Type III Environmental Product Declaration No. 848/2025

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Profiles and hydro-geotechnical systems

Owner of the EPD:

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ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804+A2 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment and their aspects verified by the independent body according to ISO 14025. Basically, comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804+A2.

Life cycle analysis (LCA): A1-A5, C1-C4 and D modules in accordance with EN 15804 (Cradle-to-Grave with options)
The year of preparing the EPD: 2025
Product standard: ITP-PIB-KOT-2023/47
Service Life: Over 50 years for standard product
PCR: ITB-PCR A (PCR based on EN 15804+A2)
Declared unit: 1 kg
Reasons for performing LCA: B2B
Representativeness: Polish, European, Global, 2024

MANUFACTURER

Fig. 1. The view of Pietrucha International Sp. z o.o. in Błaszki, Poland

Pietrucha International Sp. z o.o. is one of the leading European manufacturers of geotechnical solutions for the civil and hydrotechnical engineering sectors. Pietrucha provides cutting-edge solutions widely used in infrastructure and hydrotechnical investments, offering a tailored approach to each project, the highest production standards, and durable products made from raw materials sourced from trusted suppliers. Their vinyl sheet piles offer an environmentally friendly, lightweight, and highly durable alternative to traditional materials like steel, wood, or concrete. Owing to their corrosion resistance and lightweight design, which simplifies transport and installation in hard-to-reach areas, geotechnical profiles made from thermoplastic materials offer exceptional potential in infrastructure and hydrotechnical projects.

PRODUCTS DESCRIPTION AND APPLICATION

EcoLock profiles and hydro-geotechnical systems, manufactured by Pietrucha Group, are monolithic profiles made from rigid polyvinyl chloride (PVC). Their composition includes processing aids, impact modifiers, UV and thermal stabilizers, and mineral fillers. Produced via extrusion, these profiles incorporate recycled structural-grade PVC, enabling reprocessing and enhancing environmental sustainability. Fully recyclable, EcoLock hydro-geotechnical profiles offer a sustainable alternative to traditional construction materials such as steel, wood, or concrete.

Designed to function as durable, watertight, and corrosion-resistant barriers, EcoLock profiles are ideal for a wide range of hydro-geotechnical and civil engineering applications. They provide long-term performance with a 50-year limited service life, requiring no maintenance while maintaining excellent mechanical and structural properties. The profiles resist UV radiation, seawater, extreme temperatures, biological degradation, and mechanical damage including scratches and cracks.

The EcoLock system is cost-effective, helping reduce overall project expenses and timelines. Its lightweight and flat-profile design facilitates easy transport and rapid installation without heavy

machinery. The profiles' flexible geometry allows for installation along both linear and curved alignments, adapting well to natural shoreline contours.
The EcoLock range includes 15 types of sheet piles for various applications, along with a full set of accessories, including corner connectors that allow for joining walls at a 90-degree angle, caps that protect the sheet piles from above, and flexible fenders often used at kayak docks. The system is complemented by anchors and design assistance to transportation, execution, installation, and construction supervision.
EcoLock vinyl sheet piles come in different profiles and have diverse applications, but all are made from the same high-quality material. EcoLock vinyl sheet piles are used as structural and environmental barriers in diverse hydraulic and geotechnical projects. Typical applications include:

- Construction and reinforcement of flood levees and embankments
- Cut-off walls to prevent groundwater seepage
- Retaining walls for slopes, excavations, and landslide-prone areas
- Riverbank and canal protection against erosion and scouring
- Containment barriers for landfills and contaminated sites
- Separation walls between clean and polluted groundwater zones
- Infrastructure for marinas, piers, docks, and water reservoirs

Their ability to form both internal and external curves makes EcoLock sheet piles particularly effective for natural shorelines. Combined with complementary systems such as TerraDeck, they provide fully integrated and sustainable solutions for water-related infrastructure and land protection.
More information about profiles and hydro-geotechnical systems on the manufacturer's website.

LIFE CYCLE ASSESSMENT (LCA) – General rules applied

Declared unit

The declared unit is 1 kg of product: Profiles and hydro-geotechnical systems. Conversion factors for environmental impacts from 1 kg to square meter are provided in Table 2 for specific products based on a specific mass per m^2.

Allocation

The allocation rules used for this EPD are based on the general ITB PCR A. Production of profiles and hydro-geotechnical systems is a continuous extrusion process carried out by Pietrucha Group at the manufacturing facility located in Błaszki, Poland. Allocation of environmental impacts was performed based on product mass. All environmental impacts related to raw material extraction, including production and recycling of structural-grade PVC, are allocated to module A1 of the life cycle assessment (LCA). The impacts from the entire production process at Pietrucha Group's facility, including extrusion, finishing, and quality control, were inventoried and allocated to the EcoLock sheet piles. Water and energy consumption, associated emissions, and waste generation during production are allocated to module A3. Packaging materials used for EcoLock profiles and hydro-geotechnical systems are also included within the scope of this assessment.

System limits

At the processing plant, at least 99.0% of the input materials and 100% of the energy consumption were inventoried and included in the calculations. The assessment considered all available production data, i.e., all raw materials/components used in the formulation process, the thermal energy used for heating, and the electricity consumption. Therefore, material and energy flows with a mass or energy share of more than 99% were included. It can be assumed that the sum of omitted processes does not exceed 1% of the energy and mass consumption for modules A or D. Machinery

and equipment necessary for the production process were omitted. Packaging products (film, paper, cardboard, etc.) were also included.

Modules A1 and A2: ***Raw materials supply and transport***

The product is primarily made of plastics (PVC), colorants, and optionally fiberglass. Raw materials, including packaging and processing additives, come from both local and international suppliers. Transport to the factory is carried out exclusively by trucks. PVC and colorants are delivered regularly throughout the year over varying distances. Fiberglass is supplied occasionally. Return transport usually carries cargo. Average fuel consumption data for road transport in Poland and Europe were used to assess environmental impacts.

Module A3: ***Production***

The production process begins with mixing PVC raw materials and colorant. The mixture is then fed into the extruder, where it undergoes melting and mixing. During the extrusion phase, the material is formed into a preliminary profile. If required, a coextrusion step can be applied to add an additional material layer. The formed profile passes through a chiller, where it is cooled using chilled water, followed by a calibration stage to ensure precise dimensions and shape stability. If the product variant includes it, a gasket is joined to the profile during the gasket joining stage. The profile is then hauled off through a dedicated system (profile haul-off) and cut to the required length. Additional processing steps include forming, marking, and optionally, fiberglass reinforcement. Quality control is carried out at individual stages of the production process. Waste material is collected and milled for potential reuse. Finally, the finished profile is packaged and transferred to the warehouse as the final product. A diagram of the production process is shown in Fig. 2.

Module A4: transport to consumer and A5 installation

Vehicle transport at distance 100 km is considered (emission standard: Euro 5) with 100% load capacity. The installation is carried out using mechanical and electrical devices, the estimated energy consumption is 3 kWh per tonne of product.

Modules C1-C4 and D: ***End-of-life (EoL)***

Polypropylene geogrids are a long-lasting product, designed to remain in the ground. The current construction waste management system is not designed for their effective recovery. Efforts are underway to increase material recycling, but this remains a niche, not widespread practice. It is assumed that the geogrids used are not recycled (Table 1). Packaging materials, which represent less than 1% of total system flows, were not taken into consideration.

Table 1. End-of-life scenario for ***Profiles and hydro-geotechnical systems***

Material	Waste processing		Landfilling
	Material recovery (reuse, recycling)	**Energy recovery** (incineration)	
PVC	0%	0 %	100%

Data quality and databases

The data selected for LCA originate from ITB-LCI questionnaires completed by Pietrucha International Sp. z o.o. and verified during data audit. No data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency is judged as good. The data for the processes come from the following databases: Ecoinvent v.3.11, specific EPDs, ITB-Database. Specific data quality analysis was a part of external ISO 14001 audit.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2024 – 31.12.2024 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Assumptions and estimates

The impacts of profiles and hydro-geotechnical systems were aggregated using weighted average.

Calculation rules

LCA was performed using xls tool developed in accordance with EN15804+A2 and E.F. 3.1. Factors. No mass balance approach were used. Biogenic carbon in life cycle was balanced.

Additional information

Polish electricity (Ecoinvent v 3.11 supplemented by actual national KOBiZE data) emission factor used is 0.597 kg CO_2/kWh (National for 2024). As a general rule, no particular environmental or health protection measures other than those specified by law are necessary.

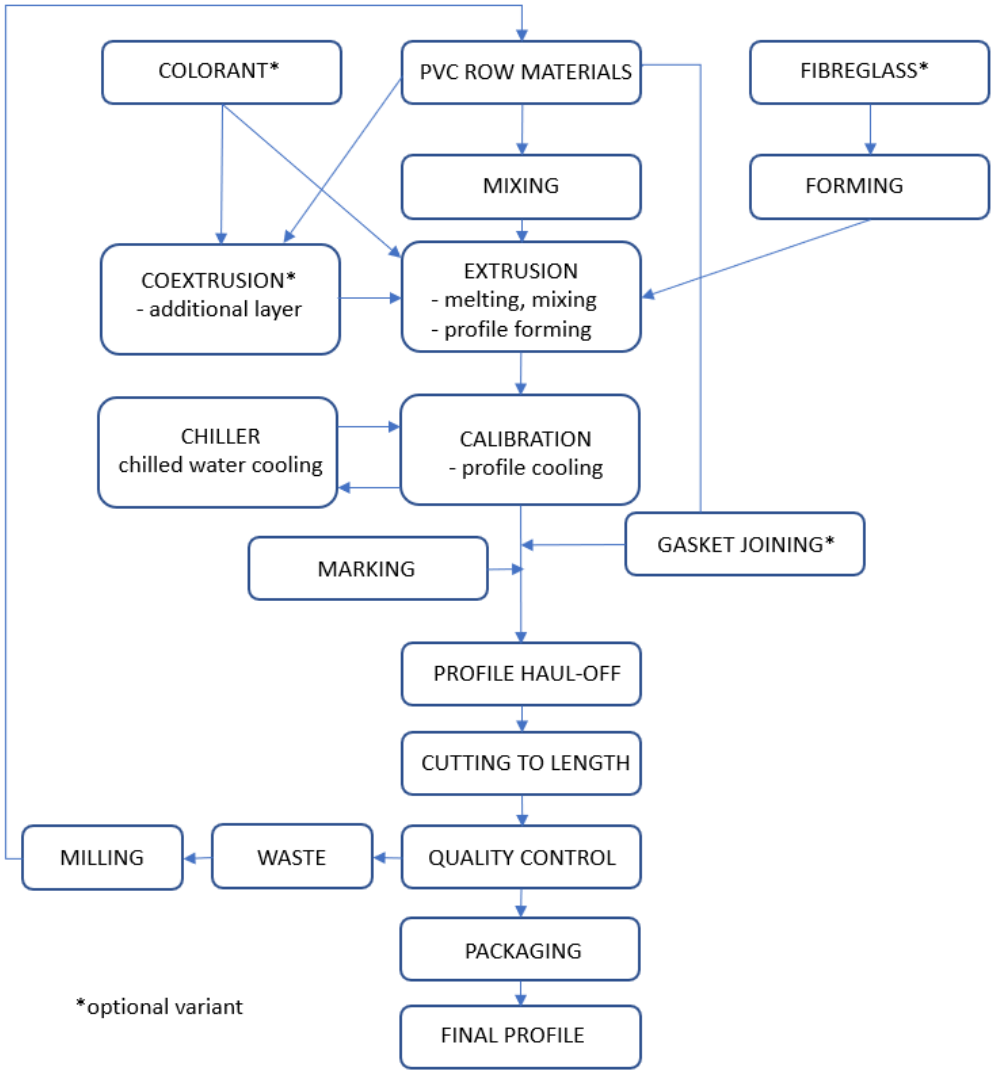

Fig. 2. The scheme of production by Pietrucha International Sp. z o.o.in Błaszki

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 kg of profiles and hydro-geotechnical systems produced by Pietrucha International Sp. z o. o. in Błaszki. To convert the environmental impact value from 1 kg to 1 m², the values from Table 5 to Table 8 should be multiplied by the coefficient values from Table 2. To convert the environmental impact value from 1 kg to 1 lm, the values from Table 5 to Table 8 should be multiplied by the coefficient values from Table 3. Tables 2 and 3 specify the conversion factors for profiles and hydro-geotechnical systems.

Table 2.The conversion factors for individual types of profiles and hydro-geotechnical systems are determined

Name	**Conversion factors** [kg/m^2]
GW-270/3.5	8.31
GW-270/5.5	12.29
GW-270/6.0	12.58
GW-300/5.5	13.70
GW-300/6.0	14.67
GW-537/5.5	9.45
GW-537/6.0	9.85
GW-458/12.0	29.20
GW-458/10.4	27.28
GW-460/5.5	13.29
GW-565/9.0	17.21
GW-580/7.0	23.63
GW-580/9.0	29.14
GW-580/11.0	35.09
GW-610/6.0	16.19
GW-610/6.4	15.15
GW-610/7.2	17.16
GW-610/9.0	22.04
M-Hex	15.37
J-Hex	13.80
D-Hex	23.14
GW-700 FR	29.44
GW-300 FR	14.30

Table 3.The conversion factors for individual types of profiles and hydro-geotechnical systems are determined

Name	**Conversion factors** [kg/lm]
Flood Warning Panel	5.51
Panel post	8.27
EKR-EKM	2.34
EKR-EKD	3.28
EKR-SEK	3.08
Corner 300	0.57
Corner 45	3.35
Corner 580/610	2.94
Corner 85/135	1.15
Quadruple	1.60
Cap 180	4.03
Cap 290/9.0	5.53
Cap 290/6.0	3.85
Cap 120	1.44
Watershed A	4.54
OGR-SLU	2.47
OGR-POP	1.44
PRB-PVC	1.40
Resistance	3.37

Table 4. System boundaries for the environmental characteristic of the product.

Environmental assessment information (MD – Module Declared, MND – Module Not Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	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**
MD	**MD**	**MD**	**MD**	**MD**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MD**	**MD**	**MD**	**MD**	**MD**

Table 5. Life cycle assessment (LCA) results for specific product – environmental impacts (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	2.40E-01	1.42E-01	1.02E+00	1.41E+00	8.34E-02	1.37E-03	0.00E+00	0.00E+00	3.44E-02	6.52E-01	-8.35E-03
Greenhouse potential - fossil	eq. kg CO_2	2.75E-01	1.42E-01	1.02E+00	1.44E+00	8.31E-02	1.37E-03	0.00E+00	0.00E+00	0.00E+00	6.52E-01	-6.93E-03
Greenhouse potential - biogenic	eq. kg CO_2	-3.44E-02	9.07E-05	6.62E-05	-3.42E-02	2.84E-04	3.69E-06	0.00E+00	0.00E+00	3.44E-02	1.36E-04	-1.40E-03
Global warming potential - land use and land use change	eq. kg CO_2	3.17E-04	4.71E-05	1.37E-04	5.01E-04	3.26E-05	2.14E-07	0.00E+00	0.00E+00	0.00E+00	1.03E-04	-1.28E-05
Stratospheric ozone depletion potential	eq. kg CFC 11	5.71E-08	3.09E-09	1.13E-08	7.15E-08	1.92E-08	7.53E-12	0.00E+00	0.00E+00	0.00E+00	7.96E+00	-1.29E-10
Soil and water acidification potential	eq. mol H+	1.27E-03	4.56E-04	1.05E-02	1.22E-02	3.37E-04	1.45E-05	0.00E+00	0.00E+00	0.00E+00	5.43E-03	-3.55E-05
Eutrophication potential - freshwater	eq. kg P	8.63E-05	9.69E-06	1.24E-03	1.34E-03	5.59E-06	2.36E-06	0.00E+00	0.00E+00	0.00E+00	4.41E-06	-3.98E-06
Eutrophication potential - seawater	eq. kg N	3.57E-04	1.53E-04	1.44E-03	1.95E-03	1.02E-04	2.05E-06	0.00E+00	0.00E+00	0.00E+00	1.85E-02	-9.18E-06
Eutrophication potential - terrestrial	eq. mol N	3.61E-03	1.67E-03	1.33E-02	1.86E-02	1.11E-03	1.79E-05	0.00E+00	0.00E+00	0.00E+00	3.49E-02	-8.16E-05
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.26E-03	6.91E-04	3.86E-03	5.81E-03	3.40E-04	5.15E-06	0.00E+00	0.00E+00	0.00E+00	7.61E-03	-1.29E-10
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.21E-06	4.89E-07	1.54E-06	4.23E-06	2.95E-07	5.16E-10	0.00E+00	0.00E+00	0.00E+00	1.47E-07	-6.97E-08
Abiotic depletion potential - fossil fuels	MJ	4.08E+00	2.01E+00	1.43E+01	2.04E+01	1.23E+00	2.16E-02	0.00E+00	0.00E+00	0.00E+00	6.18E-01	-1.26E-01
Water deprivation potential	eq. m^3	9.16E-02	1.05E-02	2.65E-01	3.67E-01	5.70E-03	4.14E-04	0.00E+00	0.00E+00	0.00E+00	1.45E-02	-2.81E-03

Table 6. Life cycle assessment (LCA) results for specific product – additional impacts indicators (DU: 1 kg)

Indicator	Unit	A1-A3	A4-A5	C1-C4	D
Particulate matter	disease incidence	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA

Table 7. Life cycle assessment (LCA) results for specific product - the resource use (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	9,40E-01	3,28E-02	1,08E+00	2,05E+00	1,77E-02	1,78E-03	0,00E+00	0,00E+00	0,00E+00	1,13E-02	-2,55E-02
Consumption of renewable primary energy resources used as raw materials	MJ	2,88E-01	0,00E+00	0,00E+00	2,88E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Total consumption of renewable primary energy resources	MJ	1,23E+00	3,28E-02	1,08E+00	2,34E+00	1,77E-02	1,78E-03	0,00E+00	0,00E+00	0,00E+00	1,13E-02	-2,55E-02
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	-1,59E+01	2,01E+00	1,65E+01	2,63E+00	1,23E+00	2,16E-02	0,00E+00	0,00E+00	0,00E+00	-3,01E+01	-9,99E-01
Consumption of non-renewable primary energy resources used as raw materials	MJ	1,96E+01	0,00E+00	9,88E-02	1,97E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,07E+01	8,73E-01
Total consumption of non-renewable primary energy resources	MJ	3,79E+00	2,01E+00	1,66E+01	2,24E+01	1,23E+00	2,16E-02	0,00E+00	0,00E+00	0,00E+00	6,18E-01	-1,26E-01
Consumption of secondary materials	kg	9,89E-01	8,99E-04	1,30E-03	9,92E-01	4,14E-04	1,88E-06	0,00E+00	0,00E+00	0,00E+00	2,79E-04	-2,49E-02
Consumption of renew. secondary fuels	MJ	2,81E-05	1,18E-05	6,23E-06	4,61E-05	4,56E-06	9,49E-09	0,00E+00	0,00E+00	0,00E+00	3,79E-06	0,00E+00
Consumption of non-renewable secondary fuels	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	0,00E+00	-8,62E-07
Net consumption of freshwater	m^3	2,27E-03	2,43E-04	7,11E-03	9,62E-03	1,55E-04	6,21E-05	0,00E+00	0,00E+00	0,00E+00	5,47E-04	-8,44E-05

Table 8. Life cycle assessment (LCA) results for specific product – waste categories (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	1.26E-02	2.88E-03	1.51E-01	1.67E-01	1.38E-03	1.68E-04	0.00E+00	0.00E+00	0.00E+00	4.44E-08	-3.72E-04
Non-hazardous waste	kg	6.25E-01	6.18E-02	6.04E+00	6.73E+00	2.46E-02	1.13E-02	0.00E+00	0.00E+00	0.00E+00	1.16E-01	-3.16E-02
Radioactive waste	kg	1.12E-05	5.92E-07	2.59E-06	1.44E-05	9.21E-08	3.25E-09	0.00E+00	0.00E+00	0.00E+00	3.30E-06	-5.01E-07
Components for re-use	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	0.00E+00	0.00E+00
Materials for recycling	kg	6.55E-01	2.41E-05	1.24E-02	6.68E-01	3.82E-06	1.45E-07	0.00E+00	0.00E+00	0.00E+00	4.13E-06	-1.97E-05
Materials for energy recovery	kg	3.32E-07	1.28E-07	1.61E-07	6.21E-07	3.09E-08	2.33E-10	0.00E+00	0.00E+00	0.00E+00	5.15E-08	-4.10E-09
Exported Energy	MJ	9.96E-03	8.80E-04	6.38E-03	1.72E-02	0.00E+00	6.92E-05	0.00E+00	0.00E+00	0.00E+00	6.30E-01	-3.99E-04

Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years, if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804+A2 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Halina Prejzner, PhD. Eng. LCI audit and verification: Filip Poznański, M.Sc. Eng. LCA, LCI audit and input data verification: Michał Piasecki, PhD., D.Sc., Eng.

Note 1: The declaration owner has the sole ownership, liability, and responsibility for the information provided and contained in EPD. Declarations of construction products may not be comparable if they do not comply with EN 15804+A2. For further information about comparability, see EN 15804+A2 and ISO 14025.

Note 2: ITB is a public Research Organization and Notified Body (EC Reg. no 1488) to the European Commission and to other Member States of the European Union designated for the tasks concerning the assessment of building products' performance. ITB acts as the independent, third-party verification organization (ISO 17025/17065/17029). ITB-EPD program is recognized and registered member of The European Platform - Association of EPD program operators and ITB-EPD declarations are registered and stored in the international ECO-PORTAL.

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- National Technical Assessment- ITP-PIB-KOT-2023/47
- ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- https://ecoinvent.org/

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CERTIFICATE № 848/2025
of TYPE III ENVIRONMENTAL DECLARATION

Products:

Profiles and hydro-geotechnical systems

Manufacturer:

Pietrucha International Sp. z o.o.

ul. Przemysłowa 10, 98-235 Błaszki, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

EN 15804+A2

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued on 19th September 2025 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, September 2025