ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	ArcelorMittal Brasil
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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Hot Dip Coated Steel with Galvalume®

ArcelorMittal Brasil

Institut Bauen und Umwelt e.V.

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General Information

ArcelorMittal Brasil

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Declaration number
EPD-ARC-20190174-CBC2-EN

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

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

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

Hot Dip Coated Steel with Galvalume®

Owner of the declaration
ArcelorMittal Brasil
Av. Carandaí, 1115
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Brazil

Declared product / declared unit
The declared unit is 1 metric ton of Galvalume® coated steel produced by ArcelorMittal in Brazil (1mm steel thickness with 3.8g/cm³ Galvalume® coating)

Scope:
This declaration and its LCA study are relevant to 1 metric ton of Galvalume® steel manufactured by ArcelorMittal Brasil, representing 100% of the production in 2017.

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.
The EPD was created according to the specifications of *EN 15804+A1*. In the following, the standard will be simplified as *EN 15804*.

Verification

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

Dr.-Ing. Wolfram Trinius
(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, Galvalume®, applied by means of a continuous hot dip galvanising process.
The Galvalume® basic composition is: 55% aluminum, 43.4% zinc and 1.6% silicon. The combined action of the aluminum and the zinc gives extraordinary corrosion resistance to this type of coating, where the first creates a protection barrier whilst the latter becomes the sacrificing element providing galvanic protection. Among its most important characteristics are high reflectivity, which generates higher thermal efficiency, and high heat resistance with no loss of protection, brilliance and colouring characteristics.

Galvalume® coated steels are described according to *NBR 15578*. They are available in a very wide range of steel grades and coating density of 3.8 g/cm3.

For the use and application of the product the respective national provisions at the place of use apply.

Application
Tiles and thermoacoustic panels for roofs and facades, flashings and gutters, profiles for light steel framing and silos. Additionally, applications in white line and in the agricultural and machinery segments, etc.
Other applications are also possible in other market segments.

Technical Data

Name	Value	Unit
Density	7825	kg/m³
Thermal conductivity	48	W/(mK)
Modulus of elasticity	210000	N/mm²
Coefficient of thermal expansion	12	10-6K-1
Melting point	1536	°C

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

Base materials/Ancillary materials
The base material of aluminum and zinc coated steel is iron.

Alloying elements are added on the form of ferroalloys or metals. The metallic coating includes aluminum and zinc.

Detailed information about mechanical properties and coatings are available at:

https://brasil.arcelormittal.com/produtos-solucoes/catalogos

Reference service life

Reference service life is not relevant due to cradle-to-gate with options (C3 and D) boundary conditions.

LCA: Calculation rules

Declared Unit

The declaration refers to the functional unit of 1 metric ton of Galvalume® coated steel as specified in Part B requirements on the EPD for Structural Steel.

Declared unit

Name	Value	Unit
Declared unit	1	t
Thickness (of sheet)	1	mm
Coating density	3.8	g/cm³
Conversion factor to 1 kg	0.001	-

System boundary

The study is performed from 'cradle-to-gate' + module C3 and module D (cradle to gate - with Options). The following life cycle stages are considered:

- Product stage
- End-of-life through Waste processing
- Benefits and loads beyond the product system boundary

Modules A1-A3 include the following:

- The provision of resources, additives and energy;
- Transport of resources 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 net benefits and loads of the net flow leaving the product system.

Data Quality
The life cycle inventory data used in this study comply with the quality requirements set out in *ISO 14044*.

All relevant background datasets are taken from *GaBI ts Software* database - Service Pack 37 and comprise the year 2018. Such database contains consistent and documented datasets which can be viewed in the online *GaBI ts documentation*.

Regarding foreground data, this study is based on a high quality of primary data for the year 2017, collected by ArcelorMittal.

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

End of life (C3)
Due to the absence of official national references and recommendation of the Brazilian context, Recycling and Reuse rates adopted for this EPD were defined according to the recommendations of *European Commission Technical Steel Research* for "Other steel": 99% (Recycling and Reuse) and 1% (Landfill). Such assumptions are similar to current practices and rates in the Brazilian market, which would not result in visible changes of the EPD results.

Name	Value	Unit
Landfilling	10	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information
18,6 kg scrap is used in the manufacturing of 1 ton of Galvalume steel. After use, 990 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: 990 – 18,6 = **971 kg.**

The system net output carries a potential credit, thus module D shows an environmental benefit.

Name	Value	Unit
Reuse	11	%
Recycling	88	%
Landfill	1	%

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 according to EN 15804+A1: 1 t Galvalume®

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	2.60E+3	2.54E+1	-1.56E+3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2.30E-5	3.14E-6	8.71E-6
Acidification potential of land and water	[kg SO_2-Eq.]	1.30E+1	2.30E-1	-3.08E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.66E+0	1.04E-1	-2.28E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.33E+0	1.77E-2	-7.21E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.01E-2	4.61E-4	-4.79E-3
Abiotic depletion potential for fossil resources	[MJ]	2.48E+4	3.55E+2	-1.52E+4

RESULTS OF THE LCA - RESOURCE USE according to EN 15804+A1: 1 t Galvalume®

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	1.39E+3	5.40E+1	1.00E+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]	1.39E+3	5.40E+1	1.00E+3
Non-renewable primary energy as energy carrier	[MJ]	2.52E+4	4.06E+2	-1.46E+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]	2.52E+4	4.06E+2	-1.46E+4
Use of secondary material	[kg]	1.86E+1	0.00E+0	9.71E+2
Use of renewable secondary fuels	[MJ]	-2.03E-30	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	-2.40E-29	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	6.90E+0	1.83E-1	2.10E+0

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES according to EN 15804+A1: 1 t Galvalume®

Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	2.91E-4	3.84E-8	-1.02E-3
Non-hazardous waste disposed	[kg]	7.94E+2	1.00E+1	1.68E+2
Radioactive waste disposed	[kg]	7.69E-2	9.68E-5	5.02E-4
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	9.90E+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

Interpretation

The production stage is the high contributing stage in the life cycle of Galvalume®.

Module C3 has a low contribution while module D presents negative contribution (credit) for all impact categories except ODP.

Due to the Hot-Rolled Steel Coil input, the Pickling stage is the biggest contributor in all environmental categories except ADPE, in which Galvanization is the process that presents the highest contribution due to the zinc and aluminium coating.

Module D has a significant part for the results, especially for GWP and ADPE (expressive only in Hot-Rolled Steel Coil).

This is because the external scrap input is low, which increase the net scrap value, reducing the original impact of the production (A1-A3).

Total use of renewable primary energy carrier (PERT) and total use of non-renewable primary energy (PENRT) are dominated by the extraction and processing of raw materials and the generation of electricity, steam and heat from primary energy resources, including extraction, refining and transport.

In general, the main contribution to primary energy in the blast furnace/basic oxygen furnace (BF/BOF) route comes from the use of coal/coke as an energy and carbon source.

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