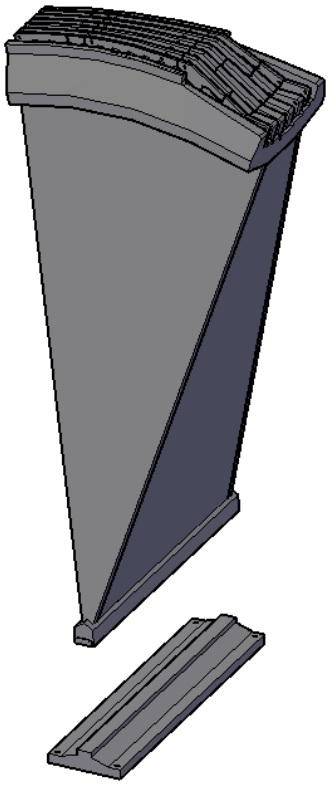
Environmental Product Declaration

In accordance with ISO14025:2006 and EN15804:2012+A2:2019

Splay Saddle



Owner of the declaration:
SAMYOUNG M-TEK

Product name:
Splay Saddle

Declared unit:
1kg Spaly Saddle

Product category /PCR:
CEN Standard EN 15804:2012+A2:2019 serves as core PCR NPCR 013:2021 NPCR Part A: Construction products and services. Ver. 2.0. April 2021, EPD-Norge Part B for Steel and aluminium construction products

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-6531-5796-EN

Registration number:
NEPD-6531-5796-EN

Issue date: 07.05.2024

Valid to: 07.05.2029

삼영엠텍주식회사
SAMYOUNG M-TEK Co., Ltd.

The Norwegian EPD Foundation

General information

Product:
Splay Saddle

Program operator:
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Declaration number:
NEPD-6531-5796-EN

This declaration is based on Product Category Rules:
CEN Standard EN 15804:2012+A2:2019 serves as core PCR NPCR 013:2021 Part B for Steel and aluminium construction products

Statement of liability:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Declared unit:
1kg of Spaly Saddle

Declared unit with option:
A1, A2, A3,A4, C1, C2, C3,C4,D

Functional unit:
-

Verification:
Independent verification of the declaration and data, according to ISO14025:2010

internal ☐ external ■

Noh-hyun Lim

Noh-hyun Lim
Independent verifier approved by EPD Norway

Owner of the declaration:
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Place of production:
631-35, Samchil-ro, Chilseo-myeon, Haman-gun, Gyeongsangnam-do, Republic of Korea

Management system:
ISO 9001:2015, ISO 14001:2015, ISO 45001:2018

Organisation no:
608-81-27893

Issue date:
2024-05-07

Valid to:
2029-05-07

Year of study:
2023

Comparability:
EPD of construction products may not be able to compare if they do not comply with EN 15804 and are seen in a building context.

The EPD has been worked out by:
Peter Yeon

Approved

Manager of EPD Norway

Product

Product description:

A structure installed to minimize the stress on the main cable when dividing it into strands and anchoring it to the anchor block through the anchor. The Base Plate is seated on the Splay Saddle Foundation, and the main body is assembled to the Base Plate.

Product specification:

Produced in Korea with iron

Materials	Value	%
Casting iron	0.416 kg	41.640
Plate	0.584 kg	58.360
Accessory	0.001 kg	0.001

Technical data:

Chemical Composition (% by mass) of Spaly Saddle

Specification	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	V
NS-EN10340 G10MnMoV6-3+QT1	Max. 0.12	Max. 0.60	0.12 ~ 0.18	Max. 0.025	Max. 0.020	Max. 0.30	0.20 ~ 0.40	Max. 0.40	Max. 0.30	0.05 0.10

Mechanical Properties of Spaly Saddle

Specification	Tensile test			Impact test (ISO V-Notch, -20℃) *Additional Requirements
NS-EN10340 G10MnMoV6-3+QT1	Y.P (MPa)	T.S (MPa)	EL (%)	
	Min.350	460~610	Min. 18	Min. 27 (Avg.)

Market:

Norway, Bridge construction

Reference service life, product:

100 years

Reference service life, building:

Not Applicable

LCA: Calculation rules

Declared unit:

1kg of Spaly Saddle

Cut-off criteria:

All major raw materials and all the essential energy is included. The production processes for raw materials and energy flows with very small amounts (less than 1%) are not included. These cut-off criteria do not apply for hazardous materials and substances.

Also, the elements and activities excluded from the system boundaries were as follow:

A. Infrastructure, maintenance efforts for infrastructure (e.g., building and machinery)

B. Personnel lodging and transport, employee commute, administration

Allocation:

The allocation is made in accordance with the provisions of EN 15804. And Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation.

A. Allocation is avoided, if possible, by dividing the unit process into two or more sub-processes and collecting LCI data for each sub-process.

B. Allocation is based on physical properties (e.g. mass, volume) when (i) there is a relevant underlying physical relationship between the products and co-products, and (ii) the difference in revenue per mass from the products and co-products is low.

C. In all other cases, allocation is based on economic values of the products and co-products when they leave the unit process.

Data quality:

Inventory data quality is judged by its precision (measured, calculated or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied) and representativeness (geographical, temporal, and technological).

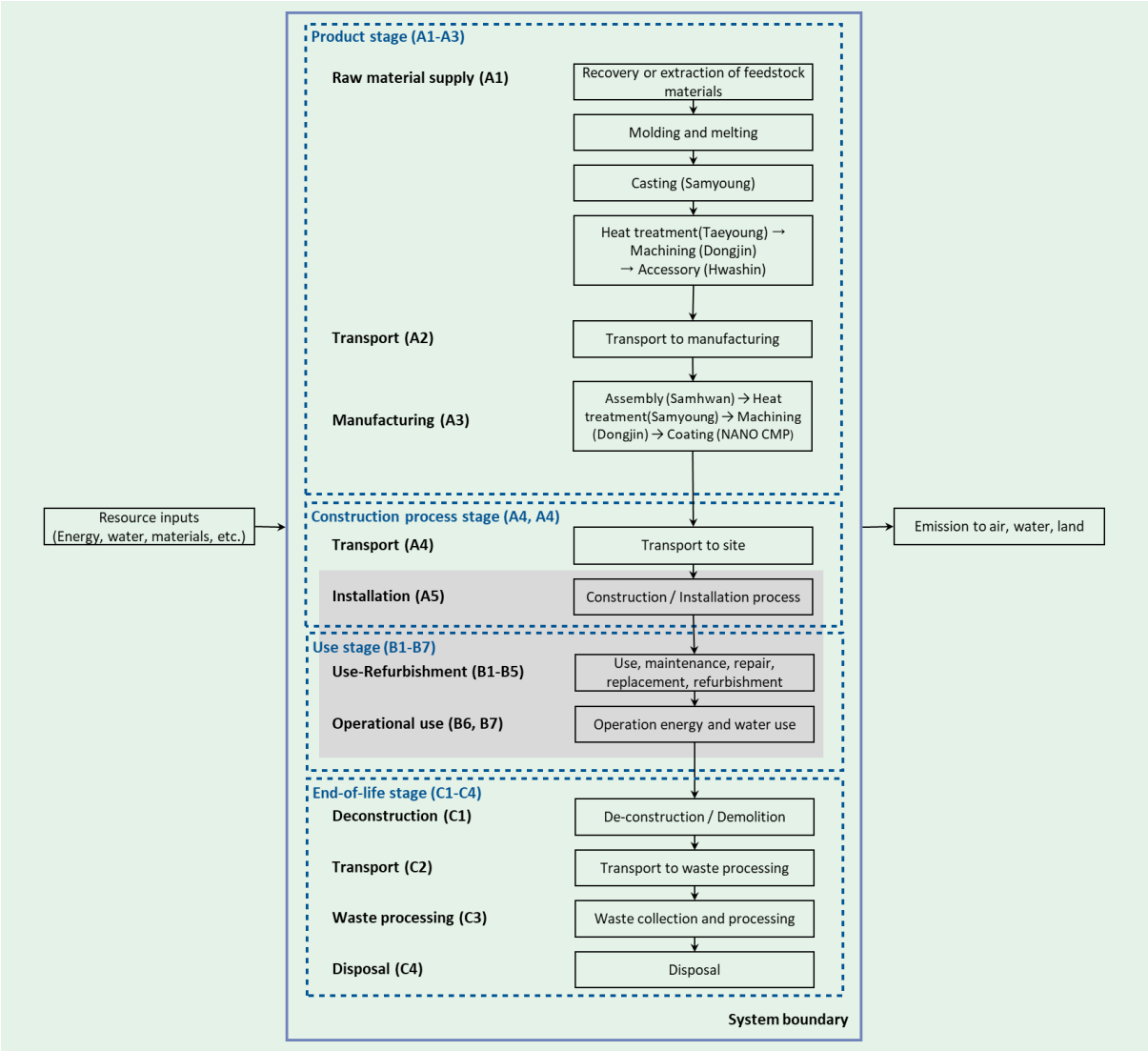
To cover these requirements and to ensure reliable results, site site specific data in combination with consistent generic data from the Ecoinvent v3.9.1 and Industry data 2.0 was used. The LCI datasets from the Ecoinvent v3.9.1 are widely distributed and used with the SimaPro Software

System boundaries (X=included, MND=module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Manufacturing	Transport	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	X	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

System boundary:

Gray phases (use stage B1-B7) are excluded from this study.



A1-A3 Product stage

The product stages include the raw material supply, raw material transport and product manufacturing.

A1- Raw material supply

The raw materials and packaging materials used to produce the Spaly Saddle were collected and calculated based on the annual production volume in 2023.

A2- Transport

The transport of raw materials and packaging is carried out by suppliers to the Spaly Saddle production site by various transport modes.

A3- Manufacturing of Spaly Saddle

All energy, industrial water, gas and environmental emission data are collected and calculated based on 2023 production year.

A4- Transport of Spaly Saddle

Transportation takes place between each of the life cycle stages. A4-Transport of Spaly Saddle includes transport from the Spaly Saddle production gate to the construction site.

B1-B7 Use stage

Module B1-B7 has been excluded according to the Product category rules NPCR 013 Part B for Steel and Aluminium Construction Products and NPCR PART A: Construction products and services.

C1- De-installation / demolition

This section provides information on the inputs and outputs of de-installation / demolition. Energy consumption of a de-installation / demolition process is on average 10kWh/m2 (Bozdag, Ö & Seçer, M. 2007).

The average mass of a reinforced concrete building is about 1000 kg/m2. Therefore, energy consumption during de-installation / demolition is 0.01 kWh/kg.

A conservative assumption has been made that the energy consumed during de-installation / demolition of a Spaly Saddle product is the same as that of a concrete building.

The source of energy is diesel fuel used by work machines. It is assumed that 100% of the waste is collected and transported to the waste treatment.

C2- Transport

Transportation distance and truck type from the construction site to the recycling site / final disposal(landfill) is assumed as 300 km and the Lorry, 7.5-16 metric ton, Euro VI..

C3- Waste processing

Approximately 85% of Spaly Saddle is assumed to be recycled based on World Steel Association, 2020.

C4- Disposal

It is assumed that the remaining 15 % of Spaly Saddle is taken to landfill for final disposal.

D Benefits and loads beyond the system boundary

Steel collected and recycled is assumed to replace a value of scrap (GLO).

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Transport from production place to assembly/user (A4)

Transport from production place to assembly/user (A4)	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy consumption	Unit	Value (Liter/tonne)
transport, freight, lorry 7.5-16 metric ton, EURO6 {RoW}	50.0 %	493.0	5.722E-02	ℓ/tkm	28.2
transport, freight, lorry 7.5-16 metric ton, EURO6 {RER}	50.0 %	33.4	5.722E-02	ℓ/tkm	1.9
municipal waste collection service by 21 metric ton lorry {RoW}	50.0 %	312.6	4.073E-01	ℓ/tkm	127.3
Transport, freight, sea, container ship {GLO}	50.0 %	21057.2	2.625E-03	ℓ/tkm	55.3

However, the storage of Spaly Saddle product, including the provision of heating, cooling, humidity control, etc was considered.

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	0.00E+00
Collected as mixed construction waste	kg	0.00E+00
Reuse	kg	0.00E+00
Recycling	kg	8.507E-01
Energy recovery	kg	0.00E+00
To landfill	kg	1.501E-01

Transport to waste processing (C2)

Transport from production place to assembly/user (C2)	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy consumption	Unit	Value
transport, freight, lorry 7.5-16 metric ton, EURO6 {RER}	50.0 %	300	5.722E-02	ℓ/tkm	17.2

Benefits and loads beyond the system boundaries (D)

Benefits and loads beyond the system boundaries (D)	Unit	Value
Substitution of primary steel with net scrap	kg	-8.507E-01

LCA: Results

Core environmental impact indicators

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP - total	kg CO2 eq	3.79E+00	2.25E-01	2.40E-04	7.01E-02	6.50E-02	9.13E-04	1.42E+00
GWP - fossil	kg CO2 eq	5.35E+00	2.25E-01	2.27E-04	7.01E-02	5.91E-04	1.42E+00	1.42E+00
GWP - biogenic	kg CO2 eq	-1.60E+00	-3.68E-05	1.02E-05	5.42E-05	2.80E-05	5.22E-07	-6.18E-04
GWP - luluc	kg CO2 eq	3.97E-02	1.71E-04	2.04E-06	3.22E-05	1.27E-05	5.51E-07	3.04E-05
ODP	kg CFC11 eq	7.82E-08	3.46E-09	3.73E-12	1.53E-09	1.01E-09	2.64E-11	3.22E-15
AP	molc H+ eq	1.95E-02	6.41E-03	7.16E-07	1.45E-04	5.91E-04	6.87E-06	3.17E-03
EP- freshwater	kg P eq	1.94E-03	7.93E-06	8.72E-08	4.85E-06	3.21E-06	7.60E-08	2.67E-07
EP -marine	kg N eq	5.69E-03	1.60E-03	1.96E-07	3.60E-05	2.70E-04	2.64E-06	5.57E-04
EP - terrestrial	molc N eq	5.81E-02	1.77E-02	2.07E-06	3.64E-04	2.93E-03	2.83E-05	4.89E-03
POCP	kg NMVOC eq	1.78E-02	4.80E-03	5.95E-07	2.26E-04	8.69E-04	9.84E-06	2.26E-03
ADP-M&M[2]	kg Sb-Eq	5.94E-05	2.42E-07	9.81E-10	2.24E-07	3.74E-08	1.27E-09	3.67E-06
ADP-fossil[2]	MJ	7.73E+01	2.78E+00	5.50E-03	9.88E-01	8.51E-01	2.27E-02	1.35E+01
WDP[2]	m^3	-3.96E+01	6.50E-03	2.32E-04	3.75E-03	2.23E-03	1.00E-03	1.77E+01

GWP-total: *Global Warming Potential;* ***GWP-fossil:*** *Global Warming Potential fossil fuels;* ***GWP-biogenic:*** *Global Warming Potential biogenic;* ***GWP-LULUC:*** *Global Warming Potential land use and land use change;* ***ODP:*** *Depletion potential of the stratospheric ozone layer;* ***AP:*** *Acidification potential, Accumulated Exceedance;* ***EP-freshwater:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water counsumption*

Reading example: 9,0 E-03 = 9,0*10-3 = 0,009

Additional environmental impact indicators

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
PM	Disease incidence	3.40E-06	6.98E-09	1.05E-11	4.39E-09	1.62E-08	1.50E-10	5.32E-08
IRP[1]	kBq U235 eq.	1.43E+01	1.48E-03	2.60E-04	1.60E-03	7.73E-04	1.44E-05	-3.32E+01
ETP-fw[2]	CTUe	4.83E+00	3.61E-01	2.31E-04	1.28E-01	9.93E-02	2.71E-03	-1.44E-01
HTP-c[2]	CTUh	6.00E-09	9.73E-11	1.95E-13	2.91E-11	2.03E-11	3.88E-13	6.02E-10
HTP-nc[2]	CTUh	3.89E-08	8.60E-10	2.33E-12	6.53E-10	1.68E-10	4.86E-12	-2.01E-09
SQP[2]	Dimensionless	4.95E+02	2.73E-01	1.86E-03	5.08E-01	7.60E-02	4.51E-02	-2.23E-01

PM: *Particulate matter emissions;* ***IRP:*** *Ionising radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts / soil quality*

[1] This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

[2] The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator

Resource use

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
RPEE	MJ	1.53E+00	1.49E-02	3.77E-02	1.31E-02	7.98E-03	1.40E-04	-4.35E-02
RPEM	MJ	4.15E+01	6.34E-03	4.93E-04	4.15E-03	1.53E-03	5.48E-05	4.55E-04
TPE	MJ	4.31E+01	2.12E-02	3.82E-02	1.73E-02	9.51E-03	1.94E-04	-4.30E-02
NRPE	MJ	1.27E+01	2.22E-02	3.51E-03	2.65E-02	1.19E-02	2.39E-04	-5.25E-01
NRPM	MJ	6.46E+01	2.76E+00	1.99E-03	9.61E-01	8.39E-01	2.25E-02	1.41E+01
TRPE	MJ	7.73E+01	2.78E+00	5.50E-03	9.88E-01	8.51E-01	2.27E-02	1.35E+01
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m^3	6.71E-02	2.33E-04	2.70E-04	1.43E-04	8.35E-05	2.41E-05	6.18E-03

RPEE *Renewable primary energy resources used as energy carrier;* ***RPEM*** *Renewable primary energy resources used as raw materials;* ***TPE*** *Total use of renewable primary energy resources;* ***NRPE*** *Nonrenewable primary energy resources used as energy carrier;* ***NRPM*** *Nonrenewable primary energy resources used as materials;* ***TRPE*** *Total use of non-renewable primary energy resources;* ***SM*** *Use of secondary materials;* ***RSF*** *Use of renewable secondary fuels;* ***NRSF*** *Use of non-renewable secondary fuels;* ***W*** *Use of net fresh water.*

End of life – Waste

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
HW	kg	2.47E-03	3.72E-05	2.19E-07	2.27E-05	8.70E-06	2.80E-07	0.00E+00
NHW	kg	5.41E-01	1.29E-02	1.68E-04	4.08E-02	1.37E-03	1.50E-01	0.00E+00
RW	kg	1.91E-04	3.40E-07	5.64E-08	3.92E-07	1.84E-07	3.36E-09	0.00E+00

HW *Hazardous waste disposed;* ***NHW*** *Non-hazardous waste disposed;* ***RW*** *Radioactive waste disposed.*

End of life – output flow

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	1.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.51E-01	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CR *Components for reuse;* ***MR*** *Materials for recycling;* ***MER*** *Materials for energy recovery;* ***EEE*** *Exported electric energy;* ***ETE*** *Exported thermal energy.*

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	0.00E+00
Biogenic carbon content in the accompanying packaging	kg C	0.00E+00

The product is exclusively made from steel. The origins of carbon contained in steel are not assessed.

Additional requirements

Location based electricity mix from the use of electricity in manufacturing

National production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing prosess (foreground/core) per functional unit.

National electricity grid	Data source	Foreground / core [kWh]	GWP_{total} [kg CO2 -eq/kWh]	SUM [kg CO2 -eq]
Electricity, medium voltage {KR}	ecoinvent 3.9.1	5.071E-01	0.698	3.54E-01

Guarantees of origin from the use of electricity in the manufacturing phase

Where guarantees of origin is applied in stead of national production mix – the electricity for the manufacturing prosess (A3) shall be stated clearly in the EPD per functional unit.

Electricity source	Foreground / core [kWh]	GWP_{total} [kg CO2 -eq/kWh]	SUM [kgCO2 -eq]
Guarantee of origin electricity used in the foreground	-	-	-
Residual mix electricity used in the foreground	-	-	-

Additional environmental impact indicators required for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator GWP-IOBC is required as it declares climate impacts calculated according to the principle of instantanious oxidation. GWP-IOBC is also refered to as GWP-GHG in context to Swedish public procurement legislation.

Parameter	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-IOBC	kg	5.39E+00	2.26E-01	2.30E-04	7.01E-02	6.50E-02	9.13E-04	1.42E+00

GWP-IOBC *Global warming potential calculated according to the principle of instantaneous oxidation.*

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation available upon request to EPD owner.

☐ The product contains no substances given by the REACH Candidate list.

Carbon footprint

While a carbon footprint analysis has not been conducted for the product separately, the results section does include an evaluation of Global Warming Potential (GWP) with such an analysis. The GWP total results presented in this EPD document represents the carbon footprint of the product studied.

Bibliography

ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products
ISO 21930:2007	Sustainability in building construction - Environmental declaration of building products

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Life cycle inventory (LCI) study 2020 data release, Seventh global LCI study for steel products (World steel association)

Bozdag, Ö & Seçer, M. 2007

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