

ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804+A1

Owner of the Declaration	ArcelorMittal Europe
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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Valid to	18.07.2026

XCarb™ Recycled and renewably produced
Structural steel sections and merchant bars
ArcelorMittal Europe

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XCarb™
Recycled and renewably
produced

General Information

ArcelorMittal Europe

Programme holder

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Germany

Declaration number

EPD-ARC-20210132-CBB2-EN

This declaration is based on the product category rules:

Structural steels, 11.2017
(PCR checked and approved by the SVR)

Issue date

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Valid to

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XCarb™ Recycled and renewably produced structural steel sections and merchant bars

Owner of the declaration

ArcelorMittal Europe – Long Products
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Luxembourg

Declared product / declared unit

1 metric tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars.

Scope:

The declared unit is 1 metric tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars produced by ArcelorMittal.

The Life Cycle Assessment is based on data collected from the EAF plants involved in the production: Differdange & Esch-Belval (sites of Belval, Differdange and Rodange) in Luxembourg; Bergara & Olaberria in Spain. The data used represent >95% of annual production with 2019 data for deliveries based on Guarantee of Origins renewable electricity supply.

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.

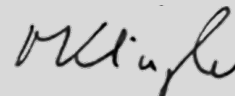
The EPD was created according to the specifications of *EN 15804+A1*. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard *EN 15804* serves as the core PCR

Independent verification of the declaration and data according to *ISO 14025:2011*

internally externally



Matthias Klingler
(Independent verifier)

Product

Product description/Product definition

This EPD applies to 1 metric tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars in usual structural steel grades for building industry based on a steel production in Electric Arc Furnace with renewable electricity supply with Guarantee of Origins.

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 XCarb™ Recycled and renewably produced structural sections and merchant bars of various steel grades and different forms of delivery produced with a certified supply of renewable electricity.

Performance data of the product in accordance with the Declaration of Performance.

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	1536	°C
Shear modulus	81000	N/mm ²

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to EN 10025-1:2004.

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 360-16 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 and composite steel and concrete structures.

- Product standards: EN 10025, ASTM A36-14, ASTM A572-15, ASTM A588-15, ASTM A709-13, ASTM A913/A913M-19 and ASTM A992-11.
- 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 XCarb™ Recycled and renewably produced structural steel sections and merchant bars is iron. Alloying elements are added in the form of ferroalloys or metals (most common elements are Manganese and Silicon). Some small quantities of other elements may be present in the steel.

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 XCarb™ Recycled and renewably produced 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.

LCA: Calculation rules

Declared Unit

The declaration refers to the functional unit of 1 metric tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars as specified in Part B requirements on the EPD for structural steels.

The final results reflect the weighted average per production volume of plants: Differdange & Esch-Belval (sites of Belval, Differdange and Rodange) in Luxembourg; Bergara & Olaberria in Spain.

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

Declared unit

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

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 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 to allow its orientation towards the recycling solutions. This process will also produce losses due to efficiency that will be oriented towards landfill sites. A conservative value of 1% landfill is then considered in C4.

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 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.

GaBi ts Software version 10.0.1.92 was used with *GaBi Database 2021.1* to calculate this EPD.

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 – Science Research Development Report and on the Umweltbundesamt (German Environmental Agency).

Transport to the user (A4)

The following scenario was used for transport calculations from the mill gate to the arrival destination:

- Step 1: Rail is commonly used for transport of structural long products. Transport of sections from mills situated in Luxembourg to the closest international seaport - Antwerp (Belgium) – was assumed to be representative of >95% of production. Standard default data from Gabi software version 10.6.2.9., data base 2022.2 was used, resulting in a total GWP of 2 kg CO₂e/to of XCarb® Recycled and Renewably produced sections and merchant bars. An electric train with a gross weight of 1000to and a conservative utilization rate of 40% was used.

- Step 2: Intercontinental oceanic going vessel - Antwerp (Belgium) to destination port. The default scenario from Gabi was used, using a container ship with a payload capacity of 15000to, and utilization rate of 60%. The associated average distance for ocean going transport was calculated using SEADISTANCES.ORG

Examples: GWP for 1 to of XCarb recycled and renewably produced Sections and merchant bars from Antwerp (Belgium) to:

· Savannah (US): Distance = 3942 nautical miles - GWP = 80 kg CO₂ eq./to

· Jeddah (Saudi Arabia): Distance = 4002 nautical miles - GWP =82 kg CO₂ eq./to

· Sydney (Australia): Distance = 11575 nautical miles - GWP =236 kg CO₂ eq./to

Additional information related to other worldwide ports and associated GWP for XCarb® recycled and renewably produced sections and merchant bars can be found following this link: Sustainability - Sections (arcelormittal.com)

Name	Value	Unit
Litres of fuel Heavy fuel oil (for intercontinental transport)	-	l/100km
Transport distance Variable, depending on final destination port (see examples below)	-	km
Capacity utilisation (including empty runs) Variable, depending on type of transport	-	%
Gross density of products transported 7850	-	kg/m ³
Capacity utilisation volume factor Variable, depending on type of transport	-	-

Use or application of the installed product (B1) see section 2.12 "Use"

Name	Value	Unit
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End of life (C1 - C4)

Name	Value	Unit
Reuse	110	kg
Recycling	880	kg
Landfilling	10	kg

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

Name	Value	Unit
Reuse	11	%
Recycling	88	%

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 to of XCarb™ structural steel sections

Parameter	Unit	A1-A3	C3	C4	D
Global warming potential	[kg CO ₂ -Eq.]	3.33E+2	1.60E+0	1.43E-1	2.14E+2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.84E-11	4.69E-14	7.83E-16	-4.74E-12
Acidification potential of land and water	[kg SO ₂ -Eq.]	7.46E-1	2.99E-3	8.57E-4	3.22E-1
Eutrophication potential	[kg (PO ₄) ³ -Eq.]	7.51E-2	4.48E-4	9.72E-5	1.25E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	8.27E-2	2.60E-4	6.58E-5	1.16E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	4.04E-4	4.70E-7	1.44E-8	5.13E-4
Abiotic depletion potential for fossil resources	[MJ]	3.81E+3	1.82E+1	1.95E+0	1.94E+3

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 metric to of XCarb™ structural steel sections

Parameter	Unit	A1-A3	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	7.53E+3	1.22E+1	2.70E-1	-1.04E+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]	7.53E+3	1.22E+1	2.70E-1	-1.04E+3
Non-renewable primary energy as energy carrier	[MJ]	4.00E+3	2.82E+1	2.01E+0	1.85E+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]	4.00E+3	2.82E+1	2.01E+0	1.85E+3
Use of secondary material	[kg]	1.16E+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 ³]	6.10E-1	1.18E-2	4.95E-4	1.09E+0

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 metric to of XCarb™ structural steel sections

Parameter	Unit	A1-A3	C3	C4	D
Hazardous waste disposed	[kg]	1.52E-6	7.00E-9	2.13E-10	-8.06E-7
Non-hazardous waste disposed	[kg]	2.02E+0	1.89E-2	1.00E+1	-2.78E+1
Radioactive waste disposed	[kg]	5.46E-2	3.89E-3	2.10E-5	-6.09E-3
Components for re-use	[kg]	0.00E+0	1.10E+2	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	8.80E+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

1163,1 kg scrap is used in the manufacturing of 1 tonne of XCarb™ Recycled and renewably produced structural steel sections and merchant bars. After use, 880 kg steel is recycled, 110 kg is reused, and 10 kg is landfilled. The potential environmental impact calculated for module D depends on the net amount of scrap left in the system, which is $880 - 1163,1 + 127,94 = -155,17$ kg.

This means that the system has a net negative output of 155,17 kg scrap, which carries a potential credit then, module D shows an environmental burden.

A4. Information module concerning transport from the Gate mill to the user (steel fabricator; job site; distribution), etc.

The following scenario was used for transport calculation from the mill gate to arrival destination:

- Step 1: Rail transport is commonly used for transport of structural long products. Transportation of sections from mills situated in Luxembourg up to closest seaport with international destination - Antwerp (Belgium), as being representative for >95% of the production was assumed. Default standard data from Gabi software version 10.6.2.9., data base 2022.2 were used, resulting in total GWP of 2 kg CO₂/to of XCarb Recycled and Renewably produced sections and merchant bars. Electric train type with a gross weight of 1000 to was used, and associated utilization rate of 40% (rather conservative scenario).
- Step 2: Intercontinental oceanic going transport; from port of Antwerp (Belgium) up to the port of destination, according to the product order (e.g. Nort America, Middle East, Asia, Australia etc). For its calculation, the default scenario from Gabi was used, with container ship vessel type with a payload capacity of 15000to, and utilization

rate of 60%. The associated average distance for oceanic going transport can be calculated via SEA-DISTANCES.ORG - Distances.

Examples of calculation:

GWP for 1 to of XCarb recycled and renewably produced Sections and merchant bars from port of Antwerp (Belgium) up to :

- Port of Savannah (US): GWP = 80 kg CO₂ eq./to, for a distance of 3942 nautical miles
- Port of Jeddah (Saudi Arabia): GWP =82 kg CO₂ eq./to, for a distance of 4002 nautical miles
- Port of Sidney (Australia): GWP =236 kg CO₂ eq./to, for a distance of 11575 nautical miles

Additional information, related to other worldwide ports and associated GWP for XCarb recycled and renewably produced sections and merchant bars can be found following the link: Sustainability - Sections (arcelormittal.com)

References

EN 15804

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

PCR Part A

PCR - Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Institut Bauen und Umwelt e.V., www.ibu-epd.com, 2021.

PCR 2017, Part B

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.

GaBi ts Software

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 und PE International, 2011.
<http://documentation.gabi-software.com>

ASTM A36-14

ASTM A36-14:2014, Standard specification for carbon structural steel.

ASTM A572-15

ASTM A572-15:2015, Standard specification for highstrength low-alloy Columbium-Vanadium structural quality steel.

ASTM A588-15

ASTM A588-15:2015, Standard specification for highstrength low-alloy structural steel, up to 50 ksi [345 MPa] minimum yield point, with atmospheric corrosion resistance.

ASTM A709-13

ASTM A709-13:2013, Standard specification for structural steel for bridges.

ASTM A913/913M-19

ASTM A913/913M-19:2019, Standard specification for high-strength low-alloy steel shapes of structural

quality, produced by quenching and self-tempering process (QST).

ASTM A992-11

ASTM A992-11:2015, Standard specification for structural steel shapes.

EN 10025-1

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

EN 1090-2

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

AISC 303-10

AISC 303-10:2010, Code of Standard Practice for Structural Steel Buildings and Bridges

AWSD1.1/D1.1M

AWSD1.1/D1.1M:2015, Structural Welding Code–Steel.

EN 1993

EN 1993:2005, Eurocode 3: Design of steel structures.

EN 1994

EN 1994:2004, Eurocode 4: Design of composite steel and concrete structures.

ANSI/AISC 360-16

ANSI/AISC 360-16:2016, Specification for Structural Steel Buildings.

Candidate list - REACH

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>

Sales Programme Sections & Merchant Bars

ArcelorMittal Europe - Long Products available at <http://sections.arcelormittal.com>.

Umweltbundesamt

Instrumente zur Wiederverwendung von Bauteilen und hochwertigen Verwertung von Baustoffen. Texte 93/2015.
<http://www.umweltbundesamt.de/publikationen/instrumente-zur-wiederverwendung-von-bauteilen>

**European Commission – Science Research
Development Report**

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

**Publisher**

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