Environmental Product Declaration

In accordance with ISO 14025:2010 and EN 15804:2012+A2:2019/AC:2021 for:

PICV (Pressure Independent Control Valve)

from

FRATELLI PETTINAROLI S.p.A.
CLIMATE SYSTEMS TECHNOLOGY

EPD of multiple products, based on the average results of the product group.
Series covered by this EPD: Dynasty, EvoPICV, EvoPICV*R* - *families 92, 91, 93, 81, 83 (brass)*

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	EPD-IES-0023057
Publication date:	2025-06-06
Valid until:	2030-06-05

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

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Programme information

Programme:	The International EPD® System
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR 2019:14. Construction products. Version 1.3.4*
PCR review was conducted by: *PCR review was conducted by: The Technical Committee of the International EPD System. See www.environdec.com for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact*
Life Cycle Assessment (LCA)
LCA accountability: LCA accountability: Studio Fieschi & soci s.r.l. - C.so Vittorio Emanuele II, 18 10123 Torino, IT - www.studiofieschi.it
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2010, via: ☒ EPD verification by individual verifier Third-party verifier: Luca Giacomello, *Green&Care S.a.s.* Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Product information

Product name: PICV (Pressure Independent Control Valve)
Series covered by this EPD: Dynasty, EvoPICV, EvoPICVR - families 92, 91, 93, 81, 83 (brass)

Company information

Owner of the EPD:
Fratelli Pettinaroli S.p.A.
Via Pianelli, 38, 28017 San Maurizio d'Opaglio (NO) – Italy
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Description of the organisation:
Founded in 1938, Fratelli Pettinaroli S.p.A. has always been synonymous with quality, reliability and innovation in the production of components for heating, air conditioning, plumbing and gas management systems. The company's mission is to provide customers with solutions that can be integrated into and managed by systems, constantly improving their performance. Its vision is "to design and develop equipment that makes buildings more reliable, efficient and sustainable". In order to establish itself on foreign markets, in the 1990s Pettinaroli embarked on an internationalisation process that resulted in a group of companies located between Europe and North America.
Today, more than 85 years after its foundation, Pettinaroli, still family-run, is a multinational group with over 300 employees and a constantly growing business, exporting its products to more than 60 countries around the world.
The company is ISO 9001, ISO 14001, ISO 50001 certified and has been awarded the EcoVadis Bronze Medal.

Product identification and description: Pressure Independent Controls Valves (PICV) are regulating and controls valves for HVAC water systems. They combine a differential pressure regulator, a flow limiter and a 2-way control valve. They are dynamic balancing valves, able to keep flow rate constant through them and achieve maximum flow rate control authority when proportionally actuated. They can be equipped with differential pressure test ports.

UN CPC code: **43240** *Taps, valves and similar appliances for pipes, boiler shells, tanks, vats or the like*

Geographical scope: Global

LCA information

Declared unit: 1 kg of PICV brass valve, packed and ready for shipment, based on the average results of the product group. The average environmental profile is calculated as the arithmetic mean of the extreme values of the group.

Product	Minimum profile	Maximum profile
PICV brass valve	92H - 3705092000C	93L1 - 3702290140C

The use of this approach means that the environmental profiles of all intermediate configurations of the products analyzed can be considered included in the study.

Reference service life: not applicable
Time representativeness: All data about the product composition, manufacturing and distribution are referred to year 2024. Secondary data are the most recent available at the time of the study and are representative of the period 2018-2023.
Database(s) and LCA software used: Ecoinvent v.3.9.1, SimaPro v. 10.1.0.6

Type of EPD:
Cradle to gate with modules C1–C4 and module D (A1–A3 + C + D)
Modules A4-A5 and modules B1 to B7 are excluded.

System boundaries:
System boundaries include the following processes:

- A1: The production of semi-finished brass products and other components necessary for the production of the valve. This includes the operations carried out on the brass semi-finished products before they enter Fratelli Pettinaroli's supply chain, as well as operations carried out by subcontractors, such as surface treatments and sandblasting;
- A2: Transport of raw materials (semi-finished products, purchased components) to the Fratelli Pettinaroli production plants;
- A3: production of the valves at Fratelli Pettinaroli's site. Production of packaging materials. Consumption of electricity used at the plant and consumption of fossil fuels used for internal handling of products. Management of waste (also derived from packaging) generated in the plant.
  The processes included in this module are:
  - mechanical processing and washing;
  - heat treatments;
  - assembly;
  - packaging of the finished product;
- C1: dismantling or demolition process;
- C2: transport of waste to treatment/disposal points;
- C3: treatment of waste from preparation for recovery-recycling;
- C4: final disposal;

Additional modules:

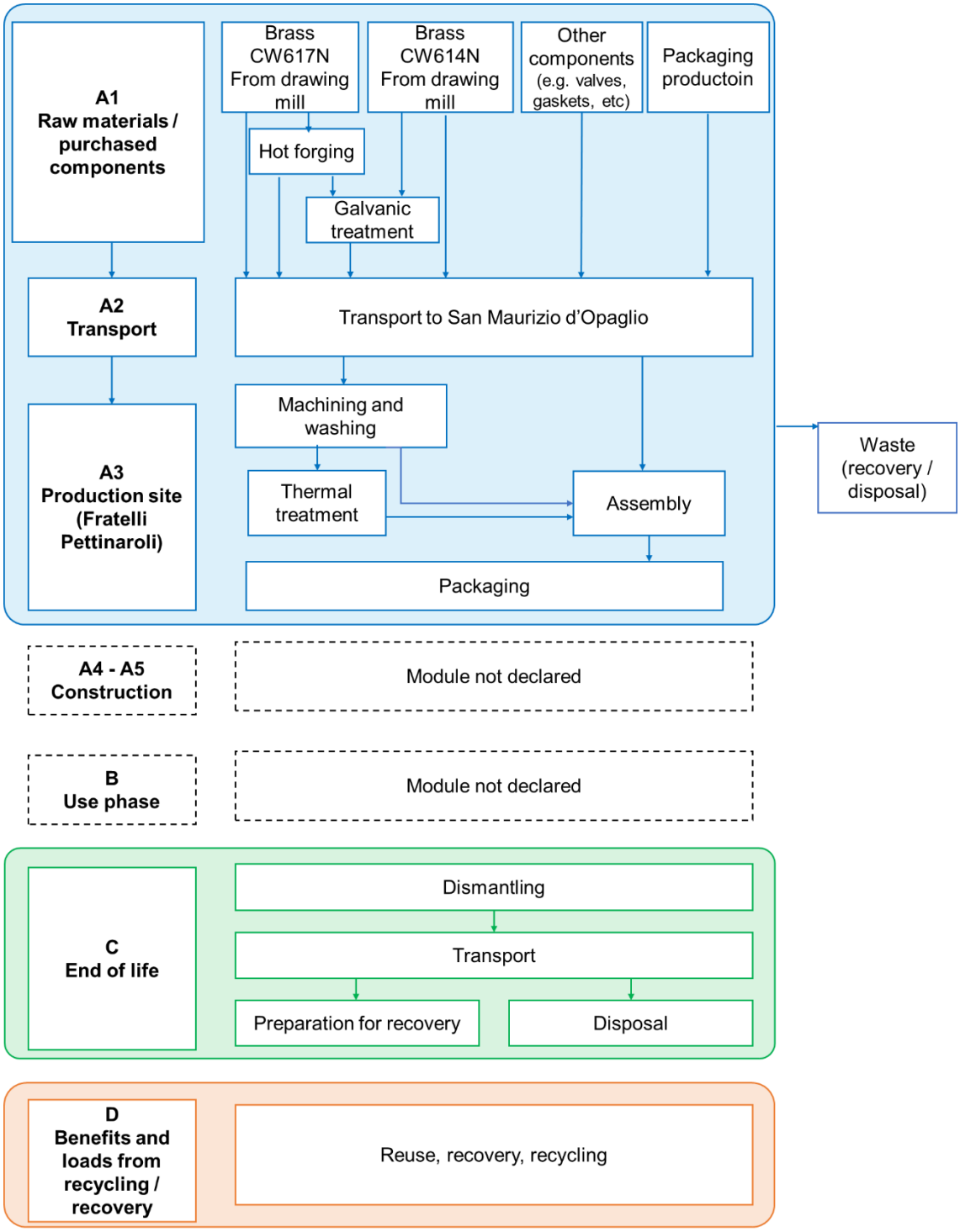
Module D: potential benefits and impacts related to recovery-reuse-recycling of materials and energy throughout the life cycle. In this module, the benefits and/or impacts related to, for example, the potential recycling of materials at the end of their life of the products under study are evaluated. The modelling of recovery-reuse-recycling benefits is carried out according to the requirements of EN 15804:2012 + A2:2019 § 6.4.3.3.

System boundaries do not include:

- Modules A4-A5 related to the distribution and installation phase of the product. Module A5 is considered included only for the balance of the biogenic carbon contained in the packaging;
- Impacts related to personnel (e.g. transport to and from the workplace, electricity and water consumption of offices, etc.);
- Impacts related to the production and transport of packaging materials of purchased semi-finished products. The impact is considered in relation to waste management (e.g. paper and cardboard) in A3.
- Input and output flows related to the production and end-of-life processes of infrastructure and capital goods[1].

[1] The exclusion of capital goods and infrastructure is limited to the main processes (foreground processes, modeled directly in the study). Impacts related to these processes could still be included in the backgruond data (e.g. Ecoinvent data).

System diagram:



More information:
Brass alloys contain around 60% copper and 40% zinc.
These alloys contain lead in a concentration greater than 0,1%, substance listed in the "Candidate List of Substances of Very High Concern for authorization".
Modules C and D are modelled according to the distribution volumes of the product.

Modules declared

Geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	x	x	x	ND	ND[2]	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x
Geography	GLO	GLO	IT	-	-	-	-	-	-	-	-	-	GLO	GLO	GLO	GLO	GLO
Specific data used	90%			-	-	-	-	-	-	-	-	-	-	-	-	-	
Variation – products	+/- 21%			-	-	-	-	-	-	-	-	-	-	-	-	-	
Variation – sites	0			-	-	-	-	-	-	-	-	-	-	-	-	-	

[2] Module A5 is considered only for the ”balancing-out reporting” of the biogenic carbon contained in the packaging

Cut-off: The cut-off rules contained in EN 15804:2012 + A2:2019 §6.3.6 and PCR 2019:14 §4.4 apply. As their total contribution is less than 1% of the impacts of the reference module, the following contributions were not included in the model:

- Pad printing and pad printing inks;
- Transport of components to subcontractors located in Gozzano and S. Maurizio d'Opaglio;
- Laser marking operations (permanent marking) carried out within Fratelli Pettinaroli.

Allocation rules:
In the case of multifunctional situations, i.e. where systems generate several products, the allocation rules in PCR 2019:14 apply.
Relevant allocations were applied in modules A1 and A3.

- A1: economic allocation was applied to the brass from the market in order to characterize the impacts related to the pre-consumer scrap used as raw material in Fratelli Pettinaroli's supply chain;
- A3: mass allocation per kg of finished product of the plant energy / fuel consumption and waste generation;
- A3: economic allocation related to the brass scrap (co-product) produced per kg of valve was applied to the processes under direct control of Fratelli Pettinaroli.

Brass: brass is the main material the PICV valves are made of. This material enters Fratelli Pettinaroli's supply chain as pre-consumer scrap input to the drawing mill. A *market-brass* flow consisting of primary material and post-consumer scrap was therefore modelled based on material flow analyses of copper and zinc, the two main components of the brass alloy. The alloy composition and the energy consumption associated with market brass were estimated based on primary data referring to 2022 obtained from Fratelli Pettinaroli's direct suppliers.

Electricity mix: The purchased electricity used in the production process (step A1-A3) and the amount of energy consumed produced by Pettinaroli's own photovoltaic panels was modelled in accordance with Ecoinvet 3.9.1. The GWP-GHG of the electricity mix used to model module A3 is 0,523 kg CO2 eq./kWh.

Assumptions for the end of life scenario of the product (modules C1-C4)

Module C1: Dismantling of the product. The process of dismantling the product is associated with the process of dismantling the building in which it is contained. It is assumed that the energy source used for this purpose is diesel and that the average energy consumption in this phase is 0.07 MJ/kg.

Module C2: Transport of waste to treatment/disposal points. An average transport scenario to collection, recovery and disposal sites of 50 km traveled by land. For transport, a 16-32 ton lorry, Euro6 related to the relevant geography was used.

Modules C3 - C4: waste preparation for recovery-recycling and final disposal.
The following considerations apply:

- The product is broken down into its main constituent materials (metal, plastic etc.) and, for each of these, specific end-of-life scenarios are applied that distinguish between recycling, energy recovery, incineration and landfill disposal;

- The share of material sent for recycling is derived from the Product Environmental Footprint (PEF);
- The shares of materials sent for energy recovery, incineration and landfilling are derived from Eurostat waste treatment statistics for European countries, while for non-EU countries a *100%-disposal* scenario is assumed;
- Given the nature of the polymeric materials obtainable from disassembly, it is assumed that EoW status is reached after incineration with energy recovery
- .

Assumptions for module D:

- Module D for metals is considered to be zero due to the uncertainty of upstream recycling rates along the supply chain;
- To account for the lower efficiency of recycled plastic material compared to the primary polymer, a quality factor of 0.9 is applied to recycled plastic.

Content declaration

1 kg of average PICV valve, packed

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Brass CW617N+CW602N+CB770S	7,72E-01	23,2%	0,0%
Brass CW614N	1,73E-01	5,2%	0,0%
Stainless steel	3,85E-02	0,0%	0,0%
Synthetic rubber	4,32E-03	0,0%	0,0%
PC + ABS	4,29E-03	0,0%	0,0%
PSU	3,74E-03	0,0%	0,0%
ABS	2,82E-03	0,0%	0,0%
PPS 40% GF	4,31E-04	0,0%	0,0%
NORYL GFN2	3,75E-04	0,0%	0,0%
PP	1,36E-04	0,0%	0,0%
POM	1,10E-04	0,0%	0,0%
Nylon	8,83E-05	0,0%	0,0%
POM 20% GF	6,79E-05	0,0%	0,0%
Total	**1,00E+00**	**28,4%**	**0,0%**
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Cardboard	6,26E-02	6,3%	2,66E-02
Wood	5,95E-02	6,0%	2,34E-02
LDPE	1,63E-03	0,2%	0,00E+00
Paper	1,86E-03	0,19%	6,14E-04
Total	**1,26E-01**	**12,6%**	**5,07E-02**

Hazardous substances

Declared products contain substances listed in the “Candidate List of Substances of Very High Concern for authorization” in a concentration greater than 0,1%:

Name of substance	CAS#	EC#
Lead	**7439-92-1**	**231-100-4**
Silicone	**556-67-2** **541-02-6** **540-97-6**	**209-136-7** **208-764-9** **208-762-8**

Lead is contained in all the product made of the following copper-zinc alloy:

- EN12164 CW614N DW
- EN12165 CW617N DW
- EN12165 CW602N
- CB770S

Environmental performance

Results for 1 kg of average PICV, packed

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks. The use of the results of modules A1-A3 is discouraged without considering the results of module C.

Mandatory impact category indicators according to EN 15804

Results for declared unit								
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**	**Delta**
GWP-fossil	kg CO_2 eq.	7,52E+00	6,54E-03	7,66E-03	4,18E-02	9,37E-02	-2,70E-02	
GWP-biogenic	kg CO_2 eq.	5,25E-02	4,30E-07	4,82E-07	1,64E-02	2,13E-01	-2,65E-06	
GWP-luluc	kg CO_2 eq.	1,28E-02	2,67E-07	1,93E-07	7,60E-06	4,20E-05	-1,81E-05	
GWP-total	kg CO_2 eq.	7,59E+00	6,54E-03	7,66E-03	5,82E-02	3,07E-01	-2,70E-02	+/- 20,9%
ODP	kg CFC 11 eq.	1,18E-07	1,03E-10	1,42E-10	1,61E-10	4,93E-10	-5,47E-10	+/- 21,8%
AP	mol H^+ eq.	3,22E-01	6,26E-05	2,09E-05	5,02E-05	1,85E-04	-8,08E-05	+/- 27,6%
EP-freshwater	kg P eq.	1,47E-03	5,59E-09	1,07E-08	6,15E-07	2,77E-06	-7,93E-07	+/- 27,1%

EP-marine	kg N eq.	1,78E-02	2,94E-05	7,96E-06	3,19E-05	4,84E-04	-1,42E-05	+/- 24,7%
EP-terrestrial	mol N eq.	2,46E-01	3,20E-04	8,44E-05	1,88E-04	6,83E-04	-1,50E-04	+/- 26,7%
POCP	kg NMVOC eq.	7,19E-02	9,41E-05	3,19E-05	6,41E-05	2,92E-04	-6,59E-05	+/- 26,2%
ADP-minerals&metals*	kg Sb eq.	4,51E-03	2,75E-10	3,37E-10	1,58E-09	4,17E-08	-6,42E-09	+/- 28,0%
ADP-fossil*	MJ	1,03E+02	8,60E-02	1,02E-01	1,12E-01	3,81E-01	-5,08E-01	+/- 23,1%
WDP*	m^3	6,21E+00	1,10E-04	1,13E-04	1,36E-03	4,99E-03	-8,21E-03	+/- 26,7%
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; 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, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end 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-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption							

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

Additional mandatory and voluntary impact category indicators

Results for declared unit								
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**	**Delta**
GWP-GHG[3]	kg CO_2 eq.	7,59E+00	6,54E-03	7,66E-03	5,82E-02	3,07E-01	-2,70E-02	+/- 20,9%

[3] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Resource use indicators

The calculation resource use indicators is carried out in accordance with Option B of Annex 3 of PCR 2019:14 v1.3.4.

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE*	MJ	1,95E+01	1,68E-04	2,23E-04	1,22E-02	2,76E-02	-2,81E-02
PERM*	MJ	1,22E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	2,10E+01	1,68E-04	2,23E-04	1,22E-02	2,76E-02	-2,81E-02
PENRE*	MJ	1,03E+02	8,60E-02	1,02E-01	6,81E-01	9,18E-01	-3,96E-01
PENRM*	MJ	7,56E-01	0,00E+00	0,00E+00	-5,68E-01	-5,37E-01	-1,11E-01
PENRT	MJ	1,03E+02	8,60E-02	1,02E-01	1,12E-01	3,81E-01	-5,08E-01
SM	kg	2,29E+00	0,00E+00	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
FW	m^3	1,65E-01	4,27E-06	4,63E-06	7,26E-05	2,07E-04	-2,67E-04
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

*Primary energy contained in the packaging material is not accounted for and is considered lost.

Waste indicators

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed*	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Non-hazardous waste disposed*	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Radioactive waste disposed**	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

*Hazardous waste disposed and Non-hazardous waste disposed indicators are set to 0 because all the relevant waste treatment processes are included within the system boundaries.
**Radioactive waste is considered not relevant within the value chains included in the study

Output flow indicators

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Material for recycling	kg	0,00E+00	0,00E+00	0,00E+00	8,31E-01	0,00E+00	0,00E+00
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	0,00E+00	0,00E+00	0,00E+00	1,80E-01	4,97E-02	0,00E+00

Additional environmental information

Conversion factors

The EPD represents average results of the product group. In accordance with paragtaph 5.4.6.1 of PCR 2019:14 (v. 1.3.4), the GWP-GHG results for the following products in the same family could be linearly scaled with conversion factors shown below.

GWP-total average profile (kgCO2eq/kg)	7,973
Product	**Conversion factor versus average profile**
93L1 - 3702290140C	1,208
91H - 3702890090C	1,156
91XL/2 - 3701410170C	1,149
93H - 3703290180C	1,045
92XVL/2 - 3701592230C	1,014
83HJP - 3703290250C	0,999
81VLJP - 3701590210C	0,981
92H - 3705092000C	0,792

List of acronyms

ABS Acrilonitrile-butadiene-stirene
ADP Abiotic Depletion Potential
AP Acidification Potential
BoM Bill of Materials
EEE Electrical and electronic equipment
EP Eutrophication Potential
EPD Environmental Product Declaration
EoL End of Life
EoW End of Waste
GF Glass fibre
GWP Global Warming Potential
IES International EPD® System
LCA Life Cycle Assessment
LCI Life Cycle Inventory
LCIA Life Cycle Impact Assessment
LDPE Low-density polyethylene
NBR Nitrile butadiene rubber
ODP Ozone Depletion Potential
PC Polycarbonate
PCR Product Category Rules
POCP Photochemical Ozone Creation Potential
POFP Photochemical Ozone Formation Potential
POM Polyoxymethylene
PPS 40% GF Polyphenylene sulfide
PSU Polysulfone
PVC Polyvinyl chloride
RSL Reference Service Life

References

- EN 15804:2012 + A2:2019 + AC, Sustainability of buildings – Environmental product declarations – Framework rules for development by product category
- International EPD System, General Programme Instructions, versione 4.0
- International EPD System, PCR 2019:14 – Construction products – version 1.3.4
- ISO 14025:2010 *Environmental labels and declarations – Type III environmental declarations – Principles and procedures*;
- ISO 14040:2021 *Environmental Management – Life Cycle Assessment – Principles and Framework*;
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