

# ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	<b>Outokumpu Oyj</b>
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-OTO-20140002-IBD1-EN
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Valid to	02.03.2019

## Cold Rolled Stainless Steel Outokumpu Oyj




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Institut Bauen  
und Umwelt e.V.



## 1. General Information

<p><b>Outokumpu</b></p> <hr/> <p><b>Programme holder</b>          IBU - Institut Bauen und Umwelt e.V.          Panoramastr. 1          10178 Berlin          Germany</p> <hr/> <p><b>Declaration number</b>          EPD-OTO-20140002-IBD1-EN</p> <hr/> <p><b>This Declaration is based on the Product Category Rules:</b>          Structural steels, 07-2012          (PCR tested and approved by the independent expert committee)</p> <hr/> <p><b>Issue date</b>          03.03.2014</p> <hr/> <p><b>Valid to</b>          02.03.2019</p> <hr/> <p></p> <hr/> <p>Prof. Dr.-Ing. Horst J. Bossemayer          (President of Institut Bauen und Umwelt e.V.)</p> <hr/> <p></p> <hr/> <p>Dr. Burkhard Lehmann          (Managing Director IBU)</p>	<p><b>Cold Rolled Stainless Steel</b></p> <hr/> <p><b>Owner of the Declaration</b>          Outokumpu Oyj          Riihitontuntie 7          FI-02201 ESPOO          Finland</p> <hr/> <p><b>Declared product / Declared unit</b>          This EPD applies to 1 ton of cold rolled stainless steel product. It covers steel delivered as sheet or as plate for various applications for building and civil work.</p> <hr/> <p><b>Scope:</b>          The declaration applies to 1 ton of cold rolled stainless steel product produced by Outokumpu.          The Life Cycle Assessment is based on data from the following Outokumpu production plants:          - Outokumpu Nirosta GmbH, Dillenburg, Germany          - Outokumpu Nirosta GmbH, Krefeld, Germany          - Outokumpu Stainless AB, Avesta, Sweden          - Outokumpu Stainless AB, Nyby, Torshalla, Sweden          - Outokumpu Stainless Oy, Tornio, Finland</p> <p>Production has been modeled using annual production data from 2011. Where required averaging is based on production output from each site. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.</p> <hr/> <p><b>Verification</b></p> <table border="1"> <tr> <td colspan="2">The CEN Norm EN 15804 serves as the core PCR</td> </tr> <tr> <td colspan="2">Independent verification of the declaration and data according to ISO 14025</td> </tr> <tr> <td><input type="checkbox"/> internally</td> <td><input checked="" type="checkbox"/> externally</td> </tr> </table> <hr/> <p></p> <hr/> <p>Mr Olivier Muller          (Independent tester appointed by SVA)</p>	The CEN Norm EN 15804 serves as the core PCR		Independent verification of the declaration and data according to ISO 14025		<input type="checkbox"/> internally	<input checked="" type="checkbox"/> externally
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## 2. Product

### 2.1 Product description

This EPD describes cold rolled stainless steel products produced by Outokumpu Oyj. Cold rolled products are supplied as coil, sheet or plate. Cold rolled stainless steel has excellent dimensional tolerances and high surface quality. A number of sheet widths and heights are available to meet the various design specifications and requirements. A multitude of surface finishes are also available, including patterned, wet or dry polished. This EPD is applicable to homogeneous Outokumpu cold rolled products which are used in the construction and building industry.

### 2.2 Application

Cold rolled products are used in a wide range of applications in building and construction. Typical applications are building envelopes, interior cladding and paneling, heating, cooling and ventilation, lifts and elevators.

### 2.3 Technical Data

#### Constructional data

Name	Value	Unit
Density	7900	kg/m <sup>3</sup>
Modulus of elasticity	205	N/mm <sup>2</sup>
Coefficient of thermal expansion	13.4	10 <sup>-6</sup> K <sup>-1</sup>
Thermal conductivity	21	W/(mK)

### 2.4 Placing on the market / Application rules

For the marketing in the EU/EFTA the Regulation (EU) No 305/2011 dated from 9 March 2011 applies. The products need a Declaration of Performance taking into consideration /EN 10088:2009/ Stainless steels and the CE-marking. For the application and use the respective national provisions apply.

The products are produced in accordance with various national and/or international technical regulations. The products are certified in accordance with product standards:

- /EN 10088:2009/, Stainless steels
- /EN 10028-7:2007/, Flat products made of steels for pressure purposes – Stainless steels
- /ASTM A240/, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- /ASME IID/, Materials
- /JIS G4304: 2012/, Stainless steel plate

More detailed information on technical properties in the Outokumpu brochure “Steel Grades, Properties and Global Standards”.

### 2.5 Delivery status

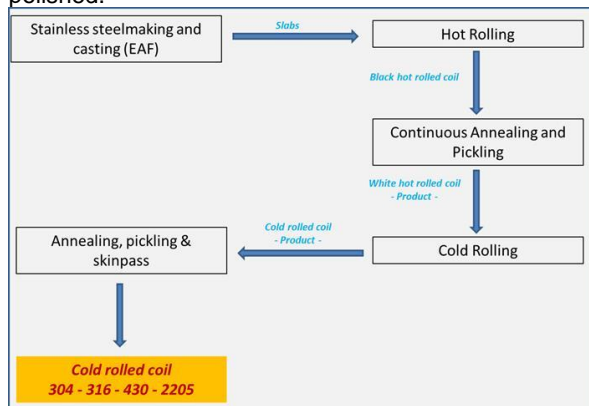
Delivered with a standard cold rolled finishing condition, (e.g. 2B) according to /EN 10088-1/ and in accordance with /EN 10204/. The dimensions of the declared product may vary according to the final use.

### 2.6 Base materials / Ancillary materials

Manufacturing is based on recycling and ferrous scrap (predominantly stainless steel scrap) is used as a major raw material. Alloying elements are also added as ferroalloys or metals. The most common alloying elements are chromium, nickel, molybdenum, manganese and silicon. Other elements, for example nitrogen, niobium and titanium may also be present in the stainless steel. The presence and rates of these alloying elements depend on the stainless steel designation as set out in /EN 10088-1/. All stainless steels contain at least 10.5 % chromium. Substances listed on the “Candidate List of Substances of Very High Concern for Authorisation” by the European Chemicals Agency are not contained in the stainless steel in declarable quantities.

### 2.7 Manufacture

The steel scrap is melted in an electric arc furnace to obtain a steel melt. The liquid steel is further refined (adjustment of sulphur, carbon and phosphorous) and alloyed to give the stainless steel the required characteristics. The molten steel is then cast into semi-finished steel products like slabs or billets. The semi-finished steel products are hot rolled and then annealed and pickled and cold rolled to a desired thickness. If required, they can also be pattern rolled or polished.



### 2.8 Environment and health during manufacturing

Environmental, occupational health and safety and quality management are in accordance with /ISO 14001/, /ISO 9001/ and /OHSAS 18001/.

### 2.9 Product processing/Installation

Processing and installation of the steel coil, sheet or plate has to be carried out according to generally recognized engineering rules and the manufacturer’s recommendation depending on the respective application.

Eurocodes /EC3/ and /EC4/ apply to the design and construction. They include the requirements regarding performance, durability and fire resistance of steel structures. During handling and use of the products, normal occupational safety measures should be applied. Instructions from the manufacturer concerning welding as well as cold forming are to be followed. Under normal conditions there will be no significant environmental impact to water, air or soil.

Residual material like steel scrap should be collected as it is 100% recyclable.

### 2.10 Packaging

Stainless coils and plates are usually delivered with interleaving paper and/or a polyethylene plastic film to protect the surface. This paper/plastic has been included in the EPD. In some cases, wooden pallets may be used for truck transport, although these have not been included in the EPD.

### 2.11 Condition of use

The maintenance requirements depend on the specific design and application, but typically stainless steel only requires a minimum of maintenance, for example, washing with mild detergents to maintain the product’s appearance.

### 2.12 Environment and health during use

Under normal conditions of use, stainless steel products do not cause adverse health effects and stainless steel does not release volatile organic compounds (VOCs) to indoor air.

Similarly no significant environmental impact to water, air or soil is expected, due to the extremely low metal release from stainless steel and the low maintenance need.

### 2.13 Reference service life

Service life is dependent upon physical and mechanical service conditions. Correct alloy designation choice can satisfy a required service life.

### 2.14 Extraordinary effects

#### Fire

Structural steel products meet the requirements of building material safety class A1 (i.e. non-flammable according to /EN 13501-1/).

#### Water

In the event of unforeseeable exposure to water caused by sudden flooding, no risks to the environment or human health are expected to occur.

#### Mechanical destruction

In the event of mechanical destruction, no risks to the environment or human health are expected to occur.

### 2.15 Re-use phase

Stainless steel structures are not generally reused at end-of-life. Reuse is possible and could take place providing that the reused component was able to meet the technical specifications required. Stainless steel is more commonly recycled as material recovered at end-of-life can be recycled to the same quality of steel without loss of properties.

### 2.16 Disposal

Stainless steel scrap is a valuable resource with well-established recycling routes. Disposal is not recommended, but has no adverse environmental impact.

The /European Waste Catalogue/ code for iron and steel products is 17 04 05.

### 2.17 Further information

For further information on these products please refer to <http://www.outokumpu.com>.

## 3. LCA: Calculation rules

### 3.1 Declared Unit

The declaration applies to one ton of cold rolled stainless steel product. The declared unit is the production and recycling of one ton of cold rolled stainless steel product.

### 3.2 System boundary

This EPD is cradle-to-gate with options, and includes the following process steps:

- Upstream production of raw materials, fuels and energy and all relevant upstream transport processes.
- Production/manufacturing of the stainless steel product.
- Waste water and treatment of wastes generated on site including swarf, dusts, scrap, slag and waste water.
- End-of-life (recycling, remelting or disposal of steel scrap).

### 3.3 Estimates and assumptions

95 % of cold rolled structural steel products are assumed to be recycled at end-of-life. The average cold rolled product produced by Outokumpu has a stainless steel scrap content of 60.8 % hence the net stainless steel scrap output is 34.2 % (95 % - 60.8 %). This stainless steel scrap is declared as a credit in module D. This means that for each 1000 kg of cold rolled stainless steel product produced, 342 kg stainless steel scrap is credited.

#### *End-of-Life Scenario*

At end-of-life, a 95 % recycling rate for the steel product is assumed. The remaining 5 % is assumed to remain uncollected or to go to disposal e.g. landfill.

### 3.4 Cut-off criteria

All data gathered from the production data acquisition are considered, i.e. all raw materials, water, thermal and electrical energy, packaging materials, and production waste. The principal material transport processes (such as alloys and scrap) are also considered. Thus, even minor material and energy flows of less than 1 % mass are included. The total sum of neglected processes per module A and D (for the sub-modules covered) does not exceed 5 %. Machines, facilities and infrastructure required during manufacture are not taken into account.

### 3.5 Background data

Background data for upstream materials, fuels and energy production are taken from the /GaBi 6 Software/ produced by PE INTERNATIONAL.

### 3.6 Data quality

Production has been modeled using 2011 average production data provided by Outokumpu's own sites and has been quality-checked by Outokumpu and PE INTERNATIONAL.

### 3.7 Period under review

Modelling is based on production data from 2011. Background data used are from the period 2010 to 2012 and are taken from the /GaBi 6 Software /. Documentation related to all the processes used in the stainless steel production model can be found in the GaBi 6 documentation /GaBi 6 Documentation/.

### 3.8 Allocation

Slag generated as a by-product of electric arc furnace (EAF) steelmaking is used as an input to a variety of industries including as a constituent of cement, in road building or as a fill material. An allocation methodology to account for this in line with the requirements of /EN 15804/ is being developed by European steel industry partners, but is not available for stainless steels at the present time. In the interim, this study has adopted a conservative approach and has assumed that all the environmental burdens associated with the production of stainless steel products and EAF slag are allocated to the production of steel.

Production losses of steel during the production process are recycled in a closed loop reducing the requirement for external scrap.

Specific information on allocation within the background data is given in the GaBi datasets documentation (/GaBi 6 Documentation/).

### 3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

#### 4. LCA: Scenarios and additional technical information

**Reuse, recovery and/or recycling potentials (D), relevant scenario information**

Name	Value	Unit
Stainless steel scrap input (into module A)	60.8	%
End-of-life recycling rate	95	%
Net stainless steel scrap credit	34.2	%
Equiv. Mass of stainless steel scrap credited per ton product	342	kg



## 5. LCA: Results

### DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

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 <sup>1)</sup>	Refurbishment <sup>1)</sup>	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

### RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: declared unit and product

Parameter	Unit	A1 - A3	D
Global warming potential	[kg CO <sub>2</sub> -Eq.]	3550	-1860
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	-1.07E-5	-1.05E-5
Acidification potential of land and water	[kg SO <sub>2</sub> -Eq.]	24.3	-16.4
Eutrophication potential	[kg (PO <sub>4</sub> ) <sup>3-</sup> -Eq.]	1.2	-1.03
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	2.05	-1.05
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	0.139	-0.114
Abiotic depletion potential for fossil resources	[MJ]	50700	-22800

### RESULTS OF THE LCA - RESOURCE USE: declared unit and product

Parameter	Unit	A1 - A3	D
Renewable primary energy as energy carrier	[MJ]	6400	-836
Renewable primary energy resources as material utilization	[MJ]	0	0
Total use of renewable primary energy resources	[MJ]	6400	-836
Non renewable primary energy as energy carrier	[MJ]	51200	-22900
Non renewable primary energy as material utilization	[MJ]	0	0
Total use of non renewable primary energy resources	[MJ]	51200	-22900
Use of secondary material	[kg]	839	0
Use of renewable secondary fuels	[MJ]	0	0
Use of non renewable secondary fuels	[MJ]	0	0
Use of net fresh water	[m <sup>3</sup> ]	-	-

### RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: declared unit and product

Parameter	Unit	A1 - A3	D
Hazardous waste disposed	[kg]	-	-
Non hazardous waste disposed	[kg]	-	-
Radioactive waste disposed	[kg]	3.23	-0.136
Components for re-use	[kg]	-	-
Materials for recycling	[kg]	178	-
Materials for energy recovery	[kg]	-	-
Exported electrical energy	[MJ]	0	0
Exported thermal energy	[MJ]	0	0

## 6. LCA: Interpretation

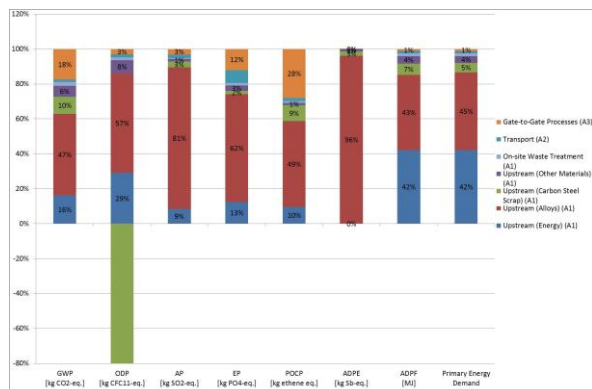


Figure 1: Environmental impact shares of production stages and major input materials

Figure 1 illustrates the percentage contribution of major raw materials and production stages to the overall cradle-to-gate environmental impact of 1t of cold rolled stainless steel. With the exception of ozone depletion potential, the production of upstream alloys was the dominant source of environmental impacts across all the environmental impact categories as well as primary energy demand. Upstream alloys contribute more than 40 % of the impacts associated with all these categories. The most significant alloying contributions come from the production of ferrochrome, ferromanganese and ferrosilicon.

For global warming potential (GWP), upstream alloys contribute 47 % with on-site emissions, the burden of carbon steel scrap and the production of electricity and other fuels collectively contributing an additional 44 %.

Acidification potential (AP), eutrophication potential (EP) and abiotic depletion of elements (ADPE) are all strongly dominated by alloy production with no other processes contributing more than 13 %. ADPE is the most extreme example with alloy production being responsible for 96 % of the cradle-to-gate impact. The formation potential of tropospheric ozone photochemical oxidants (POCP) impact category has a significant 28 % contribution from on-site emissions due to carbon monoxide emissions during processing. As both abiotic depletion potential of fossil resources (ADPF) and primary energy demand are measures of fuel resource/energy consumption the production of energy resources used on site is a significant impact (42 % for both categories).

Ozone depletion potential (ODP) is shown as gaining a large credit from the consumption of carbon steel scrap (the overall A1-A3 impact is negative for ODP). The

burden of carbon steel scrap is calculated as the LCI of a 100 % primary production route (Blast furnace/Basic Oxygen Furnace) minus the LCI of a 100 % secondary production route (Electric Arc Furnace). The ODP of EAF steel is generally higher than that of blast furnace/basic oxygen furnace (BF/BOF) steel due to higher electricity consumption, resulting in the “credit” seen in figure 1.

The EPD is based on 2011 production. Variance in the LCIA results between sites was primarily driven by differences in grid mix and the mix of stainless scrap vs carbon steel scrap/ferroalloys. As all sites were served by the same ferrochrome mine and had extremely similar profiles for other alloys (e.g. nickel/ferronickel, ferromolybdenum), there was almost no variation between the impacts per tonne for these input materials.

## 7. Requisite evidence

This EPD covers cold rolled products which are likely to be employed in a variety of applications including building envelopes, interior cladding and paneling, heating, cooling and ventilation, lifts and elevators, many of which will require further processing and fabrication related to the final application. Consequently, further documentation is not applicable.

### 7.1 Weathering performance

The majority of the applications described in section

2.2 relate to the interior of buildings. However, where cold rolled stainless steel is used in an external application, no corrosion shall occur as stainless steel is inherently non-corrosive. For this reason, stainless products are often applied where corrosion resistance is a key performance characteristic such as marine environments.

## 8. References

### Institut Bauen und Umwelt

Institut Bauen und Umwelt e.V., Berlin (pub.):  
Generation of Environmental Product Declarations (EPDs);

### General principles

for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013-04  
[www.bau-umwelt.de](http://www.bau-umwelt.de)

### PCR Part A

Institut Bauen und Umwelt e.V., Königswinter (pub.):  
Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report. April 2013  
[www.bau-umwelt.de](http://www.bau-umwelt.de)

### ISO 14025

DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

### EN 15804

EN 15804:2012-04: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

### PCR Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): PCR  
Guidance Texts for Building Related Products and

Services, Part B: Requirements on the EPD for Structural Steels. July 2012

### EN 10088-1

EN 10088-1:2009: Stainless Steels. List of stainless steels

### EN 10028-7

EN 10028-7:2007: Flat products made of steels for pressure purposes - Stainless steels

### ASTM A240

ASTM A240: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

### ASME II-D

ASME II-D: 2013: BPVC Section II Materials Part D - Properties

### JIS G4304

JIS G4304:2012: Stainless steel plate

### EN 10204

EN 10204:2004: Metallic materials. Types of inspection documents

### ISO 9001

ISO 9001:2008: Quality management systems - Requirements

### ISO 14001

ISO 14001:2004: Environmental management

**OHSAS 18001**

BS OHSAS 18001:2007: Occupational health and safety management systems – Requirements

**EC3**

EN 1993 – Eurocode 3: Design of steel structures

**EC4**

EN1994 – Eurocode 4: Design of composite steel and concrete structures

**EN 13501-1**

EN 13501-1: 2007: Fire classification of construction products and building elements-Part1

**European Waste Catalogue**

2000/532/EC - European Waste Catalogue. Commission Decision of 3 May 2000.

**GaBi 6 Software**

GaBi 6. Software and Database for Life Cycle Engineering. LBP, University of Stuttgart and PE International, 2013.

**GaBi 6 Documentation**

GaBi 6: Documentation of the GaBi 6-datasets for Life Cycle Engineering. LBP, University of Stuttgart and PE International, 2013.

<http://documentation.gabi-software.com>





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