Type III Environmental Product Declaration No. 310/2022

Issuance date: 23.03.2022
Validity date: 23.03.2027

Monostrand Systems

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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. Their aspects were verified by the independent body according to ISO 14025. Basically, a 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, C2-C4 and D modules in accordance with EN 15804 (Cradle-to-Gate with options)

The year of preparing the EPD: 2022

Product standard: ETA 03/0036 of 29.01.2021

Service Life: 100 years

PCR: ITB-PCR A

Declared unit: 1 kg

Reasons for performing LCA: B2B

Representativeness: Polish, European

MANUFACTURER

DYWIDAG-Systems International (DSI) is an international construction company established in 1865, operating in more than 50 countries and at 15 regional manufacturing sites. The company develops, produces and supplies post-tensioning and geotechnical systems, intended for a dozen sectors such as bridges, slope stabilization, high rises, stadiums, wind towers, and dams. The company offers services that include the designing, planning and installation of the systems as well as quality management and on site supervision. DYWIDAG Sp. z o.o. is a Polish branch of DSI with the manufacturing plant located in Ruda Śląska (Figure 1), focused on the production of prestressing systems and cable suspension systems for bridge and wind farm construction.

Fig. 1. DYWIDAG Sp. z o. o. manufacturing plant located in Ruda Śląska (Poland).

PRODUCTS DESCRIPTION AND APPLICATION

Monostrand Systems are unbonded post-tensioning kits for prestressing of structures with monostrands, composed of unbonded monostrand tendon with one to five tensile elements and 7 wire prestressing steel strand with nominal diameter 15.7 mm and nominal tensile strengths 1 770 / 1 860 N/mm, factory provided with a corrosion protection system, comprising corrosion protection filling material and PE-sheathing. Monostrand Systems are typically applied in the construction of buildings and used in the transversal post-tensioning of bridges.

Features:

- length: 4 – 60 m
- corrosion protection is usually prefabricated with the tendon, delivered to site, and installed
- soft corrosion-protection compound such as grease, wax, or gel
- low induced stress range
- less fretting fatigue
- monitoring of stressing forces
- restressing possible, if required
- replaceable, if required

Table 1. Specification of the Monostrand Systems produced by Dywidag Sp. z o.o.

Designation of products	Description
GF	Monolitze with anchor
GM	Monolitze with anchor assembled on construction site
MEF	Monolitze with anchor assembled on construction site
MER	Monolitze with anchor assembled on construction site
SK	Monolitze with helix
SF	Only one strand
MZ	Monolitze with anchor assembled on construction site

More information can be found on the website https://dywidag.com/ or in European Technical Assessment:

- ETA-03/0036 of 29.01.2021,
- ETA-19/0077 of 29.01.2021,
- ETA-13/0814 of 29.01.2021.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Allocation

The allocation rules used for this EPD are based on general ITB PCR A. Production of the Monostrand Systems is a line process conducted in factory of DYWIDAG Sp. z o.o. located in Ruda Śląska (Poland). Allocation was done on product mass basis. All impacts associated with the extraction and processing of raw materials used for the production of the declared product are allocated in module A1 of the LCA. Impacts from the global line production of DYWIDAG Sp. z o.o. were inventoried and 12% were allocated to Monostrand Systems production. Water and energy consumption (electrical grid and natural gas), associated emissions and generated wastes are allocated to module A3. Packaging materials were takien into consideration.

System limits

The life cycle analysis (LCA) of the declared products covers: product stage – modules A1-A3, end of life – modules C2-C4 and benefits and loads beyond the system boundary – module D (cradle-to-gate with options) in accordance with EN 15804+A2 and ITB PCR A. Energy and water consumption, emissions as well as information on generated wastes were inventoried and were included in the calculations. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A2, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA.

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

Steel semi-products (~50% BOF and ~50% EAF processes), metal parts, PE tubes, screws, additives, ancillary materials and packaging materials come from both local and foreign suppliers. Means of transport include railway and lorries. European standards for average combustion were used for calculations.

Module A3: *Production*

The production of the Monostrand Systems is carried out in Polish factory of DYWIDAG Sp. z o.o. in Ruda Śląska. A scheme of the Monostrand Systems production process by DYWIDAG Sp. z o. o. is presented in Fig. 2.

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

In the adapted scenario, dismantling of the Monostrand Systems is performed with the use of heavy machinery as part of demolition processes of a construction object, where environmental impacts from declared products can be considered minor (<1%). There are no specific deconstruction methods, applied in Poland, in regard to the tendons. It is assumed that 100% of Monostrand Systems are recovered at the EoL cycle. The resulting scrap is transported to a waste processing plant distant by 75 km, on 7.5-16t lorry EURO 5 (module C2) where PE-sheathing and steel tendons are separated using electric cutting and stripping machine (module C3) and undergo either recycling or landfilling (module C4). Module D presents credits resulting from the recycling of the steel scrap.

Table 2. End-of-life scenario for the Monostrand Systems produced by DYWIDAG Sp. z o.o.

Material	Material recovery	Recycling	Landfilling
Polimer waste	100%	0%	100%
Steel scrap	100%	95%	5%

Data quality

The data selected for LCA analysis originate from ITB-LCI questionnaires completed by DYWIDAG Sp. z o.o. using the inventory data, ITB and Ecoinvent databases v.3.8. No specific data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency are judged as good.

Data collection period

Primary data provided by DYWIDAG Sp. z o.o. covers a period of 01.11.2020 – 31.10.2021 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Assumptions and estimates

The impacts of the representative of Monostrand Systems were aggregated using weighted average. Impacts were inventoried and calculated for all products of the Monostrand System.

Calculation rules

LCA was performed in accordance with EN15804+A2 and ISO 14067:2018.

Databases

The data for the processes comes from the following databases: Ecoinvent v.3.8. Specific data quality analysis was a part of an external audit.

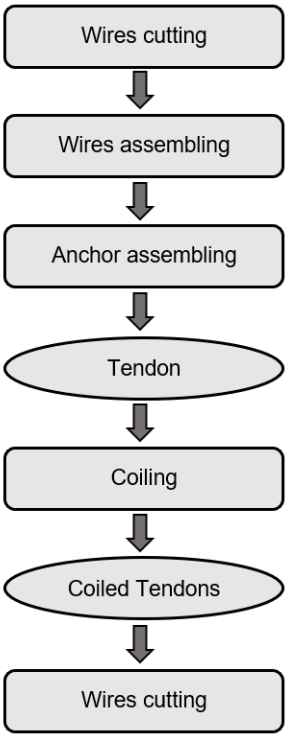

Fig. 2. The scheme of the Monostrand Systems production process by DYWIDAG Sp. z o. o.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 kg of the Monostrand Systems produced by DYWIDAG Sp. z o. o.

Table 3. System boundaries for the environmental characteristic of the Monostrand Systems

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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MD	MD	MD	MD

Table 4. Life cycle assessment (LCA) results of the Monostrand Systems manufactured by DYWIDAG Sp. z o. o. - environmental information describing waste categories (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Hazardous waste	kg	9.41E-04	2.23E-06	2.96E-04	1.24E-03	6.43E-07	6.94E-09	2.14E-08	-2.21E-05
Non-hazardous waste	kg	7.80E-01	4.40E-02	4.36E-01	1.26E+00	1.02E-02	1.98E-04	6.01E-02	-5.30E-01
Radioactive waste	kg	5.80E-05	5.78E-06	4.50E-06	6.83E-05	1.61E-06	2.87E-08	8.38E-08	-2.90E-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
Materials for recycling	kg	0.00E+00	0.00E+00	5.03E-02	5.03E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	6.75E-03	6.75E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 5. Life cycle assessment (LCA) results of the Monostrand Systems manufactured by DYWIDAG Sp. z o. o. – additional impacts indicators (DU: 1 kg)

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Particulate matter	disease incidence	INA	INA	INA	INA	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA	INA	INA	INA	INA

Table 6. Life cycle assessment (LCA) results of the Monostrand Systems manufactured by DYWIDAG Sp. z o. o. – *environmental aspects related to resource use (DU: 1 kg)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Global Warming Potential	eq. kg CO2	1.73E+00	5.67E-02	4.08E-01	2.19E+00	1.61E-02	2.24E-03	5.88E-04	-8.97E-01
Greenhouse gas potential - fossil	eq. kg CO2	1.71E+00	5.66E-02	4.02E-01	2.16E+00	1.61E-02	2.19E-03	5.82E-04	-8.67E-01
Greenhouse gas potential - biogenic	eq. kg CO2	1.20E-02	1.50E-04	5.96E-03	1.81E-02	5.03E-05	3.96E-05	5.55E-06	-5.22E-03
Global warming potential - land use and land use change	eq. kg CO2	9.07E-03	2.22E-05	8.04E-05	9.17E-03	7.57E-06	5.16E-07	5.86E-07	-4.29E-03
Stratospheric ozone depletion potential	eq. kg CFC 11	8.65E-08	1.31E-08	1.31E-08	1.13E-07	3.61E-09	3.94E-11	1.82E-10	-5.41E-08
Soil and water acidification potential	eq. mol H+	6.96E-03	2.30E-04	3.34E-03	1.05E-02	6.39E-05	2.18E-05	4.96E-06	-3.61E-03
Eutrophication potential - freshwater	eq. kg P	8.75E-04	3.64E-06	5.59E-04	1.44E-03	1.21E-06	3.73E-06	1.59E-07	-5.10E-04
Eutrophication potential - seawater	eq. kg N	1.51E-03	6.93E-05	4.78E-04	2.06E-03	1.86E-05	3.10E-06	1.71E-06	-7.78E-04
Eutrophication potential - terrestrial	eq. mol N	1.54E-02	7.56E-04	4.13E-03	2.03E-02	2.03E-04	2.66E-05	1.86E-05	-7.46E-03
Potential for photochemical ozone synthesis	eq. kg NMVOC	6.39E-03	2.31E-04	1.19E-03	7.81E-03	6.25E-05	7.45E-06	5.39E-06	-2.34E-03
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.19E-05	2.01E-07	4.97E-07	2.26E-05	7.49E-08	2.97E-09	1.92E-09	-7.72E-06
Abiotic depletion potential - fossil fuels	MJ	1.81E+01	8.40E-01	6.03E+00	2.50E+01	2.36E-01	3.35E-02	1.37E-02	-1.05E+01
Water deprivation potential	eq. m3	1.16E+00	3.85E-03	1.03E-01	1.27E+00	1.22E-03	6.82E-04	7.57E-05	-4.82E-01

Table 7. Life cycle assessment (LCA) results of the Monostrand Systems manufactured by DYWIDAG Sp. z o.o. – *environmental aspects related to resource use (DU: 1 kg)*

Indicator	Unit	A1	A2	A3	A1-A3	C2	C3	C4	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	2.35E+00	1.21E-02	3.66E-01	2.73E+00	4.06E-03	2.43E-03	2.28E-04	-1.55E+00
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.93E+01	9.08E-01	6.44E+00	2.66E+01	2.55E-01	3.55E-02	1.48E-02	-1.10E+01
Use of secondary material	kg	5.46E-01	0.00E+00	0.00E+00	5.46E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ	0.00E+00	4.54E-02	0.00E+00	4.54E-02	1.27E-02	0.00E+00	0.00E+00	0.00E+00
Use 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
Net use of fresh water	m^3	5.61E-03	4.18E-05	1.98E-03	7.63E-03	1.35E-05	1.09E-05	1.97E-06	-2.13E-03

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 (subclause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Halina Prejzner, PhD Eng LCA, LCI audit and input data verification: Justyna Tomaszewska, PhD Eng, j.tomaszewska@itb.pl Verification of LCA: Michał Piasecki, PhD, DSc, Eng

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- 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
- PN-EN ISO 14067:2018-10 Gazy cieplarniane -- Ślad węglowy wyrobów -- Wymagania i wytyczne dotyczące kwantyfikacji
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- ISO 20915:2018 Life cycle inventory calculation methodology for steel products
- EOTA. ETA 03/0036 of 29.01.2021 POST-TENSIONING SUSPA/DYWIDAG – Unbonded Monostrand System with 1 to 5 Monostrands
- KOBiZE Wskaźniki emisyjności CO_2, SO_2, NO_x, CO i pyłu całkowitego dla energii elektrycznej. Grudzień 2021

KIEROWNIK
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CERTIFICATE № 310/2022
of TYPE III ENVIRONMENTAL DECLARATION

Product:

Monostrand System

Manufacturer:

DYWIDAG Sp. z o.o. Polska

Hallera 78, 41-709 Ruda Śląska, 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 for the first time on 23rd March 2022 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, March 2022