase is also included in the life cycle.

System Boundaries

This LCA analyses the system “from cradle to grave”. This means that all the processes from raw materials extraction to the end-of-life of the product are included. In detail, the following life cycle stages are considered:

- *Manufacturing stage*: from the extraction of raw materials to component and packaging production, manufacturing consumption, assembly consumption of the product, distribution to the manufacturer’s last logistic platform;
- *Distribution stage*: transportation from the manufacturer’s last logistic platform to the installation place;
- *Installation stage*: the waste treatment of discarded materials;
- *Use stage*: energy consumption during all the RLT;
- *End-of-life stage*: removal, dismantling and transportation of the dismantled product to the treatment site and the treatment process.

Temporal, technological and geographical boundaries

All primary data collected from ABB are from 2021, which is a representative production year. Secondary data refers to the ecoinvent database v3.8 published in 2021.

Technological representativeness refers to the specific production process for primary data. For secondary data, it refers to the ecoinvent database v3.8 published in 2021 [8].

The ABB component suppliers are sourced all over the world. When the origin of the components is unknown, the selected ecoinvent processes in the LCA model have global representativeness. In this way, a conservative approach has been adopted.

The final assembly of the product occurs at ABB's plant located in Santa Palomba (RM). For the use and end-of-life stages of the product, the geographical boundaries of Europe have been considered.

Boundaries in the life cycle

As indicated in the PCR-ed4-EN-2021 09 06, capital goods, such as buildings, machinery, tools and infrastructure, and the packaging for internal transport which cannot be allocated directly to the production of the reference product, have been excluded from the system boundary.

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

Data quality

In this study, both primary and secondary data are used. The following primary data are provided by ABB: Bill of Materials (BoM) of the product, components materials, weights and suppliers, company consumption related to the product assembly, and average power loss of the product during the use phase of the product.

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 9.4 software used for the calculations.

Environmental impact indicators

The environmental impacts have been calculated according to the PCR-ed4-EN-2021 09 06 using the method EN 15804: 2012 + A2: 2019.

Allocation rules

There are no co-products in this product system, so no allocation of inputs and outputs is necessary.

No allocation is made for materials subject to recycling. For the input of recycled resources, the recycling process is included. Outputs subject to recycling are considered as inputs for the next life cycle.

Concerning the end-of-life allocation, the “polluter pay” principle is adopted as required by the PCR-ed4-EN-2021 09 06. This means that waste treatment processes are allocated to the product system that generates the waste until the end-of-waste state is reached.

However, the potential benefits and avoided loads from recovery and recycling processes beyond the end-of-waste state are not considered.

Inventory analysis

The data has been collected by ABB filling in a questionnaire relating to the LCA of F204B 300mA 25A. In addition, some data and clarifications have been provided through documents, conference calls and e-mail exchanges.

For data collection of the manufacturing stage, Bills of Material (BoM) extracted from ABB's internal SAP software were used.

To facilitate the calculations of the LCA and the presentation of the results, the LCA software SimaPro v. 9.4.0.2 has been used. For all processes for which no primary or representative data were available, the LCA ecoinvent v3.8 database, allocation, and cut-off by classification have been considered.

The following paragraphs present the data used and the main assumptions made for the LCA model of F204B 300mA 25A in the SimaPro v. 9.4.0.2 software.

Manufacturing stage

The manufacturing stage includes the production and transportation to the manufacturer’s last logistic platform of F204B 300mA 25A and its packaging.

Distribution

The transport from ABB Santa Palomba factory to ABB S.p.A. Regional Distribution Centre in Vignate, Milan was considered. For the distribution of the product from Vignate to the final customer, the intracontinental transport scenario provided by PCR-ed4-EN-2021 09 06 standard was adopted, considering the European macro-area for the use phase.

Installation

The installation phase only implies manual activities and no energy is consumed because there is no direct consumption during installation the of the product. This phase also includes the disposal of the packaging of the 2CSF204568R1630 code product. For its disposal, the statistical average data from Eurostat databases were considered, relating to landfill, incineration and recycling rates, by type of waste treated.

Use

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

For the use phase, the European average electricity consumption process "Electricity, low voltage {RER}| market group for | Cut-off, S" was adopted.

During the use phase, F200 Type B residual current circuit breakers dissipate some electricity due to power losses. The average power loss of the switch has been calculated by ABB following the assumption indicated in the PSR-0005-ed2-EN-2016 03 29:

- Nominal current load rate as 50%;
- RSL of 20 years;
- Functioning time of 30% of the RSL (α).

The formula for the calculation of the use stage electricity consumption from the average power loss is shown below:

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

Where:

- Puse [W] is the power consumed by the switch (average power loss);
- RSL is the service life of the product, assumed to be 20 years;
- 8760 is the number of hours in a year;
- α is the functioning time of 30% of the RSL;
- 1000 is the conversion factor that allows the energy consumed in kWh over the product's service life to be expressed.

End of life

The default end-of-life scenario provided by the IEC/TR 62635 document has been adopted, considering the product transport by lorry over 1000 km and its disposal, since the distance to the disposal site is not known as it is stated in the PSR. The IEC/TR 62635 document has been chosen for the LCA analysis because it is a sector-specific guideline with end-of-life data for electric and electronic equipment.

Energy models used

The energy models used for the modelling of F204B 300mA 25A are presented in the following table.

Life cycle stage	Energy models
Manufacturing stage	Manufacturing plant: Electricity, medium voltage {IT}| market for | Cut-off, System_GO energy mix_ei 3.8 System *The energy-related processes used for the remaining inputs of the manufacturing stage are those included in the ecoinvent 3.8 datasets selected for the analysis*
Use	Electricity, low voltage {RER}| market group for | Cut-off, S
End-of-life	*The energy-related processes used for the inputs of the end-of-life stage are those included in the ecoinvent datasets selected for the analysis*

Environmental indicators

The environmental impact of F204B 300mA 25A is calculated for the mandatory and optional impact categories required by the PCR. These indicators are derived from EN 15804:2012+A2:2019.

Impact category	Unit	Total	Manufacturing stage		Distribution stage		Installation stage		Use stage		End-of-life stage	
Climate change - Total	kg CO_2 eq	1.12E+02	9.44E+00	8.4%	3.11E-01	0.3%	1.61E-01	0.1%	1.02E+02	90.9%	3.05E-01	0.3%
Climate change - Fossil	kg CO_2 eq	1.08E+02	9.41E+00	8.7%	3.10E-01	0.3%	1.55E-02	0.0%	9.84E+01	90.8%	2.96E-01	0.3%
Climate change - Biogenic	kg CO_2 eq	3.35E+00	2.04E-02	0.6%	2.82E-04	0.0%	1.46E-01	4.3%	3.17E+00	94.8%	9.09E-03	0.3%
Climate change - Land use and LU change	kg CO_2 eq	2.47E-01	1.44E-02	5.8%	1.23E-04	0.0%	5.93E-06	<0.1%	2.33E-01	94.0%	2.80E-04	0.1%
Ozone depletion	kg CFC-11 eq	7.43E-06	2.37E-06	31.9%	7.24E-08	1.0%	3.20E-09	<0.1%	4.96E-06	66.8%	2.54E-08	0.3%
Acidification	mol H^+ eq	6.82E-01	1.13E-01	16.6%	1.57E-03	0.2%	7.88E-05	<0.1%	5.60E-01	82.1%	7.18E-03	1.1%
Eutrophication. freshwater	kg P eq	1.14E-01	1.44E-02	12.6%	2.02E-05	<0.1%	1.26E-06	<0.1%	9.91E-02	87.1%	3.63E-04	0.3%
Eutrophication. marine	kg N eq	1.09E-01	1.47E-02	13.4%	5.42E-04	0.5%	3.82E-05	<0.1%	9.34E-02	85.3%	8.23E-04	0.8%
Eutrophication. terrestrial	mol N eq	1.02E+00	1.80E-01	17.7%	5.92E-03	0.6%	3.03E-04	<0.1%	8.23E-01	81.1%	5.62E-03	0.6%
Photochemical ozone formation	kg NMVOC eq	2.73E-01	4.37E-02	16.0%	1.69E-03	0.6%	8.95E-05	<0.1%	2.26E-01	82.7%	1.68E-03	0.6%
Resource use. minerals and metals	kg Sb eq	5.35E-03	4.27E-03	79.7%	1.09E-06	<0.1%	5.71E-08	<0.1%	9.25E-04	17.3%	1.61E-04	3.0%
Resource use. fossils	MJ	2.23E+03	1.22E+02	5.5%	4.73E+00	0.2%	2.15E-01	<0.1%	2.10E+03	94.1%	3.37E+00	0.2%
Water use (AWARE)	m^3	2.81E+01	3.94E+00	14.0%	1.43E-02	0.1%	8.28E-04	<0.1%	2.41E+01	85.5%	1.37E-01	0.5%

Impact category	Unit	Total	Manufacturing stage	Distribution stage	Installation stage	Use stage	End-of-life stage
Use of non-renewable primary energy. excluding n.r. p.e. resources used as raw materials	MJ	2.22E+03	1.18E+02	4.73E+00	2.15E-01	2.10E+03	3.37E+00
Use of non-renewable primary energy resources used as raw materials	MJ	3.76E+00	3.76E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of non-renew primary energy res	MJ	2.23E+03	1.22E+02	4.73E+00	2.15E-01	2.10E+03	3.37E+00
Use of renewable primary energy. excluding r. p.e. resources used as raw materials	MJ	4.51E+02	1.84E+01	6.67E-02	4.15E-03	4.32E+02	4.77E-01
Use of renewable primary energy resources used as raw materials	MJ	9.81E-01	9.81E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy res	MJ	4.52E+02	1.94E+01	6.67E-02	4.15E-03	4.32E+02	4.77E-01

Impact category	Unit	Total	Manufacturing stage	Distribution stage	Installation stage	Use stage	End-of-life stage
Use of secondary material	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (from AWARE)	m3	1.95E+00	1.24E-01	5.28E-04	4.30E-05	1.82E+00	4.11E-03

Impact category	Unit	Total	Manufacturing stage	Distribution stage	Installation stage	Use stage	End-of-life stage
Hazardous waste disposed	kg	2.31E-03	6.96E-04	1.24E-05	5.56E-07	1.60E-03	7.56E-06
Non-hazardous waste disposed	kg	9.31E+00	1.40E+00	2.43E-01	2.67E-02	7.32E+00	3.15E-01
Radioactive waste disposed	kg	1.58E-02	3.64E-04	3.20E-05	1.43E-06	1.54E-02	1.90E-05

Impact category	Unit	Total	Manufacturing stage	Distribution stage	Installation stage	Use stage	End-of-life stage
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	3.14E-01	9.14E-02	0.00E+00	4.11E-02	0.00E+00	1.82E-01
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	3.43E-01	8.11E-02	0.00E+00	8.11E-02	0.00E+00	1.81E-01

Impact category	Unit	Total	Manufacturing stage		Distribution stage		Installation stage		Use stage		End-of-life stage	
Total use of primary energy during the life cycle	MJ	2.68E+03	1.42E+02	5.3%	4.80E+00	0.2%	2.19E-01	<0.1%	2.53E+03	94.4%	3.85E+00	0.1%
Particulate matter	disease inc.	2.48E-06	6.41E-07	25.8%	2.77E-08	1.1%	1.35E-09	0.1%	1.79E-06	72.0%	2.56E-08	1.0%
Ionising radiation	kBq U-235 eq	5.86E+01	1.11E+00	1.9%	2.43E-02	<0.1%	1.20E-03	<0.1%	5.74E+01	98.0%	4.32E-02	0.1%
Ecotoxicity. freshwater	CTUe	2.50E+03	1.13E+03	45.3%	3.69E+00	0.1%	2.09E-01	<0.1%	1.33E+03	53.0%	3.84E+01	1.5%
Human toxicity. cancer	CTUh	6.62E-08	2.08E-08	31.5%	1.20E-10	0.2%	1.15E-11	<0.1%	4.08E-08	61.7%	4.36E-09	6.6%
Human toxicity. non-cancer	CTUh	2.41E-06	9.74E-07	40.4%	3.87E-09	0.2%	2.10E-10	<0.1%	1.30E-06	54.1%	1.29E-07	5.4%
Land use	Pt	4.59E+02	7.36E+01	16.0%	3.25E+00	0.7%	1.47E-01	<0.1%	3.79E+02	82.5%	3.55E+00	0.8%

Biogenic carbon content	Unit (kg C)
Biogenic carbon content in the product	0.00E+00
Biogenic carbon content in accompanying packaging	3.76E-02

Extrapolation rules

The PEP can cover products different from the reference product if they belong to a homogeneous environmental family. This means that the group of products must satisfy the following characteristics:

- same function;
- same product standard;
- same manufacturing technology: the same type of materials and same manufacturing processes.

The F200B RCCBs product family satisfy these conditions, so extrapolation rules were applied to assess the environmental impact of the products belonging to the family, following the PCR indication. No extrapolation rules for differential circuit breakers are set in the PSR, thus the next steps have been followed to define the extrapolation rule:

- Analyse the products covered by the PEP belonging to the same homogenous family;
- Perform the LCA of a representative product of the homogeneous family;
- Identify and quantify the product parameters that vary between the various products of the homogeneous environmental family (i.e. dimensions, the weight of parts, materials, energy consumption, etc.).

Lastly, a sensitivity analysis was performed for each life cycle stage to identify which parameters of the ones selected are sensitive to environmental impact to create extrapolation rules.

The representative product considered for the calculation of the extrapolation rules is the one analysed in this LCA report, the code 2CSF204568R1630.

The products included in the F200B RCCBs product family and considered for the application of the extrapolation rules are resented in the following table.

ABB Code of the specific product	Name	Type of differential protection	Rated voltage (V)	Rated current in continuous operation (A)	Number of protected poles	Sensitivity (mA)	Weight of the product (g)	Average power loss (Wloss)
2CSF202568R1160	F202 B-16/0,03	B	230	16	2P	300	220	0.43
2CSF202568R1250	F202 B-25/0,03	B	230	25	2P	300	220	0.62
2CSF202568R1400	F202 B-40/0,03	B	230	40	2P	300	220	1.13
2CSF202568R1630	F202 B-63/0,03	B	230	63	2P	30	220	2.37
2CSF202568R3160	F202 B-16/0,3	B	230	16	2P	30	220	0.43
2CSF202568R3250	F202 B-25/0,3	B	230	25	2P	30	220	0.62
2CSF202568R3400	F202 B-40 0,3	B	230	40	2P	30	220	1.13
2CSF202568R3630	F202 B-63/0,3	B	230	63	2P	300	220	2.37
2CSF204568R1250	F204 B-25/0,03	B	230	25	4P	300	380	1.76
2CSF204568R1400	F204 B-40/0,03	B	230	40	4P	300	380	2.64
2CSF204568R1630	F204 B-63/0,03	B	230	63	4P	30	380	4.80
2CSF204568R3250	F204 B-25 0,3	B	230	25	4P	30	380	1.76
2CSF204568R3400	F204 B-40/0,3	B	230	40	4P	30	380	2.64
2CSF204568R3630	F204 B-63/0,3	B	230	63	4P	300	380	4.80
2CSF204592R1630	F204 B-63 0,03	B	230	63	4P	300	380	4.80
2CSF204592R4400	F204 B-40/0,5	B	230	40	4P	500	380	2.64
2CSF204592R4630	F204 B-63/0,5	B	230	63	4P	500	380	4.80
2CSF204868R3400	F204 B S-40/0,3	B S	230	40	4P	300	380	2.64
2CSF204892R3630	F204 B S-63 0,3	B S	230	63	4P	300	380	4.80
2CSF204892R4400	F204 B S-40/0,5	B S	230	40	4P	500	380	2.64
2CSF204892R4630	F204 B S-63/0,5	B S	230	63	4P	500	380	4.80
2CSF204501R3630	F204 B-63/0.3	B	230	63	4P	10	380	4.80
2CSF204568R1250	F204 B-25/0.03	B	230	25	4P	30	380	1.76
2CSF204568R1400	F204 B-40/0.03	B	230	40	4P	30	380	2.64
2CSF204568R1630	F204 B-63/0.03	B	230	63	4P	30	380	4.80
2CSF204568U1250	F204 B-25/0.03 U	B	230	25	4P	300	380	1.76
2CSF204568U1400	F204 B-40/0.03 U	B	230	40	4P	300	380	2.64
2CSF204568U1630	F204 B-63/0.03 U	B	230	63	4P	300	380	4.80
2CSF204568U3630	F204 B-63/0.3 U	B	230	63	4P	300	380	4.80
2CSF704557R1400	VYB440/030	B	230	40	4P	300	380	2.64
2CSF704557R1630	VYB463/030	B	230	63	4P	30	380	4.80
2CSF704557R3400	VYB440/300	B	230	40	4P	30	380	2.64
2CSF704557R3630	VYB463/300	B	230	63	4P	30	380	4.80

The extrapolation rules have been calculated based on the environmental impact assessment results of the reference product F204B 300mA 25A and the sensitivity analysis carried out.

For the manufacturing stage, distribution stage and end-of-life stage, the parameter considered for the calculation of the LCIA impacts of the variants is the weight of the product. For the use stage, the parameter considered for the calculation of the LCIA impacts of the variants is the average power loss during this stage. The calculation of the LCIA impacts of the variants through these parameters showed that the correlation between the impacts of the representative product and the variants is linear. For the creation of the extrapolation rules, the extrapolation principle applied is a linear correlation concerning weight for the production, distribution and end-of-life phase and

concerning average power loss for the use phase. Each environmental indicator value shall be calculated using the following formulas:

- For the manufacturing stage, distribution stage and end-of-life stage:

$$y = a_n x_1 + b_n$$

where x_1 is the *weight* of the product;

- For use stage:

$$y = a_n x_2 + b_n$$

where x_2 is the *average power loss* of the product.

For the weight and average power loss data of the variants, please refer to the table above.

The following table reports the linear coefficients a_n & b_n for each life cycle stage. The calculation of the coefficients a_3 & b_3 for the Installation Stage was not performed because the selected parameters do not affect the values for this stage.

IMPACT CATEGORY	MANUFACTURING		DISTRIBUTION		INSTALLATION		USE		END OF LIFE	
	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4	a_5	b_5
Climate change	2.44E-02	1.54E-01	6.83E-04	2.10E-02	1.00E+00	0.00E+00	2.12E+01	-3.95E-02	8.03E-04	1.55E-15
Climate change - Fossil	2.42E-02	1.95E-01	6.82E-04	2.10E-02	1.00E+00	0.00E+00	2.05E+01	-3.82E-02	7.78E-04	-4.72E-16
Climate change - Biogenic	1.61E-04	-4.09E-02	6.19E-07	1.91E-05	1.00E+00	0.00E+00	6.61E-01	-1.23E-03	2.39E-05	-6.07E-18
Climate change - Land use and LU change	3.66E-05	5.28E-04	2.70E-07	8.32E-06	1.00E+00	0.00E+00	4.85E-02	-9.02E-05	7.37E-07	1.19E-18
Ozone depletion	6.17E-09	2.41E-08	1.59E-10	4.90E-09	1.00E+00	0.00E+00	1.03E-06	-1.92E-09	6.67E-11	-3.64E-23
Acidification	2.95E-04	1.47E-03	3.45E-06	1.06E-04	1.00E+00	0.00E+00	1.17E-01	-2.17E-04	1.89E-05	3.47E-18
Eutrophication. freshwater	3.75E-05	9.03E-05	4.43E-08	1.36E-06	1.00E+00	0.00E+00	2.06E-02	-3.84E-05	9.54E-07	0.00E+00
Eutrophication. marine	3.78E-05	3.46E-04	1.19E-06	3.66E-05	1.00E+00	0.00E+00	1.95E-02	-3.62E-05	2.17E-06	-2.17E-19
Eutrophication. terrestrial	4.66E-04	2.95E-03	1.30E-05	4.01E-04	1.00E+00	0.00E+00	1.72E-01	-3.19E-04	1.48E-05	-6.07E-18
Photochemical ozone formation	1.13E-04	8.89E-04	3.71E-06	1.14E-04	1.00E+00	0.00E+00	4.71E-02	-8.77E-05	4.41E-06	-3.47E-18
Resource use. minerals and metals	1.12E-05	1.51E-05	2.39E-09	7.37E-08	1.00E+00	0.00E+00	1.93E-04	-3.59E-07	4.23E-07	-6.37E-19
Resource use. fossils	3.14E-01	2.97E+00	1.04E-02	3.20E-01	1.00E+00	0.00E+00	4.37E+02	-8.14E-01	8.86E-03	-4.88E-15
Water use (AWARE)	9.36E-03	3.81E-01	3.13E-05	9.65E-04	1.00E+00	0.00E+00	5.01E+00	-9.33E-03	3.60E-04	5.55E-16
Use of renewable primary energy. excluding renewable primary energy resources used as raw materials	3.72E-02	4.28E+00	1.47E-04	4.52E-03	1.00E+00	0.00E+00	9.00E+01	-1.67E-01	1.26E-03	8.88E-16
Use of renewable primary energy	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

IMPACT CATEGORY	MANUFACTURING		DISTRIBUTION		INSTALLATION		USE		END OF LIFE	
	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4	a_5	b_5
resources used as raw materials										
Total use renew. primary energy res.	3.72E-02	5.26E+00	1.47E-04	4.52E-03	1.00E+00	0.00E+00	1.47E-04	4.52E-03	1.26E-03	8.88E-16
Use of non-renewable primary energy. excluding non-renewable primary energy resources used as raw materials	3.14E-01	-8.12E-01	1.04E-02	3.20E-01	1.00E+00	0.00E+00	4.37E+02	-8.13E-01	8.86E-03	1.60E-14
Use of non-renewable primary energy resources used as raw materials	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use non-renew. primary energy res.	3.14E-01	2.95E+00	1.04E-02	3.20E-01	1.00E+00	0.00E+00	1.04E-02	3.20E-01	8.86E-03	1.60E-14
Use of secondary material	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	3.03E-04	9.03E-03	1.16E-06	3.57E-05	1.00E+00	0.00E+00	3.80E-01	-7.07E-04	1.08E-05	-8.67E-19
Hazardous waste disposed	1.81E-06	9.32E-06	2.71E-08	8.36E-07	1.00E+00	0.00E+00	3.32E-04	-6.19E-07	1.99E-08	2.03E-20
Non-hazardous waste disposed	3.46E-03	8.70E-02	5.35E-04	1.65E-02	1.00E+00	0.00E+00	1.53E+00	-2.84E-03	8.30E-04	1.30E-15
Radioactive waste disposed	9.31E-07	1.07E-05	7.03E-08	2.17E-06	1.00E+00	0.00E+00	3.21E-03	-5.98E-06	5.00E-08	9.99E-20
Particulate matter	1.64E-09	1.91E-08	6.08E-11	1.87E-09	1.00E+00	0.00E+00	3.72E-07	-6.93E-10	6.75E-11	1.09E-22
Ionising radiation	2.85E-03	2.15E-02	5.34E-05	1.65E-03	1.00E+00	0.00E+00	1.20E+01	-2.23E-02	1.14E-04	2.78E-17
Ecotoxicity. freshwater	2.97E+00	6.39E+00	8.11E-03	2.50E-01	1.00E+00	0.00E+00	2.76E+02	-5.15E-01	1.01E-01	9.24E-14
Human toxicity. cancer	5.35E-11	5.19E-10	2.63E-13	8.09E-12	1.00E+00	0.00E+00	8.51E-09	-1.58E-11	1.15E-11	-5.38E-24
Human toxicity. non-cancer	2.53E-09	1.18E-08	8.50E-12	2.62E-10	1.00E+00	0.00E+00	2.71E-07	-5.05E-10	3.39E-10	1.46E-22
Land use	1.47E-01	1.76E+01	7.14E-03	2.20E-01	1.00E+00	0.00E+00	7.89E+01	-1.47E-01	9.34E-03	-1.78E-15
Component for reuse	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	9.23E-05	5.63E-02	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	4.78E-04	1.67E-16
Materials for energy recovery	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	0.00E+00	8.11E-02	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	4.76E-04	-1.67E-16

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Internal ☐	External ■
The PCR review was conducted by a panel of experts chaired by Julie Orgelet (DDemain)	
PEP are compliant with XP C08-100-1 :2016 or EN 50693:2019. The elements of the present PEP cannot be compared with elements from another program.	
Document in compliance with ISO 14025: 2006, “Environmental labels and declarations. Type III environmental declarations”.	