epd-norway
Global Program Operator

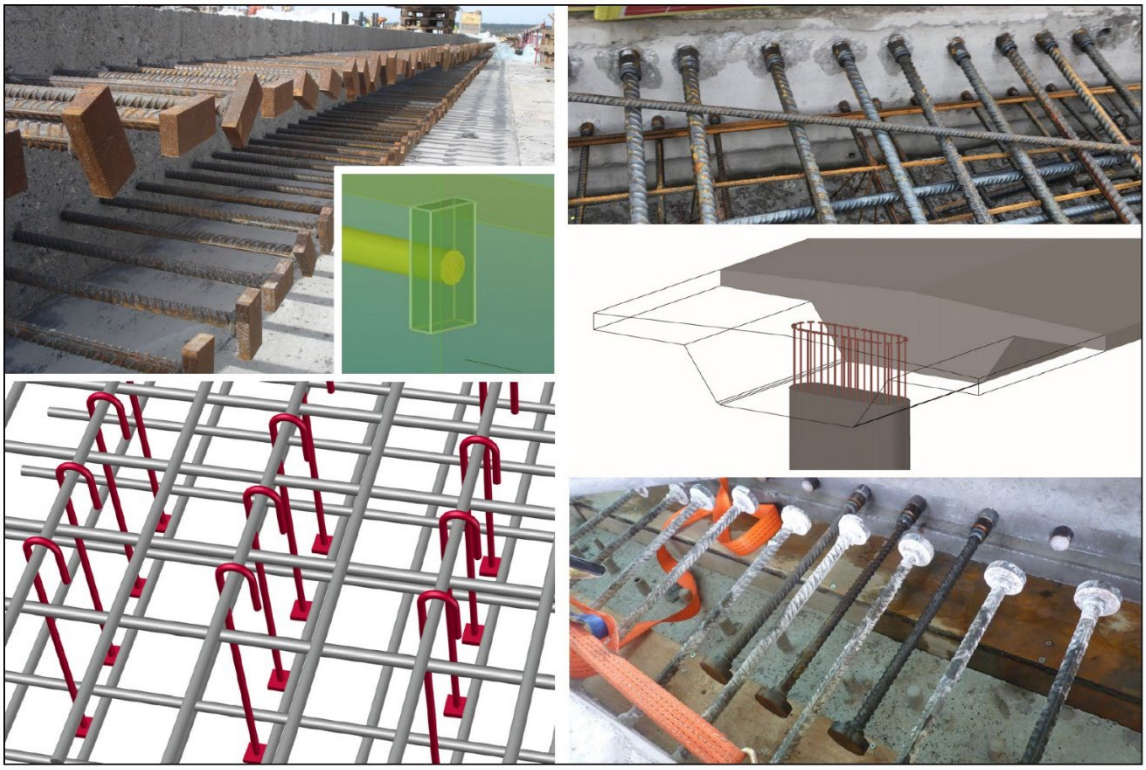
EPD®

EPD® International ref. number
S-P-12309

Environmental Product Declaration

In accordance with ISO 14025 and EN15804 +A2

HRC100, 200, 400 and 700 Series: Headed reinforcement, Rebar with mechanical couplers, Cast-in connections



Owner of the declaration:
HRC Europe AS

Product name:
HRC100, 200, 400 and 700 Series: Headed reinforcement, Rebar with mechanical couplers, Cast-in connections

Declared unit:
1 kg of steel product delivered at factory gate

Product category /PCR:
NPCR 013 Part B for Steel and Aluminum construction products

Programme operator and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-5263-4594-EN

Registration number:
NEPD-5263-4594-EN

Issue date: 03.11.2023

Valid to: 03.11.2028

General information

Product:
HRC100, 200, 400 and 700 Series: Headed reinforcement, Rebar with mechanical couplers, Cast-in connections

Programme Operator:
The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Tel: +47 23 08 80 00
e-mail: post@epd-norge.no

Declaration Number:
NEPD-5263-4594-EN

This declaration is based on Product Category Rules:
NPCR 013 Part B for steel and aluminum construction Products

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidence.

Declared unit:
1 kg of steel product delivered at factory gate.

Declared unit with options:
1 kg of steel product delivered at building site and waste treated at end of life.

Functional unit:
Not relevant for cradle-to-gate study with option

Conversion factor to mass:
Not relevant for cradle-to-gate study with option

Verification:
Independent verification of the declaration and data, according to ISO14025:2006

internal ☐ external ☒

[Silvia Vilčeková]

Independent verifier approved by EPD Norway

Owner of the declaration:
HRC Europe AS
Contact person: Thomas Kaiser
Phone: +47 32 24 04 70
e-mail: thomas.kaiser@hrc-europe.com

Manufacturer:
HRC Europe AS
Lierstranda 107, PB 591, NO-3412 Lierstranda, Norway
Phone: +47 32 24 04 70
e-mail: info@hrceurope.com

Place of production:
Lierstranda, Norway

Management system
ISO 9001, IS0 14001

Organization no:
922 875 243

Issue date:
03.11.2023

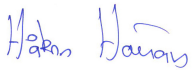
Valid to:
03.11.2028

Year of study:
2023

Comparability:
EPDs from other programmes other than EPD-Norway may not be comparable.

The EPD has been worked out by:
Elisa, M. M & Johansen, B. H/ Energiråd AS

Approved



Manager of EPD Norway

Product

Product description:

Reinforcing steel bars with component attached to one or both ends. End components are made of steel and connected to the rebar by friction welding. Various HRC components can be combined. The finished product is cut and bent according to project specifications. This is an average EPD for:

- HRC100 Series, HRC 200 Series: Headed reinforcement bars that provide mechanical anchorage and replacing anchorage lengths and hooks.
- HRC400 Series: Rebar with couplers for mechanical splicing of reinforcement bars.
- HCR700 Series: Rebar with a threaded component for connection of steel components to a concrete structure

Product Specification:

HRC end-components are made of steel and constitute 1-26% of the product weight depending on rebar diameter and product length. The chemical content of the finished product is almost identical to that of the parent reinforcing steel. The average composition of the HRC product is shown below.

Materials	kg	%
Rebar steel	0.897	89.70
End component steel	0.099	9.90
Stainless steel – end component	0.004	0.40

Technical data

All products are certified according to national provisions and international standards as follows:

- HRC100: ISO 15698, ETA-08/0035
- HRC200: ISO 15698
- HRC400: 15835, ETA-22/0573
- HRC700: SINTEF TG 20072
- For more information, see hrc-europe.com

Description of HRC's production process (A3)

The rebar is cut to length according to the production order. Small, unusable cut-off lengths are collected and sent to recycling. The raw material for end-components is cut to correct length/geometry. Threaded components (rebar couplers and cast-in connections) are processed by CNC-machines. Small, unusable cut-off lengths and swarf from cutting and CNC-machining are collected and sent to recycling. The end components are attached to the rebar by friction welding. The process uses no additional material or consumables. If required by the production order, products are bent by a rebar bending machine.

Figure 1 Examples of HRC products: HRC100 Series T-headed bars, HRC400 Series rebar couplers, and HRC720 threated sleeves

Market:
Norway/Europe

Reference service life, product:
Nor relevant

Reference service life, building:
Not relevant

LCA: Calculation rules

Declared unit:
1 kg steel product delivered at factory gate.

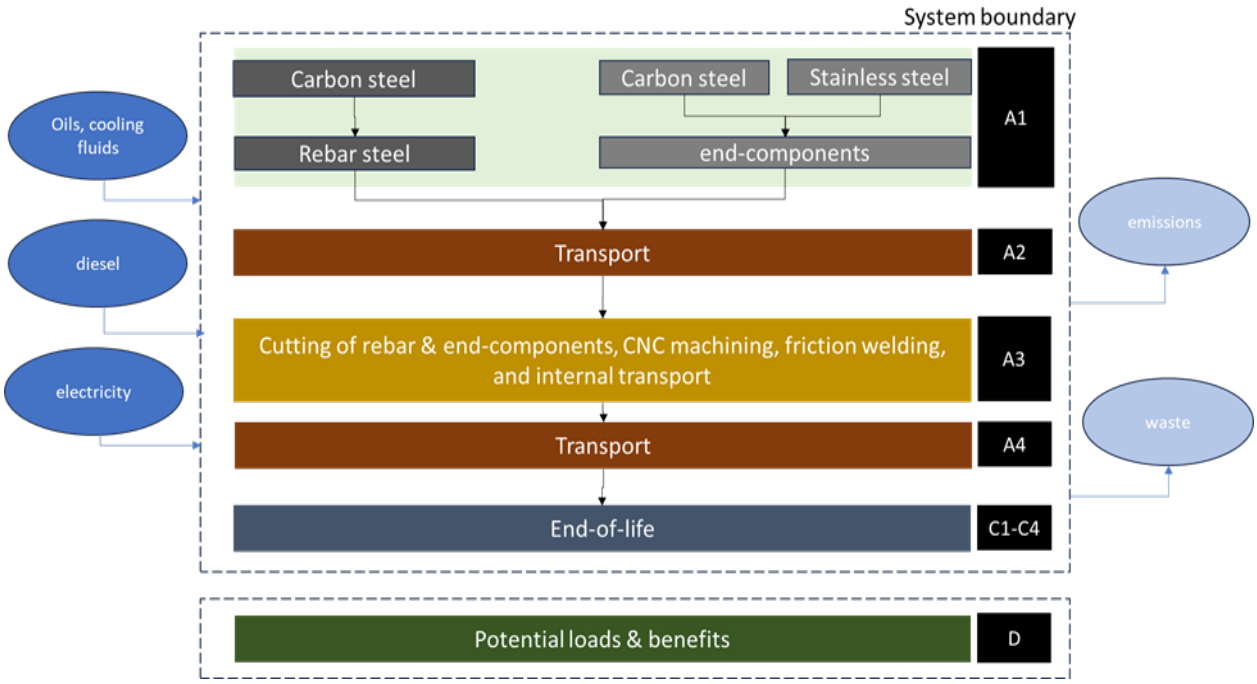
Data quality:
Site-specific data provided by the manufacturer was used for the foreground processes. The data represented productions from 2018_2022. Also, materials inputs with valid EPDs according to the EN 15804+A4 was used. Ecoinvent (version 3.8 and published in 2021) was used as the main database for the analysis and modifications were made where necessary improve technological, geographical, and temporal representations. The results that are shown are for HRC Europe's average reinforcement products. The deviation found in the products under consideration falls under the ±10% criterion. A more thorough sensitivity study, however, revealed that the average product's 0.4% mass of steel had GWP consequences that are at least 12.30 times greater than those of an average product. This needs to be considered when analyzing the results that have been shown. For instance, this EPD would not be applicable to average orders with more than 1% (by mass) stainless steel since it could result in a deviation from the values that are shown of more than ±10%.

Allocation:
The allocation is made in accordance with the provisions of EN 15804+A2. Energy and water use and in-house waste production are allocated equally among all products through mass allocation. Effects of primary production of recycled materials are allocated to the main product in which the material was used. Sorting of scrap is included in C1-C4, whereas smelting of scrap is included in A1 and not double-counted in C1-C4. Waste treatment of steel waste from A3 is included in A3.

Cut-off criteria:
For all raw material and energy inputs and waste treatment options reported by HRC Europe, for which specific data or (at least) generic data was available were included in the analysis. The general cut-off criteria in the supporting PCRs and standard were applied i.e., raw materials, energy, and waste outputs contributing less than 1% were excluded from the analysis. This cut-off rule does not apply for hazardous materials and substances, or where these flows contribute significantly more than 1% to the scores of environmental impact categories such as the GWP indicator

System boundary:
The type of this EPD is cradle-to-gate with options. Life cycle stages from extraction of raw materials, transport, and to production of the final steel products are covered. Moreover, the considered options include transport of the finished product to potential customers (A4) and end-of-life management of waste from the products (C1-C4). The potential loads and benefits from the production of these products are estimated in module D. The use phase (B1-B7) is not covered in this EPD.

Figure 2 System diagram of the life cycle assessment study



LCA: Scenarios and additional technical information

The following describes the scenarios for the considered life cycle stages. For A4, a truck was assumed to transport the product over 95 km (from Lierstranda, Norway) to the potential customer. This assumption was based on the actual (average) distance from sales in the years 2022. For customers located beyond this distance, it is advised (for them) to linearly extrapolate the environmental impacts for module A4 according to their specific locations to obtain more representative impacts resulting from the transportation of the products.

Transport from production site to potential customer (A4)	Capacity (%)	Distance (km)	Fuel/Energy efficiency	Unit	Value (l/t)
truck, over 32 tons, EURO 5	53.30%	95	0.023	l/tkm	2.20

For end-of-life scenarios, it was assumed that 100% of the reinforced concrete in which the product is used is demolished and 98% of the steel/products are collected and recycled. Whereas 2% of the steel/product is lost at the demolition site i.e., sent to landfill.

End of Life (C1, C3, C4)

Descriptions	Unit	Value
Hazardous waste disposed	Kg	0
Collected as mixed construction waste	Kg	0
Reuse	Kg	0
Recycling	Kg	0.98
Energy recovery	Kg	0
To landfill	Kg	0.02

For C2, it was assumed that the recovered materials from the demolition site are sent to a material recycling facility (MRF) located 20 km away. This is a typical MRF location in most towns in Norway.

Transport from production site to potential customer (A4)	Capacity (%)	Distance (km)	Fuel/Energy efficiency	Unit	Value (l/t)
Truck, over 32 tons, EURO 5	53.30%	20	0.023	l/t*km	0.46

In module D, it was assumed that steel scraps from modules A3 and C3 substitutes pig iron on the European steel market. Since secondary steel was used in the manufacture of raw materials consumed in module A1, it was advisable to subtract it from the total scrap resulting from modules A3 and C3. This avoids the rebound effect of steel recycling with would otherwise result in an overestimation of the potential benefits of the studied product.

Benefits and loads beyond the system boundary (D)	Unit	Value
Potential benefits i.e., amount of pig iron substituted in the European steel market	kg	0.08

LCA: Results

This section describes the system boundaries and modules of the life cycle assessment, as well as the calculated environmental impact, based on a standardized set of indicators. The indicator abbreviations are explained below each table.

System boundaries (X=included, MND=module not declared, MIR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Beyond system boundaries
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction 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
X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

The LCA results are presented below for the product defined on page 3 of the EPD document.

Core environmental impacts

Indicator	Unit	A1	A2	A3	A1-A3	A4
GWP - total	kg CO2 eq	3.46E-01	2.83E-02	1.50E-02	3.89E-01	1.55E-02
GWP - fossil	kg CO2 eq	2.77E-01	2.83E-02	1.41E-02	3.20E-01	1.55E-02
GWP - biogenic	kg CO2 eq	6.84E-02	1.92E-05	8.52E-04	6.92E-02	2.75E-05
GWP - luluc	kg CO2 eq	4.22E-04	1.70E-05	4.30E-05	4.82E-04	6.19E-06
ODP	kg CFC11 eq	1.63E-08	5.96E-09	1.80E-09	2.41E-08	3.58E-09
AP	molc H+ eq	1.17E-03	6.04E-04	1.21E-04	1.90E-03	4.39E-05
EP- freshwater	kg P eq	8.49E-05	1.28E-06	5.45E-06	9.16E-05	1.02E-06
EP -marine	kg N eq	2.72E-04	1.47E-04	3.51E-05	4.55E-04	8.94E-06
EP - terrestrial	molc N eq	2.98E-03	1.64E-03	3.87E-04	5.00E-03	9.72E-05
POCP	kg NMVOC eq	9.58E-04	4.30E-04	1.10E-04	1.50E-03	3.63E-05
ADP - M&M	kg Sb-Eq	1.35E-06	5.89E-08	8.61E-07	2.27E-06	5.27E-08
ADP - fossil	MJ	3.45E+00	3.87E-01	2.43E-01	4.08E+00	2.36E-01
WDP	m3	8.00E-01	1.34E-03	3.86E-01	1.19E+00	1.14E-03

Indicator	Unit	C1	C2	C3	C4	D
GWP - total	kg CO2 eq	5.76E-02	1.74E-03	1.85E-04	8.90E-05	-4.17E-02
GWP - fossil	kg CO2 eq	5.75E-02	1.74E-03	1.59E-04	8.84E-05	-4.09E-02
GWP - biogenic	kg CO2 eq	3.72E-05	2.78E-06	2.49E-05	6.24E-07	-6.94E-04
GWP - luluc	kg CO2 eq	5.92E-06	6.58E-07	2.47E-07	1.18E-08	-5.59E-05
ODP	kg CFC11 eq	1.23E-08	4.34E-10	1.40E-11	1.88E-11	-2.25E-09
AP	molc H+ eq	5.98E-04	5.54E-06	1.21E-06	9.03E-07	-1.81E-04
EP- freshwater	kg P eq	1.80E-06	1.14E-07	1.22E-07	3.40E-09	-2.55E-05
EP -marine	kg N eq	2.65E-04	1.24E-06	1.98E-07	3.98E-07	-3.68E-05
EP - terrestrial	molc N eq	2.90E-03	1.35E-05	2.08E-06	4.36E-06	-3.68E-04
POCP	kg NMVOC eq	7.89E-04	5.22E-06	4.88E-07	1.19E-06	-1.01E-04
ADP - M&M	kg Sb-Eq	2.69E-08	4.01E-09	1.19E-08	6.19E-11	-1.13E-07
ADP - fossil	MJ	7.85E-01	2.85E-02	1.33E-02	1.29E-03	-7.00E-01
WDP	m3	1.93E-03	1.44E-04	1.71E-03	1.53E-05	-3.31E-02

GWP-total: Global Warming Potential; 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: Depletion potential of the stratospheric ozone layer; AP: Acidification potential, Accumulated Exceedance; EP-freshwater: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional requirements" for indicator given as PO4 eq. EP-marine: Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-terrestrial: Eutrophication potential, Accumulated Exceedance; POCP: Formation potential of tropospheric ozone; ADP-M&M: Abiotic depletion potential for non-fossil resources (minerals and metals); ADP-fossil: Abiotic depletion potential for fossil resources; WDP: Water deprivation potential, deprivation weighted water consumption.

Additional environmental impact indicators

Indicator	Unit	A1	A2	A3	A1-A3	A4
PM	Disease incidence	4.05E-08	1.20E-09	2.09E-09	4.38E-08	9.79E-10
IRP	kBq U235 eq.	4.10E-02	1.85E-03	6.02E-03	4.88E-02	1.21E-03
ETP-fw	CTUe	1.93E-01	7.80E-03	1.21E-02	2.13E-01	7.85E-03
HTP-c	CTUh	5.59E-09	1.30E-11	2.39E-11	5.62E-09	4.99E-12
HTP-nc	CTUh	3.79E-08	3.10E-10	1.77E-09	4.00E-08	2.91E-10
SQP	Dimensionless	7.61E-01	1.42E-01	2.95E-02	9.33E-01	1.99E-01

Indicator	Unit	C1	C2	C3	C4	D
PM	Disease incidence	1.58E-08	1.52E-10	8.21E-12	2.41E-11	-3.62E-09
IRP	kBq U235 eq.	3.56E-03	1.43E-04	7.53E-04	1.09E-05	-1.17E-02
ETP-fw	CTUe	4.32E-03	1.20E-03	1.54E-04	6.95E-06	-2.46E-02
HTP-c	CTUh	1.48E-11	5.14E-13	2.69E-13	2.34E-14	-1.16E-09
HTP-nc	CTUh	2.37E-10	3.26E-11	2.74E-11	4.45E-13	-5.09E-09
SQP	Dimensionless	2.07E-02	4.27E-02	3.24E-04	6.27E-03	-9.98E-02

PM: Particulate matter emissions; IRP: Ionising radiation, human health; ETP-fw: Ecotoxicity (freshwater); ETP-c: Human toxicity, cancer effects; HTP-nc: Human toxicity, non-cancer effects; SQP: Land use related impacts / soil quality.

Resource use

Indicator	Unit	A1	A2	A3	A1-A3	A4	C1	C2	C3	C4	D
RPEE	MJ	1.80E+00	2.76E-03	1.22E+00	3.02E+00	2.52E-03	3.42E-03	2.80E-04	1.14E-02	8.45E-05	-6.84E-02
RPEM	MJ	7.19E-02	1.05E-03	1.17E-02	8.46E-02	8.27E-04	1.00E-03	8.00E-05	3.81E-04	2.18E-05	-1.27E-02
TPE	MJ	1.87E+00	3.81E-03	1.23E+00	3.10E+00	3.35E-03	4.42E-03	3.60E-04	1.18E-02	1.06E-04	-8.11E-02
NRPE	MJ	2.15E+00	2.93E-02	1.26E-01	2.31E+00	2.28E-02	4.38E-02	2.67E-03	1.20E-02	1.53E-04	-4.95E-01
NRPM	MJ	1.29E+00	3.57E-01	1.17E-01	1.77E+00	2.13E-01	7.41E-01	2.58E-02	1.23E-03	1.13E-03	-2.05E-01
TRPE	MJ	3.45E+00	3.87E-01	2.43E-01	4.08E+00	2.36E-01	7.85E-01	2.85E-02	1.33E-02	1.29E-03	-7.00E-01
SM	kg	1.10E+00	3.20E-04	2.69E-03	1.10E+00	2.40E-04	5.81E-04	2.49E-05	5.51E-04	4.95E-06	-6.32E-03
RSF	MJ	4.73E-03	6.29E-05	6.61E-04	5.45E-03	7.16E-05	5.53E-05	7.00E-06	3.17E-04	2.43E-06	-2.94E-03
NRSF	MJ	1.16E-02	2.25E-04	4.13E-03	1.60E-02	2.91E-04	8.84E-05	2.13E-05	1.62E-05	2.51E-07	-2.07E-03
W	m3	1.87E-02	3.23E-05	9.00E-03	2.77E-02	2.71E-05	4.58E-05	3.44E-06	3.99E-05	3.58E-07	-7.74E-04

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non-renewable primary energy resources used as energy carrier; NRPM Non-renewable primary energy resources used as materials; TRPE Total use of non-renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non-renewable secondary fuels; W Use of net fresh water.

End-of-life waste

Parameter	Unit	A1	A2	A3	A1-A3	A4	C1	C2	C3	C4	D
HW	kg	6.37E-01	6.28E-03	3.57E-02	6.79E-01	5.26E-03	8.51E-03	6.17E-01	7.05E-04	1.60E-05	-1.30E-01
NHW	kg	2.11E-01	1.00E-02	7.41E-03	2.28E-01	1.22E-02	5.80E-04	2.83E+00	4.32E-05	1.23E-06	-1.82E-02
RW	kg	4.07E-04	5.51E-06	4.77E-05	4.60E-04	4.71E-06	9.03E-06	5.69E-04	6.89E-06	6.40E-08	-1.23E-04

HW Hazardous waste disposed; NHW Non-hazardous waste disposed; RW Radioactive waste disposed.

End-of-life outflows

Parameter	Unit	A1	A2	A3	A1-A3	A4	C1	C2	C3	C4	D
CR	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
MR	kg	8.20E-01	2.55E-04	1.24E-03	8.22E-01	2.00E-04	3.63E-04	2.10E-02	9.81E-01	4.42E-06	-5.81E-03
MER	kg	3.52E-03	1.06E-04	1.16E-04	3.75E-03	5.49E-05	2.87E-04	6.58E-03	1.10E-06	4.38E-07	-7.61E-05
EEE	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
ETE	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

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy.

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Biogenic carbon content

Indicator	Unit	At the factory gate
Biogenic carbon content in product	Kg C	0.00E+00
Biogenic carbon in packaging	Kg C	0.00E+00

Note – 1 kg of carbon is equivalent to 44/12 kg CO_2.

Additional Norwegian requirements

Greenhous gas emission from the use of electricity in the manufacturing phase

The Norwegian national production mix from import, medium voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3).

National electricity grid	Unit	Value
Norwegian mix (market for electricity, ecoinvent 3.8)	kg CO2 -eq/kWh	0,028

Additional environmental impact indicators required for construction products

To increase the transparency of biogenic carbon contribution to climate impact, the indicator GWP-IOBC is required as it declares climate impacts calculated according to the principle of instantaneous oxidation. GWP-IOBC is also referred to as GWP-GHG in the context of Swedish public procurement legislation.

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-IOBC	kg	3.89E-01	1.55E-02	5.76E-02	1.74E-03	1.85E-04	8.90E-05	-4.17E-02

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

- ■ The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
- □ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- □ The product contains dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- □ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment

Not relevant.

Carbon footprint

Not considered.

Bibliography

ISO 14025:2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products.
ISO 21930:2017	Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
BREG EN EPD No. 000140	Carbon steel reinforcing bar (secondary production route – scrap) Portuguese production from SN Maia – Siderurgia Nacional S.A
SP-04910	Steel billets and hot rolled steel Norwegian production from Celsa Armeringsstål AS

epd-norway Global Program Operator	**Program Operator**	phone	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	e-mail:	post@epd-norge.no
	Norway	Web	www.epd-norge.no
epd-norway Global Program Operator	**Publisher**	phone	+47 23 08 80 00
	The Norwegian EPD Foundation		
	Post Box 5250 Majorstuen, 0303 Oslo	e-mail:	post@epd-norge.no
	Norway	web	www.epd-norge.no
HRC	**Owner of the decleration**	phone	+47 70 17 65 00
	HRC Europe AS		
	Lierstranda 107, PB 591, 3412 Lierstranda,	e-mail:	info@hrceurope.com
	Norway	Web	hrc-europe.com
energiråd	**Author of the life cycle assessment**	phone	+47 98 25 90 10
	Energiråd AS		
	Trippevegen 1, 6009 Ålesund	e-mail:	harald@energirad.no
	Norway	web	www.energirad.no
ECO PLATFORM EPD VERIFIED	Eco Platform Eco Portal	Web	www.eco-platform.org

EPD for the best environmental decision

Global Program Operator

The Norwegian EPD foundation
www.epd-norge.no

epd-norway
Global Program Operator