ENVIROMENTAL PRODUCT DECLARATION
as per /ISO 14025/ and /EN 15804/

Owner of the Declaration | ArcelorMittal Europe – Long Products
Programme holder | Institut Bauen und Umwelt e.V. (IBU)
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Valid to | 06/02/2024

Structural steel sections and merchant bars
ArcelorMittal
General Information

ArcelorMittal Europe – Long Products

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Declaration number
EPD-ARM-20190015-CBD1-EN

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

Issue date
07/02/2019

Valid to
06/02/2024

Verification
The standard /EN 15804/ serves as the core PCR
Independent verification of the declaration and data according to /ISO 14025:2010/

Prof. Dr.-Ing. Horst J. Bossenmayer
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(Head of Board IBU)

Dr.-Ing. Wolfram Trinius
(Independent verifier appointed by SVR)

Product

Product description / Product definition
This EPD applies to 1 metric ton of hot rolled structural steel sections and merchant bars in structural steel grades.

For the placing on the market of the product in the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 (CPR) applies. The product needs a Declaration of Performance taking into consideration /EN 10025-1:2004 Hot rolled products of structural steels – Part 1: General technical delivery conditions/ and the CE-marking.

For the application and use the respective national provisions apply.

Application
Structural steel sections and merchant bars are intended for bolted, welded or otherwise connected constructions of buildings, bridges and other structures, as well as in composite steel and concrete structures. For example:

- Single-storey buildings (industrial and storage halls, etc.)
- Multi-storey buildings (offices, residential, shops, car parks, high rise, etc.)
- Bridges (railway, road, pedestrian, etc.)
- Other structures (pylons, power plants, stadiums, convention centers, airports, stations, etc.)

Technical Data
This EPD is valid for structural sections and merchant bars of various steel grades and different forms of delivery. Performance data of the product in accordance with the Declaration of Performance.

Constructional data

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>7850</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Modulus of elasticity</td>
<td>210000</td>
<td>N/mm²</td>
</tr>
</tbody>
</table>
Coefficient of thermal expansion 12 $10^{-6}$ K$^{-1}$
Thermal conductivity (at 20°C) 48 W/(mK)
Melting point (depending on the alloy proportions up to) 1536 °C
Shear modulus 81000 N/mm²

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

- **Design standards:** The standards of /EN 1993/ and /EN 1994/, respectively of /ANSI/AISC 36/ apply to the design of steel structures and composite steel and concrete structures. They include the requirements regarding serviceability, bearing capacity, durability and fire resistance of steel structures (/EN 1993/,/ANSI/AISC 360/) and composite steel and concrete structures (/EN 1994/, /ANSI/AISC 360/).
- **Product standards:** /EN 10025/, /ASTM A36/, /A572/, /A588/, /A709/, /IA913/IA913M/ and /A992/.
- **Fabrication standards:** /EN 1090-2/, /AISC 303-10/, /AWS D1.1/D1.1M/. The Standard /EN 1090-2/ applies to the execution of steel structures and includes the requirements for factory production control.

Additional information on structural steel and constructing with steel can be obtained from ArcelorMittal /Sales Programme Sections & Merchant Bars/ available at http://sections.arcelormittal.com.

**Base materials / Ancillary materials**

The base material of structural steel sections and merchant bars is iron. Alloying elements are added in the form of ferroalloys or metals (most common elements are Manganese, Chromium and Vanadium). Other elements such as Nitrogen or Copper may be present in the steel, depending on the steel designation/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.

**Reference service life**

A reference service life for structural steel sections and merchant bars 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.

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### LCA: Calculation rules

**Declared Unit**

The declaration refers to the functional unit of 1 metric ton of structural steel sections and merchant bars as specified in Part B requirements on the EPD for structural steels.

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

#### Declared unit

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared unit</td>
<td>1</td>
<td>t</td>
</tr>
<tr>
<td>Conversion factor to 1 kg</td>
<td>0.001</td>
<td>-</td>
</tr>
<tr>
<td>Density</td>
<td>7850</td>
<td>kg/m³</td>
</tr>
</tbody>
</table>

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning variability of the production process, geographical representatively and the influence of background data and preliminary products compared to the environmental impacts caused by actual production.

**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 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 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 1% landfill is considered.

Module D refers to the end of life of the structural steel sections and merchant bars, 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.
**LCA: Scenarios and additional technical information**

The end of life for average structural steel sections and merchant bar products consists of 11% reuse, 88% recycling and 1% landfill, with the corresponding benefits and burdens. This is based on the /European Commission Technical Steel Research/, the /German Ministry of Environmental Affairs/ and internal documentation within ArcelorMittal.

### End of life (C3)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfilling</td>
<td>1</td>
<td>%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling</td>
<td>88</td>
<td>%</td>
</tr>
<tr>
<td>Reuse</td>
<td>11</td>
<td>%</td>
</tr>
</tbody>
</table>
### LCA: Results

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

<table>
<thead>
<tr>
<th>PRODUCT STAGE</th>
<th>CONSTRUCTION STAGE</th>
<th>USE STAGE</th>
<th>END OF LIFE STAGE</th>
<th>BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material</td>
<td>Transport</td>
<td>Manufacturing</td>
<td>Use</td>
<td>Maintenance</td>
</tr>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>MND</td>
<td>MND</td>
<td>MND</td>
</tr>
</tbody>
</table>

#### RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 metric ton of steel sections and merchant bars

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming potential</td>
<td>kg CO₂-Eq.</td>
<td>8.42E+2</td>
<td>1.84E+0</td>
<td>-9.76E+1</td>
</tr>
<tr>
<td>Depletion potential of the stratospheric ozone layer</td>
<td>kg CFC11-Eq.</td>
<td>2.45E-9</td>
<td>6.82E-12</td>
<td>2.98E-8</td>
</tr>
<tr>
<td>Acidification potential of land and water</td>
<td>kg SO₂-Eq.</td>
<td>1.98E+0</td>
<td>5.84E-3</td>
<td>-2.29E-1</td>
</tr>
<tr>
<td>Eutrophication potential</td>
<td>kg PO₄-Eq.</td>
<td>1.98E-1</td>
<td>6.69E-4</td>
<td>-2.15E-2</td>
</tr>
<tr>
<td>Formation potential of tropospheric ozone photochemical oxidants</td>
<td>kg ethene-Eq.</td>
<td>2.41E-1</td>
<td>4.01E-4</td>
<td>-2.82E-2</td>
</tr>
<tr>
<td>Abiotic depletion potential for non-fossil resources</td>
<td>kg Sb-Eq.</td>
<td>1.78E-4</td>
<td>8.92E-7</td>
<td>-3.45E-5</td>
</tr>
<tr>
<td>Abiotic depletion potential for fossil resources</td>
<td>[MJ]</td>
<td>8.21E+3</td>
<td>2.04E+1</td>
<td>-9.54E+2</td>
</tr>
</tbody>
</table>

#### RESULTS OF THE LCA - RESOURCE USE: 1 metric ton of steel sections and merchant bars

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable primary energy as energy carrier</td>
<td>[MJ]</td>
<td>1.45E+3</td>
<td>1.05E+1</td>
<td>-1.56E+2</td>
</tr>
<tr>
<td>Renewable primary energy resources as material utilization</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Total use of renewable primary energy resources</td>
<td>[MJ]</td>
<td>1.45E+3</td>
<td>1.05E+1</td>
<td>-1.56E+2</td>
</tr>
<tr>
<td>Non-renewable primary energy as energy carrier</td>
<td>[MJ]</td>
<td>1.03E+4</td>
<td>3.22E+1</td>
<td>-1.18E+3</td>
</tr>
<tr>
<td>Non-renewable primary energy resources as material utilization</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Total use of non-renewable primary energy resources</td>
<td>[MJ]</td>
<td>1.03E+4</td>
<td>3.22E+1</td>
<td>-1.18E+3</td>
</tr>
<tr>
<td>Use of secondary material</td>
<td>[kg]</td>
<td>9.85E+2</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of renewable secondary fuels</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of non-renewable secondary fuels</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of net fresh water</td>
<td>[m³]</td>
<td>4.46E+0</td>
<td>1.49E-2</td>
<td>-4.54E-1</td>
</tr>
</tbody>
</table>

#### RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 metric ton of steel sections and merchant bars

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>C3</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous waste disposed</td>
<td>[kg]</td>
<td>5.06E-6</td>
<td>1.81E-7</td>
<td>-3.94E-6</td>
</tr>
<tr>
<td>Non-hazardous waste disposed</td>
<td>[kg]</td>
<td>5.76E+1</td>
<td>1.00E+1</td>
<td>-7.77E-2</td>
</tr>
<tr>
<td>Radioactive waste disposed</td>
<td>[kg]</td>
<td>8.31E-1</td>
<td>4.07E-3</td>
<td>-9.14E-2</td>
</tr>
<tr>
<td>Components for reuse</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>1.10E+2</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Materials for recycling</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>8.30E+2</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Materials for energy recovery</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Exported electrical energy</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Exported thermal energy</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
</tbody>
</table>

**Note:**
985 kg scrap is used in the manufacturing of 1 metric ton of steel sections and merchant bars. After use, 880 kg steel is recycled, 110 kg is reused. The potential environmental impact calculated for module D depends on the net amount of scrap left in the system, which is 880 – 985 + 108 = 3 kg. This means that the system has a net output of 3 kg scrap, which carries a potential credit. All in all module D shows an environmental benefit.

**References**

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/ASTM A36-14/, Standard specification for carbon structural steel


/ASTM A588-15/, Standard specification for high-strength low-alloy structural steel, up to 50 ksi [345 MPa] minimum yield point, with atmospheric corrosion resistance.

/ASTM A709-13/, Standard specification for structural steel for bridges.

/ASTM A913/913M-15/, Standard specification for high-strength low-alloy steel shapes of structural quality, produced by quenching and self-tempering process (QST)


/EN 10025-1:2004/, Hot rolled products of structural steels. General technical delivery conditions

/EN 1090-2:2008/, Execution of steel structures and aluminum structures – Part 2: technical requirements for steel structures

/EN 13501-1:2009/, Fire classification of construction products and building elements

/AWS D1.1/D1.1M:2015/, Structural Welding Code--Steel

/AISC 303-10/, Code of Standard Practice for Steel Buildings and Bridges


/ANSI/AISC 360-16/, Specification for Structural Steel Buildings


/German Ministry of Environmental Affairs/, "Instrumente zur Wiederverwendung von Bauteilen und hochwertigen Verwertung von Baustoffen", (Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit; Forschungskennzahl 3712 32 319; UBA-FB 002208)


/Worldsteel, 2011/ Life cycle assessment (LCA) methodology report http://www.worldsteel.org/publications/

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