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

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EPD program operator:

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ITB is the verified member of The European Platform for EPD program operators and LCA practitioners.

Manufacturer:

MINOVA Arnall Sp. z o. o.
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Basic information

This declaration is the type III Environmental Product Declaration (EPD) based on EN 15804 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 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1-A3, C1-C4, D modules in accordance with EN 15804 (Cradle to Gate with options)
The year of preparing the EPD: 2020
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 based on EN 15804)
Declared unit: 1 Mg of Minova SDA systems for self-drilling micropiles, rock bolts and soil nails
Reasons for performing LCA: B2B
Representativeness: Polish product

Manufacturer Information

Minova is one of the largest manufacturers of ground control systems, with a European manufacturing base 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. Plant in Golce.

Product Information

Soil nailing and rock bolting

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

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).

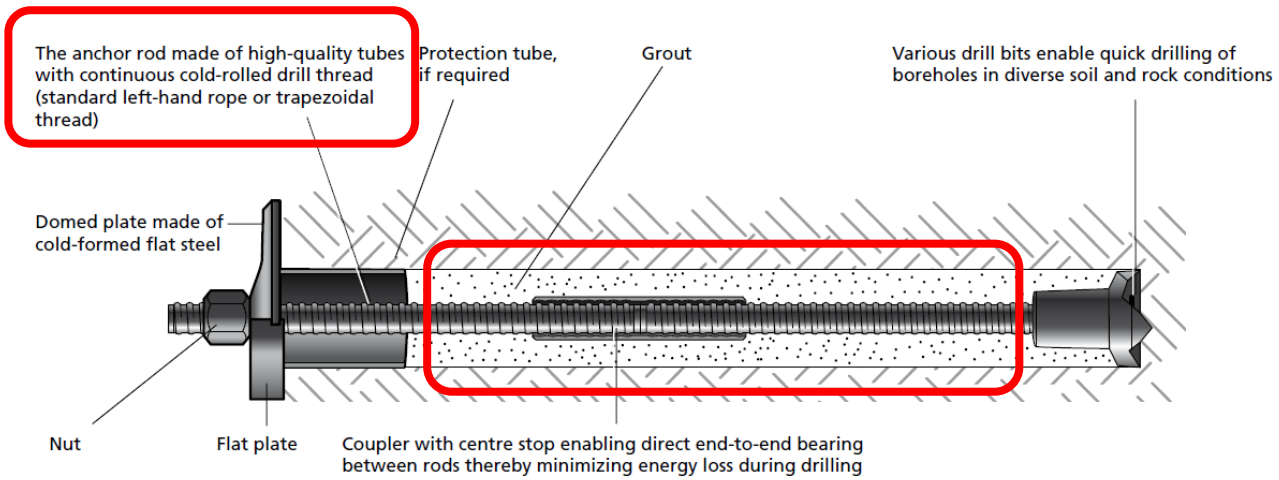

Fig. 2. System components of Minova SDA self-drilling reinforcing bar with element covered by this EPD.

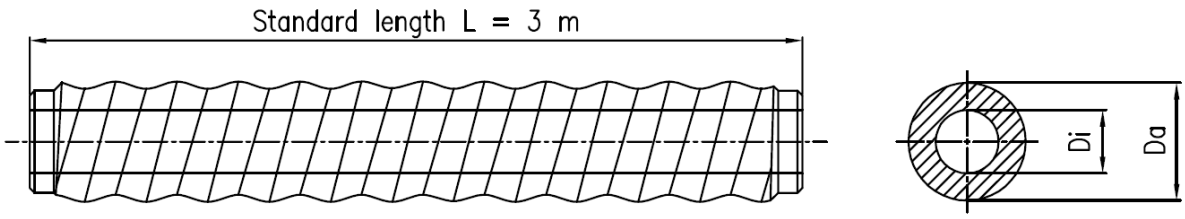

Fig. 3. Characteristics of the load bearing element – hollow-core bar (see table below).

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 below.

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 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 self-drilling 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.

A1 and A2 Modules: Raw materials supply and transport

Raw materials (hollow bars) for elements of Minova SDA system for self-drilling micropiles, rock bolts and soil nails come from one 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.

A3: Production

The Fig. 4 shows the working process during the production of elements of Minova SDA system for self-drilling micropiles, rock bolts and soil nails.

Manufacture covers all processes linked to production, which comprises various related operations besides on-site 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.

Schematic diagram of the industrial process

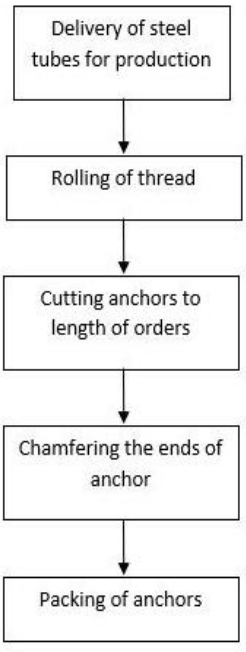

Fig. 4 Production scheme of Minova Arnall at plant in Golce.

The environmental profile of these energy carriers is modelled by ITB for average Polish and European conditions. 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.

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 with 85% capacity utilization 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 60%).

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 manufacturing of the examined products refer to period between November 2019 – November 2020. The life cycle assessments were prepared for Poland as reference area.

Data quality

The values determined to calculate the LCA originate from verified Minova Arnall Sp. z o.o. inventory data.

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 done in accordance with PCR A document.

Databases

The data for the processes come from the following databases: Worldsteel association, Ecoinvent. ITB-Data. Specific data quality analysis was a part of external ISO 14001 audit. Characterization factors are CML ver. 4.2 based on EN 15804:2013+A1 version, (PN EN 15804+A1:2014-04)

LIFE CYCLE ASSESSMENT (LCA) - Results

Declared unit

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

Table 3. System boundaries for environmental characteristic for Minova SDA system for self-drilling micropiles, rock bolts and soil nails

Environmental assessment information (MNA – Module not assessed. MD – Module 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	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MD	MD	MD	MD	MD

Elements of Minova SDA system for self-drilling micropiles, rock bolts and soil nails

Environmental impacts: (1 Mg)					
Indicator	**Unit**	**A1**	**A2**	**A3**	**A1-A3**
Global warming potential	[kg CO2 eq.]	2.10E+03	4.08E+01	4.69E+01	2.19E+03
Depletion potential of the stratospheric ozone layer	[kg CFC 11 eq.]	9.86E-05	0.00E+00	0.00E+00	9.86E-05
Acidification potential of soil and water	[kg SO_2 eq.]	3.41E+00	2.98E-01	1.23E-01	3.83E+00
Eutrophication potential	[kg $(PO_4)^{3-}$ eq.]	1.58E-01	2.17E-02	2.70E-02	2.07E-01
Formation potential of tropospheric ozone	[kg Ethene eq.]	4.30E-01	5.25E-02	4.47E-03	4.87E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	[kg Sb eq.]	2.96E+00	0.00E+00	1.74E-04	2.96E+00
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ]	2.00E+04	5.82E+02	1.12E+03	2.17E+04
Environmental aspects on resource use: (1 Mg)					
Indicator	**Unit**	**A1**	**A2**	**A3**	**A1-A3**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	9.61E+02	4.70E-01	4.92E+01	1.01E+03
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	2.20E+04	6.40E+02	1.24E+03	2.39E+04
Use of secondary material	[kg]	2.37E+02	0.00E+00	0.00E+00	2.37E+02
Use of renewable secondary fuels	[MJ]	2.99E+01	INA	INA	INA
Use of non-renewable secondary fuels	[MJ]	7.64E-03	INA	INA	INA
Net use of fresh water	[dm^3]	7.02E+00	5.53E+01	1.33E+02	1.95E+02
Other environmental information describing waste categories: (1 Mg)					
Indicator	**Unit**	**A1**	**A2**	**A3**	**A1-A3**
Hazardous waste disposed	[kg]	1.68E+01	5.17E-05	3.42E-01	1.71E+01
Non-hazardous waste disposed	[kg]	4.89E+01	4.80E-02	1.03E+01	5.92E+01
Radioactive waste disposed	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Components for re-use	[kg]	2.37E+02	0.00E+00	0.00E+00	2.37E+02
Materials for recycling	[kg]	1.06E+02	0.00E+00	5.26E+01	1.59E+02
Materials for energy recover	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	[MJ per energy carrier]	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Elements of Minova SDA system for self-drilling micropiles, rock bolts and soil nails

Environmental impacts: (1 Mg)						
Indicator	**Unit**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	[kg CO2 eq.]	4.68E-02	3.82E-01	6.67E+00	5.96E-02	-3.76E+01
Depletion potential of the stratospheric ozone layer	[kg CFC 11 eq.]	6.01E-09	0.00E+00	7.06E-07	1.91E-08	2.83E-06
Acidification potential of soil and water	[kg SO_2 eq.]	3.72E-04	2.79E-03	5.47E-02	4.86E-04	-1.44E-02
Eutrophication potential	[kg $(PO_4)^{3-}$ eq.]	4.35E-05	2.03E-04	3.27E-03	1.71E-05	-1.68E-04
Formation potential of tropospheric ozone	[kg Ethene eq.]	8.09E-05	4.92E-04	2.42E-02	5.41E-04	-1.61E-02
Abiotic depletion potential (ADP-elements) for non-fossil resources	[kg Sb eq.]	7.18E-11	0.00E+00	0.00E+00	8.18E-04	-6.41E-02
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	[MJ]	6.40E-01	3.60E+00	9.50E+01	1.68E+00	-3.26E+02
Environmental aspects on resource use: (1 Mg)						
Indicator	**Unit**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	9.00E-04	4.89E-03	1.58E+01	9.45E-02	-3.64E+01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	[MJ]	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	[MJ]	7.00E-01	3.96E+00	1.05E+02	1.80E+00	-3.58E+02
Use of secondary material	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of renewable secondary fuels	[MJ]	INA	INA	INA	INA	INA
Use of non-renewable secondary fuels	[MJ]	INA	INA	INA	INA	INA
Net use of fresh water	[dm^3]	1.22E-04	3.42E-01	0.00E+00	0.00E+00	-2.00E-01
Other environmental information describing waste categories: (1 Mg)						
Indicator	**Unit**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	[kg]	3.46E-05	4.84E-07	0.00E+00	0.00E+00	-3.58E-01
Non-hazardous waste disposed	[kg]	1.06E-01	4.50E-04	0.00E+00	1.00E+01	-9.06E+00
Radioactive waste disposed	[kg]	5.38E-04	0.00E+00	4.08E-04	1.05E-05	-8.65E-04
Components for re-use	[kg]	9.80E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	[kg]	9.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recover	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	[MJ per energy carrier]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Verification

The process of verification of this EPD is in accordance with EN ISO 14025, ISO 21930 and ECO checklist document. 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 and EN 16783
Independent verification corresponding to ISO 14025 & 8.3.1. [x] external [ ] internal
External verification of EPD: PhD. Eng. Halina Prejzner LCA. LCI audit and input data verification: M.Sc. Eng. Dominik Bekierski, d.bekierski@itb.pl Verification of LCA: PhD Eng. Michał Piasecki, m.piasecki@itb.pl

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+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
- World Steel Association 2017 Life Cycle inventory methodology report for steel products

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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

PN-EN 15804+A1:2014-04

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