ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804*

Owner of the Declaration	ArcelorMittal Europe - Flat Products
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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Hot Rolled Steel Coils
ArcelorMittal Europe

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General Information

ArcelorMittal Europe	Hot Rolled Steel Coils
Programme holder IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** ArcelorMittal Europe – Flat Products 24-26 Boulevard d'Avranches L-1160 Luxembourg Luxembourg
Declaration number EPD-ARC-20200026-CBD1-EN	**Declared product / declared unit** The declared unit is 1 ton of hot rolled steel coil.
This declaration is based on the product category rules: Structural steels, 07.2014 (PCR checked and approved by the SVR)	**Scope:** The Life Cycle Assessment is based on data collected from the ArcelorMittal plants producing Hot Rolled Coils, representing 95% of the annual production from 2015. 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.
Issue date 10/07/2020	
Valid to 09/07/2025	**Verification** The standard *EN 15804* serves as the core PCR Independent verification of the declaration and data according to *ISO 14025:2010* ☐ internally ☒ externally
Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)	
Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.))	Mr Carl-Otto Neven (Independent verifier appointed by SVR)

Product

Product description/Product definition
This Environmental Product Declaration refers to Hot Rolled Steel Coil, Slit Coil and Sheet, including Indaten® weathering steel and Amstrong® high strength steel range. The EPD results reflect the volume weighted average of these products.

Hot Rolled Coils are produced in ArcelorMittal hot-rolling mill in which solidified steel preheated to a high temperature is continuously rolled between a series of stands of rotating cylinders. Alloy composition and process parameters are set to guarantee the required grade. The coils are then delivered to manufacturers for shaping into end products to be included in building works, generally to precise dimensions, thereby avoiding losses on the construction site.

Mean thickness value is at 5 mm but the declaration covers the whole range from 1.5 mm up to 25.4 mm. Width range is from 45 mm up to 2150 mm.

For the placing of the product on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies. The product has a declaration of performance taking into consideration *EN 10025-1:2004* - Hot rolled products of structural steels - Part 1: General technical delivery conditions. For the application and use the respective national provisions Apply.

Other European standards concerning Hot Rolled Coils could also be used by manufacturers as reference: *EN 10149-1:2013* - Hot rolled flat products made of high yield strength steels for cold-forming - Part 1: General technical delivery conditions can be considered as specified in *EN 1993-1-3:2006* - Eurocode 3 - Design of steel structures - Part 1-3: General rules - Supplementary rules for cold-formed members and sheeting. Products covered by *EN 10149-1:2013* are not under CPR and did not request CE marking to be placed on the market

Characteristics are also specified in the American standard *ASTM G101-04:2015* (American Society for Testing and Materials) for hot rolled material.

Application
Hot Rolled Coils can be used in various construction applications, such as:

- Construction: structural or non-structural welded sections, façade & cladding, roofing, sun screens & shades.
- Road equipment: safety barriers, protection equipment, sound insulation wall panels.

- Art sculpture & Other industrial applications: Containers & filters, etc.

Hot Rolled Coils are delivered in wide coils, slit coils or cut-to-length sheets. It can be processed by all conventional processing operations used for hot rolled: cutting and oxy-cutting, slitting, bending, drawing, clinching, profiling, stamping, welding etc.

Indaten® weathering steels offer improved resistance to corrosion thanks to the addition of copper during manufacture.
Additional alloying elements can be added to increase the steel's tensile strength or make forming processes easier.
When weathering steel is exposed to the ambient atmosphere it develops an initial layer of iron oxide in the same way as carbon steel. The rate of oxidation depends on how much oxygen, moisture, and atmospheric contaminants can access the surface of the metal. In the initial stages, a complex mix of iron oxides covers the surface to create a layer of rust. As the process progresses, the rust layer forms a barrier against the corrosive agents and the rate of corrosion slows down.

Amstrong® high-strength steels are available as thermo-mechanically hot rolled, cold formable grades. Their main properties include high yield strength and tensile strength, combined with appropriate formability, toughness at low temperatures and fatigue resistance. These grades are an excellent choice for reducing structural thickness and weight whilst improving load-bearing capacity. These grades have better ductility and bendability than standard high strength low alloy (HSLA) grades.

Technical Data
ArcelorMittal Europe Flat products is producing Hot Rolled Steel Coils in 8 mills. The EPD covers 95 % of the total production in 2015.

ArcelorMittal offers a full range of grades in compliance with the *EN 10025-1* and *EN 10025-2* or *EN 10025-3* or *EN 10025-4* or *10025-5* or *EN 10149-1* and *EN 10149-2* or *EN 10149-3* to meet different applications. Yield strengths from 235 MPa up to 700 MPa are available.

ArcelorMittal has also created different grades of Indaten® weathering steels to meet different applications. Their chemical composition and mechanical performance are specified in *EN 10025-5*.

Constructional data

Name	Value	Unit
Density	7850	kg/m^3
Modulus of elasticity	210000	MPa
Melting point	1650	°C
Thermal conductivity	48	W/(mK)
Coefficient of thermal expansion	12	$10^{-6}K^{-1}$
Minimum yield strength	235 - 700	MPa

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 10025-1:2004* - Hot rolled products of structural steels - Part 1: General technical delivery conditions.

Base materials/Ancillary materials
The basic materials for the manufacture of ArcelorMittal's steel coil are non-alloyed and fine grain steel. Different steel grades and qualities are possible, these being recorded in the specific product standards *EN 10025-1:2004* and *EN 10025-2:2019* or *EN 10025-3:2019* or *EN 10025-4:2019* or *EN 10025-5:2019* or *EN 10149-1:2013* and *EN 10149-2:2013* or *EN 10149-3:2013*.

Steel is mainly iron and carbon, with small amounts of alloying elements. These elements modify the chemical and physical properties of steel such as strength, durability and corrosion resistance. High strength low alloyed (HSLA) carbon steel has a carbon content lower than 0.2 %.

The metallurgical composition of weathering steels includes less than 0.2 % carbon. Alloying elements (mainly copper, chromium, nickel, phosphorus, silicon, and manganese) typically comprise less than 5% of the steel. Due to their specific chemistry, the corrosion rate of weathering steels is generally much lower than that of standard carbon steel. The possible chemical compositions are defined in European standard. Weathering steels can be classified into two categories: those with limited phosphorous content (typically less than 0.035 %); and those with a higher phosphorous content. Weathering steels with a phosphorous content of between 0.06 and 0.15 % are identified by the letter P at the end of the product name.

High levels of phosphorous improves the corrosion resistance of weathering steels. This can hamper weldability and cause the weld zone to become brittle. For this reason, phosphorous weathering steels are usually only available in thicknesses lower than 12 mm.

This product contains substances listed in the candidate list (date: 26.2.2020) exceeding 0.1 percentage by mass: no

Reference service life
A reference service life for hot rolled steel coil is not declared. Hot rolled coil products are construction products with many different application purposes. The lifetime therefore will be limited by the application as well as the service life of the work.

First structural steel projects using weathering steel were completed 50 years ago in Europe and have demonstrated a very low maintenance level and no need for painting.

At the end of life, weathering steel products could be recovered, recycled and sent to the steel mill.

LCA: Calculation rules

Declared Unit
This Environmental Product Declaration refers to Hot Rolled Steel Coil, Slit Coil and Sheet, including Indaten® weathering steel and Amstrong® high strength steel range, as specified in Part B requirements on the EPD for Structural Steels.

Declared unit

Name	Value	Unit
Declared unit	1000	kg
Conversion factor to 1 kg	0.001	-
Density	7850	kg/m3

System boundary
Type of the EPD: cradle-to-gate - with options. Module A1-A3, Module C3 and module D were considered.

Modules A1-A3 of the Hot Rolled Steel Coil, Slit Coil and Sheet, including Indaten® weathering steel, and Amstrong® high strength steel range production include the following:
· The provision of resources, additives, and energy
· Transport of resources and additives to the production site
· Production processes on-site including energy, production of additives, disposal of production residues, and consideration of related emissions
· Recycling of production/manufacturing scrap. Steel scrap is assumed to reach the end-of-waste status once it is shredded and sorted, thus becomes input to the product system in the inventory.

Module C3 takes into account the sorting and shredding of after-use steel that is recycled, as well as the non-recovered scrap due to sorting efficiency which is landfilled. A conservative value of 2 % landfill is considered.

Module D refers to the End-of-Life of the steel coil, including reuse and recycling.

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.

Gabi version 9.2 was used with Gabi Database SP35 version 8.7 to calculate this EPD.

LCA: Scenarios and additional technical information

Current practice for the average Hot Rolled Steel Coil consist of 98 % recycling and 2 % landfill according to the *European Commission Technical Steel Research*.

End of life (C3)

Name	Value	Unit
Landfilling	2	%

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

Name	Value	Unit
Recycling	98	%

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LCA: Results

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

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	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	MNR	MNR	MNR	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 ton of hot rolled steel coil

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	2.23E+3	2.00E+0	-1.64E+3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.60E-9	6.89E-12	3.23E-10
Acidification potential of land and water	[kg SO_2-Eq.]	3.79E+0	6.78E-3	-3.96E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	3.90E-1	7.99E-4	-3.39E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	6.70E-1	4.75E-4	-5.09E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	7.78E-5	9.53E-7	1.69E-4
Abiotic depletion potential for fossil resources	[MJ]	1.91E+4	2.25E+1	-1.30E+4

RESULTS OF THE LCA - RESOURCE USE: 1 ton of hot rolled steel coil

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	2.95E+2	1.12E+1	1.19E+3
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	2.95E+2	1.12E+1	1.19E+3
Non-renewable primary energy as energy carrier	[MJ]	1.89E+4	3.43E+1	-1.23E+4
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	1.89E+4	3.43E+1	-1.23E+4
Use of secondary material	[kg]	1.18E+2	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	3.84E+0	1.53E-2	5.76E-1

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 ton of hot rolled steel coil

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	1.29E-5	2.18E-7	-8.62E-6
Non-hazardous waste disposed	[kg]	3.68E+0	2.01E+1	-2.61E+1
Radioactive waste disposed	[kg]	-6.70E-2	4.70E-3	2.93E-1
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	9.80E+2	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

References

EN 10025-1 to 5
EN 10025-1:2004 - Hot rolled products of structural steels - Part 1: General technical delivery conditions
EN 10025-2:2019 - Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels
EN 10025-3:2019 - Hot rolled products of structural steels - Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels
EN 10025-4:2019 - Hot rolled products of structural steels - Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels
EN 10025-5:2019 - Hot rolled products of structural steels - Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance

EN 10149-1 to 3
EN 10149-1:2013 - Hot rolled flat products made of high yield strength steels for cold forming - Part 1: General technical delivery conditions
EN 10149-2:2013 - Hot rolled flat products made of high yield strength steels for cold forming - Part 2: Technical delivery conditions for thermomechanically rolled steels
EN 10149-3:2013 - Hot rolled flat products made of high yield strength steels for cold forming - Part 3: Technical delivery conditions for normalized or normalized rolled steels

EN 1993-1-3
EN 1993-1-3:2006 - Eurocode 3 - Design of steel structures - Part 1-3: General rules - Supplementary rules for cold-formed members and sheeting

ASTM G101-04
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EN 15804
EN 15804:2012-04+A1:2013 - Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

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GaBi ts Documentation
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http://documentation.gabi-software.com

REACH
Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction
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https://echa.europa.eu/regulations/reach/legislation

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