Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Steel ties

from

Arminox

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

This LCA study has been conducted according to the requirements in EN 15804:2012+A2:2019. The LCA study is also conducted in accordance with PCR 2019:14 - Construction Products, as this is a requirement for EPDs published through The International EPD System.

The International EPD System also require that a LCA study is conducted in accordance with a complementary PCR (c-PCR) if a c-PCR exist. However, this is not the case for construction steel products since a CEN c-PCR for steel and aluminium structural products are still being developed.

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): PCR 2019:14 Construction Products (EN 15804:A2) v1.2.5 UN CPC code: 412 – products of iron or steel
PCR review was conducted by: IVL Swedish Environmental Research Institute, EPD International Secretariat
Life Cycle Assessment (LCA)
LCA accountability: Cecilie Holm Arentoft and Rikke Zuwa Kempf Bernberg, COWI A/S, Parallelvej 2, 2800 Kgs. Lyngby, Denmark
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: Pär Lindman, Miljögiraff AB, Independent approved Verifier by EPD International. Approved by: The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier:

☐ Yes ☒ No

[Procedure for follow-up the validity of the EPD is at minimum required once a year with the aim of confirming whether the information in the EPD remains valid or if the EPD needs to be updated during its validity period. The follow-up can be organized entirely by the EPD owner or together with the original verifier via an agreement between the two parties. In both approaches, the EPD owner is responsible for the procedure being carried out. If a change that requires an update is identified, the EPD shall be re-verified by a verifier]

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

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Arminox
Contact: Brian Andersen
Description of the organisation:
Arminox is one of the World's leading suppliers of stainless reinforcement steel in the construction industry. Arminox is certified by renowned international product standards and Arminox stainless reinforcement steel can be both used for new buildings as well as renovation in an aggressive environment, where damages to the concrete construction may occur. [1]

Arminox is ISO 9001:2015 certified and Arminox stainless reinforcement steel is certified in accordance to British Standard BS 6744:2016, BS8666, and Kontrollrådet in Norway.

Name and location of production site(s): Arminox located in Viborg at Jernvej 22 in Denmark.

For more information see Arminox's webpage: About Arminox Stainless.

[1] About Arminox

Product information

Product name: This EPD describes stainless steel ties.
Product identification: This EPD describes stainless steel ties produced by Arminox.
Ties for Walls are linear structural components used in construction to connect and secure two layers of masonry, typically brick or concrete block, together. They are designed to be embedded within the mortar joints between the layers of masonry during construction. Roof tile clips are small stainless ties used in roofing systems to secure roof tiles in place.

According to EN 10088-1 the classification of stainless steel is a minimum content of 10.5% chrome and maximum 1.2% carbon. Stainless steel alloys, used for reinforcement often have a higher content of chrome, as well as addition of nickel and maybe molybdenum to increase the corrosion resistance further. Arminox raw material for making steel ties is drawn wire.

There are several different kinds and shapes of steel ties produced at Arminox. Below is a picture of steel ties with different shapes.

Figure 1 Steel ties

Product description: Steel ties are used in construction to connect and secure two layers of masonry with a cavity. They play a crucial role in ensuring the structural stability and integrity of buildings by preventing the layers of masonry from separating or shifting, especially in cases where the building is

subjected to various forces like wind, earthquakes, and settling. Wall ties are of stainless steel to ensure resistance to corrosion and maintain their strength over time. The ends of the wall ties are usually shaped to grip onto the masonry units and hold them together effectively.
Roof tie/clips are particularly useful in areas prone to high winds or severe weather conditions, as they enhance the overall stability and longevity of the roof. These clips are typically attached to the roof structure, such as wooden battens or roof decking, and then the tiles are positioned over them. The clips hold the tiles down, reducing the risk of them being lifted or blown away. They come in various designs to suit different types of roof tiles and roofing systems. Expected service life is 100 years
UN CPC code: UN CPC code: 412 – products of iron or steel
Geographical scope: Denmark

Stainless ties CE-Marking[2]:

- Wall ties are covered by European regulation No. 305/2011(Construction Products Regulation, or CPR). Wall ties are subject to a common European standard requesting CE-marking.

  Wall ties are covered by product standard DS/EN 845-1 Specification for ancillary components for masonry - Part 1: Ties, tension straps, hangers and brackets. The standard can be downloaded from Danish Standard.

  Certificate of Compliance and CE-marking are available for the individual wall tie products.

LCA information

The underlying Life Cycle Assessment (LCA) has been conducted in accordance with ISO 14040 and ISO 14044. The study is also performed according to PCR 2019:14
Product Category Rules (PCR) – Construction Products – Version 1.2.5 The International EPD System. Issued 2022-09-07. Valid until 2024-12-20
Construction products and construction services, EN15804:2012+A1:2013,
and General Programme Instructions for the international EPD® System, version 4.0.

Declared unit: 1 metric tonne steel ties from Arminox.
Reference service life: 50 years.
Time representativeness: This declaration, including data collection and the modelled foreground system including results, represents the production of stainless-steel ties described as the declared products with the product descriptions presented above on the production site located Viborg, Denmark. The specific data for Arminox has been received from Arminox in February 2023. The data is based on the annual average of 2022. Background data are based on GaBi Professional 2023 and Ecoinvent v3.9 and are mostly less than 3 years old. All background processes are based on reference data from 2018 or newer or reviewed to be valid. Generally, the used background datasets are of high quality.

Foreground system: The product is produced using electricity from wind in production. Background system: Upstream and downstream processes are modelled using electricity grid mix.

Database(s) and LCA software used: Generic data and background data are based on the GaBi professional database version 2023 and the EcoInvent 3.9 database.

[2] Arminox - Stainless Reinforcement - CE Marking

Description of system boundaries: Cradle-to-grave and covers the life cycle sub modules A1-A3, B1-B7, C1-C4 and D. Yet, no environmental impacts are associated with the use stage (B1-B7).

The general rules for the exclusion of inputs and outputs follows the requirements in EN 15804, 6.3.5, where the total of neglected input flows per module shall be a maximum of 5 % of energy usage and mass and 1 % of energy usage and mass for unit processes.

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

	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	GLO	GLO	DK	EUR	EUR	DK	DK	DK	DK	DK	DK	DK	GLO	GLO	GLO	EUR	GLO
Specific data used	>90%			>90%	>90%												

Product stage (A1-A3) includes:

A1 – Extraction and processing of raw materials
A2 – Transport to the production site
A3 – Manufacturing processes

The modules A1-A3 are aggregated and comprise the acquisition of all raw materials including products and energy, transport to the production site, packaging, and waste processing of both waste from manufacturing and treatment of raw material packaging waste up to the ‘‘end-of-waste” state or final disposal.

Stainless steel ties consist of scrap steel 91% and of primary steel 9% of the total product weight. The material input for the steel has been modelled by having the exact scrap steel percentage obtained by a mass input of a mix of electric arc furnace (EAF) steel billet with 20% scrap and blast furnace (BF) which is 100% scrap steel. The energy related to producing the stainless steel has been by the process in GaBi called stainless steel white hot rolled coil (304). The process meets the criteria that it

has a chromium content of more than 10.5% and a carbon content lower than 1.2%. Furthermore, the input is hot rolled and stainless as required.

The production waste from manufacturing consists of steel and is sent to recycling. Raw material packaging products polypropylene, LDPE plastic and wood pallet are sent to incineration. Steel and cardboard in packaging of raw materials are sent to recycling.

No benefits from recycling of waste or energy recovery from A3 is credited in module D.

Cardboard in product packaging consist of 79% recycled material.

The manufacture process consists of aligning, cutting, and bending the drawn wire into steel ties. Purchased electricity used in the manufacturing process of module A3 does not account for more than 30% of the GWP-GHG results of modules A1-A3. The EPD does therefore not include a declaration of the energy source behind the purchased electricity and its climate impact. However, the EPD is modelled with wind energy, since Arminox buys green certificates on their electricity, which are based on wind energy.

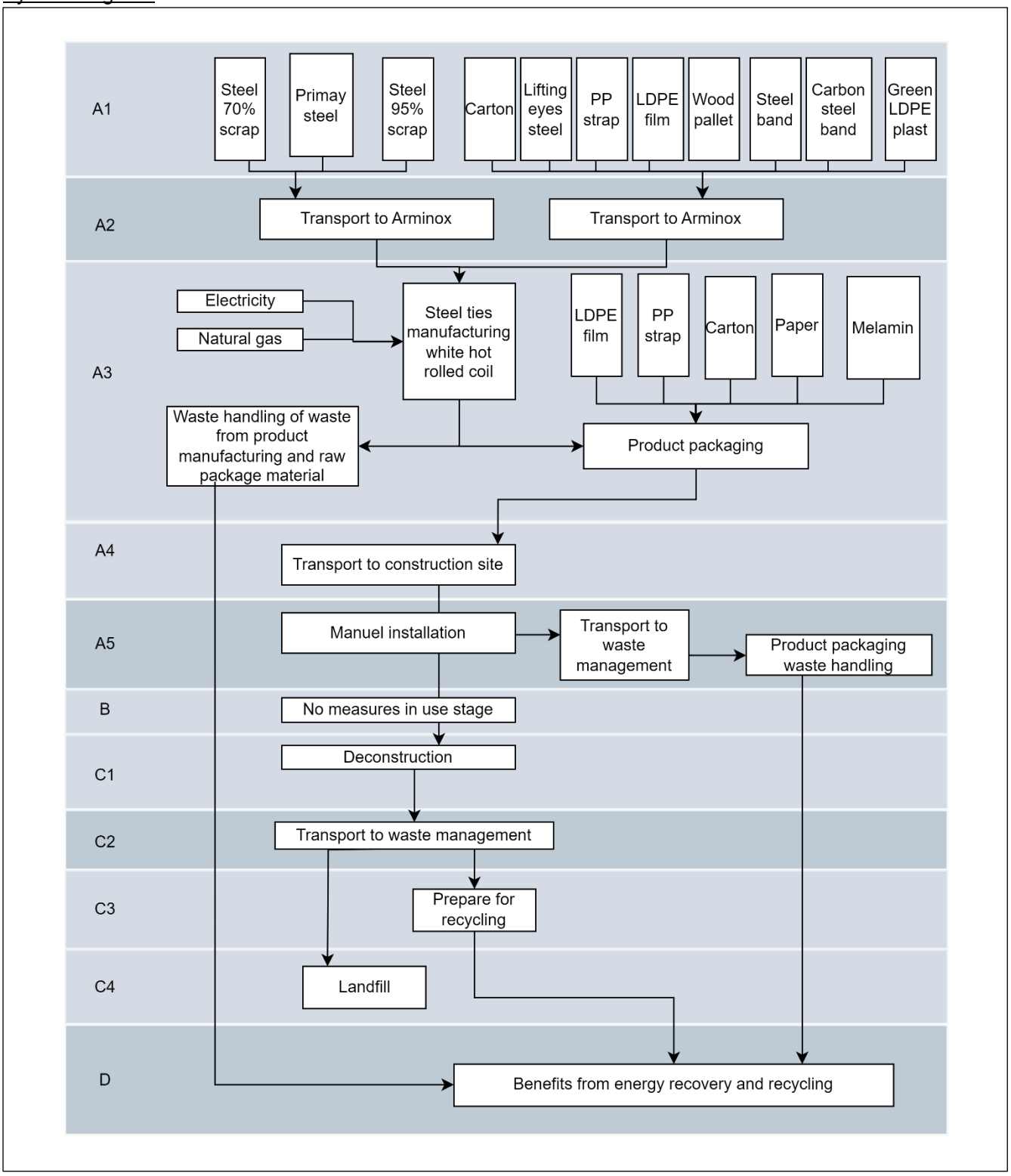
Construction process stage (A4-A5) includes:
The products are transported to the consumer by truck. An average distance of 201.5 km by truck to consumers in Scandinavia and Northern Germany is used. There is no waste associated with installation. There is no consumption of electricity associated with the installation.

The product packaging is sent to incineration and recycling.

End of Life (C1-C4) includes:
There is no electricity consumption associated with the deconstruction of the product.
The product is transported 60 km by truck to a waste management facility in Scandinavia.
85% of steel ties is recycled in the waste processing module C3 while 15% of steel ties is going to landfill, disposal, C4.

Re-use, recovery and recycling potential (D) includes:
Module D includes material credits and thermal and electrical energy credits from waste handling of product packaging and product waste from the modules A5 and C3.

System diagram:



Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight- % and kg C/kg
Drawn wire	1000	91%	0 resp. 0
Product packaging	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Packaging material	58	6%	0.43

The product itself has a weight of 1000 kg. Therefore, the product component is 1000 kg. It should be noted that the production has a waste, and therefore the total weight of raw materials used to produce the declared unit is 1007 kg (1.01E+03). The packaging materials weight% per product is the weight excluding production waste.

There is biogenic carbon in the packaging used for stainless steel ties, but not in the product itself.

Biogenic carbon at factory gate

BIOGENIC CARBON CONTENT PER DU of stainless steel ties		
Parameter	**Unit**	**At the factory gate**
Biogenic carbon content in product	[kg C]	0
Biogenic carbon content in accompanying packaging	[kg C]	25
Note	1 kg biogenic carbon is equivalent to 44/12 kg of CO_2	

In total 58 kg packaging is used, which results in 25 kg C is contained/DU. 25 kg C per 58 kg packaging results in a fraction of 43% biogenic carbon per kg package material.

Arminox has declared no dangerous substances from the candidate list of SVHC for Authorisation.

Results of the environmental performance indicators

Mandatory impact category indicators according to EN 15804

ENVIRONMENTAL IMPACTS PER TON										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	[kg CO_2 eq.]	2.23E+03	1.78E+01	3.41E+01	0.00E+00	4.17E-01	5.29E+00	0.00E+00	7.26E+00	-1.81E+03
GWP-fossil	[kg CO_2 eq.]	2.25E+03	1.76E+01	6.40E+00	0.00E+00	3.93E-01	5.24E+00	0.00E+00	7.25E+00	-1.81E+03
GWP-biogenic	[kg CO_2 eq.]	-2.77E+01	0.00E+00	2.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP-luluc	[kg CO_2 eq.]	7.00E+00	1.61E-01	3.02E-03	0.00E+00	2.33E-02	4.77E-02	0.00E+00	7.13E-03	-6.87E-01
ODP	[kg CFC 11 eq.]	2.05E-06	2.26E-12	4.08E-12	0.00E+00	3.27E-13	6.71E-13	0.00E+00	1.16E-11	-9.31E-08
AP	[mol H^+ eq.]	2.32E+01	2.57E-02	7.79E-03	0.00E+00	1.91E-03	7.68E-03	0.00E+00	2.25E-02	-4.16E+00
EP-freshwater	[kg P eq.]	1.70E-02	6.35E-05	2.32E-06	0.00E+00	9.20E-06	1.88E-05	0.00E+00	6.35E-06	-1.98E-03
EP-marine	[kg N eq.]	3.60E+00	9.34E-03	2.78E-03	0.00E+00	4.55E-04	2.80E-03	0.00E+00	5.65E-03	-1.02E+00
EP-terrestrial	[mol N eq.]	3.94E+01	1.11E-01	3.54E-02	0.00E+00	5.78E-03	3.31E-02	0.00E+00	6.21E-02	-1.10E+01
POCP	[kg NMVOC eq.]	1.03E+01	2.26E-02	7.35E-03	0.00E+00	1.52E-03	6.75E-03	0.00E+00	1.77E-02	-3.49E+00
ADPm[1]	[kg Sb eq.]	4.09E-03	1.14E-06	5.64E-08	0.00E+00	1.66E-07	3.40E-07	0.00E+00	1.92E-07	-9.46E-05
ADPf[1]	[MJ]	3.83E+04	2.37E+02	1.42E+01	0.00E+00	3.43E+01	7.02E+01	0.00E+00	1.05E+02	-1.51E+04
WDP[1]	[m^3 world eq. deprived]	1.72E+03	2.10E-01	3.52E+00	0.00E+00	3.04E-02	6.23E-02	0.00E+00	0.00E+00	-2.70E+01
Caption	GWP-total = Globale Warming Potential - total; GWP-fossil = Global Warming Potential - fossil fuels; GWP-biogenic = Global Warming Potential - biogenic; GWP-luluc = Global Warming Potential - land use and land use change; ODP = Ozone Depletion; AP = Acidification; EP-freshwater = Eutrophication – aquatic freshwater; EP-marine = Eutrophication – aquatic marine; EP-terrestrial = Eutrophication – terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential – minerals and metals; ADPf = Abiotic Depletion Potential – fossil fuels; WDP = Water Depletion Potential									
	The numbers are declared in scientific notation, e.g., 1.95E+02. This number can also be written as: $1.95*10^2$ or 195, while 1.12E-11 is the same as $1.12*10^{-11}$ or 0.0000000000112.									
Disclaimer	[1] The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									

Additional mandatory and voluntary impact category indicators

ADDITIONAL ENVIRONMENTAL IMPACTS PER TON										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG	GWP-GHG	2.26E+03	1.78E+01	6.40E+00	0.00E+00	4.17E-01	5.29E+00	0.00E+00	7.26E+00	-1.81E+03
PM	[Disease incidence]	4.28E-04	2.13E-07	4.85E-08	0.00E+00	0.00E+00	6.36E-08	0.00E+00	2.43E-07	-5.83E-05
IRP[2]	[kBq U235 eq.]	1.99E+02	6.63E-02	7.74E-02	0.00E+00	0.00E+00	1.97E-02	0.00E+00	1.80E-01	-8.51E+00
ETP-fw[1]	[CTUe]	2.40E+04	1.68E+02	7.99E+00	0.00E+00	0.00E+00	4.99E+01	0.00E+00	2.98E+01	-3.18E+03
HTP-c[1]	[CTUh]	4.53E-04	3.44E-09	3.44E-10	0.00E+00	0.00E+00	1.02E-09	0.00E+00	3.69E-09	-2.38E-06
HTP-nc[1]	[CTUh]	3.70E-05	1.83E-07	1.94E-08	0.00E+00	0.00E+00	5.44E-08	0.00E+00	3.68E-07	-2.13E-05
SQP[1]	-	2.03E+04	9.89E+01	4.52E+00	0.00E+00	0.00E+00	2.93E+01	0.00E+00	9.79E+00	-2.37E+03
Caption	PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Soil Quality (dimensionless)									
	The numbers are declared in scientific notation, e.g., 1.95E+02. This number can also be written as: $1.95*10^2$ or 195, while 1.12E-11 is the same as $1.12*10^{-11}$ or 0.0000000000112.									
Disclaimers	[1] The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.									
	[2] This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.									

Resource use indicators

RESOURCE USE PER TON										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	1.33E+04	1.72E+01	2.73E+00	0.00E+00	0.00E+00	5.11E+00	0.00E+00	9.42E+00	-1.11E+03
PERM	[MJ]	8.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	[MJ]	1.41E+04	1.72E+01	2.73E+00	0.00E+00	0.00E+00	5.11E+00	0.00E+00	9.42E+00	-1.11E+03
PENRE	[MJ]	3.82E+04	2.38E+02	1.42E+01	0.00E+00	0.00E+00	7.05E+01	0.00E+00	1.05E+02	-1.47E+04
PENRM	[MJ]	1.21E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	[MJ]	3.83E+04	2.38E+02	1.42E+01	0.00E+00	0.00E+00	7.05E+01	0.00E+00	1.05E+02	-1.47E+04
SM	[kg]	9.51E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	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]	5.74E+01	1.89E-02	8.32E-02	0.00E+00	0.00E+00	5.60E-03	0.00E+00	1.18E-03	-2.27E+00
Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Net use of fresh water									
	The numbers are declared in scientific notation, e.g., 1.95E+02. This number can also be written as: $1.95*10^2$ or 195, while 1.12E-11 is the same as $1.12*10^{-11}$ or 0.0000000000112.									

Waste and output flow indicators

WASTE CATEGORIES AND OUTPUT FLOWS PER TON										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	[kg]	2.30E-01	7.36E-10	2.73E-10	0.00E+00	0.00E+00	2.18E-10	0.00E+00	8.66E-09	0.00E+00
NHWD	[kg]	1.07E+02	3.62E-02	1.26E+00	0.00E+00	0.00E+00	1.07E-02	0.00E+00	1.50E+02	-2.18E+01
RWD	[kg]	1.81E+00	4.45E-04	5.00E-04	0.00E+00	0.00E+00	1.32E-04	0.00E+00	1.22E-03	-8.71E-02
CRU	[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
MFR	[kg]	3.07E+01	0.00E+00	3.92E+01	0.00E+00	0.00E+00	0.00E+00	8.50E+02	0.00E+00	0.00E+00
MER	[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
EEE	[MJ]	6.02E+00	0.00E+00	4.66E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	[MJ]	1.08E+01	0.00E+00	8.43E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy									
	The numbers are declared in scientific notation, e.g., 1.95E+02. This number can also be written as: $1.95*10^2$ or 195, while 1.12E-11 is the same as $1.12*10^{-11}$ or 0.0000000000112.									

Additional environmental information

EN 15804:2012+A1:2013 results

ENVIRONMENTAL IMPACTS PER TON										
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP	[kg CO_2-eq.]	2.15E+03	1.74E+01	3.40E+01	0.00E+00	3.52E-01	5.15E+00	0.00E+00	6.86E+00	-1.77E+03
ODP	[kg CFC11-eq.]	2.00E-06	2.66E-12	4.80E-12	0.00E+00	3.86E-13	7.90E-13	0.00E+00	1.36E-11	-7.88E-08
AP	[kg SO_2-eq.]	1.96E+01	1.83E-02	5.39E-03	0.00E+00	1.44E-03	5.48E-03	0.00E+00	1.80E-02	-3.35E+00
EP	[kg PO_4^{3-}-eq.]	1.36E+00	4.01E-03	1.10E-03	0.00E+00	2.70E-04	1.20E-03	0.00E+00	1.99E-03	-3.59E-01
POCP	[kg ethene-eq.]	8.28E-01	-1.83E-03	3.35E-04	0.00E+00	2.12E-04	-5.59E-04	0.00E+00	1.65E-03	-5.89E-01
ADPE	[kg Sb-eq.]	6.66E-02	1.15E-06	5.97E-08	0.00E+00	1.66E-07	3.40E-07	0.00E+00	2.00E-07	-9.52E-05
ADPF	[MJ]	3.33E+04	2.33E+02	1.26E+01	0.00E+00	3.37E+01	6.91E+01	0.00E+00	9.97E+01	-1.46E+04
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non fossil resources; ADPF = Abiotic depletion potential for fossil resources									
	The numbers are declared in scientific notation, e.g., 1.95E+02. This number can also be written as: $1.95*10^2$ or 195, while 1.12E-11 is the same as $1.12*10^{-11}$ or 0.0000000000112.									

The results for “Resource use indicators” and “Waste and output flow indicators” calculated regarding the old standard EN 15804:2012+A1:2013, is the same as calculated with the current standard EN 15804:2012+A2:2019.

The results of the current EPD refer to the functional unit of 1 ton of stainless-steel ties. The calculated environmental impacts show that raw material module A1 has the largest contribution to the total impact in 17 out of the 19 environmental impact categories. The production of steel is generally the process with the highest contribution.

Transport to the building site (A4)

Scenario information	Value	Unit
Road transport	GLO: Truck, Euro 6 A-C, more than 32t gross weight / 24.7t payload capacity Sphera <u-so>	
Fuel type	Diesel	-
Vehicle type	EURO 6	-
Weighted transport distance	201	km
Capacity utilization (including empty runs)	61%	%
Gross density of products transported		
Stainless steel ties	7,950	kg/m³

Installation of the product in the building (A5)

Installation of the products does not require any electric or heating energy or machines. They are installed simply by hand.

Reference service life

RSL information		Unit
Reference service Life	50	Years

End of life (C1-C4)

Scenario information	ties	Unit
Collected separately	0	kg
Collected with mixed waste	1000	kg
For reuse	0	kg

For recycling	850	kg
For energy recovery	0	kg
For final disposal	150	kg

The relative credit potential depending on the input material of the actual products as well as what LCI data is used as substituting material when recycling can be seen in the tables below.
The Table below is the potential of crediting from the A3 module.

Re-use, recovery and recycling potential (D)

Credit potential for the module A3.

Material	Steel ties (kg)	GaBi process for incineration (energy credit)	GaBi process for recycling (material credit)
Stainless steel recycling	30.35		DE: BF steel billet
Polyester plastic	0.14	RER: Plastic packaging in municipal waste	
LDPE plastic	0.53	RER: Plastic packaging in municipal waste	
Carton	0.01		RER: Kraft paper production, unbleached Edited, so only the virgin wood inputs are credited from the process, not other inputs.
Wood	2.04	RER: Untreated wood in waste incineration	

Credit potential for module A5.

Material	Steel ties (kg)	GaBi process for incineration (energy credit)	GaBi process for recycling (material credit)
LDPE	0.06		DE: Polyethylene Low Density Granulate (LDPE/PE-LD) (2021); Sphera
	0.21	RER: Plastic packaging in municipal waste	
Paper	1.80	RER: Paper and board (water 0%) in waste incineration plant	
LDPE Cardboard	4.07		RER: Kraft paper production, unbleached Edited, so only the virgin wood inputs are credited from the process, not other inputs.
	15.25	RER: Paper and board (water 0%) in waste incineration plant	
Paper Melamine	34.42		RER: Kraft paper production, unbleached Edited, so only the virgin wood inputs are credited from the process, not other inputs.
	1.25	RER: Plastic packaging in municipal waste	
Cardboard Polypropylene	0.37		RER: Melamine production edited so only the virgin melamin input are credited from the process, no other inputs
	0.19	RER: Plastic packaging in municipal waste	
Melamine	0.06		DE: Polypropylene granulate (PP) mix Sphera

The stainless steel tie has a credit potential of 850 kg steel billet for the C3 module.

The energy and recycled material (MFR) can be seen below related to steel ties for module D.

Product	Material	Leaving A3/A5/C3			Credited in module D after removal of burden free input to avoid double crediting		
		EET (MJ)	EEE (MJ)	MFR(kg)	EET (MJ)	EEE (MJ)	MFR(kg)
Steel ties	Stainless steel (A3)			9.44			9.44
	Carbon steel (A3)			20.91			20.91
	Carton (A3)			0.01			0.01
	Wood (A3)			2.04			2.04
	LDPE (A3)			0.36			0.36
	Polyester (A3)	1.14	0.64		1.14	0.64	
	Green LDPE (A3)	1.38	0.77		1.38	0.77	
	LDPE (A5)	17.90	10.00	0.23	17.90	10.00	0.23
	Polypropylene Strap (A5)			0.06			0.06
	Melamine edging (A5)			0.37			0.37
	Paper (A5)	7.00	3.86	4.07	7.00	3.86	4.07
	Carton boxes (A5)	59.3	32.7	34.46	12.5	6.89	7.23
	Steel ties(C3)			850			850

Indoor air

The EPD does not give information on release of dangerous substances to indoor air because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A2 chapter 7.4.1.

Soil and water

The EPD does not give information on release of dangerous substances to soil and water because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A2 chapter 7.4.2.

References

General Programme Instructions of the International EPD® System. Version 4.0.

Other references to be added, e.g. c-PCR used
EN 15804 + A2:2019 - ”Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products”

EN 15804 + A1:2013 - ”Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products”

PCR 2019:14 - Product Category Rules (PCR) – Construction Products – Version 1.2.5 The International EPD System. Issued 2022-07-08. Valid until 2024-12-20.

Arminox Project report covering the following EPDs: S-P-10576 Hot-rolled rebars
S-P-10575 Cold-rolled rebars, S-P-10341 Steel ties.

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