

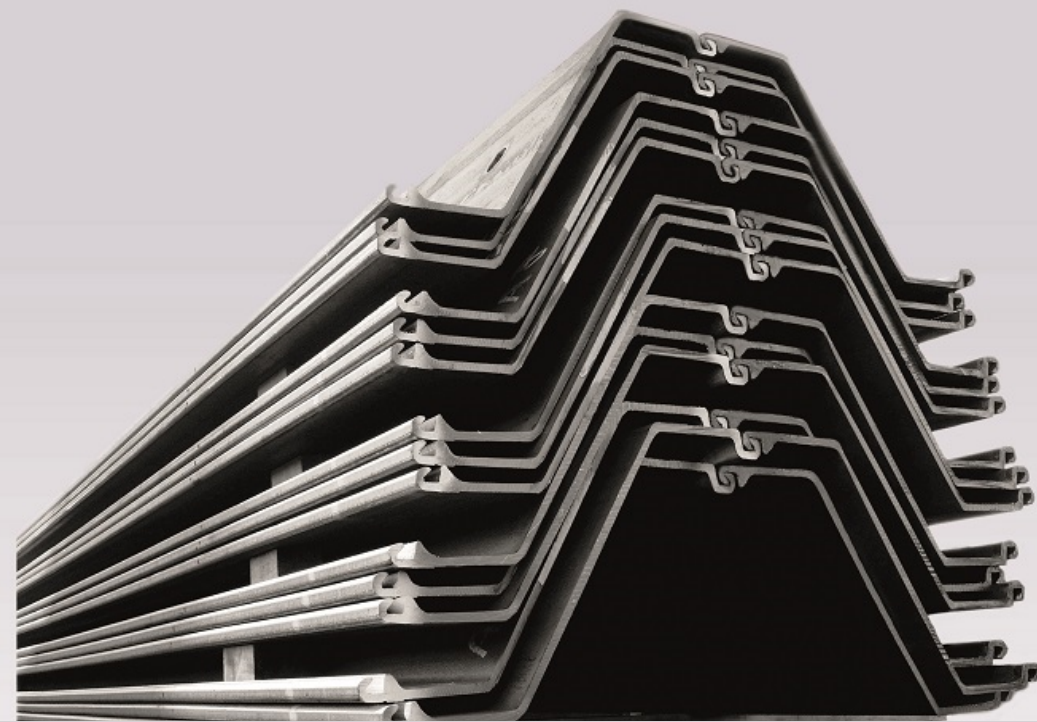
# ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804+A1



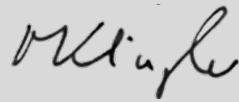
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Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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EcoSheetPile™ Plus  
ArcelorMittal

[www.ibu-epd.com](http://www.ibu-epd.com) | <https://epd-online.com>



## General Information

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## Product

### Product description/Product definition

This EPD applies to 1 metric ton of steel sheet piles EcoSheetPile™ Plus in steel grades *EN 10248-1 - S 240 GP to S 355 GP, ASTM A572 - Gr.50 and CSA 350W* for civil engineering applications, infrastructures and buildings. It is based on a steel production in an Electric Arc Furnace with 100% renewable electricity supply with Guarantee of Origins.

EcoSheetPile™ Plus are produced at the ArcelorMittal sites Differdange and Esch-Belval in Luxembourg from ca. 100% scrap in an electric arc furnace route and are 100% reusable and recyclable. The types of EcoSheetPile™ Plus available are: Z-shaped, U-shaped, straight-web, and H-shaped.

For the use and application of the product the respective national provisions at the place of use apply, in Germany for example the building codes of the federal states and the corresponding national specifications.

### Application

Steel sheet pile walls resist high pressure and can support the massive height of soil with a small quantity of steel compared to the applied loads. Steel sheet piles are used worldwide in many kinds of permanent and temporary structures: quay walls and breakwaters in harbours, locks, bank reinforcement on rivers and canals, pumping stations, bridge abutments, retaining walls for underpasses, tunnels and underground car parks, impervious containment walls, temporary

cofferdams in land and in water, containment barriers, and load bearing foundations, among others.

**Technical Data**

This EPD is valid for EcoSheetPile™ Plus steel sheet piles of varied grades and geometries, as well as different forms of delivery.

**Constructional data**

Name	Value	Unit
Density	7850	kg/m <sup>3</sup>
Modulus of elasticity	210000	N/mm <sup>2</sup>
Coefficient of thermal expansion	12	10 <sup>-6</sup> K <sup>-1</sup>
Thermal conductivity	48	W/(mK)
Melting point	1536	°C
Shear modulus	81000	N/mm <sup>2</sup>

Performance data of the product with respect to its characteristics in accordance with the relevant technical provision (no CE-marking).

Specific information on dimension tolerances, constructional data, as well as mechanical and chemical properties can be found in the relevant standards:

- European standards *EN 10248-1*, *EN 10248-2*.
- ASTM international standards *ASTM A572*, *ASTM A6*.

- Canadian standard association (CSA) *CSA 260W*, *CSA 300W*, *CSA 350W*.

**Base materials/Ancillary materials**

The base material of EcoSheetPile™ Plus is iron. Alloying elements are added in the form of ferroalloys or metals (the most common elements are Manganese and Silicon). Steel sheet pile products according to *EN 10248* are non-alloy steel products. Some small quantities of other elements may be present in the steel (e.g. copper or nitrogen). The chemical composition of the sheet piles depends mainly on the steel grade.

No substances listed on the “Candidate List of Substances of Very High Concern for Authorisation” by the European Chemicals Agency EC 1907-2006 are contained in the steel in declarable quantities.

This product contains substances listed in the candidate list (date: 22.2.2021) exceeding 0.1 percentage by mass: no

**Reference service life**

A reference service life for EcoSheetPile™ Plus is not declared. These are construction products with many different applications purposes. The lifetime therefore will be limited by the service life of the work.

**LCA: Calculation rules**

**Declared Unit**

The declaration refers to the functional unit of 1 metric ton of EcoSheetPile™ Plus as specified in Part B requirements on the EPD for structural steels.

The background data are taken from *GaBi ts Documentation*.

The final results reflect the weighted average per production volume of the two rolling lines in Differdange & Esch-Belval.

**Declared unit**

Name	Value	Unit
Declared unit	1	t
Density	7850	kg/m <sup>3</sup>
Conversion factor to 1 kg	0.001	-

production residues, and consideration of related emissions

- Recycling of production/manufacturing scrap. Steel scrap is assumed to reach the end-of-waste status once is shredded and sorted, thus becomes an 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 1% landfill is considered.

**Module C4** takes into account the waste disposal including physical pre-treatment and management of the disposal site. Steel is an inert material which does not require any specific treatment on disposal site.

**Module D** refers to the end of life of the steel sheet piles, including reuse and recycling. In module D the recycled material gets a credit in accordance with the “value of scrap” methodology by *WorldSteel* and the reused material receives a credit as avoided manufacturing of steel sheet piles.

**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.

**System boundary**

Type of the EPD: cradle-to-gate - with options. Module A1-A3, Module C3, Module C4 and Module D were considered.

**Modules A1-A3** of the structural steel 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

**LCA: Scenarios and additional technical information**

The end of life for steel sheet piles consists of 85% being retrieved for recycling or reuse and 15% landfill, with the corresponding benefits and burdens. This is based on the *European Commission – Science Research Development Report* and internal estimations.

**Reuse**

Part of the production is used for temporary works (lasting up to 3 years). Steel sheet piles can be reused up to 10 times without loss of their properties. The frequency of reuse varies depending on the use case. For instance, the same steel sheet piles can be used successively for different parts of a construction site or stocked by a company between two usages. According to internal documentation within ArcelorMittal, currently part of the sheet piles are reused several times, leading to an overall reuse rate of 25%.

**Recycling**

Steel can be recycled to the same (or higher/lower) quality of steel depending upon the metallurgy and processing of the recycling route. Steel sheet piles can be recycled without any problem after dismantling, and recycling routes are well established. 85% of the sheet piles are recovered for reuse and recycling. Since 25% of the sheet piles are reused, the remaining 60% is considered as recycled with the corresponding benefits and burdens. In module D the recycled material gets a credit or a burden based on the “value of scrap” methodology by *Worldsteel* and the reused material receives a credit as avoided manufacturing of EcoSheetPile™ Plus.

For specific case studies, dedicated scenarios can be calculated by contacting ArcelorMittal or using the data provided in this document.

**End of life (C1 - C4)**

Name	Value	Unit
Reuse	250	kg
Recycling	600	kg
Landfilling	150	kg

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

Name	Value	Unit
Reuse	25	%
Recycling	60	%

## 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	X	X	

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 metric ton of EcoSheetPile™ Plus

Parameter	Unit	A1-A3	C3	C4	D
Global warming potential	[kg CO <sub>2</sub> -Eq.]	3.70E+2	1.60E+0	2.15E+0	3.24E+2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	5.59E-11	4.69E-14	1.17E-14	-1.30E-11
Acidification potential of land and water	[kg SO <sub>2</sub> -Eq.]	9.50E-1	2.99E-3	1.29E-2	4.34E-1
Eutrophication potential	[kg (PO <sub>4</sub> ) <sup>3</sup> -Eq.]	7.83E-2	4.48E-4	1.46E-3	1.50E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.15E-1	2.60E-4	9.87E-4	1.80E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	4.86E-4	4.70E-7	2.16E-7	8.05E-4
Abiotic depletion potential for fossil resources	[MJ]	4.25E+3	1.82E+1	2.92E+1	2.86E+3

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 metric ton of EcoSheetPile™ Plus

Parameter	Unit	A1-A3	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	7.71E+3	1.22E+1	4.05E+0	-2.28E+3
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	7.71E+3	1.22E+1	4.05E+0	-2.28E+3
Non-renewable primary energy as energy carrier	[MJ]	4.41E+3	2.82E+1	3.01E+1	2.70E+3
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	4.41E+3	2.82E+1	3.01E+1	2.70E+3
Use of secondary material	[kg]	1.14E+3	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	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	0.00E+0
Use of net fresh water	[m <sup>3</sup> ]	1.37E+0	1.18E-2	7.43E-3	1.58E+0

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 metric ton of EcoSheetPile™ Plus

Parameter	Unit	A1-A3	C3	C4	D
Hazardous waste disposed	[kg]	1.81E-6	7.00E-9	3.20E-9	-1.52E-6
Non-hazardous waste disposed	[kg]	4.97E+0	1.89E-2	1.50E+2	-4.70E+1
Radioactive waste disposed	[kg]	5.17E-2	3.89E-3	3.15E-4	-1.31E-2
Components for re-use	[kg]	0.00E+0	2.50E+2	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	6.00E+2	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0

## References

### EN 15804

EN 15804+A1:2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

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### PCR Part A

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Requirements on the EPD for Structural steels - Institut Bauen und Umwelt e.V., Berlin (pub.): From the range of Environmental Product Declarations of Institute Construction and Environment e.V. (IBU), 2017

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GaBi ts Software and Databases for Life Cycle Engineering. LBP, University of Stuttgart und PE International, 2013.

**GaBi ts Documentation**

GaBi ts Documentation of the GaBi datasets for Life Cycle Engineering. LBP, University of Stuttgart and PE International, 2011.

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**EN 10248-1**

EN 10248-1:1995, Hot rolled sheet piling of non alloy steels - Part 1: Technical delivery conditions. CEN, 1995.

**EN 10248-2**

EN 10248-2:1995, Hot rolled sheet piling of non alloy steels - Part 2: Tolerances on shape and dimensions. CEN, 1995.

**ASTM A572**

ASTM A572 / A572M-21e1:2021, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel, ASTM International, West Conshohocken, PA, 2021.

**ASTM A6**

ASTM A6 / A6M-19:2019, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling, ASTM International, West Conshohocken, PA, 2019.

**CSA 260W, CSA 300W, CSA 350W**

CSA G40.20:2013, General requirements for rolled or welded structural quality steel. Canadian Standard Association.

CSA G40.21:2013, General requirements for structural quality steel. Canadian Standard Association.

**Candidate List of Substances of Very High Concern for Authorization**

Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

<https://echa.europa.eu/candidate-list-table>

**European Commission – Science Research Development Report**

Life-Cycle Assessment (LCA) for steel construction. Technical steel research. 2002

**Publisher**

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