PRODUCT ENVIRONMENTAL PROFILE

Environmental Product Declaration

MS132 Manual Motor Starter

REGISTRATION NUMBER ABBG-00397-V01.01-EN	DRAFTING RULES: PCR-ED4-EN-2021 09 06 SUPPLEMENTED BY PSR-0005-ED3-EN-2023 06 06
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INTERNAL ☐	EXTERNAL ☒
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PEP ARE COMPLIANT WITH XP C08-100-1 :2016 AND EN 50693:2019 THE COMPONENTS OF THE PRESENT PEP MAY NOT BE COMPARED WITH COMPONENTS FROM ANY OTHER PROGRAM.	
DOCUMENT IN COMPLIANCE WITH ISO 14025: 2006 « ENVIRONMENTAL LABELS AND DECLARATIONS. TYPE III ENVIRONMENTAL DECLARATIONS »	

EPD Owner	**ABB Xinhui Low Voltage Switchgear Co., Ltd.** **www.abb.com**
Manufacturer name and address	ABB Xinhui Low Voltage Switchgear Co., Ltd. Xinhui district, Jiangmen city, Guangdong Province, 529100, P.R. China.
Company contact	EPD_ELSP@in.abb.com
Reference product	MS132-6.3 Manual Motor Starter
Description of the product	The MS132 manual motor starter is a compact device which is used to manually switch on and off motors and to protect them reliably and without the need for a fuse from short-circuits, overload and phase failures.
Functional unit	The functional unit of this study is a single Manual Motor Starter/Motor Protection Circuit Breaker (including its packaging and accessories) to protect during 20 years the installation against overload and short circuits in circuit with assigned voltage U and rated current In. Up = Rated Operational voltage (V) 690 Ip = Rated Operational Current (A) 6.3 Number of Poles 3
Other product ranges covered	**Product cluster** / **Product variants** **MS132 (-B / -L / -T / -LC) ≤ 10A**: **MS132** followed by **-*** or **-*B** or **-*L** or **-*T** or **-*LC** with * up to 10 (e.g. MS132-10, MS132-10B) **MS132 (-B / -L / -T / -LC) ≥ 12A**: **MS132** followed by **-*** or **-*B** or **-*L** or **-*T** or **-*LC** with * from 12 (e.g. MS132-12, MS132-12B) **MO132 (-B) ≤ 10A**: **MO132** followed by **-*** or **-*B** with * up to 10 (e.g. MO132-10, MO132-10B) **MO132 (-B) ≥ 12A**: **MO132** followed by **-*** or **-*B** with * from 12 (e.g. MO132-12, MO132-12B)
Reference lifetime	20 years
Product category	Electrical, Electronic and HVAC-R Products- PSR-0005-ED3-EN-2023 06 06, 3.2 Circuit-breakers
Use Scenario	The use phase has been modeled based on the sales mix data (2022), and the corresponding low voltage electricity countries mix
Geographical representativeness	Raw materials & Manufacturing: [China / Global] Assembly: [China] Distribution / Use: [Global] specific sales mix EoL: [Global]
Technological representativeness	Primary data are specific for the production of MS132 Manual Motor Starters and secondary data are based on ecoinvent database v.3.9.1.
LCA Study	This study is based on the LCA study described in the LCA report 1SAC200383H0001
EPD type	Products family declaration
EPD scope	“Cradle to grave”
Year of reported primary data	2022
LCA software	SimaPro 9.5.0.1 (2023)
LCI database	Ecoinvent v3.9 (2023)
LCIA methodology	EN 50693:2019

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 voltage 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

ABB Xinhui Low Voltage Switchgear Co., Ltd, located in Xinhui District, Jiangmen City, Guangdong Province, the hometown of overseas Chinese. It is a joint venture company of ABB specializing in the production of low-voltage electrical appliances in China. The company mainly produces low voltage molded case circuit breakers (Tmax XT, Tmax and Formula) for power distribution protection and control, ATS automatic transfer switch appliances, Compact/Modular series pilot devices, OT isolating switches, OS isolating switch fuses, PSR/ PSTX series softstarters, electronic overload relays E/EF, thermal overload relays TF, Manual Motor Starters MS, A/AS/AF/AX series contactors, etc. In addition to meeting the needs of domestic customers, the products are also exported to markets such as Europe and Asia.

The current analysis is performed on the Manual Motor Starters. This device is used to manually switch on and off motors and to protect them reliably and without the need for a fuse from shortcircuits, overload and phase failures during the service life of 20 years.

In the factory, the different components and subassemblies are assembled on the manufacturing line. All components and subassemblies are produced by ABB's suppliers. These are assembled and tested as per the standards within the factory premises.

MS132 Product Cluster

Product cluster declared in this PEP of MS132 Manual Motor Starters covers the following variants:

Product	Product Range	Number of poles	Rated voltage, U [V]	Rated current, In [A]
MS132-6.3	**MS132 (-B / -L / -T / -LC) ≤ 10A**	3	690	6.3
MS132-32	**MS132 (-B / -L / -T / -LC) ≥ 12A**	3	690	32
MO132-6.3	**MO132 (-B) ≤ 10A**	3	690	6.3
MO132-32	**MO132 (-B) ≥ 12A**	3	690	32

Table 1: Technical characteristics of MS132 Manual Motor Starter

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

Reference Product:

The reference product for the LCA of the complete range of MS132 is MS132-6.3.

Constituent Materials

The MS132-6.3 weights about 0.288 kg including its installed accessories and packaging.

MS132-6.3				
Materials	**Name**	**IEC 62474 MC**	**[g]**	**%**
Metals	Steel	M-119	100.1	34.8%
	Cu and Cu Alloys	M-121	13.4	4.6%
	Stainless Steel	M-100	7.2	2.5%
	Precious Metals	M-159	0.7	0.2%
Plastics	Polyamide	M-258	117.1	40.6%
	PolyButyleneTerephthalate	M-261	12.2	4.2%
	Polyethylene	M-251	4.2	1.5%
	Unsaturated Polyester	M-301	2.5	0.9%
	Other Polymers	NA	0.8	0.2%
Other	Paper/Cardboard	M-341	30.1	10.4%
Total			288.3	100%

Table 2: Weight of materials MS132-6.3

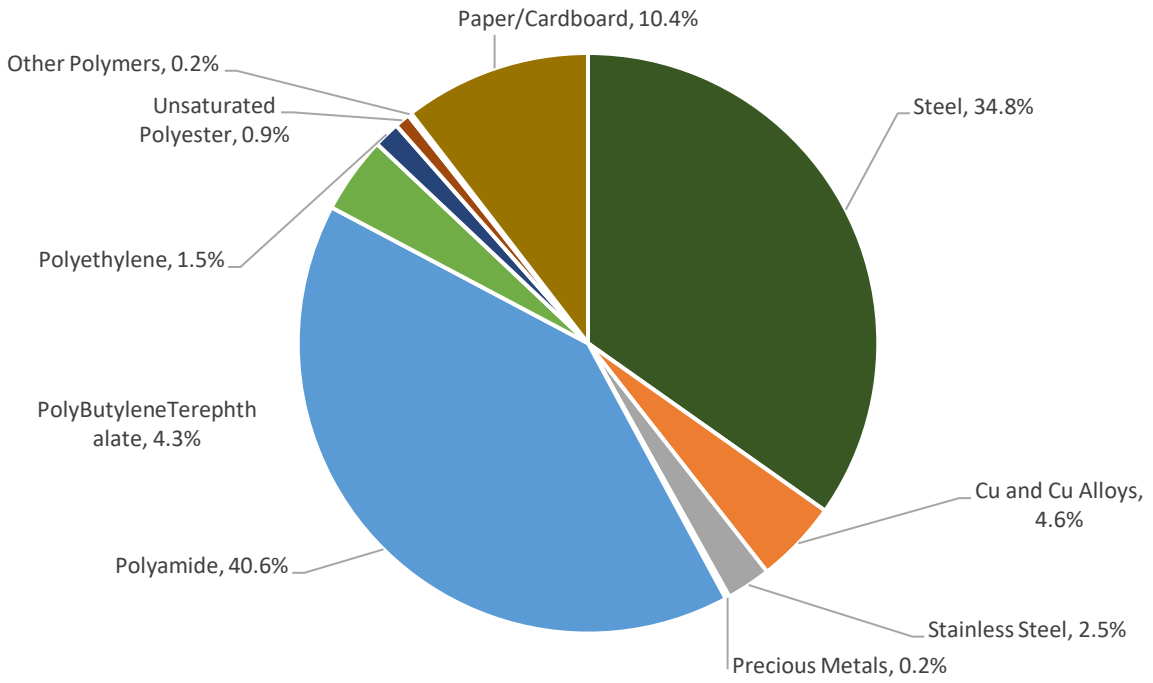

Figure 1: Composition of MS132-6.3

Packaging weighs 26.8 g, with the following substance composition:

Material	Unit	Total	%
Corrugated Cardboard	g	25.7	8.9%
Paper	g	1.1	0.4%
Total	g	26.8	9.3%

Table 3: Weight of Packaging for MS132-6.3

Functional unit and Reference Flow

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.

The functional unit of this study is a single Manual Motor Starter/Motor Protection Circuit Breaker (including its packaging and accessories) to protect during 20 years the installation against overload and short circuits in circuit with assigned voltage U and rated cur-rent In.

Manual Motor Starter	MS132-6.3
U_p = Rated Operational voltage (V)	690
I_p = Rated Operational Current (A)	6.3
Number of Poles	3

The Reference Flow of the study is a Manual Motor Starter (including its packaging and accessories) with mass described, table 2.

System boundaries and life cycle stages

The life cycle of the Manual Motor Starter, 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 acquisition of raw material, preparation of semi-finished goods, etc. 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 EN 50693:2019 [3] for the evaluation of electronic and electrical products and systems.

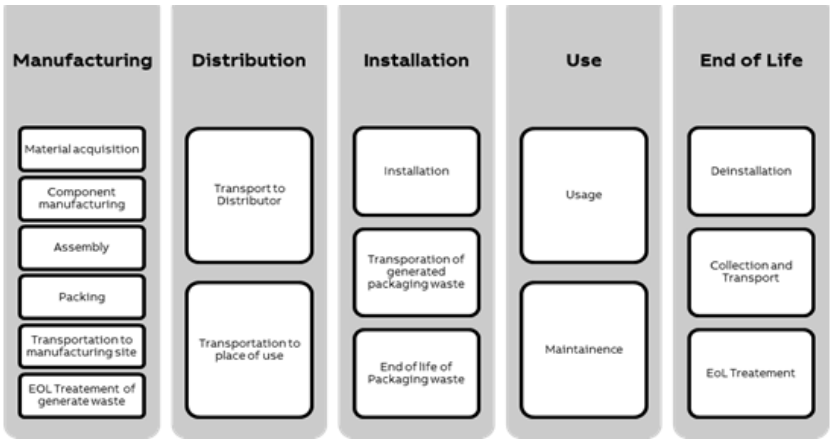

Table 4: Phases for the evaluation of construction products according to EN50693:2019 [3].

Temporal and geographical boundaries

The ABB component suppliers are sourced all over the world. All primary data collected are from 2022, which is a representative production year. Secondary data are also representative for this year, as provided by ecoinvent [6].

The selected ecoinvent [6] processes in the LCA model have a 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 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 [6] database have not been excluded.

Data quality

In this PEP, both primary and secondary data are used. Site specific foreground data have been provided by ABB. Main data sources are the bill of materials & drawings which are available on the ERP (SAP) & Windchill. For all processes for which primary are not available, generic data originating from the ecoinvent database [6], allocation cut-off by classification, are used. The ecoinvent database available in the SimaPro software [7] is used for the calculations.

The data quality characterized by quantitative and qualitative aspects, is presented in Appendix 1. Each data quality parameter has been rated according to DQR tables from Chapter 7.19.2.2 of the Product Environmental Footprint Guide v.6.3 to give an indication of geography, technology and temporal representativeness.

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-ed4-EN-2021 09 06” and EN 50693 [3] the environmental impact indicators must be determined using the characterization factors and impact assessment methods specified in EN 15804:2012+A2:2019 [8].

PCR-ed4-EN-2021 09 06 and the EN 50693:2019 [3] standard establish four indicators for GWP: GWP (total) which includes all greenhouse gases; GWP (fossil fuels); GWP (biogenic) which includes the emissions and absorption of biogenic carbon dioxide and biogenic carbon stored in the product; GWP (land use) - land use and land use transformation. Other indicators as per the PCR[1].

Allocation Rules

Allocation coefficients are based on labour hours required to produce one unit of MS132 Manual Motor Starter. Total electrical energy consumption for the year 2022 is divided by the total labour hours in the year 2022 to calculate average per hour energy consumption of the total factory. The allocation of the total amount of waste generated by the production line and water consumption has been based on this criterion.

Limitations and simplifications

Raw materials life cycle stage includes the extraction of raw materials as well as the transport distances to the manufacturing suppliers. These distances are assumed to be 1000 km as per PCR. This distance has been added to the one already included in the market processes used for the model, as a result of a conservative choice made by the LCA operators.

Application of grease lubricant on the Manual Motor Starter operating mechanism has been excluded since it is negligible.

Surface treatments like galvanizing, tin and silver plating as well as their related transport processes (back and forth from the finishing suppliers) have been considered in the LCA model.

Scraps for metal working and plastic processes are included when already defined in ecoinvent[6].

Energy Models

LCA Stage	EN 15804:2012 +A2:2019 module	Energy model	Notes
Raw material extraction and processing	A1-A2	Electricity, {GLO}| market group for | Cut-off Electricity, {RoW}| market group for | Cut-off	Based on materials and suppliers locations
Manufacturing	A3	ABB Green Mix Low Voltage	Specific Energy model for ABB Xinhui manufacturing plant, 100% renewable
Installation (Packaging EoL)	A5	Electricity, {GLO}| market group for | Cut-off	
Use Stage	B1	Electricity, [country]x | market for | Cut-off, S **	Low voltage, based on 2022 country sales mix
EoL	C1-C4	Electricity, {GLO}| market group for | Cut-off	

Table 5: Energy models used in each LCA stage.

** Please refer the use phase page 11 for further description

Inventory Analysis

In this PEP, 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 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 Distances & Time (Searates).

All primary data collected from ABB are from 2022, which was a representative production year. The ecoinvent v3.9 cut-off by classification system processes [6] are used to model the background system of the processes.

Due to the large amounts of components in the Manual Motor Starter, raw material inputs have been modelled with data from ecoinvent[6] representing either a Rest of World [RoW] or Global [RoW] market coverage based on the supplier's location. These datasets are assumed to be representative.

Manufacturing stage

The Manual Motor Starter are 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 component parts.

The single use packaging as well as paper documentation are also included in the analysis in the manufacturing stage. ABB receives packaging components from outside suppliers and packages the Manual Motor Starter before shipping them.

Most of the inputs to the products' manufacturing stage are already produced component parts from the supply chain. In the ABB manufacturing plant, the different components and subassemblies are assembled into the Manual Motor Starter. All the semi-finished and ancillary products are produced by ABB's suppliers.

The entire Manual Motor Starter suppliers' network has been modelled with the calculation of each transportation stage: from the first manufacturing supplier to the next. All the distances from the last subassembly suppliers' factories to the ABB manufacturing facility have been calculated.
All the distances from the last subassembly suppliers' factories to the ABB manufacturing facility have been calculated.
In the ABB factory, the different components and subassemblies are assembled into the Manual Motor Starter. All the semi-finished and ancillary products are produced by ABB's suppliers.

The energy mix used for the production phase is representative for ABB Xinhui production site and includes renewable energy only.

The complete energy mix has been modeled considering the certificate on Guarantee of origins provided to ABB for the year 2022.

Distribution

The transport distances from ABB manufacturing plant to the distribution centers (regional distribution centers / local sales organizations) have been calculated considering the specific 2022 sales mix data for this product cluster (SAP ERP sales data as a source).

Since no specific data is available for the transport distances from the Distribution Centre to place of actual use (Customer site), distances of 1000 km are assumed (local/domestic transport by lorry, according to PCR [1]).

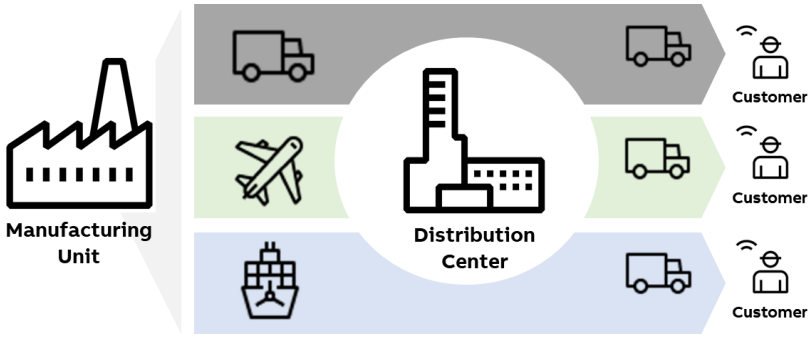

Figure 2: Distribution methodology.

Installation

The installation phase only implies manual activities, and no energy is consumed. This phase also includes the disposal of the packaging of the Manual Motor Starter.

For the disposal of the packaging after installation of the Manual Motor Starter at the end of its life, a transport distance of 1000 km (according to PCR[1]) was assumed. The chosen transportation datasets are from Ecoinvent [6].
The actual disposal site is unknown and is managed by the customer.

Use

Use and maintenance are modelled according to the PCR [1].

During the use phase, Manual Motor Starter, dissipates some electricity due to power losses. They are calculated according to the data provided in the catalogue of the Manual Motor Starter and following the PCR [1] & PSR [2] rules:

Parameters		
Iu	[A]	6.3
Iu	[%]	50
h/year	[h]	8760
RSL	[years]	20
Time operating coefficient	[%]	30

Table 6: Use phase parameters.

The formula for the calculation of the electricity consumed is shown below and it is described as follows, where P_{use} is the power consumed by the switch at a given value of current:

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

The above calculations have been performed according to the number of poles on which relevant current flows during use phase.

The Energy model used for this phase has been modelled based on the 2022 actual sales mix data (SAP ERP sales data as a source). From the Ecoinvent [6] database, the low voltage electricity country mix for each country(x) has been selected with its respective percentage on the total sales mix (Electricity, low voltage [country]x | market for | Cut-off, S).

Since no maintenance happens during the use phase, the environmental impacts linked to this procedure have been considered as null in the analysis.

End of life

The end-of-life stage is modelled according to PCR [1] and IEC/TR 62635 [9]. The percentages for end-of-life treatments of materials are taken from IEC/TR 62635 [9]. Since no specific data is available, the transport distances from the place of use to the place of disposal are assumed to be 1000 km (local/domestic transport by lorry, according to PCR [1]). Disassembly manuals can be provided to the customer to support product disposal.

Environmental impacts

The following tables show the environmental impact indicators of the life cycle of a Manual Motor starter, as indicated by PEP Ecopassport PCR and EN 50693:2019 [3]. 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).

MS132-6.3

Impact category	Unit	Total	Manufacturing	Distribution	Installation	Use	End of Life
GWP-total	kg CO2 eq	6.71E+01	2.07E+00	5.85E-01	1.88E-02	6.44E+01	4.97E-02
GWP-fossil	kg CO2 eq	6.68E+01	2.06E+00	5.85E-01	4.50E-03	6.41E+01	4.81E-02
GWP-biogenic	kg CO2 eq	2.19E-01	5.05E-03	1.47E-04	1.43E-02	1.98E-01	1.57E-03
GWP-luluc	kg CO2 eq	4.84E-02	1.94E-03	6.13E-05	2.22E-06	4.64E-02	3.04E-05
ODP	kg CFC11-eq	5.71E-07	2.29E-07	9.24E-09	9.01E-11	3.32E-07	6.97E-10
AP	mol H+ eq	3.26E-01	1.58E-02	2.49E-03	2.12E-05	3.07E-01	2.01E-04
EP-freshwater	kg P eq	2.44E-02	1.36E-03	1.03E-05	3.85E-07	2.30E-02	6.83E-06
EP-marine	kg N eq	6.75E-02	3.29E-03	1.01E-03	1.34E-05	6.31E-02	1.02E-04
EP-terrestrial	mol N eq	6.95E-01	2.86E-02	1.08E-02	8.46E-05	6.55E-01	6.24E-04
POCP	kg NMVOC eq	1.98E-01	8.62E-03	3.43E-03	3.09E-05	1.85E-01	2.22E-04
ADP-m&m	kg Sb eq	6.92E-04	4.04E-04	2.15E-07	1.22E-08	2.87E-04	7.90E-08
ADP-fossil	MJ	7.26E+02	2.88E+01	7.66E+00	6.44E-02	6.88E+02	5.49E-01
WDP	m3 of equiv. depriv.	9.62E+00	1.18E+00	1.46E-02	3.62E-04	8.43E+00	3.47E-03
PENRE	MJ	7.22E+02	2.56E+01	7.66E+00	6.44E-02	6.88E+02	5.49E-01
PENRM	MJ	3.26E+00	3.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	7.26E+02	2.88E+01	7.66E+00	6.44E-02	6.88E+02	5.49E-01
PERE	MJ	7.97E+01	2.93E+00	3.15E-02	1.01E-03	7.67E+01	2.49E-02
PERM	MJ	4.94E-01	4.94E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	8.02E+01	3.42E+00	3.15E-02	1.01E-03	7.67E+01	2.49E-02
SM	Kg	6.04E-02	6.04E-02	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
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PET	MJ	8.06E+02	3.22E+01	7.70E+00	6.54E-02	7.65E+02	5.74E-01
FW	m3	2.69E-01	3.19E-02	5.17E-04	1.50E-05	2.36E-01	1.32E-04
HWD	Kg	1.33E-03	2.58E-04	5.15E-05	4.02E-07	1.02E-03	2.74E-06
N-HWD	Kg	5.04E+00	3.36E-01	5.56E-02	1.07E-02	4.58E+00	6.27E-02
RWD	Kg	7.98E-04	4.29E-05	6.66E-07	1.70E-08	7.54E-04	3.96E-07
CfR	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MfR	Kg	5.11E-01	2.50E-01	0.00E+00	2.82E-02	0.00E+00	2.33E-01
MfER	Kg	7.64E-03	0.00E+00	0.00E+00	5.29E-03	0.00E+00	2.35E-03
EN	MJ by energy vector	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Efp	disease inc.	3.39E-06	1.11E-07	9.08E-09	4.61E-10	3.27E-06	4.12E-09
IrHH	kBq U-235 eq	3.20E+00	1.53E-01	2.96E-03	7.14E-05	3.04E+00	1.62E-03
ETX FW	CTUe	1.98E+02	7.71E+01	3.94E+00	5.46E-02	1.16E+02	2.57E-01
HTX CE	CTUh	2.06E-08	4.04E-09	7.35E-11	3.59E-12	1.64E-08	3.48E-11
HTX N-CE	CTUh	9.48E-07	1.11E-07	7.16E-09	7.86E-11	8.28E-07	1.77E-09
IrLS	Pt	1.54E+02	1.13E+01	1.03E+00	6.62E-02	1.41E+02	4.73E-01

Table 7: Impact indicators for MS132-6.3

Impact category	Unit	Total
Biogenic Carbon content of the product	kg	1.22E-02
Biogenic Carbon content of the packaging	kg	5.33E-03

Table 8: Inventory Flow indicators of MS132-6.3

Environmental impact indicators

GWP-total	Global Warming Potential total (Climate change)
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 - fraction of nutrients reaching marine end compartment
EP-terrestrial	Eutrophication potential -Accumulated Exceedance
POCP	Formation potential of tropospheric ozone
ADP-m&m	Abiotic Depletion for non-fossil resources potential
ADP-fossil	Abiotic Depletion for fossil resources potential, WDP
WDP	Water deprivation potential.

Resource use indicators

PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw material
PERM	Use of re-newable primary energy resources used as raw material
PERT	Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw material
PENRM	Use of non-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)
PET	Total use of primary energy during the life cycle

Secondary materials, water and energy resources

SM	Use of secondary materials
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	FW: Net use of fresh water

Waste category indicators

HWD	Hazardous waste disposed
N-HWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed

Output flow indicators

MfR	Materials for recycling
MfER	Materials for energy recovery
CfR	Components for Reuse
EN	Energy for reuse

Others indicators

Efp	Emissions of Fine particles
IrHH	Ionizing radiation, human health
ETX FW	Ecotoxicity, freshwater
HTX CE	Human toxicity, carcinogenic effects
HTX N-CE	Human toxicity, non-carcinogenic effects

Extrapolation for Homogeneous environmental family

This PEP covers different build configurations Of MS132/MO132 Manual Motor Starter. All the analyzed configurations have the same main functionality, product standards and manufacturing technology. The different life cycle stages can be extrapolated to other products of the same homogeneous environmental family by applying a rule of proportionality to the parameters in the following tables, divided by different life cycle stages.

For other products than the Reference product covered by this PEP, the environmental impacts for each phase of the lifecycle are obtained by multiplying the values of the Reference product by the following factor in listed table.

*If the factor is "1", the impacts of the phase of the life cycle are same in comparison to the reference product.

LCA Phase: Manufacturing

Product	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-minerals & metals	ADP-fossil	WDP
MS132 (-B / -L / -T / -LC) ≤ 10A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MS132 (-B / -L / -T / -LC) ≥ 12A	1.08	1.08	0.90	1.12	0.98	1.99	1.73	1.19	1.28	1.28	1.16	1.09	1.28
MO132 (-B) ≤ 10A	0.93	0.93	1.12	0.82	0.73	0.89	0.82	0.89	0.86	0.88	0.69	0.93	0.95
MO132 (-B) ≥ 12A	1.06	1.06	1.46	1.02	0.75	1.77	1.60	1.17	1.24	1.22	1.25	1.06	1.23

Table 9: Extrapolation factors for MS132 – Manufacturing

LCA Phase: Distribution

Product	LCA Stage	Factor
MS132 (-B / -L / -T / -LC) ≤ 10A	**Distribution**	1.00
MS132 (-B / -L / -T / -LC) ≥ 12A		1.05
MO132 (-B) ≤ 10A		0.91
MO132 (-B) ≥ 12A		0.97

Table 10: Extrapolation factors for MS132 – Distribution

LCA Phase: Installation

Installation phase impacts are common across all variants of the MS132 Manual Motor Starters.

LCA Phase: Use

Product	No. Of Poles	LCA Stage	Factor
MS132 (-B / -L / -T / -LC) ≤ 10A	3	**Use Phase**	1.00
MS132 (-B / -L / -T / -LC) ≥ 12A	3		1.72
MO132 (-B) ≤ 10A	3		0.61
MO132 (-B) ≥ 12A	3		1.72

Table 11: Extrapolation factors for MS132 - Use Phase

LCA Phase: End of Life

Product	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-minerals & metals	ADP-fossil	WDP
MS132 (-B / -L / -T / -LC) ≤ 10A	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MS132 (-B / -L / -T / -LC) ≥ 12A	1.03	1.03	1.03	1.03	1.04	1.03	1.03	1.04	1.03	1.03	1.03	1.03	1.03
MO132 (-B) ≤ 10A	0.82	0.78	0.83	0.77	0.77	0.79	0.79	0.77	0.79	0.78	0.77	0.77	0.78
MO132 (-B) ≥ 12A	0.85	0.81	0.85	0.81	0.80	0.82	0.82	0.80	0.82	0.82	0.81	0.81	0.81

Table 12: Extrapolation factors for MS132- EoL

Additional environmental information

According to the waste treatment scenario calculation in Simapro, based on the recycling rate in the technical report IEC/TR 62635 Edition 1.0 [9] Table D.6, the following recyclability potentials were calculated. The recyclability potential is calculated based on the product weight (excluding packaging).

Product	Recyclability potential
MS132-6.3	88.9%

Table 13: Recyclability potential of MS132-6.3

References

[1] PEP Ecopassport PCR-ed4-EN-2021 09 06 “Product Category Rules for Electrical, Electronic and HVAC-R Products”

[2] PEP Ecopassport PSR-0005-ED3-EN-2023 06 06 “Product Specific Rules for Electrical Switchgear and Control gear Solutions”

[3] EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems

[4] ISO 14040:2006 - Environmental management -Life cycle assessment - Principles and framework

[5] ISO 14044:2006 - Environmental management - Life cycle assessment - Requirements and guidelines

[6] ecoinvent v3.9 (2023). ecoinvent version 3.9. Swiss, Centre for Life Cycle Inventories, Dübendorf, Switzerland

[7] PRé Consultants, 2023. Software SimaPro versione 9.5.0.1 (www.pre.nl).

[8] UNI EN 15804:2012+A2:2019: Sustainability of constructions - Environmental product declarations (September 2019).

[9] IEC/TR 62635 - Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment - Edition 1.0 2012-10

[10] 1SAC200383H0001-LCA Report