# ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

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|---|---|
| Owner of the Declaration | ArcelorMittal Europe – Flat Products |
| Programme holder | Institut Bauen und Umwelt e.V. (IBU) |
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## Hot dip galvanized steel with Magnelis® coating
## ArcelorMittal

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD EN 15804 VERIFIED

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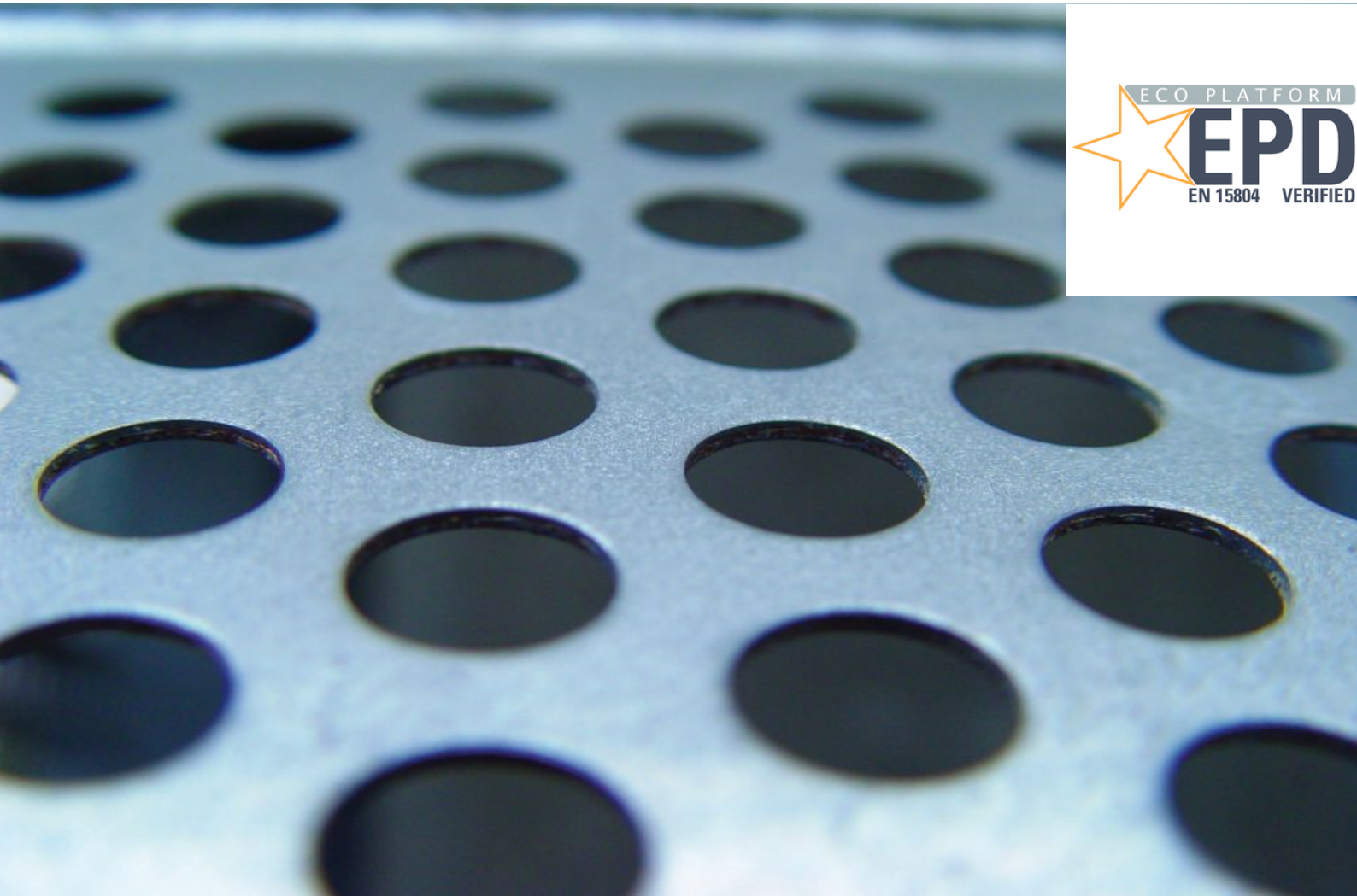

## General Information

ArcelorMittal

**Programme holder**
IBU - Institut Bauen und Umwelt e.V.
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Germany

**Declaration number**
EPD-ARM-20170140-IBD1-EN

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

**Issue date**
25/01/2019

**Valid to**
24/01/2024

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dipl. Ing. Hans Peters
(Head of Board IBU)

Hot dip galvanized steel with Magnelis® coating

**Owner of the declaration**
ArcelorMittal Europe – Flat Products
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L-1160 Luxembourg
Luxembourg

**Declared product / declared unit**
The declared unit is 1 metric ton of Magnelis® coated steel. (1mm steel thickness with 120 g/m² Magnelis® coating)

**Scope:**
The Life Cycle Assessment is based on data collected from the ArcelorMittal plants producing Magnelis® coated steel, representing 100% of the production in 2016.

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)

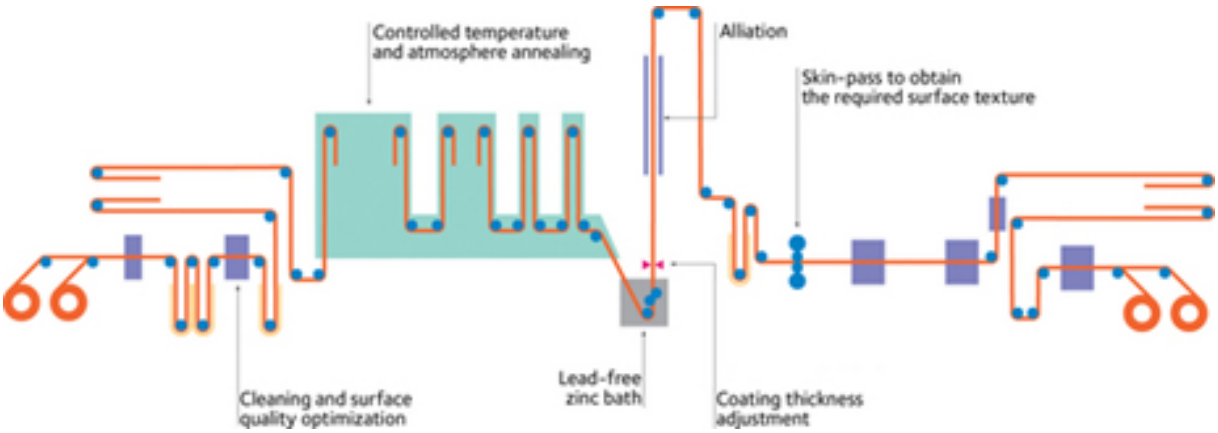
## Product

**Product description / Product definition**

This Environmental Product Declaration refers to a double-sided hot dip galvanized coated steel, consisting of steel substrate with a specific metallic alloyed zinc coating, Magnelis®, applied by means of a continuous hot dip galvanising process.

Magnelis® coated steel is a hot-dip galvanized carbon steel coated on both sides with a zinc-aluminium-magnesium alloy. This alloy, composed of 93.5% zinc, 3.5% aluminium and 3% magnesium, is applied by means of a continuous hot dip galvanising process. This chemical composition has been selected to provide an excellent corrosion resistance.

Magnelis® coated steel is described according to /EN 10346:2015/. Magnelis® coated steel is available in a very wide range of steel grades (steels for cold forming and deep drawing applications, structural steels and High Strength Low Alloy steels), and coating masses (from 90 to 430 g/m²). ZM is the symbol used in /EN 10346/ to refer to Zinc Magnesium coatings to which Magnelis® coated steel belongs.




**Application**
Magnelis® coated steel can be used in various industrial applications, such as:

- Construction: structural or non-structural profiles, roofing & cladding, decking, cable trays, expanded metal, gratings, composite flooring, concrete moulds
- Road and railway infrastructure: safety barriers, protection equipment, sound insulation wall panels, walls providing protection against hail
- Agriculture and farming: barns, greenhouse structures, agricultural equipment
- Solar energy generation: structures for photovoltaic plants
- Tubular applications: structural tubes for scaffolding, road signals, poles

Magnelis® coated steel is delivered in wide coils, slit coils or sheets. It can be process by all conventional processing operations used for hot dip galvanised steel: bending, drawing, clinching, profiling, stamping, welding etc. The friction coefficient of Magnelis® coated steel is lower than the one of standard hot dip galvanised steel and is stable during cold forming operations.

**Technical Data**
Due to its 3% magnesium content, Magnelis® coated steel offers self-healing on cut edges and corrosion resistance in chloride and ammonia atmospheres. This high corrosion resistance means that less metallic coating is required to insure an equivalent corrosion protection than with standard hot dip galvanized steels.
The coating process can apply various thickness of the Zinc Aluminium Magnesium layer, up to 430 g/m² (total of both sides). Specific mechanical properties are defined for each steel grade used as substrate and measured according to /EN ISO 6892/. The corrosion resistance performance can be evaluated with different indoor & outdoor tests. One of the most common tests is the 'Salt Spray Test' defined according to /EN ISO 9227/.

**Base materials / Ancillary materials**
The substrates can be made of different steel grades (DX51D to DX57D, S220GD to S550GD, HX260LAD to HX500LAD, /EN10346:2015/) with Magnelis® coating ZM120 (120 g/m² total for both sides, equivalent to a coating thickness of 9µm /EN10346:2015/) and steel thicknesses ranging between 0.20 mm and 6.0 mm.

Detailed steel and coating properties and chemical compositions are available at:
http://industry.arcelormittal.com/catalogue/E35/EN

The base material of Magnelis® coated steel is iron. Alloying elements are added on the form of ferroalloys or metals. The metallic coating includes only zinc, aluminum and magnesium.

**Reference service life**
Construction process (stages A4 & A5) and Use stage (B1-B7) are not declared in this EPD. A reference service life for Magnelis® coated steels is not declared, since the lifetime will depend on specific application as well as environmental conditions.

## LCA: Calculation rules

**Declared Unit**
The declaration refers to the functional unit of 1 metric ton of double-sided Magnelis® coated steel as specified in Part B requirements on the EPD for Structural Steel /PCR Part B/.
(1mm steel thickness with 120 g/m² Magnelis® coating)

**Declared unit**

| Name | Value | Unit |
|---|---|---|
| Declared unit | 1 | t |
| Thickness (of sheet) | 1 | mm |
| Density | 7828 | kg/m³ |
| Conversion factor to 1 kg | 0.001 | - |
| Conversion factor to 1 m² | 0.00797 | - |

**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 structural steel production, include:

- 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 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, 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 structural steel, including reuse and recycling.

**Data quality**
All relevant background datasets are taken from the GaBi software database /GaBi ts Software/. Regarding foreground data, this study is based on high quality of primary data, collected by ArcelorMittal.
The GaBi-database contains consistent and documented datasets which can viewed in the online GaBi-documentation /GaBi ts Documentation/.

**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.

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## LCA: Scenarios and additional technical information

Current practice for the average hot dip galvanized steel 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 | % |

## 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 | 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 metric ton of Magnelis® coated steel**

| Parameter | Unit | A1-A3 | C3 | D |
|---|---|---|---|---|
| Global warming potential | [kg $CO_2$-Eq.] | 2.57E+3 | 2.00E+0 | -1.71E+3 |
| Depletion potential of the stratospheric ozone layer | [kg CFC11-Eq.] | 5.14E-9 | 6.89E-12 | 3.36E-10 |
| Acidification potential of land and water | [kg $SO_2$-Eq.] | 4.53E+0 | 6.78E-3 | -4.12E+0 |
| Eutrophication potential | [kg $(PO_4)^{3-}$-Eq.] | 4.69E-1 | 7.99E-4 | -3.53E-1 |
| Formation potential of tropospheric ozone photochemical oxidants | [kg ethene-Eq.] | 7.40E-1 | 4.75E-4 | -5.29E-1 |
| Abiotic depletion potential for non-fossil resources | [kg Sb-Eq.] | 5.43E-2 | 9.53E-7 | 1.75E-4 |
| Abiotic depletion potential for fossil resources | [MJ] | 2.30E+4 | 2.25E+1 | -1.35E+4 |

**RESULTS OF THE LCA - RESOURCE USE: 1 metric ton of Magnelis® coated steel**

| Parameter | Unit | A1-A3 | C3 | D |
|---|---|---|---|---|
| Renewable primary energy as energy carrier | [MJ] | 1.12E+3 | 1.12E+1 | 1.24E+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] | 1.12E+3 | 1.12E+1 | 1.24E+3 |
| Non-renewable primary energy as energy carrier | [MJ] | 2.34E+4 | 3.43E+1 | -1.28E+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] | 2.34E+4 | 3.43E+1 | -1.28E+4 |
| Use of secondary material | [kg] | 8.32E+1 | 0.00E+0 | 8.97E+2 |
| 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 | [$m^3$] | 5.61E+0 | 1.53E-2 | 5.99E-1 |

**RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 metric ton of Magnelis® coated steel**

| Parameter | Unit | A1-A3 | C3 | D |
|---|---|---|---|---|
| Hazardous waste disposed | [kg] | 1.53E-5 | 2.18E-7 | -8.97E-6 |
| Non-hazardous waste disposed | [kg] | 1.18E+1 | 2.01E+1 | -2.72E+1 |
| Radioactive waste disposed | [kg] | 1.66E-1 | 4.70E-3 | 3.04E-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 |

Note: 83kg scrap is used in the manufacturing of 1 ton of Magnelis® coated steel. After use, 980 kg steel is recycled. The potential environmental benefit calculated for the end-of-life stage (module D) is based on the net amount of scrap in the system: 980 - 83 = 897 kg. The system has a net output of 897 kg scrap (which carries a potential credit), thus module D shows an environmental benefit.

## References


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**/EN 15804/**
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**/EN 10346:2015/** Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions

**/EN ISO 6892:2016/** Metallic materials — Tensile testing

**/EN ISO 9227:2017**/ Corrosion tests in artificial atmospheres — Salt spray tests

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