ENVIRONMENTAL PRODUCT DECLARATION/
PRODUCT ENVIRONMENTAL PROFILE

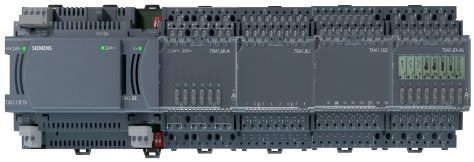
Desigo Essentials

Desigo Essentials I/O Extension Modules

Type III according to ISO 14025



Type of product covered by this PEP



Reference product considered for this PEP

Owner of the declaration: Siemens Switzerland Ltd	**Program holder and publisher:** PEP Ecopassport
In compliance with: ISO 14025; EN 50693:2019; PCR-4-ed4-EN-2021 09 06; PSR-0005-ed3.1-EN-2023 12 08	
EPD Type: Representative product with extrapolation rules for homogeneous product family	**EPD scope:** Cradle to Grave

General information

This environmental product declaration (EPD) is based on the international standard ISO 14025 (“Environmental labels and declarations — Type III environmental declarations”). The data in this EPD has been evaluated on a full-scale life cycle assessment (LCA) study according to ISO 14040/44, taking into account the product category rules (PCR) for electronic and electrotechnical products and systems defined in EN 50693:2019 as well as PCR-4-ed4-EN-2021 09 06 Product Category Rules for Electrical, Electronic and HVAC-R Products and PSR-0005-ed3.1-EN-2023 12 08 – SPECIFIC RULES FOR Electrical switchgear and control gear Solutions, product category ’other equipment - active product’.

Siemens is dedicated to an environmentally conscious design of its products in line with IEC 62430 and has implemented an integrated management system according to ISO 9001, ISO 14001 and ISO 45001.

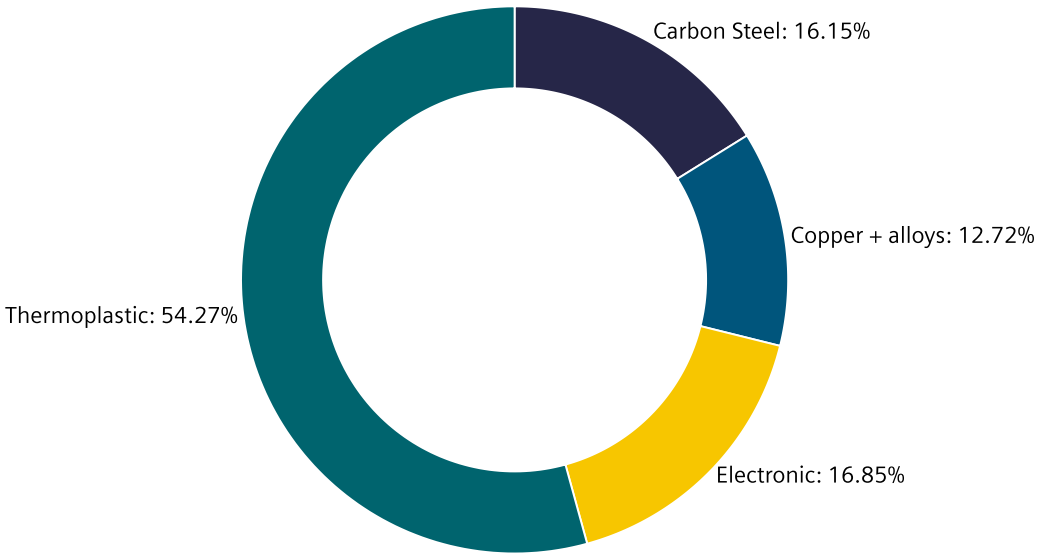
Products	All products which can be found in the appendix.
Represented by	BPZ:TXM1.16D (TXM1.16D) This product is the reference product of this homogeneous product family (HPF) valid for this EPD, too. Product-specific scaling factors are given in the appendix.
Product Description	EM modules extend the interface capabilities of the connected automation station. The Desigo Essentials I/O Extension Modules product range includes input/output modules.
Functional Unit	Continuous signal and data exchange with connected devices with 1 W over a reference lifetime of 10 years.
Production Site	Zug, Switzerland

Material composition

The product weight of 0.2 kg combined with the packaging weight of 0.02 kg results in a total weight of 0.22 kg. The following chart outlines the overall material composition of the reference product, excluding packaging. Packaging consists of: Wooden pallet (single use), Graphic paper.

The product, including packaging, consists of 26.03% metal, 48.92% plastics, and 25.04% other materials.

Product Weight 0.2 kg



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Substance assessment

At Siemens, we are committed to the development and production of environmentally sound and sustainably produced equipment. This includes avoiding hazardous substances in our products without compromising their benefits for our customers.
Please visit the following website to learn more about how we comply with product-related environmental regulations like RoHS, REACH, WEEE and others: Product Related Environmental Protection

System boundaries and scenarios

The EPD covers the cradle to grave of the product including the following stages.

Manufacturing stage			Distribution	Installation	Use stage							End-of-Life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Production	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-Installation	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	0	0	0	0	0	X	0	0	X	X	X	X

Temporal and geographical scope and representativeness	Primary data of FY2022 for BOM and inbound transport and FY2024 for factory consumption and outbound transport; Secondary data: LCA tool: Green Digital Twin Version 4.0, Database: One Siemens LCA Database (based on MLC CUP 2024.1). The materials and components used in production are globally sourced and have been selected from Sphera data sets according to the global or regional representativeness.
Data quality	Both primary and secondary data are used. To ensure the high quality and completeness of the LCA results, primary data have been used whenever possible. The main sources for primary data are the bill of materials and the bill of processes. Site specific data are provided by Siemens reporting system. Datasets for resources, such as electrical energy or natural gas, are chosen from the region where the device is produced and assembled. If primary data are not available, datasets reflecting state-of-the-art manufacturing technology are considered. Generic data originating from the LCA tool: Green Digital Twin Version 4.0, Database: One Siemens LCA Database (based on MLC CUP 2024.1).
Allocation	For the end-of-life allocation, the “Polluter Pays” principle is adopted as required by the PCR–ed4-EN-2021 09 06 and PSR-0005-ed3.1-EN-2023 12 08. 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. Potential benefits and avoided loads from recovery and recycling processes are considered in separate Benefits & Loads beyond system boundary section.

Cut-off	According to EN 50693:2019 and PCR–ed4-EN-2021 09 06, the cut-off criteria can be set to a maximum of 5% of the overall environmental impacts. In this LCA, metal manufacturing scrap EoL has been excluded as the total overall impacts are below 1%.

Scenarios:

The following information describes the scenarios in the different modules of the EPD.

Manufacturing	This stage covers the extraction of natural resources, production of raw materials, manufacturing, packaging, and upstream transportation.
Transportation to production site	Primary data and EN 50693:2019
Production energy model used	A1: Global; A3: Switzerland (CH: Electricity grid mix Standard)
Distribution	This stage covers the product's distribution.
Distribution: Transport model use	Truck (20-26 t) 817 km
Installation	This stage covers the End-of-Life treatment of transport packaging.
Installation: Energy model used	Not relevant
Use	This stage covers the operational energy use. All other modules do not apply for this product. Different operating conditions can lead to deviations from the reference scenario.
Use: Energy model used and use scenario	B: Europe (EU-28: Electricity grid mix Standard); Energy consumption model with 1.0 W 365 days 24/7 Reference lifetime 10 years
EoL	This stage covers the disassembly, material recycling in addition to thermal treatment of all recoverable materials and the disposal of all other materials.
EoL: Transport model use	Road Truck, 20 - 26t gross weight 1000.0 km
EoL: Energy model used	C & D: Europe

Life cycle assessment - results

The following impact categories characterize the product's environmental footprint. They have been calculated with characterization method EN15804+A2 (EF3.1); LCA tool: Green Digital Twin Version 4.0, Database: One Siemens LCA Database (based on MLC CUP 2024.1).

To ensure the high quality and completeness of the LCA results, primary data have been used whenever possible. Datasets for resources, such as electrical energy or natural gas, are chosen from the region where the device is produced and assembled. If primary data are not available, datasets reflecting state-of-the-art manufacturing technology are considered.

Environmental performance indicators

Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
CC - total	kg CO_2 eq	3.13E+1	5.76E+0	1.64E-2	3.24E-2	2.53E+1	1.78E-1	-8.64E-2
CC - fossil	kg CO_2 eq	3.11E+1	5.76E+0	1.60E-2	7.80E-4	2.51E+1	1.78E-1	-8.76E-2
CC - biogenic	kg CO_2 eq	2.48E-1	-6.99E-3	3.84E-5	2.86E-2	2.26E-1	8.67E-5	2.10E-4
CC - luluc	kg CO_2 eq	1.01E-2	5.62E-3	2.70E-4	6.40E-7	3.82E-3	3.44E-4	-8.08E-4
ODP	kg CFC-11 eq	9.58E-9	9.01E-9	2.37E-15	4.05E-15	5.69E-10	1.07E-13	-2.28E-13
AP	Mole of H+ eq	9.97E-2	5.12E-2	2.34E-5	7.92E-6	4.84E-2	6.86E-5	-7.09E-4
EP - freshwater	kg P eq	1.37E-4	3.07E-5	6.87E-8	1.56E-8	1.05E-4	1.02E-6	-3.31E-7
EP - marine	kg N eq	1.72E-2	5.08E-3	8.68E-6	2.95E-6	1.21E-2	2.07E-5	-9.83E-5
EP - terrestrial	Mole of N eq	1.83E-1	5.52E-2	1.03E-4	3.50E-5	1.27E-1	2.63E-4	-1.03E-3
POCP	kg NMVOC eq	4.89E-2	1.68E-2	2.33E-5	8.54E-6	3.20E-2	5.84E-5	-3.09E-4
ADP - M & M	kg Sb eq	6.95E-4	6.90E-4	1.40E-9	4.60E-11	4.69E-6	2.73E-9	-2.60E-5
ADP - fossil	MJ	6.10E+2	8.44E+1	2.12E-1	1.07E-2	5.25E+2	4.08E-1	-9.89E-1
WDP	m^3 world eq deprived water	8.45E+0	1.59E+0	2.49E-4	3.51E-3	6.84E+0	1.45E-2	-3.59E-2
PM	Disease incidences	8.22E-7	4.17E-7	2.30E-10	4.88E-11	4.04E-7	6.18E-10	-6.25E-9
IRP	kBq U235 eq	1.44E+1	5.57E-1	5.60E-5	7.22E-5	1.38E+1	2.30E-3	-1.94E-3
ETP - fw	CTUe	1.99E+2	4.69E+1	1.57E-1	5.14E-3	1.52E+2	2.95E-1	-3.16E-1
HTP - c	CTUh	1.04E-8	1.79E-9	3.18E-12	2.96E-13	8.55E-9	7.26E-12	-4.01E-11
HTP - nc	CTUh	1.86E-7	5.46E-8	1.43E-10	1.32E-11	1.31E-7	2.46E-10	-1.88E-9
SQP	dimensionless (pt)	2.45E+2	2.15E+1	1.04E-1	2.81E-3	2.23E+2	1.75E-1	-1.87E-1

***CC-total**: Climate change; **CC-fossil**: Climate change fossil; **CC-biogenic**: Climate change biogenic; **CC-LULUC**: Climate change land use and land use change; **ODP**: Depletion potential of the stratospheric ozone layer; **AP**: Acidification potential, accumulated exceedance; **EP-freshwater**: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-marine**: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-terrestrial**: Eutrophication potential, accumulated exceedance; **POCP**: Formation potential of tropospheric ozone; **ADP-M&M**: Abiotic depletion potential for non-fossil resources (minerals and metals); **ADP-fossil**: Abiotic depletion potential for fossil resources; **WDP**: Water deprivation potential, deprivation weighted water consumption; **PM**: Particulate matter emissions; **IRP**: Ionizing radiation, human health; **ETP-fw**: Ecotoxicity freshwater; **HTP-c**: Human toxicity, cancer effects; **HTP-nc**: Human toxicity, non-cancer effects; **SQP**: Land use related impacts / soil quality*

Resource use indicators and biogenic carbon content

Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
PERE	MJ	4.06E+2	2.61E+1	1.83E-2	2.55E-3	3.80E+2	9.08E-2	-1.86E-1
PERM	MJ	0.00E+0	3.38E-1	0.00E+0	-3.38E-1	0.00E+0	0.00E+0	0.00E+0
PERT	MJ	4.06E+2	2.64E+1	1.83E-2	-3.35E-1	3.80E+2	9.08E-2	-1.86E-1
PENRE	MJ	6.11E+2	8.44E+1	2.12E-1	1.07E-2	5.26E+2	4.08E-1	-9.99E-1
PENRM	MJ	0.00E+0	3.39E+0	0.00E+0	0.00E+0	0.00E+0	-3.39E+0	1.94E-16
PENRT	MJ	6.11E+2	8.78E+1	2.12E-1	1.07E-2	5.26E+2	-2.97E+0	-9.99E-1
SM	kg	4.92E-3	4.92E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	m3	3.47E-1	5.62E-2	2.03E-5	8.27E-5	2.90E-1	3.80E-4	-4.39E-3
BIOGCPRODUCT	kg of C	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
BIOGCPACKAGING	kg of C	1.53E-2	1.53E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

***PERE**: Use of renewable primary energy; **PERM**: Use of renewable primary energy resources used as raw material; **PERT**: Total use of renewable primary energy resources; **PENRE**: Use of non-renewable primary energy; **PENRM**: Use of non-renewable primary energy resources used as raw material; **PENRT**: Total use of non-renewable primary energy resources; **SM**: Use of secondary materials; **RSF**: Use of renewable secondary fuels; **NRSF**: Use of non-renewable secondary fuels; **FW**: Use of net fresh water; **BIOGCPRODUCT**: Biogenic carbon content of the Product; **BIOGCPACKAGING**: Biogenic carbon content of the Packaging*

End-of-Life - Waste and output flows

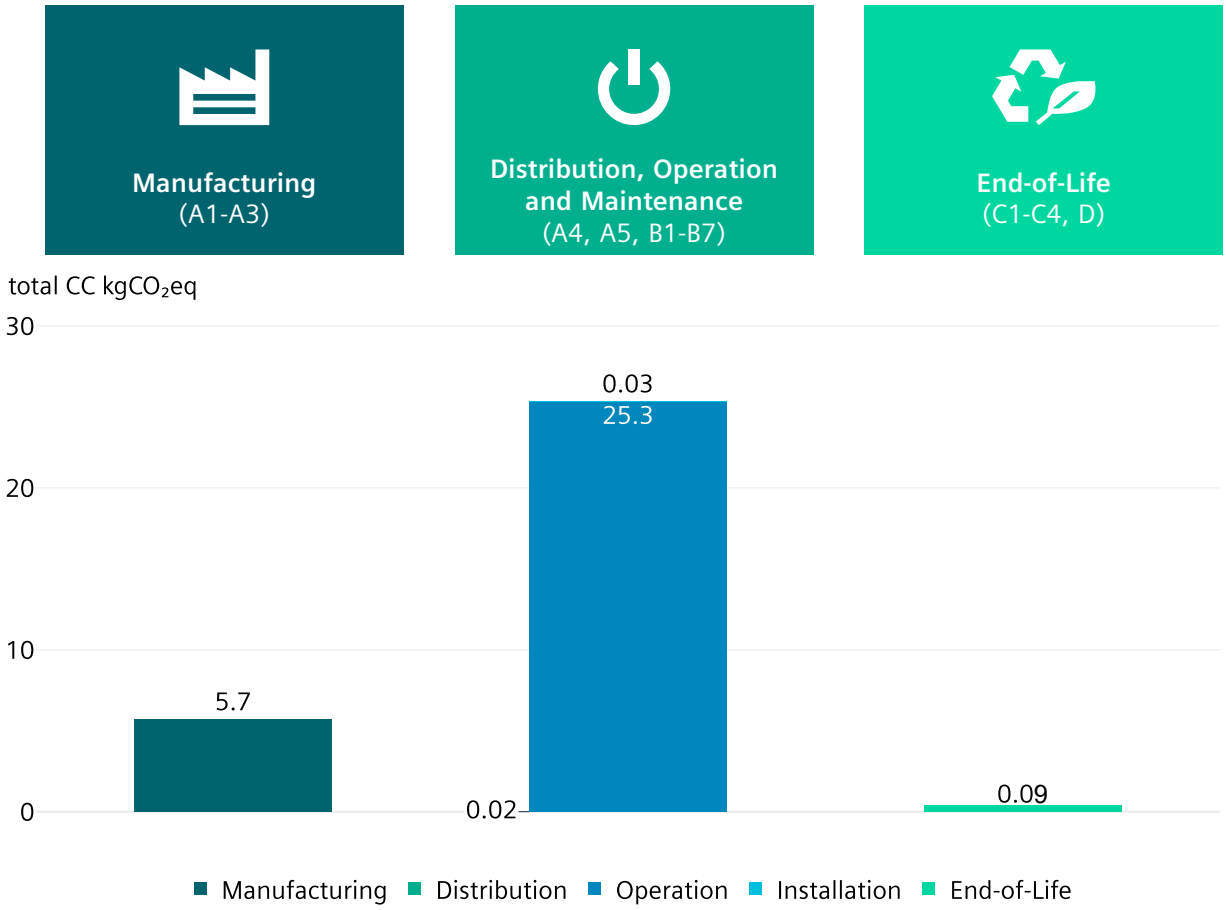
Indicators	Unit	Total - (w/o D)	A1-A3	A4	A5	B1-B7	C1-C4	D
			Manufacturing	Distribution	Installation	Use stage	End of life	Benefits & loads
HWD	kg	1.52E-6	1.52E-6	8.12E-12	5.23E-12	7.59E-7	1.45E-10	-2.85E-9
NHWD	kg	4.92E-1	3.77E-1	3.46E-5	2.35E-3	4.34E-1	1.12E-1	3.82E-3
RWD	kg	4.66E-3	4.64E-3	3.86E-7	4.59E-7	8.39E-2	1.43E-5	-2.16E-5
MER	kg	6.18E-2	7.18E-3	0.00E+0	0.00E+0	0.00E+0	5.46E-2	0.00E+0
MFR	kg	3.48E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.48E-2	0.00E+0
CRU	kg	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
ETE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	MJ	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

***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 electric energy.*

Additional environmental information

Climate change

This chart shows the overall impact of the product on climate change – total. The operations phase is the life cycle phase with the biggest overall impact. Different operating conditions can lead to deviations from the reference scenario.



End-of-Life results

The end-of-life stage was modelled by shredding of the device, followed by sorting and material separation process.The end-of-life parameters are calculated according to IEC TR 62635.

It leads to:

- **an overall product recyclability of up to 21%**
- **an energy recoverability of up to 27%**
- **a minimum disposal rate of 52%**

The exact final values depend on the recycling process used and together add up to a cumulative total of 100%. However, the LCA calculation of this PEP is carried out based on the default end-of-life scenarios of the PCR and its FAQ.

Note: The device should not be disposed of as unsorted municipal waste. Special treatment for specific components may be mandated by law or recommended for environmental reasons. Observe all local and applicable laws.

Appendix

Scaling factors

The results of the LCA of the reference product can be extrapolated to other products of a homogeneous product family according to the standard EN50693:2019. The scaling factors listed here are calculated according to this standard.

The extrapolation rules have been defined as follow:

- Manufacturing (A1-A3): $\frac{m_{plastics,i}+m_{metals,i}+13\cdot m_{PCBA,i}+m_{others,i}}{m_{plastics,ref}+m_{metals,ref}+13\cdot m_{PCBA,ref}+m_{others,ref}}$
- Distribution (A4): $\frac{m_{product,i}}{m_{product,ref}}$
- Installation (A5): $\frac{m_{product,i}}{m_{product,ref}}$
- Use Phase (B1-B7): $\frac{m_{annual\ power\ consumption,i}}{m_{annual\ power\ consumption,ref}}$
- End of life (C1-C4): $\frac{6\cdot m_{plastics,i}+0.01\cdot m_{metals,i}+1\cdot m_{PCBA,i}+0.04\cdot m_{others,i}}{6\cdot m_{plastics,ref}+0.01\cdot m_{metals,ref}+1\cdot m_{PCBA,ref}+0.04\cdot m_{others,ref}}$
- Benefits & Loads (D): $\frac{1\cdot m_{plastics,i}+4\cdot m_{metals,i}+19\cdot m_{PCBA,i}+2\cdot m_{others,i}}{1\cdot m_{plastics,ref}+4\cdot m_{metals,ref}+19\cdot m_{PCBA,ref}+2\cdot m_{others,ref}}$

To extrapolate the impact from the reference product to another product from the range, multiply the following scaling factors to the impact category per life cycle stage from page 5:

Article Type	A1-A3	A4	A5	B1-B7	C1-C4	D	Typ. Power Consumption [kWh/a]*
Reference product	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**8.8**
EM.8D	1.02	0.76	0.76	2.80	0.56	0.91	24.5
EM.8R	1.67	0.90	0.90	3.60	0.61	1.50	31.5
EM.8U	1.02	0.76	0.76	2.80	0.56	0.90	24.5
EM1.4D4R	1.33	0.83	0.83	3.00	0.58	1.19	26.3
EM1.8D	1.02	0.76	0.76	2.80	0.56	0.91	24.5
EM1.8R	1.67	0.90	0.90	3.60	0.61	1.50	31.5
EM1.8U	1.02	0.76	0.76	2.80	0.56	0.90	24.5

References

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14040/44	Lifecycle Assessment – Principles and framework
EN 50693:2019	Product category rules for life cycle assessments of electronic and electrical products and systems
PCR–ed4-EN-2021 09 06	Product Category Rules for Electrical, Electronic and HVAC-R Products
PSR-0005-ed3.1-EN-2023 12 08	SPECIFIC RULES FOR Electrical switchgear and control gear Solutions



The GreenDigitalTwin is under regular surveillance by TÜV Rheinland®. In accordance with the standards ISO 14040:2006 + A1:2020 /ISO 14044:2006 + A1:2018 + A2:2020 the reviewer concludes that the LCA methodology developed by Siemens AG is scientifically based and reflects the state of the art.



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Registration number: **SIEM-00006-V01.01-EN**	Drafting rules: **PCR-4-ed4-EN-2021 09 06** **Supplemented by PSR-0005-ed3.1-EN-2023 12 08**
Verifier accreditation number: **VH57**	Information and reference documents: **www.pep-ecopassport.org**
Date of issue: **12-2025**	Validity period: **5 years**
Independent verification of the declaration and data in compliance with ISO 14025: 2006	
Internal: ☐	**External:** ☒
The PCR review was conducted by a panel of experts chaired by Julie Orgelet (DDemain)	
PEPs are compliant with XP C08-100-1:2026 and EN 50693:2019 or NF E38-500:2022. The components of the present PEP may not be compared with components from any other program.	
Document complies with ISO 14025:2006 'Environmental labels and declarations. Type III environmental declarations'	