Type III Environmental Product Declaration No. 140/2020

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Minova SDA system for self-drilling micropiles, soil nails & rock bolts

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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, D modules in accordance with EN 15804 +A2
(Cradle to Gate with options)

The year of preparing the EPD: 2020

The date of validation: July 2024

Product standard: EN 14490:2010, EN 14199:2015

Declared durability: Under normal conditions, Minova SDA systems for self-drilling micropiles, rock bolts and soil nails have reference service life (RSL) of 100 years

PCR: ITB PCR A (PCR v1.6. based on EN 15804+A2)

Declared unit: 1 Mg of Minova SDA systems for self-drilling micropiles, rock bolts and soil nails

Reasons for performing LCA: B2B, Polish, European

MANUFACTURER

Minova is one of the largest manufacturers of ground control systems, with a European manufacturing base located in Golce (Poland), specialising in the production of high-quality steel products for the mining and construction sectors, exporting across EU and non-EU markets. Products include resin bolts, expansion shell bolts, cable bolts, injection bolts, micropiles, soil nails, rock anchors, drilling and bolting equipment, monitoring equipment, tooling and bolting accessories. Various services including bolting installation & operation training, bolt design and application consultancy are also offered. Minova Poland is part of Minova International Ltd, a global manufacturer of ground support products and a part of the Orica Group.

Fig. 1. Manufacturing Plant in Golce.

Product Information

Soil nailing and rock bolting are construction methods used to maintain or improve the stability of soil and rock masses in accordance with the appropriate guidelines for geotechnical works. The nails and bolts are often combined with other elements, including shotcrete, steel face meshes, drainage and retaining walls to create the supporting structure of the reinforced masses of soil / rock. The general principles for the implementation of the soil nailing system are specified in standard EN 14490.

Micropiles are point-load bearing elements, that transfer tensile, compressive or alternating loads to the ground. The general rules for the implementation of micropile systems are specified in standard EN 14199.

The self-drilling system can be used both for nailing soil and rock bolting (SRN) and micropiles (MIP). Self-drilling systems provide an efficient and cost effective soil strengthening solution.

The hollow bar is equipped with rope (R) or trapezoidal (T) threads which makes it easy to combine with conventional drilling equipment.

The hollow rod is made of seamless steel pipes to create complete uniformity around the diameter if the bar. In order to improve corrosion resistance, the components of the self-drilling system can be galvanized or twin coated (galvanized with an additional double coating epoxy).The hollow rod is equipped with a left-hand thread or right type R or T which makes it easy to input and combining with conventional drilling equipment to drilling in rock.

The hollow rod is made of seamless steel pipes. R thread according to ISO standards and T thread as per factory standard are formed by a cold rolling process.

In order to improve corrosion resistance, components the components of the self-drilling system are galvanized or TwinCoat coated (coating galvanized with an additional double coating epoxy).

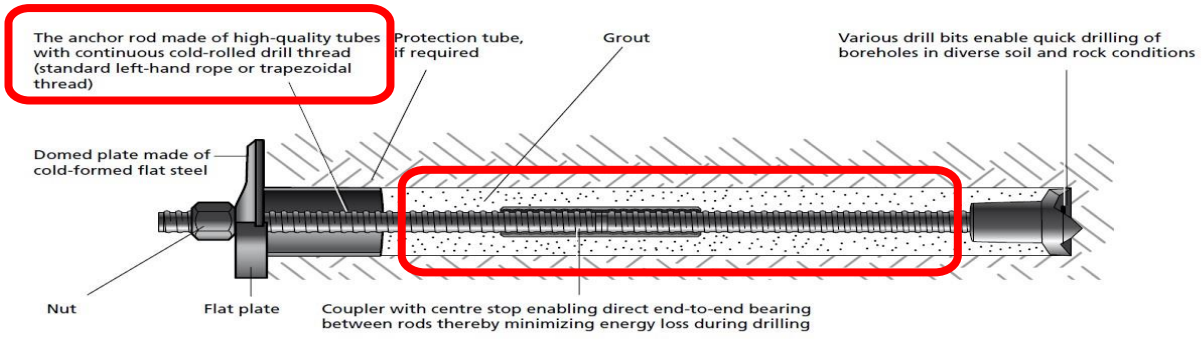

Fig. 2. System components of Minova SDA self-drilling reinforcing bar with element covered by this EPD.

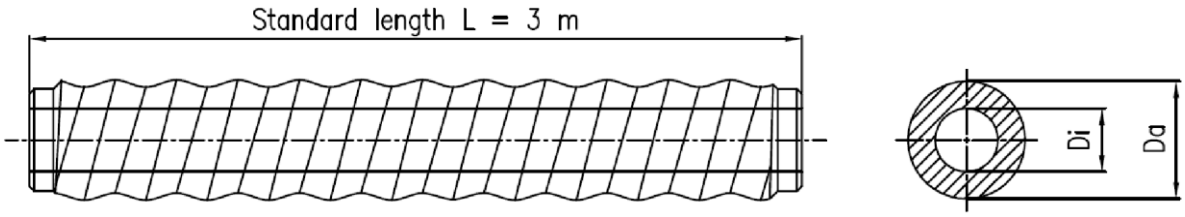

Fig. 3. Characteristics of the load bearing element – hollow-core bar (see table below).

Table 1. Selected characteristics of the load bearing element – hollow-core bar.

Products	Description	kg/m	Inner diameter (mm)	Outer diameter (mm)	Nominal cross sectional area (mm^2)
R25N	Holow bars with external thread	2.35	14.0	24.7	300
R28	Holow bars with external thread	3.40	12.0	28.0	440
R32L	Holow bars with external thread	2.75	20.6	31.3	350
R32N	Holow bars with external thread	3.40	18.5	31.3	430
R32S	Holow bars with external thread	4.10	15.0	31.3	520
R38N	Holow bars with external thread	5.90	19.0	38.0	750
R51L	Holow bars with external thread	7.05	33.3	50.0	900
R51N	Holow bars with external thread	8.40	30.2	50.0	1070
T51S	Holow bars with external thread	10.40	26.6	51.9	1325
T63N	Holow bars with external thread	13.50	40.6	64.9	1720
T76N	Holow bars with external thread	14.70	51.0	75.5	1870
T76S	Holow bars with external thread	18.85	44.0	75.4	2400
T111L	Holow bars with external thread	25.00	85.0	111.0	3185
T111N	Holow bars with external thread	34.50	75.5	111.0	4395

This Environmental Product Declaration covers elements of Minova SDA self-drilling bolts.

The Minova SDA system for self-drilling micropiles, rock bolts and nails includes:

- Hollow bars with round thread (R) and trapezoidal thread (T);
- Couplers with round thread (R) and trapezoidal thread (T);
- Nuts with round thread (R) and trapezoidal thread (T);
- Thrust plates with different diameters, square sides, sheet thicknesses and hole diameters; - Technological elements: spacers, drill bits etc.

Environmental characteristics (LCA) for elements of Minova SDA system for self-drilling micropiles, rock bolts and soil nails is presented in Tables 4-7.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 ton of product.

System boundary

The life cycle analysis of the declared products covers “Product Stage” A1-A3, A4-A5, C1-C4+D modules in accordance with EN 15804+A2 and ITB PCR A (cradle to gate with options). Energy and water consumption, emissions as well as information on generated wastes were inventoried in manufacturing plant and were included in the calculation. It can be assumed that the total sum of omitted processes does not exceed 2% 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.

Allocation

The allocation rules used for this EPD are based on general ITB-PCR A. Production of the elements of system is a line process in one factory of Minova Arnall Sp. z o.o. in Golce (Poland). Allocation was done on product mass basis. All impacts from raw materials extraction are allocated in A1 module of EPD. 100% of impacts from line production were inventoried and 18% were allocated to elements of Minova SDA system for selfdrilling micropiles, rock bolts and soil nails production. Municipal waste and waste water of whole factory were allocated to module A3. Electricity was inventoried for whole production process. Emissions are measured separately as well and presented in A3 module.

System limits

The life cycle analysis of the examined products covers A1-A3, C1-C4, D modules (Cradle to Gate with options) in accordance with EN 15804+A1 and ITB-PCR A. Details on systems limits are provided in product specific report. All materials and energy consumption inventoried in factory were included in calculation. Office impacts were also taken into consideration. In the assessment. all significant parameters from gathered production data are considered, i.e. all material used per formulation, utilized thermal energy, internal fuel and electric power consumption, direct production waste, and all available emission measurements. This study also takes into account some material flows of less than 1% and energy flows with a proportion of less than 1 %. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804. machines and facilities (capital goods) required for and during production are excluded. as is transportation of employees.

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

The modules A1 and A2 represent the extraction and processing of raw materials (mainly steel elements) and transport to the production site. Raw materials for elements of Minova SDA system for self-drilling micropiles, rock bolts and soil nails come from specific supplier. Data on transport of products to the manufacturing plant is collected and modelled for factory by assessor. Means of transport include road transport and Polish and European fuel averages are applied.

Module A3: *Production*

The Fig. 4 shows the working process during the production of elements of Minova SDA system for selfdrilling micropiles, rock bolts and soil nails. Manufacture covers all processes linked to

production, which comprises various related operations besides onsite activities, including Minova components production process, packaging and internal transportation. The manufacturing process also yields data on the combustion of refinery products, such as diesel and gasoline, related to the production process. Use of electricity, fuels and auxiliary materials in the production is taken into account using national data. The environmental profile of these energy carriers is Fig. 4 Production scheme of Minova modelled by ITB for average Polish and European Arnall at plant in Golce. Packaging-related flows in the production process and all upstream packaging are included in the manufacturing module. Apart from production of packaging material, the supply and transport of packaging material are also considered in the LCA model. It is assumed that packaging waste generated in the course of production and up-stream processes is 100% collected based on a multi-input and multi-output process specific to the elementary composition of the waste. Energy (e.g. electricity) are credited using national production averages.

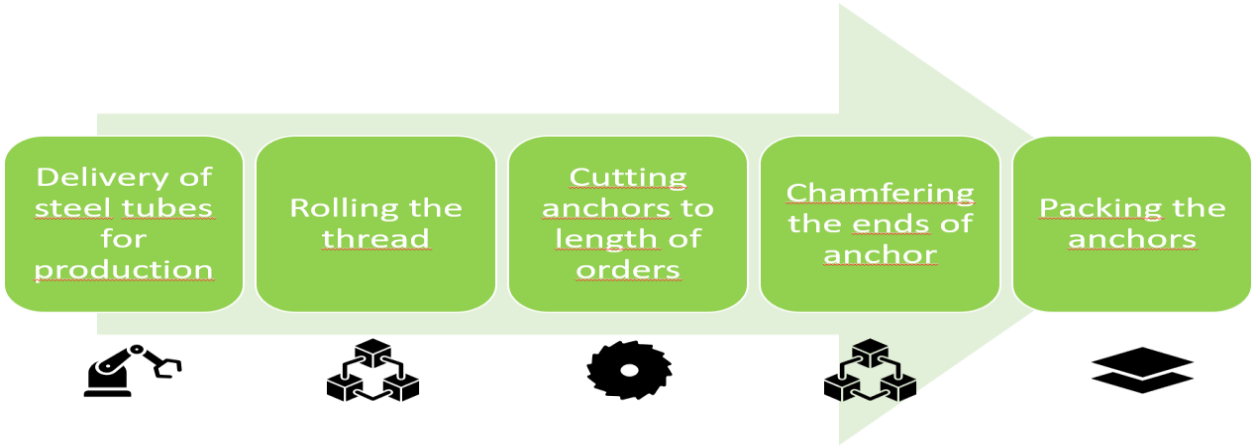

Fig. 4. A basic scheme of the steel product manufacturing process

Module A4-A5: Transport to construction site, installation

Transport to the customer over a distance of 100 km was assumed, > 16t lorry, EURO 5, with a 100% load capacity (35 l/100 km oil consumption). Installation is carried out using electrical equipment.

C1-C4: End of Life

Disposal and recycling scenario for used and demolished product including transport to disposal or recycling facility is covered.

Assumptions and estimates C1: Demolition

According to the intended use of the Minova SDA System, it is permanently built-up in building structures.

Nevertheless, it is assumed that at the end of life 10% of the product - shallow construction - is recovered by excavation. Fuel use for a hydraulic excavator has been included in relation to exhuming bolts. It is assumed that the lifting of 1 Mg of anchors requires as much energy as moving 1 m^3 of material with an excavator. This module takes into account 1% of losses resulting from the collection of mixed construction wastes.

C2: Transport to waste processing

Transport from a demolition site to a waste processing plant is estimated to an average 50 km on a 24 Mg loaded lorry and fuel consumption of 35 l per 100 km.

C3: Waste processing .

This module takes into account sorting, shredding and pressing of the waste bolts at the end-of-life.

C4: Disposal

Steel is 100% recyclable, thus it is estimated that at the end-of-life only 1% of the declared product is disposed to landfill in the form of mixed construction wastes. Utilization of products such as steel mounting elements or packaging tape which constitute less than 1% of the total system flows was not taken into consideration.

D: Re-use, recovery, recycling potential

Benefits and loads beyond the system boundary were calculated using a net scrap formulation proposed by World Steel Association in Life cycle inventory methodology report (2017) where the net scrap is determined as a difference between the amount of steel recycled at end-of-life and the scrap input from previous product life cycle (assumed 50%).

Table 2 Re-use, recovery and recycling potential – scenario information

Parameter	Value
Collection	10%
Loss (mixed construction waste)/landfill	1%
Recycling	9%

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2023 – 01.12.2023 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Data quality

The data selected for LCA originate from ITB-LCI questionnaires completed by Minova Arnall Sp. z o.o. using the inventory data, ITB and Ecoinvent v. 3.10. database. 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. The background data for the processes comes from the following databases: Ecoinvent v.3.10 (welding process, galvanizing process, transport, energy carriers, heat, diesel, paints, other) and KOBiZE (Polish electricity mix and combustion factors for fuels). KOBiZE data is supplemented with Ecoinvent data on the national electricity mix impact where no specific indicator data is provided. Specific (LCI) data quality analysis was a part of the input data verification. The time related quality of the data used is valid (5 years).

Assumptions and estimates

The impacts of the representative Minova Arnall Sp. z o.o. products were aggregated using weighted average. The weighted average method was used according to the mass per meter of each product in rock bolts and soil nails based on the relation to whole production quantity. Impacts for each product were inventoried and calculated.

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 the CML-IA baseline method

Additional information

Polish electricity mix used is 0.698 kg CO_2/kWh (KOBiZE).

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to 1 Mg (ton) of Minova SDA system for self-drilling micropiles, rock bolts and soil nails.

Table 3. System boundaries for the environmental characteristic of the elements

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 4. Life cycle assessment (LCA) results of the products manufactured by Minova – environmental impacts (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	1.38E+03	9.18E+01	1.30E+02	1.60E+03	1.67E+01	3.43E+00	6.85E-01	8.34E-01	5.18E-01	2.13E-01	-5.59E+02
Greenhouse gas potential - fossil	eq. kg CO_2	1.35E+03	9.14E+01	1.30E+02	1.57E+03	1.66E+01	3.43E+00	6.85E-01	8.31E+00	5.16E-01	2.10E-01	-5.61E+02
Greenhouse gas potential - biogenic	eq. kg CO_2	1.95E+01	3.12E-01	2.30E+00	2.21E+01	5.68E-02	1.00E-01	2.00E-02	2.84E-02	1.32E-03	2.12E-03	-2.40E+00
Global warming potential - land use and land use change	eq. kg CO_2	4.91E+00	3.59E-02	3.51E-02	4.98E+00	6.52E-03	1.20E-03	2.40E-04	3.26E-03	4.87E-04	2.13E-04	-2.18E-02
Stratospheric ozone depletion potential	eq. kg CFC 11	6.97E-05	2.12E-05	3.03E-06	9.39E-05	3.85E-06	7.00E-08	1.40E-08	1.92E-06	2.09E-07	6.40E-08	-1.94E-05
Soil and water acidification potential	eq. mol H+	5.70E+00	3.71E-01	1.31E+00	7.39E+00	6.75E-02	3.80E-02	7.60E-03	3.37E-02	4.85E-03	1.78E-03	-2.23E+00
Eutrophication potential - freshwater	eq. kg P	7.04E-01	6.15E-03	1.78E-01	8.88E-01	1.12E-03	6.50E-03	1.30E-03	5.59E-04	4.81E-05	6.11E-05	-2.37E-01
Eutrophication potential - seawater	eq. kg N	1.23E+00	1.12E-01	1.84E-01	1.53E+00	2.04E-02	5.50E-03	1.10E-03	1.02E-02	1.69E-03	6.13E-04	-4.87E-01
Eutrophication potential - terrestrial	eq. mol N	1.27E+01	1.22E+00	1.63E+00	1.55E+01	2.22E-01	4.65E-02	9.30E-03	1.11E-01	1.85E-02	6.66E-03	-5.33E+00
Potential for photochemical ozone synthesis	eq. kg NMVOC	5.13E+00	3.74E-01	4.65E-01	5.97E+00	6.80E-02	1.30E-02	2.60E-03	3.40E-02	5.37E-03	1.93E-03	-2.83E+00
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	1.75E-02	3.24E-04	4.06E-04	1.82E-02	5.89E-05	1.67E-05	3.34E-06	2.95E-05	1.18E-06	7.13E-07	-1.11E-02
Abiotic depletion - fossil fuels	MJ	1.48E+04	1.36E+03	1.88E+03	1.80E+04	2.47E+02	5.80E+01	1.16E+01	1.23E+02	1.41E+01	4.86E+00	-4.53E+03
Water deprivation potential	eq. m^3	7.67E+02	6.27E+00	3.01E+01	8.03E+02	1.14E+00	1.20E+00	2.40E-01	5.70E-01	4.49E-02	2.82E-02	-6.57E+01

Table 5. Life cycle assessment (LCA) results of the steel products manufactured by Minova– additional impacts indicators (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A4-A5	C1-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 steel products manufactured by Minova- the resource use (DU: 1 ton)

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	2.58E+00	1.95E+01	1.10E+02	1.32E+02	3,54E+00	4,30E+00	8,60E-01	1,77E+00	1,23E-01	8,54E-02	-3,84E+02
Consumption of renewable primary energy resources used as raw materials	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	0,00E+00
Total consumption of renewable primary energy resources	MJ	1.79E+03	1.95E+01	1.10E+02	1.92E+03	3,54E+00	4,30E+00	8,60E-01	1,77E+00	1,23E-01	8,54E-02	-3,84E+02
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	2.97E+01	1.36E+03	1.90E+03	3.20E+03	2,47E+02	5,82E+01	1,16E+01	1,23E+02	1,41E+01	5,26E+00	-4,33E+03
Consumption of non-renewable primary energy resources used as raw materials	MJ	2.15E+01	0.00E+00	0.00E+00	2.15E+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 non-renewable primary energy resources	MJ	1.57E+04	1.36E+03	1.90E+03	1.89E+04	2,47E+02	5,82E+01	1,16E+01	1,23E+02	1,41E+01	5,26E+00	-4,33E+03
Consumption of secondary materials	kg	6.00E+02	4.55E-01	1.59E-01	6.01E+02	8,27E-02	5,30E-03	1,06E-03	4,14E-02	2,97E-03	0,00E+00	-7,55E+01
Consumption of renewable secondary fuels	MJ	8.52E-05	5.01E-03	9.45E-04	6.04E-03	9,11E-04	2,95E-05	5,91E-06	4,56E-04	7,77E-05	0,00E+00	-1,03E-01
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	1.11E+00	1.11E+00	0,00E+00	4,70E-02	9,39E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Net consumption of freshwater resources	m^3	2.58E+00	1.95E+01	1.10E+02	1.32E+02	3,54E+00	4,30E+00	8,60E-01	1,77E+00	1,23E-01	8,54E-02	-3,84E+02

Table 7. Life cycle assessment (LCA) results of the steel products manufactured by Minova - waste categories (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A4	C1	C2	C3	C4	D
Hazardous waste	kg	4.15E+00	1.71E-01	6.11E-01	4.93E+00	3.10E-02	1.58E-02	3.15E-03	1.55E-02	1.55E-02	7.59E-04	-4.08E+00
Non-hazardous waste	kg	1.31E-01	1.52E+00	8.80E+00	1.05E+01	2.77E-01	6.00E-04	1.20E-04	1.38E-01	1.50E-02	7.66E-06	-5.74E-02
Radioactive waste	kg	6.76E+02	2.70E+01	1.16E+02	8.19E+02	4.92E+00	3.12E-02	6.24E-03	2.46E+00	2.12E-01	2.01E+01	-9.66E+01
Components for re-use	kg	5.11E-02	1.01E-04	1.78E-03	5.30E-02	1.84E-05	4.35E-05	8.70E-06	9.21E-06	9.39E-05	2.96E-05	-1.08E-02
Materials for recycling	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 energy recovery	kg	7.31E-04	4.20E-03	1.70E+02	1.70E+02	7.64E-04	6.00E-05	1.20E-05	3.82E-04	2.83E-05	0.00E+00	0.00E+00

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: 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
- 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
- ISO 20915:2018 Life cycle inventory calculation methodology for steel products
- KOBiZE Wskaźniki emisyjności CO_2, SO_2, NO_x, CO i pyłu całkowitego dla energii elektrycznej. December 2021
- World Steel Association 2017 Life Cycle inventory methodology report for steel products

Signature Not Verified
Dokument podpisany przez Michał Piasecki, ITB
Data: 2024.08.30 10:10:19 CEST

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CERTIFICATE № 140/2020
of TYPE III ENVIRONMENTAL DECLARATION

Product:

Minova SDA system for self-drilling micropiles, soil nails & rock bolts

Manufacturer:

Minova Arnall Sp. z o.o.
Golce 100, 42-134 Truskolasy, 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

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

This certificate, issued for the first time on 11th December 2020 is valid for 5 years or until amendment of mentioned Environmental Declaration

Deputy 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, December 2020