

# Environmental Product Declaration - Summary

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

## GE bolt with wedge<sup>®</sup>

from

### GMA

### Ground Machinery Applications AB



Programme:	The International EPD <sup>®</sup> System, <a href="http://www.environdec.com">www.environdec.com</a>
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## General information

### Program information

<b>Program:</b>	The International EPD® System
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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 1.2.5
PCR review was conducted by: <i>Claudia A. Peña</i> . Contact <a href="mailto:info@environdec.com">info@environdec.com</a> for more information
LCA-analysis conducted by <i>Camilla Blomqvist, WSP</i>
Independent third-party verification of the declaration and data, according to ISO 14025:2006: <input type="checkbox"/> EPD process certification <input checked="" type="checkbox"/> EPD verification
Third party verifier: Håkan Stripple at IVL Swedish Environmental Research Institute, <a href="http://www.IVL.se">www.IVL.se</a> E-mail: <a href="mailto:hakan.strippl@ivl.se">hakan.strippl@ivl.se</a> Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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:

Jesper Gunnarsson Berg

### Company description:

GMA is part of the industrial group INEV and has developed and produced packers and grouting equipment for more than 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:

GE bolt with wedge<sup>®</sup> with dimension 25 mm (M27) and length 3000 mm.

### Product description:

The GE bolt is used for rock reinforcement and is manufactured in various designs, dimensions, and lengths. The bolt is cast into the rock with a cement-based grout to reinforce the rock. Normally no maintenance work is required, and the GE bolt will remain in the rock for a very long period.

The GE bolt can be produced in varying lengths and dimensions, anchor performance, bolt dimensions and threads, mostly in 20 mm (M22), 22 mm (M24) and 25 mm (M27) dimensions. Specifically, it is the length of the central steel tube that varies, between 1800–3000 mm, as well as its radius, between 20–25 mm. See Table 1 for technical data of the GE bolt covered.

Approximately 88 % of the steel used in the GE bolt is recycled steel.

Table 1. Technical data for GE bolt with wedge.

Technical data	
Weight per GE bolt	12.77 kg
Round bar, length	3000 mm
Round bar, diameter	25 mm
Round bar thread	M27
Steel quality	Ovako 280
Breaking point	450 N/mm <sup>2</sup>
Breaking point thread	550–750 N/mm <sup>2</sup>
Extension A5	21 %

**Product content:**

A GE bolt consists of five components: round bar, nut, wedge, hemisphere, and washer, see Table 2. The inputs are transported by truck from two suppliers in Sweden, and by shipping and truck from one supplier in China, to the production facility in Sunne.

Table 2. Product content per GE bolt.

Product content	Amount	Other description
Round bar	11.454 kg	Dim. Ø 25x3000 mm
Nut	0.160 kg	M22-2.5P hex nut
Wedge	0.180 kg	20x120 mm cast wedge
Hemisphere	0.180 kg	50x26x21 socket
Washer	0.800 kg	6x150 mm
<b>Total weight excl. package</b>	<b>12.774 kg</b>	
Wood latch	192/4 620 p = 0.042 kg	
Steel band	0.35/60 p = 0.006 kg	
<b>Total weight incl. package</b>	<b>12.921 kg</b>	

Due to the fact that not all components can vary in dimensions, there is not a linear relationship between environmental impact and GE bolts of different dimensions. This EPD consists of the GE bolt with the greatest environmental impact, corresponding to the bolt with the largest dimensions (25 mm (M27), 3000 mm). With conversion factors it is possible to calculate the GWP-GHG for different dimensions of the GE bolt. The GE bolt with the highest impact is presented, which means that all conversion factors are <1, see section More environmental information.

The GE bolt is also available without the wedge, which apart from the wedge is produced in the same way as the GE bolt with wedge, in other words the product included in this EPD. The GWP-GHG for the GE bolt without the wedge can be calculated by subtracting the impact from the wedge from the total impact, see More environmental information.

In general, GE bolts are packaged with wooden latches and steel straps and delivered to the customer via truck transport. A GE bolt contains no biogenic carbon. The wooden latch on which the GE bolt is delivered consists of wood, which contains biogenic carbon, and the amount of wooden latch makes up about 88 % of the total mass of the packaging. The packaging's contribution is thus 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 GE bolt, with the specified dimensions, assembled in place in a rock reinforcement application and considered throughout the life of the bolt.

### **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), as well as the final handling stage (C) and effects after the product has left the system boundary (D).

**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, CN	CN, EU	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	SE	
Specific data used <sup>1</sup>	80 %					-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0 %, only 1 product					-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0 %, only 1 site					-	-	-	-	-	-	-	-	-	-	-	-	-

<sup>1</sup> As % of GWP-GHG

**Technical lifespan:**

The technical lifespan of a GE bolt is very long and is determined by the life of the mine.

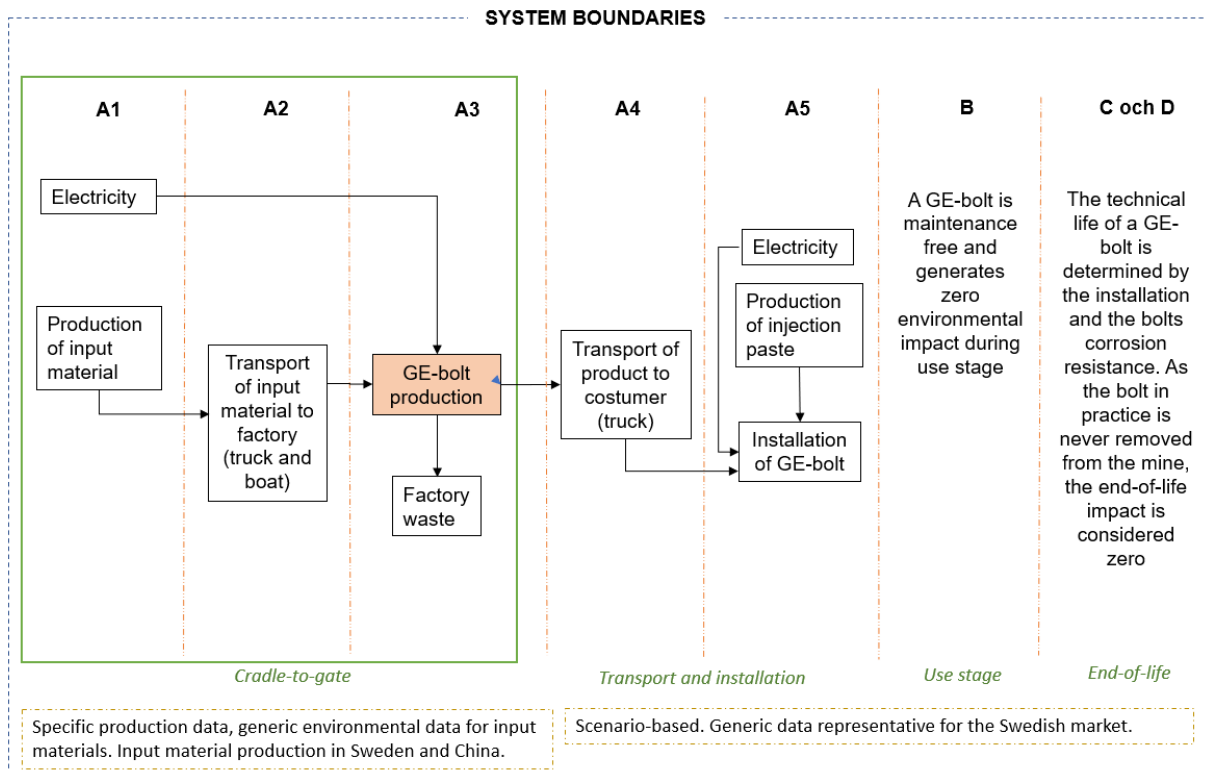


Figure 1. System boundaries categorized within the relevant module.

**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.

**Temporal delimitations:**

All data has been collected for the 12 months between January 2022 and December 2022, and data for this period have been used consistently for production, energy, waste, and inputs. These 12 months of production are 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.

**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 9.4. 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. 3.9 and cover most of the processes, specifically transport, waste and inputs.

GMA purchases 100 % renewable electricity via Karlstads Energi coming from energy sources as declared in Table 3.

Table 3. Electricity mix year 2022.

%	Hydro power	Wind power	Bio power
2022	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.
- The GHG-GWP indicator is calculated using the method EPD (2018) V1.02 as implemented in SimaPro.
  - o 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



## 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, C and D	A-C
Climate change - Fossil	kg CO <sub>2</sub> eq.	8.09E+00	7.79E-01	7.87E-02	<b>8.95E+00</b>	2.73E+00	6.16E+00	0.00E+00	<b>1.78E+01</b>
Climate change - Biogenic	kg CO <sub>2</sub> eq.	6.46E-02	5.74E-04	1.01E-01	<b>1.67E-01</b>	2.33E-03	1.66E-01	0.00E+00	<b>3.35E-01</b>
Climate change - Land use and LU change	kg CO <sub>2</sub> eq.	6.39E-03	3.37E-04	8.65E-06	<b>6.74E-03</b>	1.07E-03	9.81E-04	0.00E+00	<b>8.79E-03</b>
Climate change – total	kg CO <sub>2</sub> eq.	8.17E+00	7.80E-01	1.80E-01	<b>9.13E+00</b>	2.73E+00	6.26E+00	0.00E+00	<b>1.81E+01</b>
Ozone depletion	kg CFC11 eq.	5.72E-07	1.77E-07	3.45E-09	<b>7.53E-07</b>	6.31E-07	2.08E-07	0.00E+00	<b>1.59E-06</b>
Acidification	mol H <sup>+</sup> eq.	3.75E-02	5.81E-03	1.12E-04	<b>4.34E-02</b>	1.11E-02	1.49E-02	0.00E+00	<b>6.94E-02</b>
Eutrophication, freshwater	kg P eq.	4.72E-03	4.72E-05	6.12E-06	<b>4.77E-03</b>	1.76E-04	7.12E-04	0.00E+00	<b>5.66E-03</b>
Eutrophication, marine	kg N eq.	7.37E-03	1.58E-03	4.63E-05	<b>8.99E-03</b>	3.33E-03	3.96E-03	0.00E+00	<b>1.63E-02</b>
Eutrophication, terrestrial	mol N eq.	7.17E-02	1.74E-02	4.54E-04	<b>8.96E-02</b>	3.64E-02	4.45E-02	0.00E+00	<b>1.71E-01</b>
Photochemical ozone formation	kg NMVOC eq.	2.63E-02	4.95E-03	1.24E-04	<b>3.14E-02</b>	1.12E-02	1.13E-02	0.00E+00	<b>5.38E-02</b>
Resource use, minerals and metals <sup>2</sup>	kg Sb eq.	4.22E-05	2.51E-06	3.56E-08	<b>4.47E-05</b>	9.48E-06	9.22E-06	0.00E+00	<b>6.34E-05</b>
Resource use, fossils <sup>2</sup>	MJ	1.01E+02	1.16E+01	2.46E-01	<b>1.13E+02</b>	4.12E+01	4.56E+01	0.00E+00	<b>1.99E+02</b>
Water deprivation potential <sup>2</sup>	m <sup>3</sup> depriv.	2.04E+00	3.31E-02	1.62E-02	<b>2.09E+00</b>	1.23E-01	2.01E+03	0.00E+00	<b>2.02E+03</b>

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

<sup>2</sup> 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
GWP-GHG <sup>3</sup>	kg CO <sub>2</sub> eq.	7.90E+00	7.72E-01	7.83E-02	<b>8.75E+00</b>	2.70E+00	6.12E+00	0.00E+00	<b>1.76E+01</b>

<sup>3</sup> 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
PERE	MJ	2.62E+01	1.54E-01	4.02E-03	<b>2.64E+01</b>	5.81E-01	9.63E+00	0.00E+00	<b>3.66E+01</b>
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
PERT	MJ	2.62E+01	1.54E-01	4.02E-03	<b>2.64E+01</b>	5.81E-01	9.63E+00	0.00E+00	<b>3.66E+01</b>
PENRE	MJ	1.08E+02	1.23E+01	2.63E-01	<b>1.20E+02</b>	4.38E+01	4.70E+01	0.00E+00	<b>2.11E+02</b>
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
PENRT	MJ	1.08E+02	1.23E+01	2.63E-01	<b>1.20E+02</b>	4.38E+01	4.70E+01	0.00E+00	<b>2.11E+02</b>
SM	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
FW	m <sup>3</sup>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>

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
<b>Waste production<sup>4</sup></b>									
Hazardous waste disposed	kg	0.00E+00	0.00E+00	2.00E-02	<b>2.00E-02</b>	0.00E+00	0.00E+00	0.00E+00	<b>2.00E-02</b>
Non-hazardous waste disposed	kg	0.00E+00	0.00E+00	1.29E-01	<b>1.29E-01</b>	0.00E+00	4.80E-02	0.00E+00	<b>1.77E-01</b>
Radioactive waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>Output flows</b>									
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Material for recycling	kg	0.00E+00	0.00E+00	1.27E-01	<b>1.27E-01</b>	0.00E+00	6.00E-03	0.00E+00	<b>1.33E-01</b>
Materials for energy recovery	kg	0.00E+00	0.00E+00	2.20E-02	<b>2.20E-02</b>	0.00E+00	4.20E-02	0.00E+00	<b>6.40E-02</b>
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>

<sup>4</sup> All waste flows are managed within the system limits in Ecoinvent processes, which is why there is 0 kg of waste under these modules.

## Additional environmental information

### Converting factors for calculation of GWP-GHG for different dimensions of GE bolt

In Table 4, converting factors are presented which can be used to calculate the GWP-GHG for GE bolts with varying dimensions. The converting factors cover module A1-A3.

Table 4. Converting factors to calculate GHG-GWP for module A1-A3 for different dimensions of GE bolt.

Converting factors of GHG-GWP (kg CO <sub>2</sub> eq./bolt)				
Round bar dim.	M22, 20 mm	7/8 tum, 20 mm	M24, 22 mm	M27, 25 mm
<b>Round bar length</b>	<i>Converting factor</i>	<i>Converting factor</i>	<i>Converting factor</i>	<i>Converting factor</i>
1800 mm	0.511	0.487	0.621	0.727
1900 mm	0.526	0.502	0.638	0.750
2000 mm	0.541	0.517	0.656	0.772
2100 mm	0.556	0.532	0.674	0.795
2200 mm	0.571	0.547	0.691	0.818
2300 mm	0.586	0.562	0.709	0.841
2400 mm	0.601	0.577	0.726	0.863
2500 mm	0.616	0.592	0.744	0.886
2600 mm	0.631	0.607	0.762	0.909
2700 mm	0.646	0.622	0.779	0.932
2800 mm	0.661	0.637	0.797	0.954
2900 mm	0.676	0.652	0.815	0.977
3000 mm	0.691	0.667	0.832	1.000

**Calculation example:** GE bolt with dimensions 20 mm (M22) and 3 000 mm has GWP-GHG =  $0.691 \times 8.77 = 6.06$  kg CO<sub>2</sub> eq./bolt

### Calculation of GWP-GHG for GE bolt without wedge

The GE bolt is available in a 45-degree variant without the wedge. The exclusion of the wedge is the only difference between this product and the product included in this LCA. Thereby, the GWP-GHG for the GE bolt without the wedge can be calculated by subtracting the impact from the wedge.

The wedge is produced in only one dimension and for module A1-A3 it has GWP-GHG 0.320 kg CO<sub>2</sub> eq./wedge.

To calculate GWP-GHG for A1-A3 for one GE bolt without wedge follow the calculation example below:

**Calculation example 1:** GE bolt without wedge with dimensions M27 and 3000 mm has GWP-GHG =  $8.77 - 0.320 = 8.45$  kg CO<sub>2</sub> eq./bolt.

**Calculation example 2:** GE bolt without wedge with dimensions M22 and 3000 mm has GWP-GHG =  $0.691 \times 8.77 - 0.320 = 5.74$  kg CO<sub>2</sub> eq./bolt.

## 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. Bergförstärkningsbult. WSP Sverige

