Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Mono-oriented geogrids

From

TENAX SPA

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
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This is an EPD of multiple products, based on the average results of the product group. Products included: TT 55L - TT 75L - TT 100L - TT 045 GS - TT 060 GS - TT 090 GS - TT 120 GS - TT 160 GS - TT 045 RW - TT 060 RW - TT 090 RW - TT 120 RW.

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

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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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): *Construction products, 2019:14, version 1.3.1*
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.*
Life Cycle Assessment (LCA)
LCA accountability: *Spinlife srl*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by accredited certification body Third-party verification: SGS Italia S.p.A. via Caldera, 21, 20153 – Milano T +39 02 73 931 - www.it.sgs.com SGS Italia is an approved certification body accountable for the third-party verification The certification body is accredited by: Accredia*, accreditation certification n. 0005VV*
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 shall be based on the same PCR (including the same version number up to the first two digits) 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.

This is an EPD of multiple products and for each indicator the results are referred to an average product. This product has an average composition based on the actual production of the reference year. Results are also calculated for two other cases, one called “best”, which has the lowest impact for GWP-GHG category, and one called “worst”, which has the highest impact for GWP-GHG category. The best and worst cases differ from the average product in the packaging composition only. The maximum difference between these two cases and the average impact is reported in the results.

Company information

Owner of the EPD: Tenax S.p.A. – Via dell'industria 17 - 23897 Viganò (LC) – Italy (for further information: www.tenax.net/it)

Contact: 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 organisation: 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.

Product-related or 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 production site(s): Tenax S.p.A. – Via dell'industria 17 - 23897 Viganò (LC) - Italy

Product information

Product name: Mono-oriented geogrids

Product description and applications: these uniaxial products are made of high-density polyethylene through mono-directional extrusion and stretching, which allows us to obtain high-performance products. They are used for soil reinforcement and retaining structures (slopes, roads and railways, landfills and contaminated sites). The packaging of the product consists of an iron core.

UN CPC code: 36950

Geographical scope: Italy for primary data, global otherwise.

The product composition represents the proportion of raw materials and waste actually reported in the reference year, and it has an average packaging. All product codes that belong to the family because of their physical and technical characteristics, produced in previous years and still in the catalogue, are represented by the results calculated for the average product.
All environmental performance indicators have been calculated taking the above-mentioned average product as a reference.
The performances were calculated with reference to the Tenax plants in Viganò (LC). The reference market is international.

LCA information

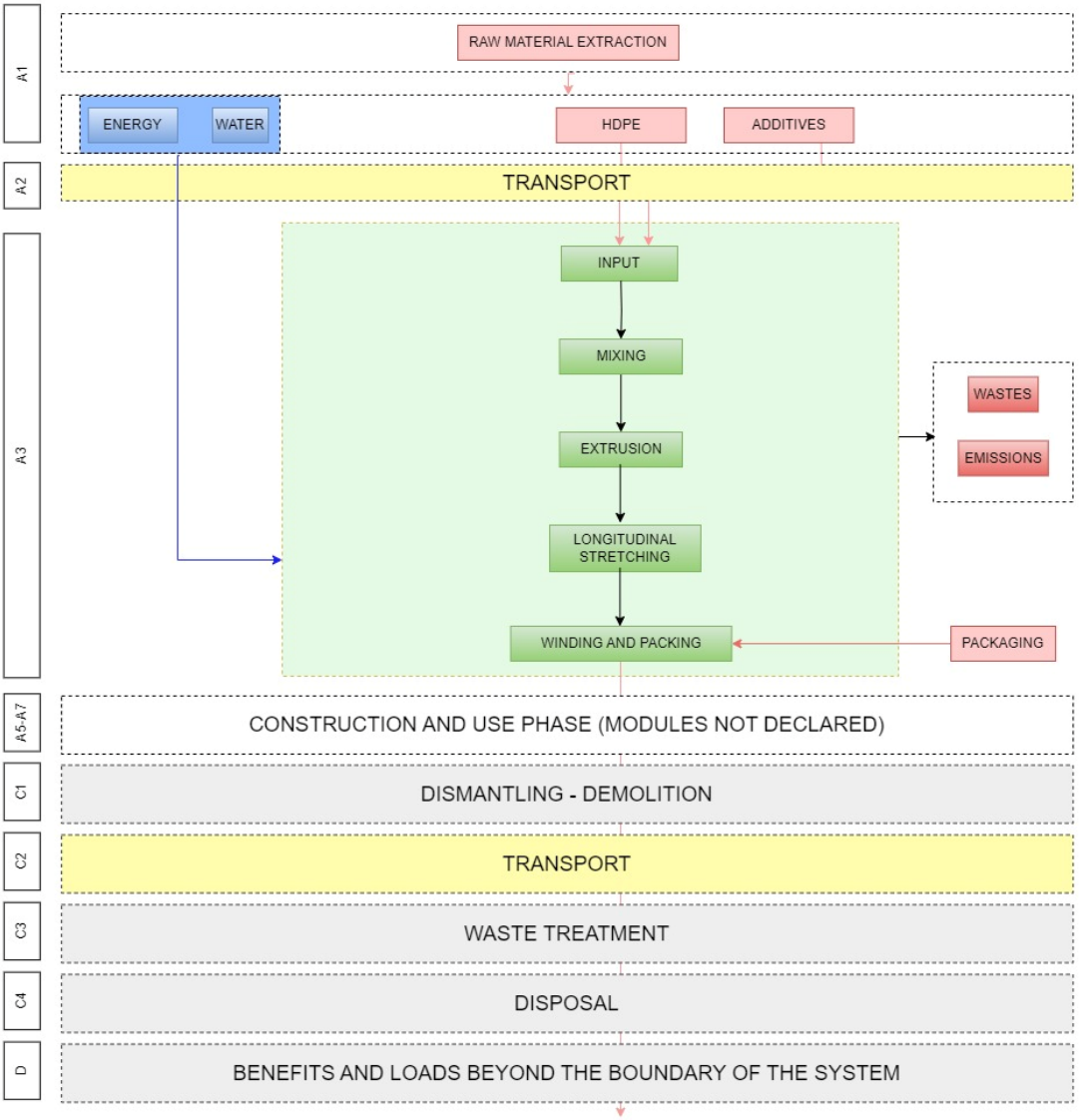
Declared unit: 1 kg of mono-oriented geogrid, with its packaging (the packaging is not included in the declared kg)

Time representativeness: The primary data cover a period of 12 months, reference year 2022.

Database(s) and LCA software used: Ecoinvent 3.8 database; SimaPro software version 9.3.0.2.

Description of system boundaries:
b) Cradle to gate with options, modules C1–C4, module D and with optional modules (A1–A3+C+D and additional modules). A5 is included for the "balancing-out reporting" only.

System diagram:



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.
A5	This phase is included for the “balancing-out reporting” only, with reference to the 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 the end-of-life recovery of the product. In this case it is equal to zero.
C4	This phase includes the end-of-life disposal of the product. It is assumed that 100% of the product is disposed in landfill.
D	This phase contains the potential impacts and benefits related to the recycling of the products. In this case it is equal to zero.

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 2022 report as a data source. The breakdown of the energy sources used is shown below.

Source	Residual Mix 2022
Renewables Unspecified	0,01%
Solar	5,97%
Wind	0,84%
Hydro&Marine	0,54%
Geothermal	0,00%
Biomass	1,68%
Nuclear	2,62%
Fossil Unspecified	2,74%
Lignite	0,02%
Hard Coal	12,20%
Gas	68,92%
Oil	4,47%
TOTAL	100,00%

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	X*	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	GLO	GLO	IT		GLO								GLO	GLO	GLO	GLO	GLO
Specific data used	>60%																
Variation – products	<4%																
Variation – sites	Not relevant																

*A5 is included for the “balancing-out reporting” only.

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
HDPE	9,85E-01	0%	0,00E00
Master	1,50E-02	0%	0,00E00
TOTAL	1,00E00	0%	0,00E00
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Iron core	3,50E-03	0,35%	0,00E00
TOTAL	3,50E-03	0,35%	0,00E00

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%.

Results of the environmental performance indicators

Mandatory impact category indicators according to EN 15804

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	2,79E+00	1,18E-02	0,00E+00	0,00E+00	1,26E-01	0,00E+00
GWP-biogenic	kg CO_2 eq.	4,85E-03	2,17E-06	0,00E+00	0,00E+00	7,08E-05	0,00E+00
GWP-luluc	kg CO_2 eq.	8,09E-04	1,48E-06	0,00E+00	0,00E+00	1,10E-05	0,00E+00
GWP-total	kg CO_2 eq.	2,80E+00	1,18E-02	0,00E+00	0,00E+00	1,26E-01	0,00E+00
ODP	kg CFC 11 eq.	2,58E-07	2,54E-09	0,00E+00	0,00E+00	3,21E-09	0,00E+00
AP	mol H^+ eq.	1,27E-02	1,21E-04	0,00E+00	0,00E+00	9,13E-05	0,00E+00
EP-freshwater	kg P eq.	4,00E-04	5,74E-07	0,00E+00	0,00E+00	1,58E-06	0,00E+00
EP-marine	kg N eq.	2,62E-03	5,30E-05	0,00E+00	0,00E+00	4,79E-04	0,00E+00
EP-terrestrial	mol N eq.	2,82E-02	5,80E-04	0,00E+00	0,00E+00	3,38E-04	0,00E+00
POCP	kg NMVOC eq.	7,93E-03	1,60E-04	0,00E+00	0,00E+00	1,29E-04	0,00E+00
ADP-minerals&metals*	kg Sb eq.	1,95E-05	8,61E-09	0,00E+00	0,00E+00	3,54E-08	0,00E+00
ADP-fossil*	MJ	8,42E+01	1,63E-01	0,00E+00	0,00E+00	2,51E-01	0,00E+00
WDP*	m^3	1,76E+00	3,30E-04	0,00E+00	0,00E+00	1,08E-02	0,00E+00
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.*

Since module C is included in the EPD, the use of the results of modules A1-A3 without considering the results of module C is discouraged.

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 variation of the GWP-GHG indicator among the different products of the family is lower than 10% compared to the impact of the average product.
The indicators that present a variation higher than ±10% are: GWP-biogenic, GWP-luluc, EP-freshwater, Land use.

Additional mandatory and voluntary impact category indicators

Results per functional or declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	2,80E+00	1,18E-02	0,00E+00	0,00E+00	1,26E-01	0,00E+00

Resource use indicators

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1,49E+00	1,36E-03	0,00E+00	0,00E+00	4,60E-03	0,00E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	1,49E+00	1,36E-03	0,00E+00	0,00E+00	4,60E-03	0,00E+00
PENRE	MJ	4,34E+01	1,63E-01	0,00E+00	0,00E+00	2,51E-01	0,00E+00
PENRM	MJ	4,09E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	MJ	8,42E+01	1,63E-01	0,00E+00	0,00E+00	2,51E-01	0,00E+00
SM	kg	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
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m^3	2,85E-02	1,16E-05	0,00E+00	0,00E+00	2,63E-04	0,00E+00
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						

The results of the primary energy use indicators are calculated by adopting the option B (as described in the Annex 3 of the PCR) for the separation of the use of primary energy into energy used as raw material and energy used as energy carrier.

[1] 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.

Waste indicators

Results per functional or 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

Output flow indicators

Results per functional or 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	9,64E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery	kg	3,84E-03	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	0,00E+00	0,00E+00	0,00E+00

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 2022 to December 2022 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 3.8);
- Operating machines: emissions (Ecoinvent 3.8 data sets);
- Electricity: distribution network, losses (Ecoinvent 3.8 data sets);
- The productions of the materials used (Ecoinvent 3.8 data sets).

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

References

General Programme Instructions of the International EPD® System. Version 4.0.

PCR 2019:14. *Construction products, 2019:14. version 1.3.1*

European Residual Mixes. Results of the calculation of Residual Mixes for the calendar year 2022. AIB, 2022LCA Report "Studio di Life Cycle Assessment delle Georeti, Geogriglie bi-orientare, geogriglie mono-orientate e delle geostuoie di Tenax S.p.A.." rev.2 del 17/10/2023

Ecoquery (https://ecoquery.ecoinvent.org/)

Standard

- ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework + AMD 1:2020 (Amendment 1);
- ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines + AMD 1:2017 (Amendment 1) and AMD 2:2020 (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.

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