Environmental Product Declaration

In accordance with ISO14025:2010 and EN 15804:212+A1:2014

Stainless Steel Reinforcing Bar

Roldan, S.A. (ACERINOX S.A)

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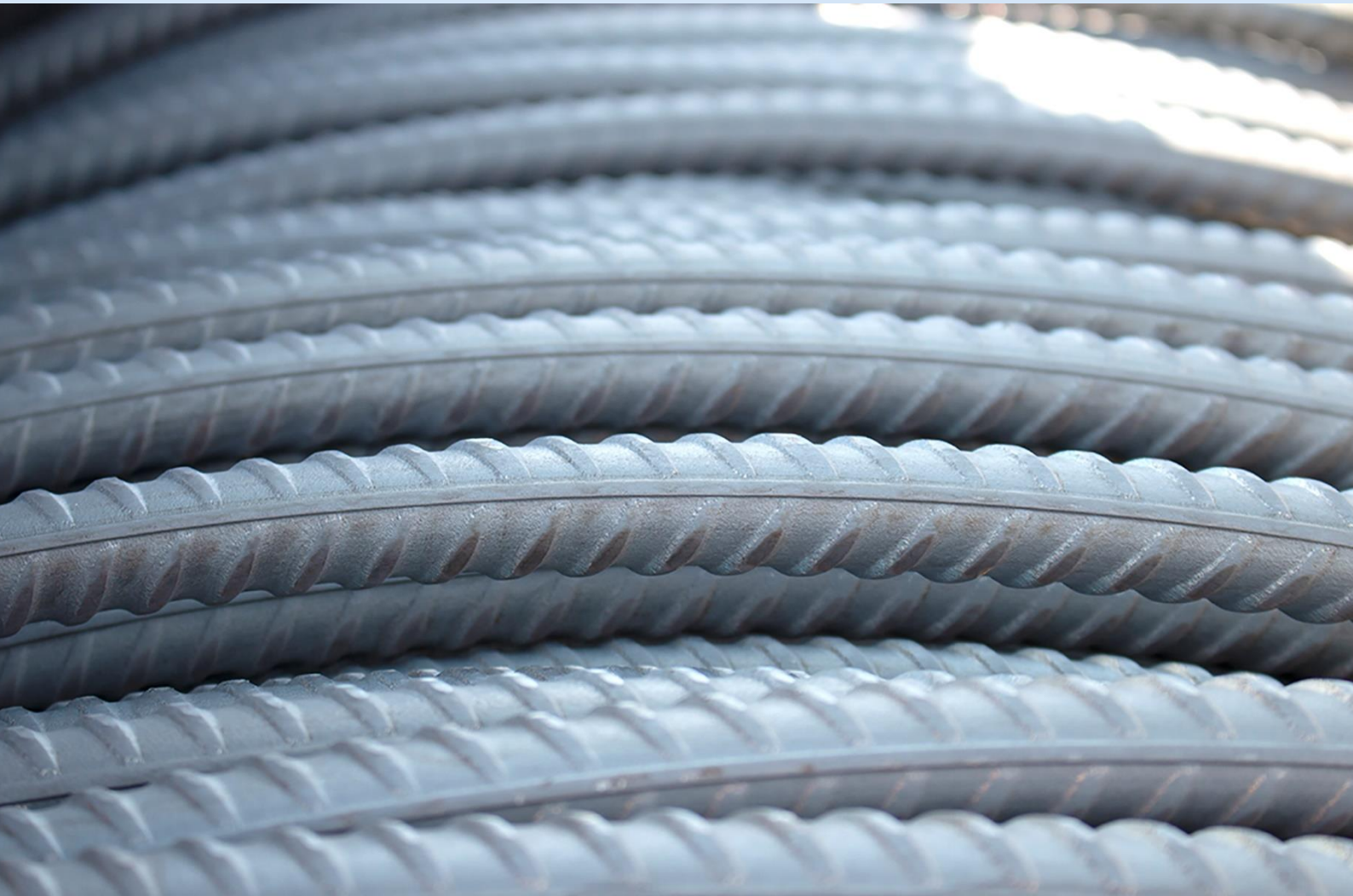

Programme information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com

Product category rules (PCR): PCR 2012:01 Construction products and construction services, version 2.33) (EN 15804:2012+A1).
PCR review was conducted by: The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via *info@environdec.com*
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: Marcel Gómez Ferrer. Marcel Gómez Consultoría Ambiental (www.marcelgomez.com) Tlf: 0034 630 64 35 93 Email: info@marcelgomez.com Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No
Manufacturer information EPD owner: ROLDAN, S.A (ACERINOX S.A) Address: Santo Tomás de las Ollas s/n Ponferrada 24400 (León). Contact details: Juan José Fernández // juanjose.fernandez@acerinox.com Website: www.acerinox.com
EPD developer: SGS TECNOS S.A.U

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1 Company information

Acerinox is one of the most competitive companies in the world in the manufacturing of stainless steels and nickel alloys. It is the most global company in the sector, with a presence on the five continents, factories on four continents and supplying to customers in 96 countries. Since its incorporation, now 50 years ago, Acerinox has been carrying out a continuous investment programme, with the development of its own technological innovations, which, in some cases, have constituted a true milestone in stainless steel technology.

Acerinox, S.A. is the Parent company of the Group and the main holder of the shares of each of its subsidiaries. Acerinox, S.A. also facilitates access to new stainless markets and promotes the exchange of best practices among the various subsidiaries of the Group.

Acerinox's stainless steel manufacturing in Spain is divided in three plants. Acerinox Europa, in Palmones –Algeciras, is the main plant where the electric steelworks and production of flat products are located. This plant produces the billets that are rolled at the Roldán-Ponferrada plant, to long products, wire rod, bars, angle profiles, including the stainless steel reinforcing bars in lengths and coils. The stainless wire rod is also used by the Inoxfil-Igualada plant for the cold drawing of stainless steel wire, and the production of reinforcing or ribbed stainless steel wire. The long products manufactured by the latter two plants supply both the national market and international customers, and its stainless steels are present in some of the most emblematic international construction projects.

Management system certifications

All Acerinox factories and workplaces comply with the quality and environmental controls required by the legislation in each country. Each of them have implemented Environmental Management Systems in accordance with the ISO 14001:2015 standard. In addition, each of the subsidiaries has assumed standards that exceed the legislative requirements in various fields such as quality, safety and the environment. Roldan plant is certified according to ISO 9.001.

Further information is available on www.acerinox.com/en/

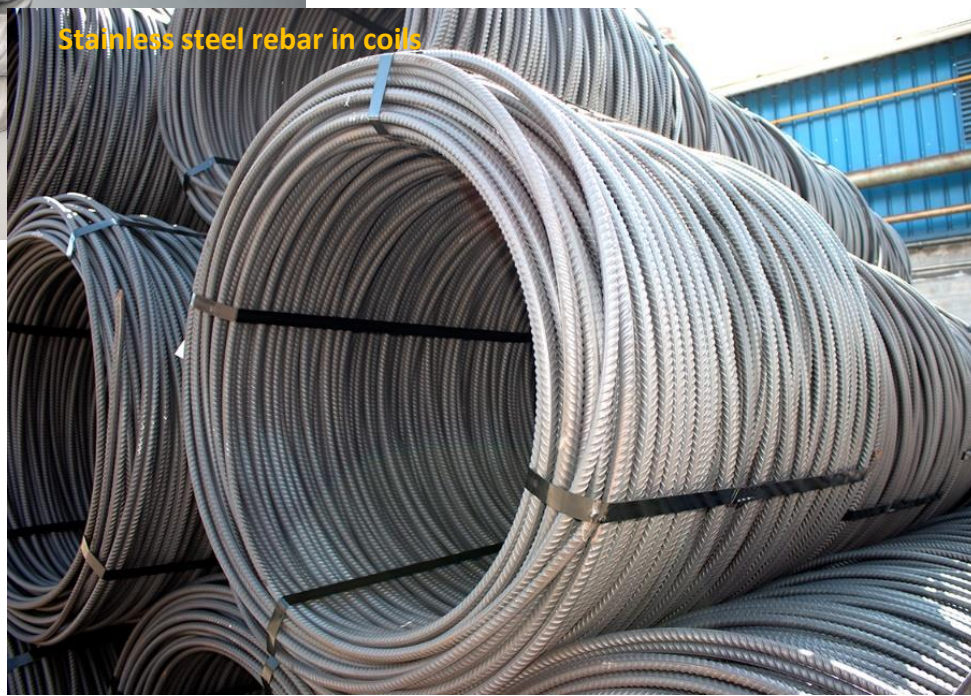
2 Product information

This EPD describes **stainless steel rebar** produced at Roldan S.A. plant located in Ponferrada (Spain). The products are defined as **hot rolled products** with a circular section with at least two rows of transverse ribs uniformly distributed throughout its length. Stainless steel rebar is supplied as coil, bars and cut lengths. Stainless steel rebar is also available in a wide **range of sizes** in both standard and special grades. Roldan provides reinforcement of different height of coils (1.700 to 2.200 mm) and bar lengths (up to 12.000 mm).

Stainless steel reinforcing bar is produced according to BS 6744 and UNE 36067. It is made with over 70% of steel scrap, which is melted in an Electric Arc Furnace (EAF) and less than 30% of primary steel, which is melted iron in an A.O.D converter followed by continuous casting of the billet and hot rolling.
The classification of the product in UN CPC is 4124.

The product is commercialized by Roldán S.A as **REBARINOX®**


Stainless steel rebar


Stainless steel rebar in coils

2.1 Application

Stainless steel rebar is a product similar to carbon steel reinforcing bar in size and shape, but with the special characteristic that its chemical composition is of a stainless steel type, which ensures a better performance against corrosion and provides mechanical properties , depending on the type of stainless steel used, similar or superior to those of carbon steel.

Therefore, the product is used to reinforce concretes, in particular areas where there is a high risk that the reinforcement will suffer corrosion problems. These problems can cause the structure to collapse.

2.2. Technical data

Parameter	Value	Unit
Density	7800-8000	Kg/m^3
Modulus of elasticity	160.000-200.000	N/mm^2
Coefficient of thermal expansion for 20-100°C range	13-16	$10^{-6}\ K^{-1}$
Thermal conductivity 20°C	13- 15	W(mK)
Melting point	1375-1450	°C
Recycled content	>70	%

2.3 Mechanical properties

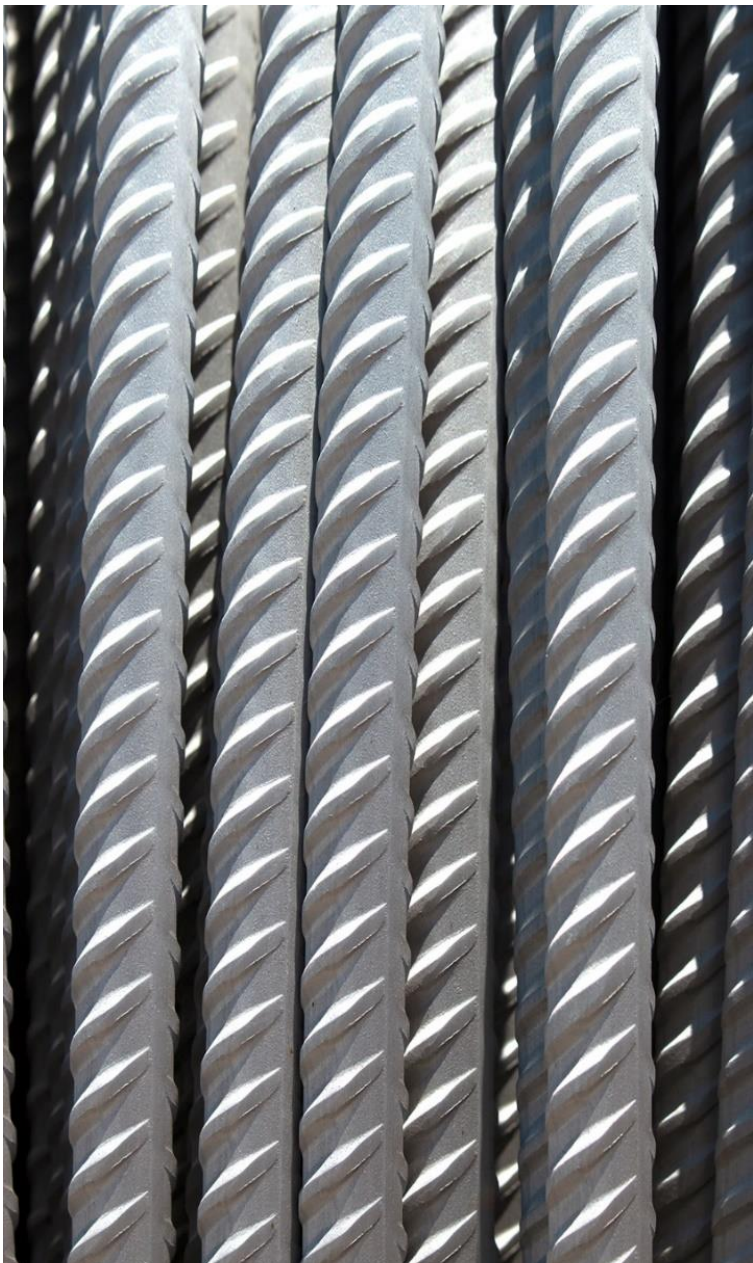
Ø (mm)	Rm	$Rp_{0,2\%}$ (MPa)	A_5 %	A_{gt} %	$Rm/Rp_{0,2\%}$
6-50	540	> 500	>14	> 5	>1,08

The most commonly stainless steel used in the manufacture of reinforcing products for concrete (rebars) are the following commercialized by Acerinox as DUPLEX grades. Duplex grades combine great corrosion resistance with high mechanical properties, making them the preferred option for stainless rebar.

Euronorm	UNS	AISI
1.4362	X_2CrNiN_{23-4}	S32304 (2304)
1.4462	$X_2CrNiMoN_{22-5-3}$	S31803 (2205)
1.4482	$X_2CrMnNiMoN_{21-5-3}$	S32001 (2001)

2.4 Manufacturing process

The raw material for the stainless steel rebar (billets) are supplied by Acerinox Europa and the transportation is by road from Los Barrios (Spain) to Ponferrada where Roldan's plant is located. Once the raw materials reach Roldan's plant they are rolled to the required dimensions. After hot rolling, the stainless steel is pickled (coil) or it is straightened cut and picked (rebar).



3 LCA information

3.1 Declared unit

The declared unit is 1 ton of stainless-steel reinforcing rebar manufactured by Roldan, S.A.

3.2 Reference service life

Stainless steel reinforcing products are used in the main project structure so the reference service life will equal the lifetime of the project.

3.3 Time representativeness

Specific data used for the LCA calculations refer to year 2019.

3.4 Geographical scope

Global.

3.5 Database and LCA software used

Ecoinvent v3.6 database (cut-off by classification) and SimaPro 9.1.11 software was used for the LCA performance.

3.6 System boundary

The system boundary if the EPD follows the modular design by EN 15804. This EPD is Cradle-to-gate with options (Module B Use, stages C2-C4 and module D).

*X: Included; MND: Module non declared

SYSTEM BOUNDARY																
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Water 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	MND	MND	X	X	X	X	X	X	X	MND	X	X	X	X

3.7 Data quality

The material and energy data collected are from the year 2019 and include the raw materials and energy consumption data. The collected data were checked for plausibility and consistency. Good data quality can be assumed.

3.8 Cut off criteria

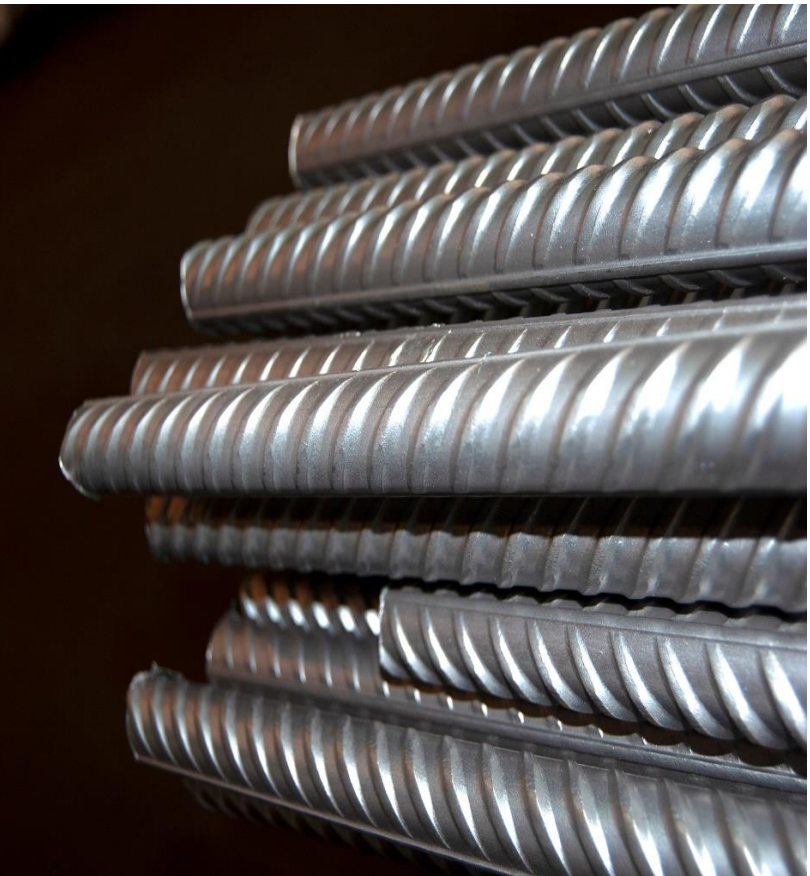
All reported data were incorporated and modelled i.e raw materials production and transportation to Roldan's plant, water and energy consumption and production waste.

Overall, the ancillary materials which composition is below to 1% have been excluded. It is solidly assumed that the environmental impacts of those material will not exceed 1% each or 5% in total.

The modularity principle and the "polluter pays" principle have been considered.

3.9 Allocation

An allocation criterion based on mass was used.



4 LCA scenarios

A1. Raw material production

The main component is the material known as billet. This material is supplied by Acerinox Europa with a content more than 70% of scrap steel (secondary steel) and less than 30% of primary steel. This material is not classified as hazard in REACH Regulation 1907/2006.

A2. Raw material transport

Transportation of all raw materials and ancillary materials by road in lorry 16-32 metric ton, EURO 6.

A3. Stainless steel reinforcing rebar manufacturing

Once the raw materials reach Roldan's plant they are rolled to the required dimensions. After hot rolling the stainless steel is pickled (coils), or it is straightened and pickled (rebars). Electricity for the manufacture is supplied by FORTIA ENERGIA S.L. It has been considered the supplier mix for 2019.

Primary energy source 2019	Contribution
Renewable	3,7%
Co-generation	12,6%
Natural Gas	34,9%
Coal	8,1%
Oil + petroleum products	3,6%
Nuclear	35,5%
Others	1,6%

Heat and water are also consumed during the manufacturing process.

Packaging materials required and wastes generated during the manufacturing process are included.

B1. Use

Scenario information	Description	Unit	Value
Use process description or source of information	No consumption or outputs during use	-	-

B2. Maintenance

Scenario information	Description	Unit	Value
Maintenance process description or source of information	No maintenance required	-	-

B3. Repair

Scenario information	Description	Unit	Value
Repair process description or source of information	No repair process required	-	-

B4. Replacement

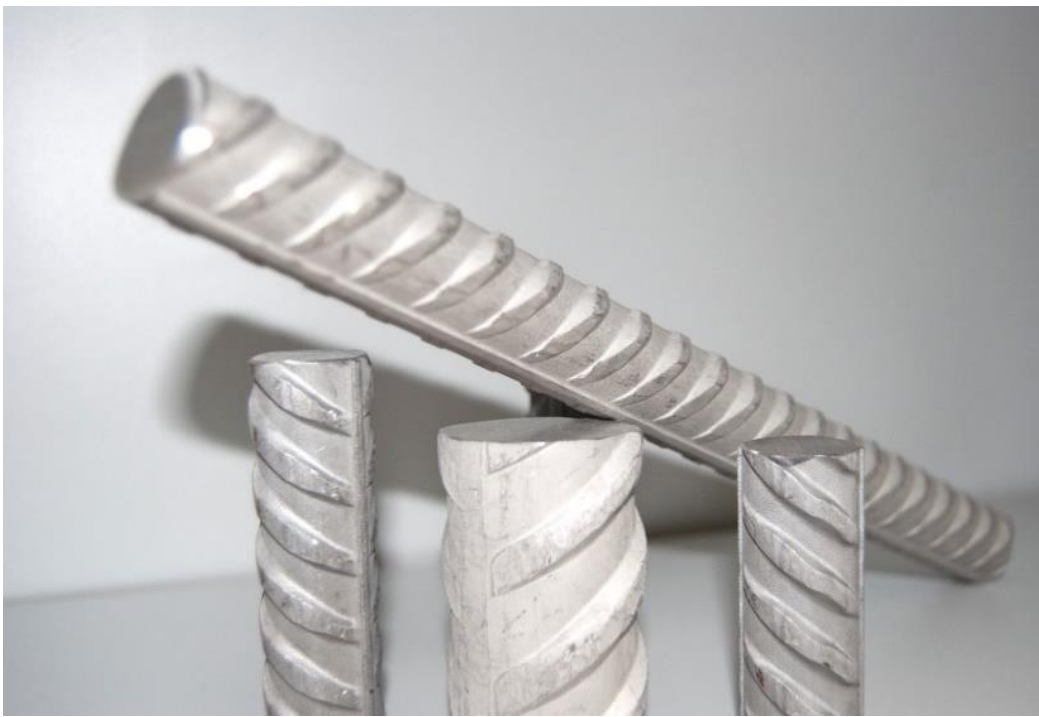
Scenario information	Description	Unit	Value
Replacement cycle	No replacement considerations required	-	-

B5. Refurbishment

Scenario information	Description	Unit	Value
Refurbishment process description or source of information	No refurbishment process required	-	-

B6. Use of energy; and B7 Use of water

Scenario information	Description	Unit	Value
Other assumptions for scenario development, e.g, frequency of use, number of occupants	No use phase requirements of either water or energy required	-	-



Module C End of life: C2, C3 and C4

The considered waste treatment rates are those reported by ISSF (International Stainless Steel Forum) for the most recent year published. The recycling rate for the stainless steel used in building and infrastructure is 85%. Therefore, 15% of recovered steel is considered to become landfill scrap.

Scenario information	Unit	Value
Recovery system	Kg/DU for re-use	0
	Kg/DU for recycling	850
	Kg/DU for energy recovery	0
Disposal	Kg/ to landfill	150
Waste transportation	50 km for the recycling plant 100 km to landfill, the return trip is included in the system	

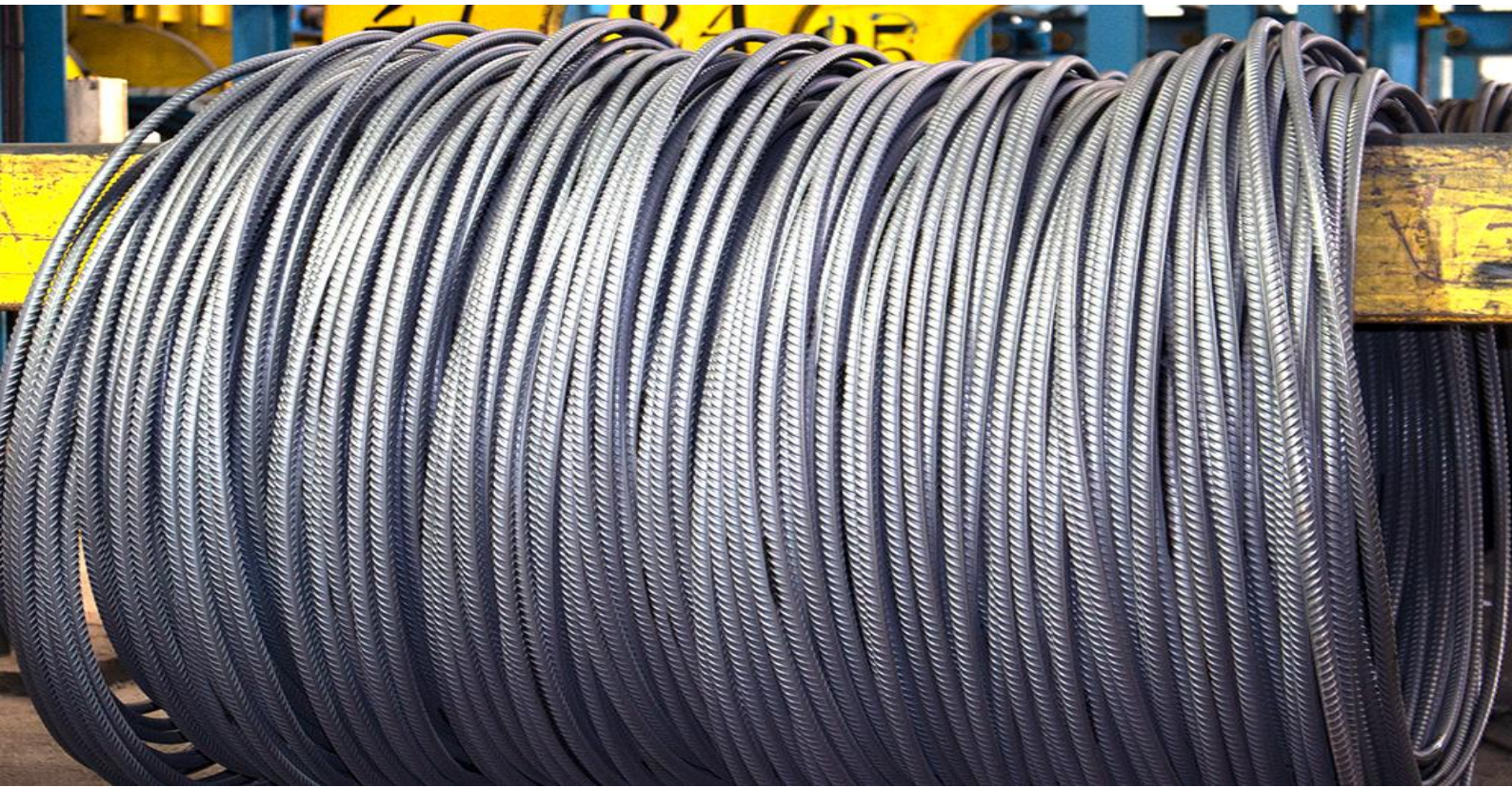
*DU: Declared unit

Module D. Reuse- Recovery- Recycling potential

Losses by recovery of steel from crushed concrete, per 1 ton of steel in the building.

	Quantity (kg)
Substitution of raw material	-30 kg

The load to replace these losses is calculated as the environmental impacts of producing the equivalent quantity of rolled steel via the blast furnace route. The considered waste treatment rates are those reported by ISSF (International Stainless Steel Forum) for the most recent year published.



5 Content declaration

Roldan, S.A declares that their products do not contain substances of very high concern (SVHC) as defined and listed in the European Chemicals Agency (ECHA) Candidate List of substances of very high concern for Authorization, in levels above 0.1 % by weight for the products that concern this LCA report.

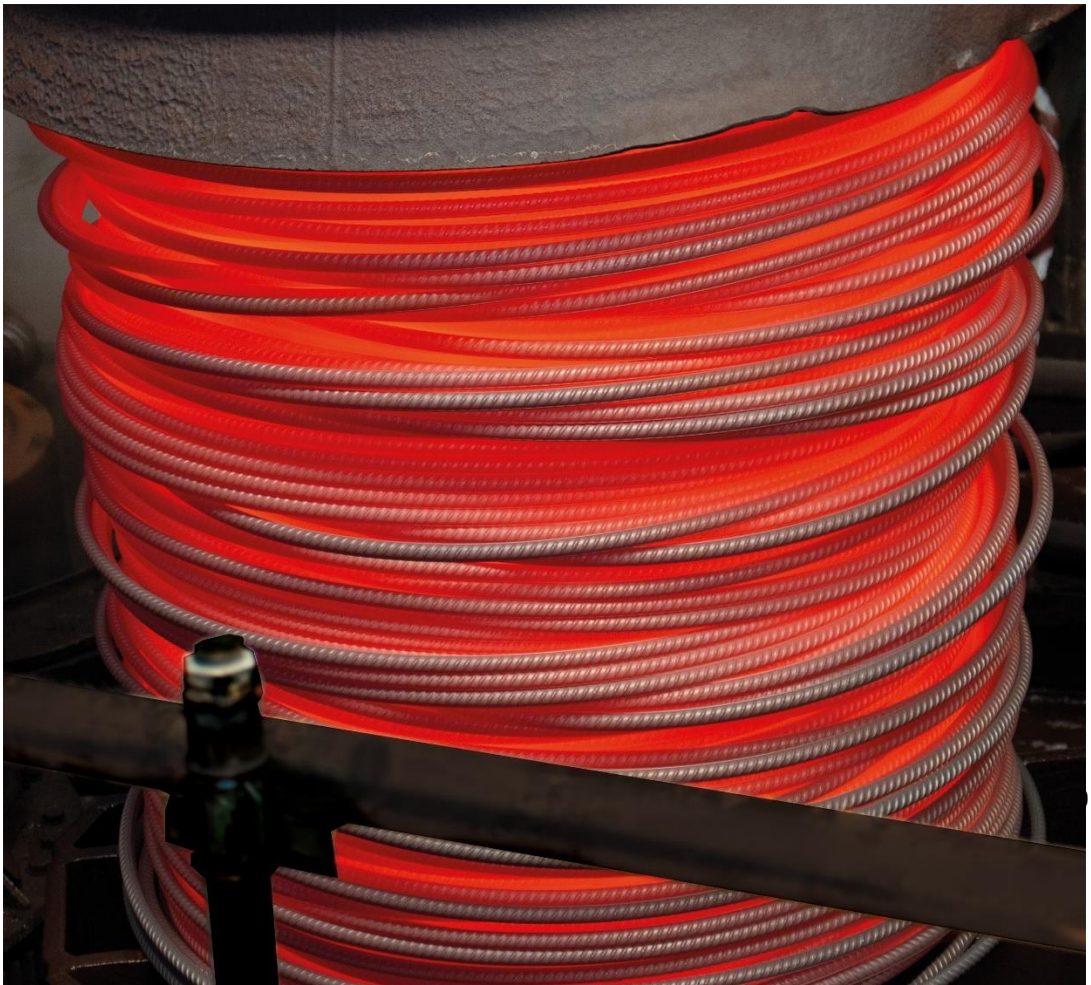
Materials/chemical substances	%	Environmental / hazardous properties
Billet	>100	No classified
Calcium hydroxide	3,6	01-2119491178-29-0000
Other minor inorganic chemicals	< 6	01-2119458838-20-0075 01-2119458860-33-0007 01-2119487297-23

Packaging

Materials/chemical substances	%	Environmental / hazardous properties
Plastic bags (poly-olefins fiber)	0,04	--
Steel strip	0,003	--
Polypropylene strip	0,7	--

Recycled material

Stainless steel is a fully recyclable material and scrap steel has a strong market position. The high value of stainless-steel scrap makes it worth collecting and sorting, and that is the reason why it is recycled at such a high rate. The high end-of-life recycling rate indicates how efficiently stainless steel is recycled. For the product, the recycled content of scrap steel to produce billets is more than 70%.



6 Environmental performance

According to UNE EN 15804, impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Potential environmental impact

Parameters describing environmental impacts were calculated using CML-IA method version 3.05

PARAMETER	UNIT	TOTAL A1-A3	B1	B2	B3	B4	B5	B6	B7	C2	C3	C4	D
Global warming potential (GWP)	kg CO2 eq.	4,99E+03	0	0	0	0	0	0	0	9,31E+00	0	7,73E-01	-3,64E-04
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	3,25E-04	0	0	0	0	0	0	0	1,71E-06	0	2,58E-07	-1,02E-11
Acidification potential (AP)	kg SO2 eq.	2,67E+01	0	0	0	0	0	0	0	2,21E-02	0	5,67E-03	4,77E-01
Eutrophication potential (EP)	kg PO43- eq.	2,67E+00	0	0	0	0	0	0	0	2,82E-03	0	9,99E-04	6,90E-02
Formation potential of tropospheric ozone (POCP)	kg C2H4 eq.	1,41E+00	0	0	0	0	0	0	0	1.15E-03	0	2,38E-04	3,83E-02
Abiotic depletion potential – Elements	kg Sb eq.	1,96E-01	0	0	0	0	0	0	0	2,59E-04	0	7,23E-06	-3,02E-10
Abiotic depletion potential – Fossil resources	MJ, net calorific value	5,38E+04	0	0	0	0	0	0	0	1,39E+02	0	2,18E+01	-3,41E-03

Use of resources

Parameters describing resource use were evaluated with the Cumulated Energy Demand method version 1.11 except for the indicator of use of net fresh water that was evaluated with Recipe 2016 Midpoint (H) version 1.02

PARAMETER		UNIT	TOTAL A1-A3	B1	B2	B3	B4	B5	B6	B7	C2	C3	C4	D
Primary energy resources – Renewable	**Use as energy carrier**	MJ, net calorific value	1,48E+04	0	0	0	0	0	0	0	2,03E+00	0	1,79E-01	1,79E+02
	Used as raw materials	MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	MJ, net calorific value	1,48E+04	0	0	0	0	0	0	0	2,03E+00	0	1,79E-01	1,79E+02
Primary energy resources – Non-renewable	**Use as energy carrier**	MJ, net calorific value	6,43E+04	0	0	0	0	0	0	0	1,51E+02	0	2,35E+01	-3,02E+03
	Used as raw materials	MJ, net calorific value	1,38E+01	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	MJ, net calorific value	6,43E+04	0	0	0	0	0	0	0	1,51E+02	0	2,35E+01	-3,02E+03
Secondary material		kg	7,50E+02	0	0	0	0	0	0	0	0	0	0	0
Renewable secondary fuels		MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	0	0	0	0	0	0	0	0	0	0	0	0
Net use of fresh water		m^3	1,28E-01	0	0	0	0	0	0	0	1,52E-02	0	2,36E-02	2,36E+00

Waste production and output flows

Waste production

Environmental indicators describing waste generation were obtained from LCI except for background information which has been calculated using EDIP 2003 method.

PARAMETER	UNIT	TOTAL A1-A3	B1	B2	B3	B4	B5	B6	B7	C2	C3	C4	D
Hazardous waste disposed	kg	7,91E-02	0	0	0	0	0	0	0	3,72E-04	0	3,30E-05	-5,09E-02
Non-hazardous waste disposed	kg	6,15E+03	0	0	0	0	0	0	0	6,95E-03	0	1,50E+02	7,55E+00
Radioactive waste disposed	kg	1,77E-01	0	0	0	0	0	0	0	9,67E-04	0	1,45E-04	6,93E-03

Output flows

PARAMETER	UNIT	TOTAL A1-A3	B1	B2	B3	B4	B5	B6	B7	C2	C3	C4	D
Components for reuse	kg	0	0	0	0	0	0	0	0	0	0	0	0
Material for recycling	kg	4,80E-01	0	0	0	0	0	0	0	0	8,50E+02	0	0
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0	0	0	0	0	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0	0	0	0	0	0	0	0	0

7 References

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