Type III Environmental Product Declaration No. 600/2024

Issuance date: 13.02.2024
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Polystyrene boards with recycled raw content min. 15%

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-A3, A4, C1-C4 and D modules in accordance with EN 15804
(Cradle-to-Gate with options)
Product Standards: EN 13163+A2
The year of preparing the EPD: 2024
Service Life: RSL depends on the specific installation and the exposure
PCR: ITB-PCR A, EN 16783:2017
Declared unit: 1 m^3
Reasons for performing LCA: B2B
Representativeness: Poland, European, 2022

MANUFACTURER

Tyron is a manufacturer of expanded polystyrene insulation, which are expanded polystyrene panels and roof system (TYRON ROOF). The factory is located in Kluczbork, the Opole province (Poland) and is the largest factory in the region. Expanded polystyrene panels TYRON received Certificate issued by the Building Research Institute (ITB) in Warsaw, Department of Certification. EPS products meet the provisions of standard PN-EN 13163. The company goal is to provide customers with high quality products. This EPD covers TYRON Polystyrene Boards produced in Kluczbork (Poland).

PRODUCT DESCRIPTION

TYRON polystyrene boards are made of expanded polystyrene. The main parameters are:

- thickness: from 10 to 300 mm
- dimensions: 500x1000mm; 1000x1000mm; 1000x2000mm
- finish: straight or milled board
- color: white, grey, blue - depending on the type

Boards are widely used in building and construction industry thanks to its insulation properties, chemical inertness, bacterial & pest resistance, etc. Its closed cell structure allows only little water absorption. It is durable, strong and can be used as insulated panel systems for facades, walls, roofs and floors in buildings, as flotation material in the construction of marinas and pontoons and as a lightweight fill in road and railway construction. Expanded polystyrene insulation offers numerous environmental advantages, including:

- Reduced energy consumption
- Recycled content
- Localized distribution and
- Improved indoor air quality

A detailed overview of the products and their technical data are available on the manufacturer's website.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 m^3 of product of EPS. Tyron's average weight EPS product has calculated density of 16 kg/m^3. Coefficients to convert the LCA results to other densities are given in Table 7.

System boundary

The life cycle analysis of the declared products includes the "Product stage" A1-A3, A4 and the modules related to the end of life cycle C1-C4 and D (so-called From the cradle to the factory gate with options) in accordance with EN 15804 + A2 and ITB PCR A. The calculations take into account input materials and energy consumption, inventoried in representative factory (Kluczbork). The assessment took into account all relevant parameters from the collected production data, i.e. all material used in the EPS recipe, blowing agent, heat energy used, internal fuel and electricity consumption. It is assumed that the sum of omitted processes does not exceed 1% of all impact categories. In accordance with the EN 15804 guidelines, machinery and equipment (capital goods) required for production were excluded from the calculations, as was the transport of employees.

Allocation

The allocation rules used for this EPD are based on general ITB-PCR A and EN 16783.

Impacts related to the extraction and processing of raw materials, including the production of polystyrene, n-pentane, flame retardants, packaging materials (foil), energy carriers and water were allocated to module A1 (production of raw materials). About 98% of all impacts from production lines have been inventoried and assigned to the production of EPS polystyrene boards. The calculations also took into account the disposal of packaging materials. Module A2 (transport) covers the transport of raw materials such as EPS, auxiliary materials from suppliers to production plants. Municipal and technological waste of factories has been assigned to module A3 (factory production). Energy resources were inventoried for all factories and 100% allocated to the production of EPS products. Factory emissions have been estimated using national conversion factors (KOBiZE - 2021) and assigned to module A3.

System limits

All raw materials submitted for the formulations and production data were taken into consideration. In the assessment, all available data from production have been considered, i.e. all raw materials/elements used as per formulation process, utilized thermal energy for heating, and electric power consumption. Thus, material and energy flows contributing less than 1 % of mass or energy have been considered. It can be assumed that the total sum of neglected processes does not exceed 1 % of energy usage and mass per modules A or D. Machines and facilities required during production are neglected. The production of etiquettes was not considered.

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

Polystyrene, which is an intermediate in the production of commercial polystyrene, is in the form of hard, glassy granules with a diameter of 0.2 to 2.5 mm. It is transported to the plants producing polystyrene products in special containers. The manufacturer declared the addition of min. 15 recycled polystyrene inputs to production. EPS insulation is a foamed porous plastic and is free from chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs). All components used for LCA calculations come from the LCI questionnaires and the Ecoinvent v 3.10 database. Data on transport of the different products to the manufacturing plants is collected and

modelled for factory by assessor. Means of transport include trucks and Polish and European fuel averages are applied.

Module A3: *Production*

Thermal insulation polystyrene boards intended for construction applications are made in a multi-stage process. Pre-foaming is the process of softening raw material granules (polystyrene) using steam at a temperature above 90°C. This process takes 2 to 5 minutes. During this time, the polystyrene granules expand, increasing their volume from 15 to 65 times. Directly after foaming, the process of cooling the foamed particles takes place. The resulting particles of expanded polystyrene must undergo the seasoning stage in airy silos before further processing. In this way, by diffusion, air enters their interior, giving them the stability necessary in the following stages. The granules of pre-expanded polystyrene are poured into large cuboidal forms and expanded again using steam at a temperature of 110°C to 120°C, under the influence of which they combine to form a closed, foam structure At this stage, recycled granulate is added to the production in amounts of at least 15% by weight in relation to the polystyrene granulate. After cooling, the polystyrene blocks are taken out of the molds and seasoned. Cutting blocks into boards of the desired dimensions is carried out using thermal-mechanical devices. Additional edge profiling is performed by milling. The waste (cuttings) generated during the cutting of blocks into boards are subject to internal recycling and re-used in the production cycle. The block diagram in Figure 1 shows the basic elements of the technological process of an EPS production.

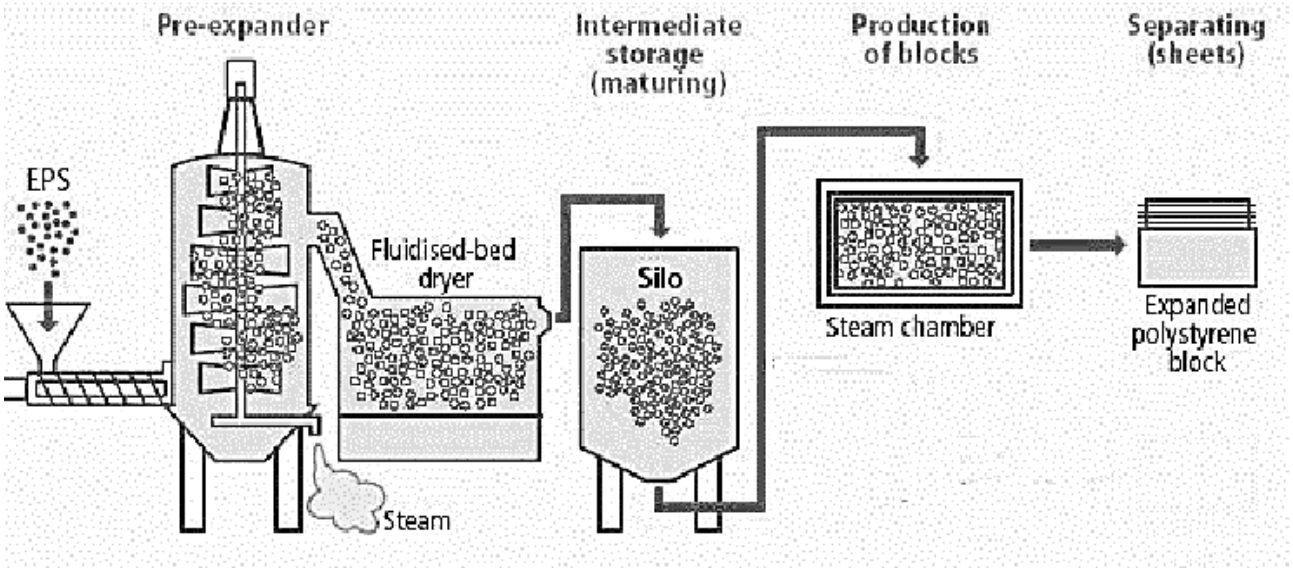

Figure 1. The technological process of an EPS production.

Module A4: transport to consumer

Vehicle transport at distance 500 km is considered (Euro 5).

Modules C1 - C4: End of life cycle

The product (C1) is removed mechanically from the building. The end-of-life scenarios include transport to an incinerator or landfill (C2). The adopted scenarios result from the assumed duration of EPS use in the building. EPS has significant recycling potential. With shorter-than-expected lifetimes, EPS reuse and recycling technologies are developed that are not included in this declaration. Two separate end-of-life scenarios were adopted (Table 1).

Table 1. Two end-of-life scenarios (modules C3 and C4) for EPS products

Scenarios	Mass included
Incineration of EPS - scenario no 1	100%
Landfill of EPS- scenario no 2	100%

Module D - profits and losses outside the product system

Environmental gains occurring outside the product system, included in the adopted calculation model, result from waste incineration after the end of their life cycle (alternative fuel replacing conventional fossil fuels).

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2022 – 31.12.2022 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Data quality

Data for LCA calculations come from verified databases: Ecoinvent v.3.10 (styrene / EPS, chemicals, transport), films/foils (Plastic Europe), KOBiZE (energy carriers: electricity, crude oil, ON, natural gas and LPG). Specific data quality analysis was a part of external audit. Data quality is assessed as very good.

Assumptions and estimates

The impacts of the representative products were aggregated using weighted average.

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN 15804+A2. Emission of greenhouse gases was calculated using the IPCC 2013 GWP method with a 100-year horizon. Emission of acidifying substances, Emission of substances to water contributing to oxygen depletion, Emission of gases that contribute to the creation of ground-level ozone, Abiotic depletion, and ozone depletion emissions where all calculated with EN 15804+A2 baseline methods.

Additional information

Polish electricity (Ecoinvent supplemented by actual national KOBiZE data) emission factor used is 0.698 kg CO_2/kWh.
As a general rule, no particular environmental or health protection measures other than those specified by law are necessary.

Recycled material content

As calculated the recycled content in expanded polystyrene boards (EPS) produced by Tyron is 2.4 kg/m^3. Calculation is based on the recycled content weight and verified according to ISO 14021:2016 using the 2022 raw material and production data.

HEALTH and VOC

Some member states require special documentation on VOC emissions into indoor air for specific areas of application. According to the VOC emission tests carried out by the ITB for PSPS after 28 days (floor or ceiling) using the chamber method, the TVOC concentration (by emission from EPS) statistically should be below 70 µg/m^3.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 m^3 of EPS by Tyron. The following life cycle modules (Table 2) were included in the analysis. The following tables 3-6 show the environmental impacts of the life cycle of selected modules (A1-A4, C1-C4, and D).

Table 2. System boundaries for the environmental characteristic of the EPS

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**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MD**	**MD**	**MD**	**MD**	**MD**

Table 3. Life cycle assessment (LCA) results of the EPS boards – environmental impacts (DU: 1 m^3, density= 16 kg/m^3)

Indicator	Unit	A1	A2	A3	A1-A3	A4	C1	C2	C3 Scenario 1	C4 Scenario 2	D
Global Warming Potential	eq. kg CO_2	4.44E+01	2.70E+00	4.56E+00	5.17E+01	1.33E+00	1.11E+00	5.31E-02	4.10E+01	1.69E-01	-2.24E+01
Greenhouse potential - fossil	eq. kg CO_2	4.44E+01	2.69E+00	4.50E+00	5.16E+01	1.32E+00	1.09E+00	5.29E-02	4.15E+01	1.67E-01	-2.24E+01
Greenhouse potential - biogenic	eq. kg CO_2	3.41E-01	6.02E-03	5.38E-02	4.00E-01	4.52E-03	3.18E-02	1.81E-04	8.43E-06	1.69E-03	-1.07E-02
Global warming potential - land use and land use change	eq. kg CO_2	4.98E-04	7.24E-04	6.47E-04	1.87E-03	5.19E-04	3.82E-04	2.07E-05	1.08E-05	1.70E-04	-9.74E-04
Stratospheric ozone depletion potential	eq. kg CFC 11	3.99E-08	5.41E-07	6.71E-07	1.25E-06	3.06E-07	2.23E-08	1.22E-08	4.29E-08	5.09E-08	-2.21E-06
Soil and water acidification potential	eq. mol H+	1.67E-01	3.62E-02	3.70E-02	2.40E-01	5.36E-03	1.21E-02	2.15E-04	9.24E-01	1.41E-03	-2.42E-02
Eutrophication potential - freshwater	eq. kg P	5.44E-04	1.57E-04	2.71E-03	3.41E-03	8.88E-05	2.07E-03	3.55E-06	1.01E-05	4.86E-05	-2.95E-04
Eutrophication potential - seawater	eq. kg N	2.59E-02	1.57E-02	6.92E-03	4.85E-02	1.62E-03	1.75E-03	6.48E-05	4.65E-01	4.87E-04	-4.37E-03
Eutrophication potential - terrestrial	eq. mol N	2.85E-01	1.71E-01	5.72E-02	5.13E-01	1.77E-02	1.48E-02	7.06E-04	5.09E+00	5.30E-03	-4.73E-02
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.24E-01	4.49E-02	2.00E-02	1.89E-01	5.41E-03	4.13E-03	2.16E-04	1.26E+00	1.53E-03	-2.24E-02
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	6.96E-06	1.54E-05	7.99E-06	3.04E-05	4.68E-06	5.31E-06	1.87E-07	1.59E-07	5.67E-07	-1.61E-05
Abiotic depletion potential - fossil fuels	MJ	1.06E+03	3.49E+01	6.17E+01	1.16E+03	1.96E+01	1.84E+01	7.85E-01	7.79E-01	3.87E+00	-3.09E+02
Water deprivation potential	eq. m^3	2.90E+01	1.29E-01	7.64E-01	2.99E+01	9.07E-02	3.82E-01	3.63E-03	7.48E-01	2.25E-02	-2.02E-01

Table 4. Life cycle assessment (LCA) results of the EPS – additional impacts indicators (DU: 1 m^3)

Indicator	Unit	A1-A3	A4	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 5. Life cycle assessment (LCA) results of the EPS boards - the resource use (DU: 1 m^3)

Indicator	Unit	A1	A2	A3	A1-A3	A4	C1	C2	C3 Scenario 1	C4 Scenario 2	D Scenario 1
Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of renewable primary energy resources	MJ	4.14E+00	3.83E-01	1.88E+00	6,40E+00	2.81E-01	1.37E+00	1.13E-02	1.21E-02	6.79E-02	-7.13E-01
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of non-renewable primary energy resources	MJ	1.05E+03	3.77E+01	6.49E+01	1,16E+03	1.96E+01	1.85E+01	7.85E-01	7.79E-01	4.18E+00	-3.43E+02
Consumption of secondary materials	kg	2.40E+00	0.00E+00	7.95E-02	2,33E+00	6.58E-03	1.69E-03	2.63E-04	1.03E-04	0.00E+00	1.61E+01
Consumption of renew. secondary fuels	MJ	2.24E-05	0.00E+00	1.40E-05	3,64E-05	7.25E-05	9.40E-06	2.90E-06	2.70E-06	0.00E+00	-5.61E-05
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	1.90E-02	1,90E-02	0.00E+00	1.49E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net consumption of freshwater	m^3	6.74E-01	1.78E-03	5.66E-02	7,32E-01	2.47E-03	5.01E-03	9.87E-05	6.36E-03	6.03E-04	-4.14E-03

Table 6. Life cycle assessment (LCA) results of the EPS – waste categories (DU: 1 m^3)

Indicator	Unit	A1	A2	A3	A1-A3	A4	C1	C2	C3 Scenario 1	C4 Scenario 2	D Scenario 1
Hazardous waste	kg	5.67E-01	1.13E-04	8.76E-03	5.76E-01	2.20E-02	1.91E-04	8.80E-04	1.59E-02	6.09E-06	-3.09E-04
Non-hazardous waste	kg	1.15E+00	8.95E-02	1.17E-01	1.36E+00	3.91E-01	9.92E-03	1.56E-02	4.29E-02	1.59E+01	-1.65E-01
Radioactive waste	kg	8.68E-06	2.40E-04	2.92E-04	5.41E-04	1.46E-06	1.38E-05	5.86E-08	3.18E-08	2.35E-05	-6.29E-05
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
Materials for recycling	kg	2.21E-03	0.00E+00	1.59E-01	1.61E-01	6.07E-05	1.91E-05	2.43E-06	1.27E-06	0.00E+00	-7.14E-04
Materials for energy recovery	kg	2.40E-07	0.00E+00	2.45E-07	4.85E-07	4.91E-07	1.67E-07	1.96E-08	1.56E-07	0.00E+00	-2.30E-06
Exported Energy	MJ	1.59E+00	0.00E+00	8.04E-02	1.68E+00	0.00E+00	5.50E-02	0.00E+00	2.54E-04	0.00E+00	-1.49E-01

Conversion factors to EPS product with specific density

To convert the environmental impacts from Tables 3-6 (with weighted average density 16 kg/m^3) for other specific EPS product densities, the conversion factors from Table 7 should be used.

Table 7. The conversion factors for EPS products with specific density

Product name	kg/m^3	Conversion factor
A100/036/0000/0000/0000/BLO	18	1.13
A120/035/0000/0000/0000/BLO	20	1.25
D100/038/0000/0000/0000/BLO	18	1.13
DS10/036/0000/0000/0000/BLO	19	1.19
F120/036/0000/0000/0000/BLO	20	1.25
F150/036/0000/0000/0000/BLO	24	1.50
F200/036/0000/0000/0000/BLO	28	1.75
FS60/032/0000/0000/0000/BLO	12.5	0.78
FS60/033/0000/0000/0000/BLO	11.5	0.72
FS60/040/0000/0000/0000/BLO	12.5	0.78
FS70/038/0000/0000/0000/BLO	13.5	0.84
FSAD/042/0000/0000/0000/BLO	11	0.69
G100/031/0000/0000/0000/BLO	18	1.13
GPLU/031/0000/0000/0000/BLO	13	0.81
GR70/031/0000/0000/0000/BLO	14	0.88
P200/036/0000/0000/0000/BLO	28	1.75
PSUP/038/0000/0000/0000/BLO	15	0.94
SCIA/045/0000/0000/0000/BLO	10	0.63
SP10/038/0000/0000/0000/BLO	18	1.13
SP70/038/0000/0000/0000/BLO	13.5	0.84

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 and ITB PCR A
Independent verification corresponding to ISO 14025 (sub clause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Halina Prejzner, PhD. 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 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: Note: 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
- EN 16783:2017 Thermal insulation products - Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations
- 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+A1:2013 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- EN 15942:2011 Sustainability of construction works - Environmental product declarations - Communication format business-to-business
- Wartości opałowe (WO) i wskaźniki emisji CO_2 (WE) do raportowania w ramach Systemu Handlu Uprawnieniami do Emisji za rok 2021, KOBiZE 2022.

Signature Not Verified
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Thermal Physics, Acoustics and Environment Department
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CERTIFICATE № 600/2024
of TYPE III ENVIRONMENTAL DECLARATION

Products:

Polystyrene boards with recycled raw content min. 15%

Manufacturer:

TYRON Sp. z o.o.
ul. Sienkiewicza 22, 46-200 Kluczbork, 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 13th February 2024 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, February 2024