Environmental Product Declaration

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for:

PLURIMA, orange version

Bi-oriented net for constructions

from

TENAX SPA

Product category rules (PCR): *PCR 2019:14 (v1.11)*

Geographical area: The services are calculated with reference to the Tenax plant - Viganò (LC) - Italy. The market is international.

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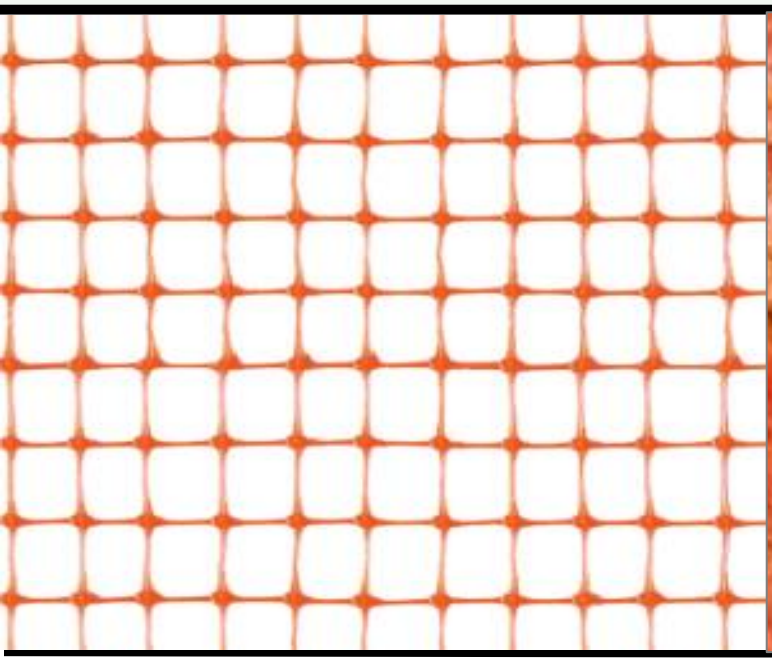


An EPD should provide current information and may be updated if conditions change.
The stated validity is therefore subject to the continued registration and publication at www.environdec.com.

Programme information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com

Product category rules (PCR): *PCR 2019:14 Construction products and construction services (v1.11)* *EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction works* PCR review was conducted by: The Technical Committee of the International EPD® System. See www.environdec.com/TC 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.
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: SGS Italia S.p.A. via Caldera, 21, 20153 – Milano T +39 02 73 931 - www.it.sgs.com *Accreditation certification n 006H* Accredited by: *ACCREDIA*
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 from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804:2012+A2:2019 and ISO 14025.

Company information

EPD owner: Tenax S.p.A. – Via dell'industria 17 - 23897 Viganò (LC) - Italy

Reference person: Piergiorgio Recalcati piergiorgio.recalcati@tenax.net, Silvia Manzoni silvia.manzoni@tenax.net
Technical support: Spin Life S.r.l – Spinoff dell'Università di Padova, via Cerato 14, Padova

Description of the organization: Tenax S.p.a (hereinafter referred to as Tenax) is specialized in high quality plastics products used in five main sectors: gardening, constructions, agriculture, geosynthetics and industry.
Tenax was founded in 1960 and it was specialized in thermoplastic polymer extrusion. Today, Tenax is an international group that has progressively expanded its structure, favouring the birth of different production and commercial units (United States and Germany), while the headquarter is located in Viganò, Lecco, where there are the production units and the executive offices.
Over the years, Tenax has continuously created new products, such as orange nets for construction or new nets for civil engineering purposes with ten times drainage capacity than any other net.

Management system-related certifications:
UNI EN ISO 9001:2015 Quality management - certificate n° IT93/0008
UNI EN ISO 14001:2015 Environmental management - certificate n° IT22/00000132

Name and location of the production site: Tenax S.p.A. – Via dell'industria 17 - 23897 Viganò (LC) - Italy

Figure 1: Tenax S.p.A production plant – Viganò (LC)

Product information

Product Name**:** PLURIMA, orange version.

Products description:

PLURIMA is mainly used to cover contaminated or polluted soils as a warning. It is a light and resistant square-mashed, polypropylene net with a reinforced edge, produced by the extrusion and stretching od thermoplastic polymers. Compared to the normal extruded nets, PLURIMA has a reinforced mesh that prevent tearing and it is UV resistant, thanks to a stabilization treatment, to ensure long life and reuse possibilities.

Applications: The product under study is used in the construction sector, in particular to notify a contaminated or polluted soil.

PLURIMA, orange version, is a single product and all the environmental performance indicators have been calculated taking itself as a reference.
In 2021 PLURIMA, orange version, has been defined with two product codes: “69000254” e “69001004”. Any new product codes relating to PLURIMA, orange version, are intended to be included in this EPD because product codes only reflect the dimension of the roll, while the composition of the product does not vary between them.

UN CPC code: 36950

Geographical area: Italy

The performances were calculated with reference to the Tenax plants in Viganò (LC). The reference market is international.

The technical data are listed in the table below.

Characteristic	Value	Unit of measure
Material	Polypropylene	-
Mass per unit area	35	g/m^2
Height	4	m
Length	62,5 500	m
Weight	8,75 72,8	kg
Tensile strength	2,5	kN/m

Table 2: Technical Data

LCA information

Declared unit: 1 kg of bi-oriented net, with its packaging (the packaging is not included in the declared kg).

Time representativeness: The primary data cover a period of 12 months, reference year 2021.

Used database and software: Ecoinvent 3.6 database; SimaPro software version 9.3.0.2.

System boundaries and process units excluded: The system boundaries include the mandatory modules A1, A2, A3, C1, C2, C3, C4 and D required by Standard EN 15804:2012+A2:2019 (CEN, 2019), as reported in the following table according to a “from cradle to gate with module C1-C4 and module D” type application. It is emphasized that the construction, maintenance and decommissioning of infrastructures, understood as buildings, and the occupation of industrial land were not considered, since it is believed that their contribution to the environmental impact of the declared unit is negligible. The consumption of oils for machine maintenance and water treatment is included. It is also emphasized that the deployment, installation, and maintenance phases are not included in the study.

The table below shows a detail of the modelling of the various modules.

Module	Scenario
A1	This phase includes extraction and processing of raw materials, generation of electricity and heat, processing up to the end-of-waste state or disposal of final residues.
A2	This phase includes transportation up to the factory gate and internal transport.
A3	This phase includes manufacturing of the products and their packaging.
C1	This phase includes the removal of the products from the installation site, assuming a civil scenario. An excavation hydraulic digger is considered.
C2	This phase includes the transportation of the discarded products. Average distance from the demolition site to the waste treatment is assumed to be 100km for landfill disposal.
C3	This phase includes disassembly for recycling of the products. In this case it is equal to zero.
C4	This phase includes disposal in the final stage of the life of the products. It is assumed that 100% of the material is disposed in landfills.
D	This module contains the potential impacts and benefits related to the recycling of the products. In this case it is equal to zero.

Table 2: Modelling of the various modules

In case of insufficient input data or data gaps for a unit process, a 1% cut-off criterion has been applied (1 % of primary energy usage and 1 % of the total mass input of that unit process). The total of neglected input flows per module is less than 5 % of energy usage and mass.

The method chosen to evaluate the potential environmental impacts of the product subject of this study is the method provided by the standard EN 15804:2012+A2:2019 (CEN, 2019).

Electricity modelling (Module A1): The modelling of electricity consumption in module A1 was carried out using the residual Italian national mix, using the AIB 2021 report as a data source. The breakdown of the energy sources used is shown below.

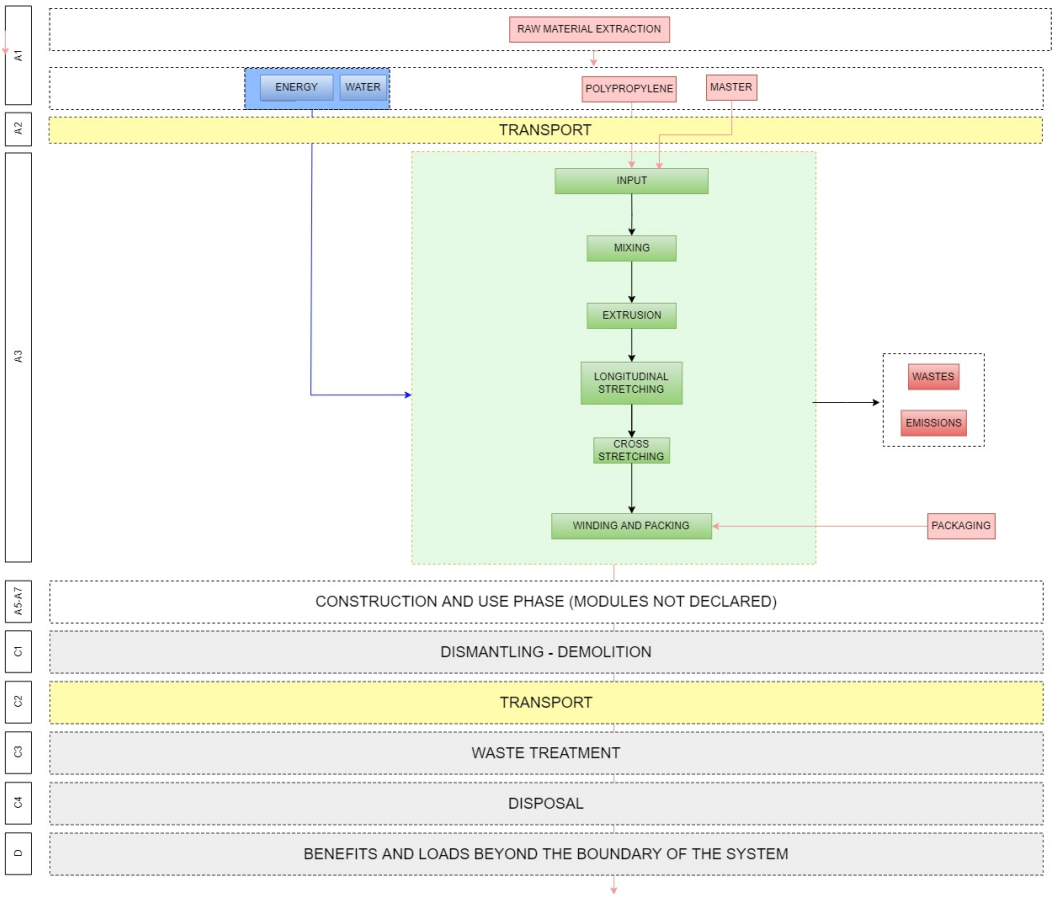
Source	Residual Mix 2021
Renewables Unspecified	0,00%
Solar	5,24%
Wind	0,76%
Hydro&Marine	2,48%
Geothermal	0,00%
Biomass	2,33%
Nuclear	6,42%
Fossil Unspecified	1,80%
Lignite	0,19%
Hard Coal	12,75%
Gas	63,60%
Oil	4,43%
TOTAL	100,00%

Table 3: Electricity modelling

Table 4: Summary table in reference to the declared unit

Characteristic	Unit of measurement	Value
Reference year	-	2021
Mass Unit	g/m^2	35
Components		
Polypropylene	kg/kg_product	9,80E-01
Master - orange	kg/kg_product	2,00E-02
Packaging		
Cardboard core	kg/kg_product	1,30E-01
External plastic film	kg/kg_product	4,30E-03
Plastic cap	kg/kg_product	1,60E-02
Consumptions and other data		
Diesel	L/kg_product	1,53E-03
Electricity	kWh/kg_product	1,02E+00
Thermal energy	kWh/kg_product	1,24E+00
Waste	kg/kg_product	1,74E-01
Emissions	kg/kg_product	3,44E-04
Upstream transport		
Master	km truck/kgmaster	6,48E+02
Polypropylene	km truck/kgPP	1,71E+03
	km sea ship/kgPP	3,76E+02

Figure 2: System diagram (Plurima)



Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation:

	Product Stage			Construction Stage		Use stage							End of life stage				Benefits beyond system boundaries
	Raw Materials Supply	Transport	Manufacturing	Transport to site	On site processes	Use	Maintence	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/Demolition	Transport	Waste processing	Disposal	Reuse/Recovery/Recycling
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	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	< 10%																
Variation - sites	Not relevant																

Content declaration

Product components	Weight, kg	Post-consumer material, weight-%	Renewable material, weight-%
Polypropylene	9,8E-01	0%	0%
Master - orange	2,00E-02	0%	0%
TOTAL	1,00E0	0%	0%
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	
Cardboard core	1,30E-01	11,3%	
External film	1,6E-02	1,4%	
Plastic cap	4,3E-03	0,4%	
TOTAL	1,50E-01	13,1%	

Product components

The bi-oriented net is mostly composed by virgin polypropylene, not renewable.

Packaging materials

Plurima's finished product packaging consists of a cardboard core, a LDPE film and a HDPE cap.

Dangerous substances from the candidate list of SVHC for Authorisation

The product does not contain substances included in the "Candidate list of substances of very high concern (SVHC) for authorization" in a percentage greater than 0.1%.

Environmental performance

Potential environmental impact

The values relating to Plurima product are shown below.

Parameter	Unit	A1	A2	A3	Total	C1	C2	C3	C4	D
GWP-total	kg CO2 eq	2,92E+00	1,33E-01	7,43E-02	3,13E+00	1,52E-01	2,14E-02	0,00E+00	2,58E-01	0,00E+00
GWP-fossil	kg CO2 eq	2,89E+00	1,33E-01	2,01E-01	3,23E+00	1,52E-01	2,14E-02	0,00E+00	1,27E-01	0,00E+00
GWP-biogenic	kg CO2 eq	2,46E-02	5,65E-05	-1,30E-01	-1,05E-01	5,85E-05	1,06E-05	0,00E+00	1,32E-01	0,00E+00
GWP-luluc	kg CO2 eq	5,63E-04	5,15E-05	2,84E-03	3,46E-03	1,59E-05	9,26E-06	0,00E+00	5,10E-06	0,00E+00
ODP	kg CFC11 eq	1,73E-07	2,98E-08	1,33E-08	2,17E-07	3,19E-08	4,75E-09	0,00E+00	3,28E-09	0,00E+00
AP	mol H+ eq	1,09E-02	1,13E-03	1,47E-03	1,35E-02	1,56E-03	1,05E-04	0,00E+00	9,17E-05	0,00E+00
EP-freshwater	kg P eq	5,39E-04	9,18E-06	1,04E-04	6,52E-04	8,52E-06	1,84E-06	0,00E+00	1,72E-06	0,00E+00
EP-freshwater	kg PO_4^{3-} eq.	1,65E-03	2,82E-05	3,18E-04	2,00E-03	2,61E-05	5,64E-06	0,00E+00	5,30E-06	0,00E+00
EP-marine	kg N eq	1,71E-03	3,43E-04	4,02E-04	2,46E-03	6,81E-04	3,47E-05	0,00E+00	4,08E-04	0,00E+00
EP-terrestrial	mol N eq	1,89E-02	3,78E-03	3,38E-03	2,60E-02	7,46E-03	3,79E-04	0,00E+00	3,39E-04	0,00E+00
POCP	kg NMVOC eq	7,76E-03	1,04E-03	8,12E-04	9,62E-03	2,06E-03	1,09E-04	0,00E+00	1,25E-04	0,00E+00
ADP – mineral&metals*	kg Sb eq	3,00E-05	3,26E-06	2,41E-06	3,57E-05	2,63E-07	7,72E-07	0,00E+00	1,13E-07	0,00E+00
ADP – fossil*	MJ	8,41E+01	1,97E+00	3,94E+00	9,00E+01	2,09E+00	3,20E-01	0,00E+00	2,50E-01	0,00E+00
WDP*	m^3 world eq. depriv.	1,65E+00	5,16E-03	2,41E-01	1,90E+00	3,66E-03	9,82E-04	0,00E+00	1,05E-02	0,00E+00
GWP-GHG	kg CO2 eq	2,80E+00	1,32E-01	2,04E-01	3,14E+00	1,52E-01	2,13E-02	0,00E+00	1,08E-01	0,00E+00

GWP-total: Global Warming Potential total; **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, Accumulated Exceedence; **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 Exceedence; **POCP**: Formation potential of tropospheric ozone; **ADP-minerals&metals**: Abiotic depletion potential for non fossil resources*; **ADP-fossil**: Abiotic depletion for fossil sources potential*; **WDP**: Water (user) deprivation potential, deprivation-weighted water consumption*. **The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

Potential incidence of disease due to PM emissions (PM), Potential Human exposure efficiency relative to U235 (IRP), Potential Comparative Toxic Unit for ecosystems (ETP-fw), Potential Comparative Toxic Unit for humans (HTP-c), Potential Comparative Toxic Unit for humans (HTP-nc) and Potential soil quality index (SQP) are not declared (ND) in this document.

Use of resources

Parameter	Unit	A1	A2	A3	Total	C1	C2	C3	C4	D
PERE	MJ	9,66E-01	1,78E-02	1,61E-01	1,14E+00	1,28E-02	3,65E-03	0,00E+00	3,38E-03	0,00E+00
PERM	MJ	5,00E-01	0,00E+00	1,83E+00	2,33E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,47E+00	2,61E-02	2,00E+00	3,49E+00	1,67E-02	5,45E-03	0,00E+00	4,47E-03	0,00E+00
PENRE	MJ	7,44E+01	1,97E+00	3,64E+00	8,00E+01	2,09E+00	3,20E-01	0,00E+00	2,50E-01	0,00E+00
PENRM	MJ	9,70E+00	0,00E+00	3,01E-01	1,00E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	8,41E+01	1,97E+00	3,94E+00	9,00E+01	2,09E+00	3,20E-01	0,00E+00	2,50E-01	0,00E+00
SM	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+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	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	0,00E+00	0,00E+00	0,00E+00
FW	m3	2,69E-02	1,95E-04	7,29E-03	3,44E-02	1,29E-04	3,81E-05	0,00E+00	2,62E-04	0,00E+00

PERE: Use of renewable primary energy excluding resources used as raw materials; **PERM**: Use of renewable primary energy resources used as raw materials; **PERT**: Total use of renewable primary energy; **PENRE**: Use of non-renewable primary energy excluding 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; **SM**: Secondary material; **RSF**: Renewable secondary fuels; **NRSF**: Non-renewable secondary fuels; **FW**: Net use of fresh water.

Production of waste and outflows

Waste production

Parameter	Unit	A1	A2	A3	Total	C1	C2	C3	C4	D
HWD	kg	2,54E-05	4,83E-06	3,58E-06	3,38E-05	5,75E-06	8,61E-07	0,00E+00	3,79E-07	0,00E+00
NHWD	kg	9,55E-02	8,09E-02	2,27E-02	1,99E-01	3,86E-03	1,26E-02	0,00E+00	1,00E+00	0,00E+00
RWD	kg	5,33E-05	1,35E-05	1,11E-05	7,79E-05	1,42E-05	2,16E-06	0,00E+00	1,49E-06	0,00E+00

HWD: Hazardous waste disposed; **NHWD**: Non-hazardous waste disposed; **RWD**: Radioactive waste disposed.

Outgoing flows

Parameter	Unit	A1	A2	A3	Total	C1	C2	C3	C4	D
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	9,27E-02	9,27E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	1,67E-03	1,67E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

CRU: Components for reuse; **MFR:** Material for recycling; **MER:** Materials for energy recovery; **EE:** Exported energy.

Information on biogenic carbon content

The average Plurima product contains 0 kgC per kg of net, while the content in its packaging is equal to 5,61E-02 kgC per kg of net.

Type and source of data

In choosing the data to be used for the LCA study, primary data collected at Tenax through a campaign of measurements were privileged. The primary data cover a period of 12 months, from January 2021 to December 2021 and concern:

- the transport of incoming materials for the production of the analyzed products (distance traveled, type of fuel, Euro class of vehicles, flow rate);
- the raw materials used (quantity and type);
- the production process at Tenax (mass balance and energy/water consumption);
- the waste produced at Tenax (quantity and destination).

In the event that primary data or models for calculating such data were not available, secondary data obtained by consulting internationally recognized databases were used, preferring where possible the use of the most up-to-date ones. The secondary data in particular concern:

- The combustion processes of vehicles: emissions, maintenance, use of the road network, fuel consumption (data sets Ecoinvent version 3.6);
- Operating machines: emissions (Ecoinvent 3.6 data sets);
- Electricity: distribution network, losses (Ecoinvent 3.6 data sets);
- The productions of the materials used (Ecoinvent 3.6 data sets).

Data proxies are less than 10% as required by the program rules.

References

- General Programme Instructions of the International EPD® System. Version 3.01
- PCR construction Products and construction services 2019:14 version 1.11 valid until 2024-12-20
- European Residual Mixes. Results of the calculation of Residual Mixes for the calendar year 2021. AIB, 2022
- LCA Report "Studio di Life Cycle Assessment dei geocompositi SD, HD, TDP, TENDRAIN, TN/TNT e della rete PLURIMA di Tenax S.p.A." rev.2 del 15/09/2022

Standard

- ISO 14040:2006/AMD 1:2020 Environmental management - Life cycle assessment - Principles and framework – Amendment 1;
- ISO 14044:2006/AMD 1:2017 Environmental management — Life cycle assessment — Requirements and guidelines — Amendment 1
- ISO 14044:2006/AMD 2:2020 Environmental management — Life cycle assessment — Requirements and guidelines — Amendment 2;
- ISO 14025:20010 Environmental labels and declarations — Type III environmental declarations — Principles and procedures;
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction works.

List of figures

List of tables

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