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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Heavy Steel Plates
ArcelorMittal Europe

Institut Bauen und Umwelt e.V.

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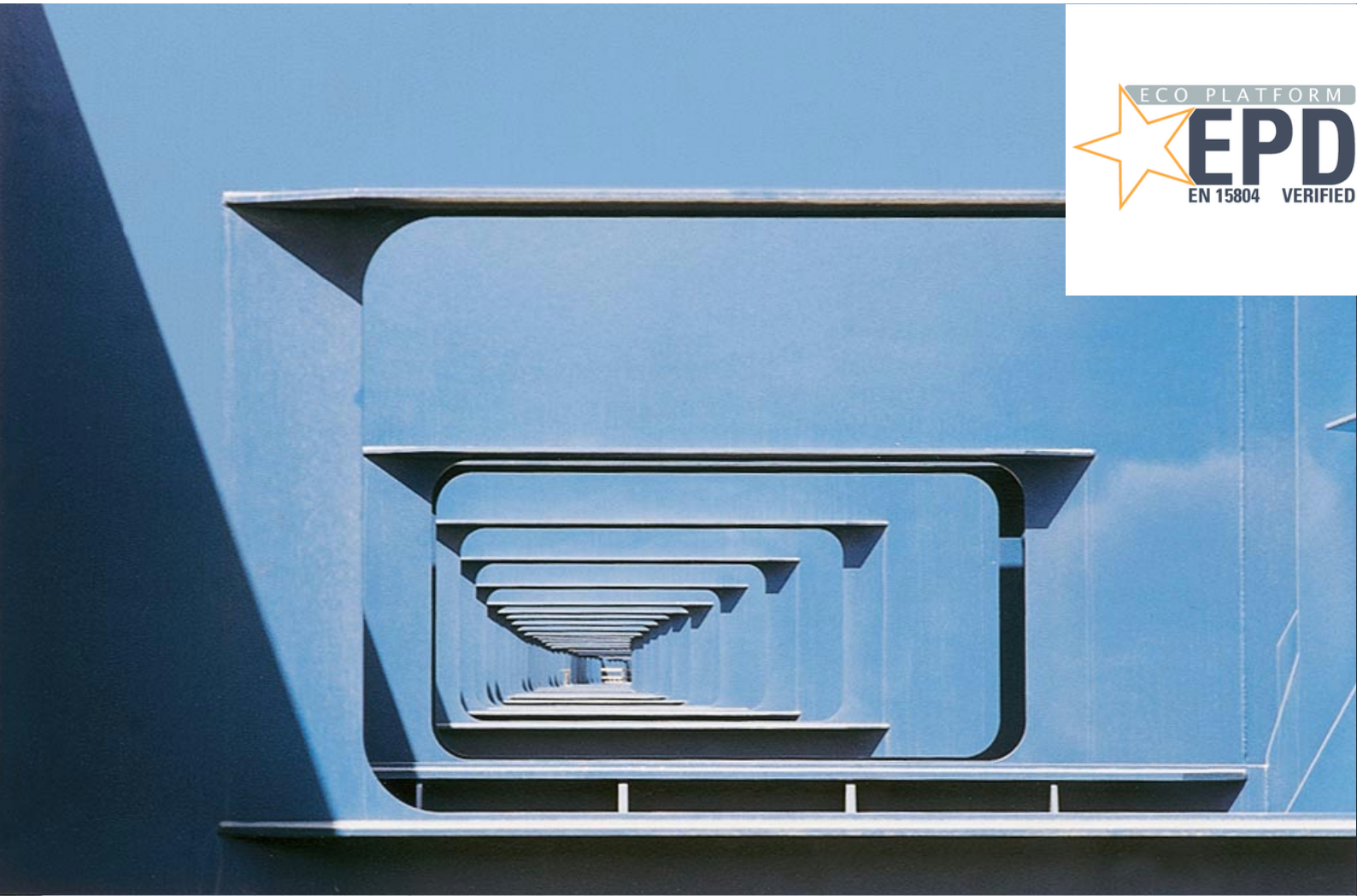

General Information

ArcelorMittal Europe

Programme holder
IBU – Institut Bauen und Umwelt e.V.
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10178 Berlin
Germany

Declaration number
EPD-ARC-20200038-CBA1-EN

This declaration is based on the product category rules:
Structural steels, 07.2014
(PCR checked and approved by the SVR)

Issue date
10/07/2020

Valid to
09/07/2025

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

Heavy Steel Plates

Owner of the declaration
ArcelorMittal Europe – Flat Products
24-26 Boulevard d'Avranches
L-1160 Luxembourg
Luxembourg

Declared product / declared unit
The declaration applies to 1 metric ton of Heavy Plate.

Scope:
The Life Cycle Assessment is based on data collected from the ArcelorMittal plant in Aviles/Gijon in Spain producing Heavy Plates, representing 100 % of the annual production from 2018.

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.

Verification

The standard *EN 15804* serves as the core PCR
Independent verification of the declaration and data according to *ISO 14025:2010*
☐ internally ☒ externally

Mr Carl-Otto Neven
(Independent verifier appointed by SVR)

Product

Product description/Product definition
This Environmental Product Declaration refers to heavy plates, hot rolled products produced on dedicated quarto plate mill. Steel grade range for construction include low alloy structural steels, as-rolled, normalized and thermomechanically rolled, including weathering steels.

Mean thickness value is at 20 mm but the declaration covers the whole range from 5 mm up to 100 mm. Width range is from 1400 mm up to 3300 mm.

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.

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.

Application
Heavy plates for construction can be used in various construction applications, such as:

- Buildings: structural and built-up welded sections, trusses, box girders, for heavy industrial steel frames, high rise buildings, long-span structures for transport terminals and other infrastructure.
- Road and railway bridges: steel & composite structures made of welded built-up sections or box girders or trusses, arch and bow-string bridges, pedestrian and bicycles bridges, cable-stayed and suspension deck & pylons bridges.
- Art sculpture.

Heavy Plates can be processed by conventional processing operations used for steelwork fabrication: oxy-cutting, bending, drilling, welding etc.

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 oxidisation 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.

Technical Data
ArcelorMittal offers a full range of grades in compliance with the *EN 10025-1* and *EN 10025 - part 2 to 5* to meet different applications.

ArcelorMittal has also created different grades of weathering steels to meet different applications. Their chemical composition and mechanical performance are specified in *EN 10025-5*. Yield strengths from 235 MPa up to 460 MPa are available.

ArcelorMittal Europe Flat products is producing heavy plates in one mill located in Gijon in Spain.

Constructional data

Name	Value	Unit
Density	7850	kg/m^3
Modulus of elasticity	210000	N/mm^2
Coefficient of thermal expansion	12	$10^{-6}K^{-1}$
Thermal conductivity	48	W/(mK)
Melting point	1500 - 1540	°C
Minimum yield strength	235 - 460	N/mm²

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to *EN 10025-1* - Hot rolled products of structural steels - Part 1: General technical delivery conditions. For the application and use the respective national provisions apply.

Base materials/Ancillary materials
The basic materials for the manufacture of ArcelorMittal's heavy steel plates 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* and *EN 10025-2* or *EN 10025-3* or *EN 10025-4* or *EN 10025-5*.

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 improve the corrosion resistance of weathering steels. Phosphorous is not used in heavy plate for structural uses as it can form iron phosphide (FeP3) during welding. 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 heavy steel plate is not declared. Heavy steel plates 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.

Bridges using heavy plates are designed and calculated according to Eurocodes to ensure more than 100 years of durability.

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 Heavy Steel Plates including weathering steel, 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 Heavy Steel Plates, including weathering 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 heavy steel plates, 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 SP39 version 8.7 to calculate this EPD.

LCA: Scenarios and additional technical information

Current practice for the average Heavy Steel Plates consists 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 heavy steel plate

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	2.60E+3	1.99E+0	-1.80E+3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	1.21E-12	4.48E-14	1.12E-11
Acidification potential of land and water	[kg SO_2-Eq.]	4.76E+0	6.28E-3	-4.21E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	4.58E-1	7.23E-4	-3.59E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	8.93E-1	4.70E-4	-5.47E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	8.08E-5	4.99E-7	4.27E-5
Abiotic depletion potential for fossil resources	[MJ]	2.35E+4	2.28E+1	-1.43E+4

RESULTS OF THE LCA - RESOURCE USE: 1 ton of heavy steel plate

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	6.21E+2	1.18E+1	1.49E+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]	6.21E+2	1.18E+1	1.49E+3
Non-renewable primary energy as energy carrier	[MJ]	2.37E+4	3.42E+1	-1.35E+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]	2.37E+4	3.42E+1	-1.35E+4
Use of secondary material	[kg]	4.22E+1	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]	5.23E+0	1.44E-2	-1.41E+0

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 ton of heavy steel plate

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	1.01E-5	2.05E-7	-8.98E-6
Non-hazardous waste disposed	[kg]	7.58E+0	2.00E+1	-2.82E+1
Radioactive waste disposed	[kg]	1.01E-1	4.54E-3	2.89E-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
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