Environmental Product Declaration - Summary

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for

Thorbolt®

from

GMA

Ground Machinery Applications AB

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-05735
Publication date:	2022-03-21
Valid until:	2027-03-21

General information

Program information

Program:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

CEN standard EN 15804 serves as the Core Product Category Rules (PCR), specifically EN 15804:2012+A2:2019 (henceforth EN 15804:A2)
Product category rules (PCR): PCR Construction Products (2019:14), version 1.1
PCR review was conducted by: *Claudia A. Peña*. Contact info@environdec.com for more information
LCA-analysis conducted by *Camilla Blomqvist, WSP*
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: Martin Erlandsson Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD:
GMA Ground Machinery Applications AB

Contact:
Lars Eriksson

Company description:
GMA is part of the industrial group INEV and has developed and produced packers and grouting equipment for almost 30 years. All production occurs at the production facility in Sunne, Sweden, which increases the flexibility to manufacture and deliver exactly the products that customers need. GMA has developed both knowledge and experience over the years as a leading supplier to several projects both in Scandinavia and around the world.

Production sites:
The product is manufactured in Sunne, Värmland.

Product information

Products:
Thorbolt® with specified dimensions

Product description:
Thorbolt is a rock reinforcement system involving dynamic bolting that enables cement-cast rock bolts in water-bearing holes, which is not possible with conventional rock bolts. Cement paste is pumped through the Thorbolt, pushing out air and water through the evacuation hose, after which the hole and surrounding cracks are filled. Drilling fewer holes saves time and resources. The Thorbolt is molded into the rock with cement paste and is corrosion resistant.

The Thorbolt can be produced in varying lengths and dimensions, but is primarily sold in one specific size, which is the size that this EPD covers. Specifically, it is the length of the central steel tube, its radius and the surface treatment which varies. See Table 1 for technical data for the Thorbolt covered. The Thorbolt is mounted with a comb steel and cement-based grouting. Normally, no maintenance work is required and the Thorbolt will remain mounted in the rock during a very long period of time.

Table 1. Technical data

Technical data	
Weight per Thorbolt	2 kg
Standard	S355.C according to EN 10305-1
Surface treatment	Corrosivity class Im3, galvanized, epoxy-paint
Central steel tube, length	420 mm
Tensile strength	190 kN
Central steel tube, thread	M24x3
Injection pressure	Up to70 bar
VCT for injection paste	Recommended 0,28-0,70

Product content:

A Thorbolt consists of eight components: central steel tube, steel socket, precision tube, washer, rubber sleeve, rubber tip, evacuation pipe and rubber tube, see Table 2. The inputs are transported by truck from various suppliers in Sweden, and one supplier in Italy, to the production facility in Sunne. The central tube and socket are transported onward to Halmstad and Töcksfors for galvanization and coating before they are transported back to Sunne.

Approximately 38 % of the steel used in the Thorbolt is recycled steel.

Table 2. Product content

Product content		
Central steel tube	1,271 kg	Dimensions: Ø 25x8 mm
Socket	0,209 kg	
Precision steel tube	0,159 kg	Dimensions: Ø 8x1 mm
Washer	0,044 kg	
Rubber sleeve (SBR-rubber)	0,150 kg	
Rubber tip (SBR-rubber)	0,042 kg	
Evacuation pipe, steel	0,065 kg	Dimensions: Ø 6x1 mm
Rubber tube (PEM)	0,066 kg	
Total weight excl. package	**2,006 kg**	
EU-pallet	25kg/500 pieces = 0,05 kg	An EU-pallet weighs approx. 25 kg
Total weight incl. package	**2,056 kg**	

In general, Thorbolts are delivered to the customer packed on EU pallets via truck transport. An EU-pallet holds about 500 Thorbolts. A Thorbolt contains no biogenic carbon. The wooden pallet on which the Thorbolt is delivered consists of standardized EU pallets of wood, which contains biogenic carbon, but the EU-pallet constitutes less than 5% of the product´s total mass (approximately 2.5%) and is therefore not reported for GWP-biogenic in accordance with EN 15804:2012+A2:2019.

The product does not contain any substances on the Reach Candidate List (Substance of Very High Concern).

LCA information

Declared unit:

Declared unit is one Thorbolt, with the specified dimensions.

Technical lifespan:

The technical lifespan of a Thorbolt is very long and is determined by the life of the tunnel.

Geographical delimitations:

Foreground data is based on the company´s facility in Sunne. Sweden. Background data has, as far as possible, been geographically based on where the suppliers´ production takes place but includes several European and global processes that are considered representative.

The Thorbolt is sold in Sweden and all life cycle stages when the product has left the factory gates are based on Swedish conditions. The results should be interpreted accordingly.

Temporal delimitations:

All data has been collected for the 12 months between July 2020 and June 2021, and data for this period have been used consistently for production, energy, waste and inputs. These 12 months of production are considered to be representative for the production mix at GMA.

Delimitations to nature:

All known material has been calculated. The production of the infrastructure in the factories, such as the work machines, is excluded in accordance with the cut-off in EN 15804, as well as energy consumption from the galvanizing process and painting which takes place in a place other than Sunne.

Cut-off:

All known inputs and outputs of the manufacturing process are included in the analyses. In accordance with EN 15804:A2, no less than 99% of all inflows (mass and energy) must be included, which is considered fulfilled in this study.

LCA-modelling:

LCA modeling has been done in the software SimaPro 9.1.0.11. The environmental impact of the activities covered by this LCA combines generic and specific data. Generic data (emission and impact factors) are taken from Ecoinvent v. 3.8 and cover most of the processes, specifically transport, waste and inputs. Specific data have been used for the comb steel used in the installation of a Thorbolt.

GMA purchases 100% renewable electricity via Karlstads Energi coming from energy sources as declared in table 1. An average mix from 2020 and 2021 has been used in this LCA study.

Table 1 Electricity mix year 2020.

%	Hydropower	Wind power	Biopower
2020	60 %	18 %	22 %
2021	75 %	17 %	8 %

Generic data from Ecoinvent are considered conservative and the use of specific LCA data would likely result in lower environmental impact for the product in this study. The following assessment methods in SimaPro have been used:

- EN 15804 + A2 Method V1.00 / EF 3.0 normalization and weighting set as implemented in SimaPro, which is compatible with EN 15804: A2 in terms of characterization factors and impact categories
    - In this method, the emission factor for biogenic carbon dioxide is 1 kg CO2-eq / kg. Imports and exports of stored coal in wood products / materials are thus considered to contribute to global warming.
- The GHG-GWP indicator is calculated using the method EPD (2018) V1.02 as implemented in SimaPro.
    - This method uses characterization factors from IPCC AR5, which include all greenhouse gases except biogenic greenhouse gases and biogenic carbon stored in the product.

For assessments of resource use, waste flows and water use, the following methods are used in SimaPro:

- Cumulative Energy Demand V1.11
- AWARE V1.03

System boundaries:

The LCA analysis is of the "cradle to grave" type and includes all life cycle modules, i.e. components and raw materials in the manufacture of the input goods (A1), transport of raw materials and components to factories (A2), energy and resource consumption in factories (A3), transport of product to installation process (A4), installation process (A5) and use phase (B) and the final handling stage and effects after the product has left the system boundary (C and D, respectively). See Figure 2 for an overview.

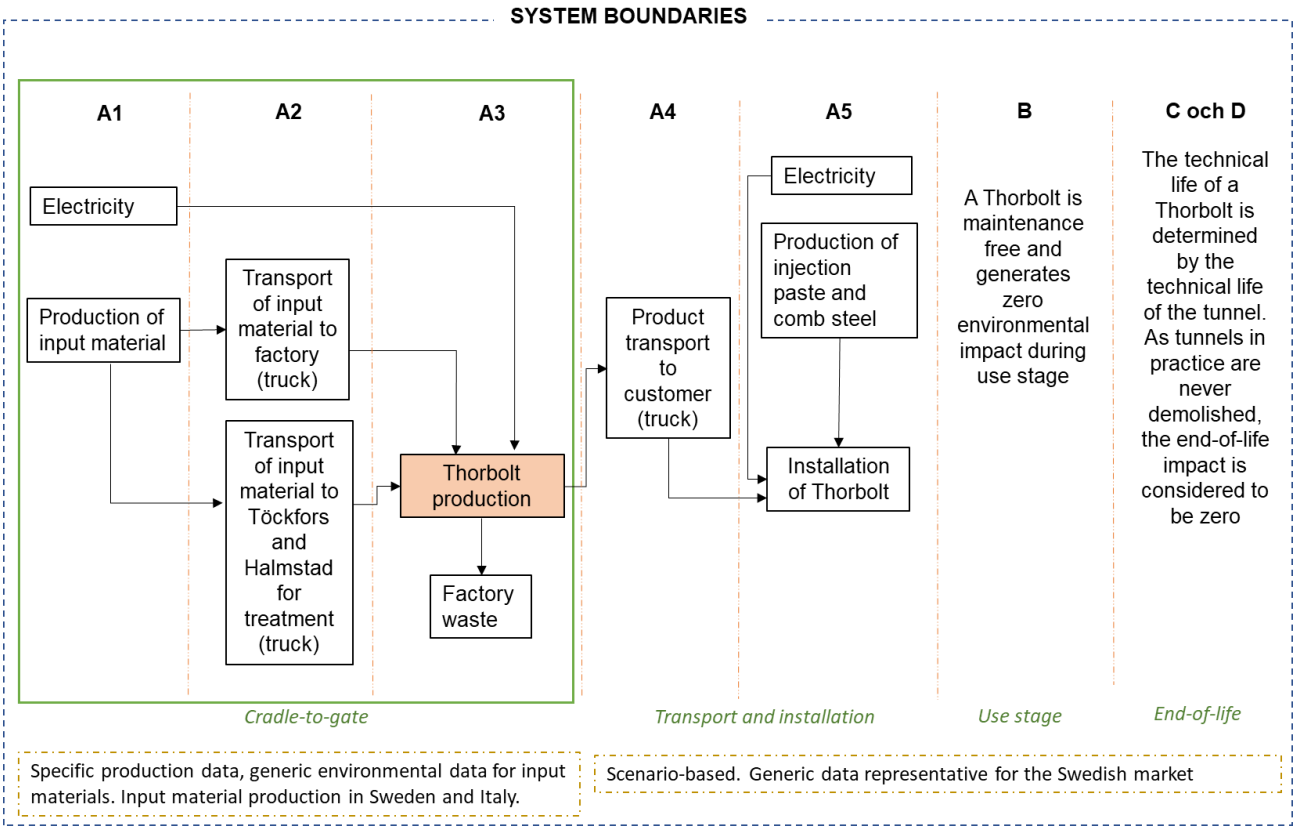

Figure 1. System boundaries categorized within the relevant modules.

Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation:

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	SE, IT	EU	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE
Specific data used[1]	7 %					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0 %, only 1 product					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0 %, only 1 site					-	-	-	-	-	-	-	-	-	-	-	-

[1] As % of GWP-GHG

Environmental Information

Potential environmental impact – mandatory indicators according to EN 15804

Environmental impact		Production				Construction stage		Use and end-of-life	Full life cycle	
Impact categories	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**A4**	**A5**	**B and C**	**A-C**	**D**
Climate change - Fossil	kg CO2 eq	4,07E+00	6,88E-01	4,28E-01	**5,19E+00**	1,17E-01	1,32E+01	0,00E+00	**1,85E+01**	0,00E+00
Climate change - Biogenic	kg CO2 eq	-6,96E-02	5,86E-04	1,02E-01	**3,34E-02**	9,95E-05	2,68E-01	0,00E+00	**3,01E-01**	0,00E+00
Climate change - Land use and LU change	kg CO2 eq	1,99E-02	2,70E-04	2,91E-04	**2,04E-02**	4,58E-05	6,34E-03	0,00E+00	**2,68E-02**	0,00E+00
Climate change – total	kg CO2 eq	4,03E+00	6,89E-01	5,31E-01	**5,25E+00**	1,17E-01	1,34E+01	0,00E+00	**1,88E+01**	0,00E+00
Ozone depletion	kg CFC11 eq	3,19E-07	1,59E-07	2,15E-08	**4,99E-07**	2,70E-08	7,80E-07	0,00E+00	**1,31E-06**	0,00E+00
Acidification	mol H+ eq	1,91E-02	2,79E-03	1,66E-03	**2,35E-02**	4,74E-04	4,82E-02	0,00E+00	**7,21E-02**	0,00E+00
Eutrophication, freshwater	kg P eq	1,90E-03	4,43E-05	1,71E-04	**2,12E-03**	7,52E-06	5,30E-03	0,00E+00	**7,43E-03**	0,00E+00
Eutrophication, marine	kg N eq	4,36E-03	8,41E-04	4,15E-04	**5,61E-03**	1,43E-04	9,78E-03	0,00E+00	**1,55E-02**	0,00E+00
Eutrophication, terrestrial	mol N eq	4,83E-02	9,19E-03	3,97E-03	**6,15E-02**	1,56E-03	1,01E-01	0,00E+00	**1,64E-01**	0,00E+00
Photochemical ozone formation	kg NMVOC eq	1,93E-02	2,82E-03	1,70E-03	**2,38E-02**	4,77E-04	2,91E-02	0,00E+00	**5,34E-02**	0,00E+00
Resource use, minerals and metals[2]	kg Sb eq	7,34E-05	2,39E-06	4,14E-06	**7,99E-05**	4,06E-07	2,44E-05	0,00E+00	**1,05E-04**	0,00E+00
Resource use, fossils[5]	MJ	8,78E+01	1,04E+01	4,03E+00	**1,02E+02**	1,76E+00	1,39E+02	0,00E+00	**2,43E+02**	0,00E+00
Water deprivation potential[5]	m3 depriv.	3,73E+00	3,12E-02	1,48E-01	**3,91E+00**	5,28E-03	2,01E+03	0,00E+00	**2,02E+03**	0,00E+00

Note that impact from packaging is included but embodied energy and biogenic carbon is directly balanced out.

[2] The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

Other environmental indicators

Impact categories	Unit	A1	A2	A3	A1-A3	A4	A5	B, C and D	A-C	D
GWP-GHG[3]	kg CO_2 eq.	3,94E+00	6,81E-01	4,14E-01	**5,03E+00**	1,16E-01	1,30E+01	0,00E+00	**1,82E+01**	0,00E+00

[3] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Resource use

Resource use		Production				Construction stage		Use and end-of-life	Full life cycle	
Impact categories	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**A4**	**A5**	**B, C and D**	**A-C**	**D**
PERE	MJ	4,29E+01	1,47E-01	3,48E-01	**4,34E+01**	2,49E-02	3,71E+01	0,00E+00	**8,05E+01**	0,00E+00
PERM	MJ	1,00E+00	0,00E+00	0,00E+00	**1,00E+00**	0,00E+00	0,00E+00	0,00E+00	**1,00E+00**	0,00E+00
PERT	MJ	4,39E+01	1,47E-01	3,48E-01	**4,44E+01**	2,49E-02	3,71E+01	0,00E+00	**8,15E+01**	0,00E+00
PENRE	MJ	9,12E+01	1,10E+01	4,27E+00	**1,07E+02**	1,87E+00	1,48E+02	0,00E+00	**2,56E+02**	0,00E+00
PENRM	MJ	1,00E+00	0,00E+00	0,00E+00	**1,00E+00**	0,00E+00	0,00E+00	0,00E+00	**1,00E+00**	0,00E+00
PENRT	MJ	9,22E+01	1,10E+01	4,27E+00	**1,08E+02**	1,87E+00	1,48E+02	0,00E+00	**2,57E+02**	0,00E+00
SM	Kg	6,68E-01	0,00E+00	0,00E+00	**6,68E-01**	0,00E+00	1,16E+01	0,00E+00	**1,23E+01**	0,00E+00
RSF	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
NRSF	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
FW	M^3	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

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

Waste and outflows

Waste and outflows		Production				Construction		Use and end-of-life	Full life cycle	
Impact categories	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**A4**	**A5**	**B, C and D**	**A-C**	**D**
Waste production[4]										
Hazardous waste disposed	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
Non-hazardous waste disposed	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
Radioactive waste disposed	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
Output flows										
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
Material 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
Materials for energy recovery	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
Exported energy, electricity	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
Exported energy, thermal	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

[4] All waste flows are managed within the system limits in Ecoinvent processes, which is why there it is 0 kg of waste under these modules.

References

General Programme Instructions of the International EPD® System. Version 3.01.

PCR Construction Products (2019:14), version 1.1

EN 15804:2012 + A2:2019 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations. Principles and procedures.

ISO 14044:2006 Environmental management. Life Cycle Assessment. Requirements and guidelines.

LCA-report. Thorbolt. WSP Sverige

EPD®

www.environdec.com