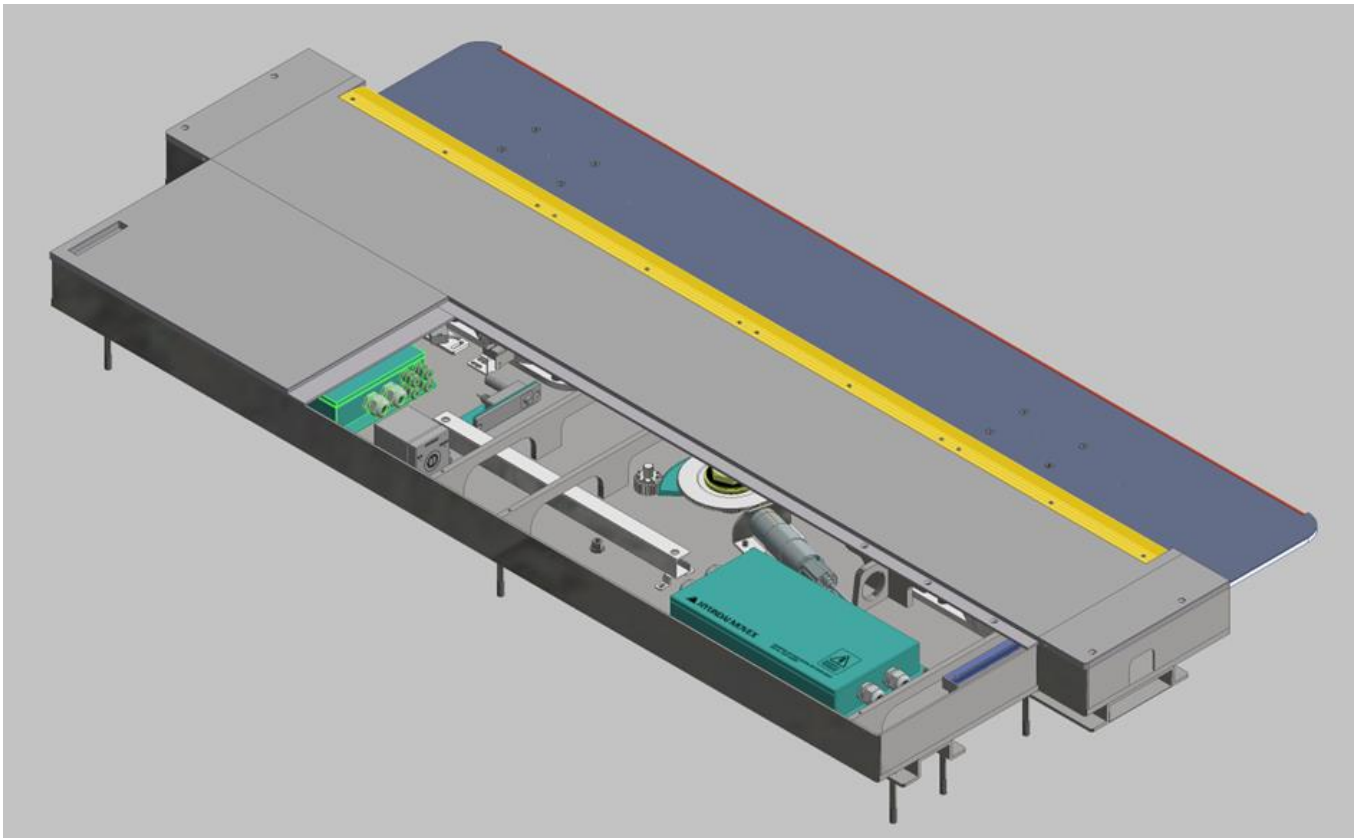


Environmental Product Declaration

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

MGF(Mechanical Gap Filler)



Owner of the declaration:
HYUNDAI MOVEX Co., Ltd.

Product name:
MGF

Declared unit:
1 set MGF

Product category /PCR:
NPCR Part A for Construction products and services ver2.

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-7650-7031-EN

Registration number:
NEPD-7650-7031-EN

Issue date: 27-09-2024

Valid to: 27-09-2029

General information

Product:

MGF

Program operator:

The Norwegian EPD Foundation
Post Box 5250 Majorstuen, 0303 Oslo, Norway
Tlf: +47 23 08 80 00
e-mail: post@epd-norge.no

Declaration number:

NEPD-7650-7031-EN

This declaration is based on Product Category Rules:

NPCR Part A for Construction products and services ver2

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:

1 set MGF (4.86E+02kg)

Verification:

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

internal external

Noh-hyun Lim

Lim, Noh-hyun

Independent verifier approved by EPD Norway

Owner of the declaration:

HYUNDAI MOVEX Co., Ltd.

Contact person: Sangho Rim

Phone: +82. 32.240.9942

e-mail: sangho@hyundaimovex.com

Manufacturer:

HYUNDAI MOVEX Co., Ltd.

Hyundai Group Building, 194 Yulgok-ro, Jongno-gu, Seoul, Republic of Korea

Phone: +82. 2.2072.6038

Place of production:

30, Gongdan 1-daero 322beon-gil, Siheung-si, Gyeonggi-do, Republic of Korea

Management system:

ISO 14001, ISO 9001, ISO45001

Organisation no:

796-87-01173

Issue date:

27-09-2024

Valid to:

27-09-2029

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:

YoungSeok Lee and Soon Yoo, Tres Works Co., Ltd.

Approved

Håkon Hauøy

Manager of EPD Norway

Product

Product description:

Hyundai Movex's MGF is a safety floor board installed between the platform and train door that prevents passengers' feet from getting caught in the gap. Eliminating the gap improves wheelchair accessibility, and provides additional safety for children who are more prone to these types of incidents.

Components	Dimension	Material
MGF Frame	2,170mm x 1,000mm	- Surface material : Extruded aluminium alloy (AL 6063-T5) - plate : Stainless steel 316L
Filler plate	2,000mm x 320mm	- Plate : Extruded aluminium alloy (AL 6063-T5) - Insulation cover : Norament
Upper cover	2,308mm x 1,000mm	- Frame : Extruded aluminium alloy (AL 6063-T5) - Surface material : Styrene-butadiene rubber (S-SBR)

Product specification:

Hyundai Movex's MGF is a Sliding Against Pivot Point type system that automatically slides out and back in, based on the direction of the train. It is more durable than other fixed type rubber or aluminum floorings that are susceptible to damage and breakage from external impact, and is designed to withstand loads of up to 6kN/m² to support use of electrical wheelchairs.

Materials		Value (kg)	%
Product	SUS304	3.08.E+02	63.34%
	Steel_etc.	7.87.E+01	16.20%
	Al	5.53.E+01	11.38%
	MC NYLON(BLUE)	2.44.E+01	5.02%
	Rubber	1.18.E+01	2.44%
	MOTOR	1.89.E+00	0.39%
	cable/harness	1.32.E+00	0.27%
	SILICONE	1.04.E+00	0.22%
	GCD_500	1.04.E+00	0.21%
	PCB	5.94.E-01	0.12%
	LED	5.54.E-01	0.11%
	PBT	3.25.E-01	0.07%
	POM	1.38.E-01	0.03%
	Acrylic	1.36.E-01	0.03%
	Urethane	4.38.E-02	0.01%
C3604	1.50.E-02	0.00%	

	PTFE	4.50.E-03	0.00%
	PowerSupply	7.60.E-01	0.16%
	Total	4.86E+02	100%
Packaging	Wood	1.24.E+01	96.39%
	Film	4.64.E-01	3.61%
	Total	1.28E+01	100%

Technical data:

The product is custom-designed and manufactured to order, so the required technical data information is not provided.

Features	Description
Operation Type	Sliding-Against-Pivot-Point
Overall Size	2,000mm(W) x 1,100mm(D) x 100mm(H)
Filler Plate Stroke	Max. 200mm
Time for Fully Extended or Retracted	1 second (adjustable)
Allowable Normal Passenger Load on Cover	6kN/m ²
Allowable Load on Filler Plate	3.5kN
Material of MGF Cover	Stainless Steel HDG Structural Steel finished with anti-slipping pattern
Type of Motor	BLDC motor, worm gear
Protection Rating of Motor	IP65

Market:

Australia_Sydney Metro

Reference service life, product:

Not Applicable

Reference service life, building:

Not Applicable

LCA: Calculation rules

Declared unit:

The declared unit of the product under study in this report is “1 set MGF”.

Cut-off criteria:

All major raw materials and energies included in the BOM have been accounted for. However, the production processes for raw materials used in component processing and small amounts of energy (less than 1%) are not included.

Allocation:

During the collection period, the electricity consumption due to MGF production was allocated as the remainder after deducting the electricity consumption of other products produced during the collection period from the total electricity usage (annual electricity unit in 2023*production amount during the collection period).

Data quality:

The primary data is the material composition of the product, the material composition of the product, the distance from the raw material manufacturer to the product manufacturer, and the distance from product manufacturer to user provided by Hyundai Movex. The MGF product is produced only at DS SYSTEM Co., Ltd works in Korea, and in this regard, we received data from the actual production period of MGF was provided by the manufacturer.

The Ecoinvent and Gabi database(Sphera) is available in Gabi v10.7.0.183 which is the LCA software used for the calculations.

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	

Product Stage
(A1~A3)



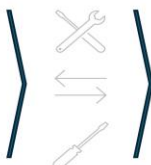
- A1 Raw Material Supply
- A2 Transportaion(to A3)
- A3 Manufacturing

Construction Stage
(A4~A5)



- A4 Distribution (to Construction site)
- A5 installation

Use Stage
(B1~B7)



- B1 Use
- B2 Maintenance
- B3 Repair
- B4 Replacement
- B5 Refurbishment

End of Life Stage
(C1~C4)



- C1 De-installation/Demolition
- C2 Transportation(to C3)
- C3 Waste processing
- C4 Disposal

Beyond sys. boundary
(D)



- D Reuse /recovery /recycling potential

LCA: Scenarios and additional technical information

Raw material supply (A1)

The components are received individually and categorized by material type for calculation.

Transport (A2)

Transportation for the LCA model is based on data provided by the manufacturer for transport from the raw materials manufacturer to the production facility. Road transport is assumed to be by 7.5ton lorry truck. Primary data for mass of raw materials, distances from raw materials manufacturers to product manufacturer were converted into ton.km and applied.

Raw material supplier	Type	Type of vehicle	Distance(km)	Mass(kg)	value (ton.km)
Supplier A	Truck	transport, freight, lorry 7.5-16 metric ton, EURO6, RER	4.10.E+00	2.92.E+02	1.20.E+00
Supplier B			5.00.E-01	7.92.E+01	3.96.E-02
Supplier C			2.59.E+01	1.30.E-01	3.37.E-03
Supplier D			2.60.E+00	5.07.E+00	1.32.E-02
Supplier E			1.36.E+01	2.82.E+01	3.84.E-01
Supplier F			2.82.E+01	2.45.E+01	6.92.E-01
Supplier G			3.83.E+02	1.02.E+00	3.90.E-01
Supplier H			7.60.E+00	9.52.E-01	7.24.E-03
Supplier I			3.85.E+02	1.42.E-01	5.46.E-02
Supplier J			1.73.E+01	1.98.E+01	3.43.E-01
Supplier K			1.60.E+00	1.59.E+01	2.55.E-02
Supplier L			2.77.E+01	6.39.E+00	1.77.E-01
Supplier M			2.36.E+02	4.64.E-01	1.10.E-01
Supplier N			2.14.E+01	1.24.E+01	2.65.E-01
Supplier O	Ocean	transport, freight, sea, container ship, GLO	1.02.E+04	1.24.E+01	1.26.E+02

Manufacturing (A3)

The product is manufactured at production facility in Korea. The manufacturer provided primary data for their whole production at the facility.

Energy flow	Unit	Value
Electricity consumption	kWh	2.68.E+02

Material flow	Unit	Value	
Product	kg	4.61E+02	
Transport	ton · km	8.55.E-01	
Waste	SUS304	kg	2.20.E+01

	Steel_etc.	kg	2.93.E+00
	Al	kg	7.91.E-02

Transport from production place to user (A4)

Transportation of the MGF product is based on data provided by the manufacturer for transportation from the production facility to the construction site. Road transportation is assumed to be a 7.5-ton truck, and ocean transportation is assumed to be a bulk carrier.

Primary data such as the mass of the product and the distance from the manufacturer to the construction site were converted to ton.km and applied

Transport flow		Amount of transportation (ton · km/f.u)
Road Transportation	Product + Packaging	3.27E+01
Ocean Transportation	Product + Packaging	4.17E+03

Demolition (C1)

According to the installation guide, MGF is installed at each Sydney Metro station using anchor bolts. Although the installation guide provided by Hyundai Movex does not include details about product disassembly, the demolition of MGF is expected to involve the removal of the fixed anchor bolts. It is anticipated that the material and energy required for this will be minimal, so calculations for this module have been excluded.

Transport to waste processing (C2)

It is assumed that the dismantled MGF is processed at JJ's Waste & Recycling Material Recovery Facilities, a leading waste management company in Australia. Transportation will begin from Punchbowl Station, the representative station of Sydney Metro, and the distance to the facility is based on the shortest route provided by Google Maps.

Transport flow	Type	Type of vehicle	Distance(km)	Mass(kg)	value (ton.km)
1 set MGF	Road	transport, freight, lorry 7.5-16 metric ton, EURO6, RER	8.70.E+02	4.73.E+02	4.12.E+02

End of Life (C3, C4)

Recycling rates were applied based on the "National Waste Report 2022" from the Australian Department of Environment, specifically the Resource Recovery Rates by Material Category for Australia 2020-21, to estimate the recycling weight.

Material flow	Weight(kg)	Recycling		Landfill Weight(kg)	
		Rate	Weight(kg)		
Product	Metals	4.18.E+02	87.0%	3.63.E+02	5.43.E+01
	Plastics	2.61.E+01	13.0%	3.39.E+00	2.27.E+01
	Others	4.45.E+00	40.0%	1.78.E+00	2.67.E+00
	Organics	1.24.E+01	47.0%	5.81.E+00	6.55.E+00
	Textiles, leather & rubber	1.29.E+01	5.2%	6.70.E-01	1.22.E+01

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	3.63.E+02
Substitution of primary plastics	kg	4.06.E+00
Substitution of primary wood	kg	5.81.E+00
Substitution of primary others	kg	1.78.E+00

LCA: Results

The results calculated using the EF 3.1 methodology are as follows.

Core environmental impact indicators

Indicator	Unit	A1-A3	A4	C1	C2	C3~C4	D
GWP - total	kg CO ₂ eq	2.54E+03	1.24E-02	0.00E+00	9.96E+01	4.71E+01	-1.19E+03
GWP - fossil	kg CO ₂ eq	2.53E+03	1.24E-02	0.00E+00	9.96E+01	4.62E+01	-1.19E+03
GWP - biogenic	kg CO ₂ eq	4.13E+00	2.39E-06	0.00E+00	2.65E-02	8.46E-01	-1.56E+00
GWP - luluc	kg CO ₂ eq	2.54E+00	9.04E-06	0.00E+00	5.05E-02	1.68E-02	-1.22E+00
ODP	kg CFC11 eq	3.42E-05	1.88E-10	0.00E+00	1.52E-06	6.59E-07	-3.34E-05
AP	molc H+ eq	1.40E+01	3.16E-04	0.00E+00	2.41E-01	3.64E-01	-5.59E+00
EP- freshwater	kg P eq	1.06E+00	5.04E-07	0.00E+00	7.99E-03	2.06E-03	-8.36E-01
EP -marine	kg N eq	2.66E+00	7.89E-05	0.00E+00	5.78E-02	2.91E-01	-1.07E+00
EP - terrestrial	molc N eq	2.72E+01	8.71E-04	0.00E+00	5.89E-01	1.80E+00	-1.10E+01
POCP	kg NMVOC eq	9.17E+00	2.38E-04	0.00E+00	3.13E-01	5.40E-01	-3.42E+00
ADP-M&M ²	kg Sb-Eq	1.37E-01	1.62E-08	0.00E+00	3.14E-04	2.57E-05	-2.40E-01
ADP-fossil ²	MJ	3.61E+04	1.55E-01	0.00E+00	1.41E+03	5.55E+02	-1.48E+04
WDP ²	m ³	8.08E+02	5.99E-04	0.00E+00	8.09E+00	3.56E+00	-2.31E+02

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 consumption

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	1.62E-04	3.98E-10	0.00E+00	5.14E-06	1.01E-05	-4.41E-05
IRP ¹	kBq U235 eq.	1.67E+02	8.47E-05	0.00E+00	1.19E+00	3.49E-01	-5.28E+01
ETP-fw ²	CTUe	1.69E+04	7.71E-02	0.00E+00	7.66E+02	2.82E+02	-1.78E+04
HTP-c ²	CTUh	3.67E-05	6.99E-12	0.00E+00	4.32E-08	2.28E-08	-2.35E-07
HTP-nc ²	CTUh	6.16E-05	5.49E-11	0.00E+00	8.52E-07	1.37E-07	-2.16E-05
SQP ²	Dimensionless	1.25E+04	2.33E-02	0.00E+00	7.11E+02	1.40E+02	-3.15E+03

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	7.32E+01	2.62E-05	0.00E+00	3.69E-01	2.97E-01	-2.35E+01
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TPE	MJ	7.32E+01	2.62E-05	0.00E+00	3.69E-01	2.97E-01	-2.35E+01
NRPE	MJ	8.12E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.52E+02
NRPM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRPE	MJ	8.12E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.52E+02
SM	kg	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
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m ³	1.78E-05	2.64E-13	0.00E+00	4.03E-09	9.81E-10	-1.97E-05

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	3.66E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-4.69E-05
NHW	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RW	kg	3.09E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.87E-04

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
MR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	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
ETE	MJ	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

Not applicable to biogenic content

Additional requirements

Location based electricity mix from the use of electricity in manufacturing

We apply Sphera(GaBi) DB "Electricity grid mix, KR" for electricity. It's carbon emission factor(EF3.1 Climate change – total, GWP-total) is 5.59E-01kg CO2 eq./kWh. In A3 module, the input of electricity is 2.68E+02 kWh and the GWP-total is 1.50E+02 kg CO2 eq. (Manufacturing, A3).

National electricity grid	Data source	Foreground / core [kWh]	GWP _{total} [kg CO2 - eq/kWh]	SUM [kg CO2 - eq]
Electricity grid mix, KR	Sphera	2.68.E+02	5.59E-01	1.50E+02

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

This product is manufactured in Korea, so it is not applicable.

Additional environmental impact indicators required for construction products

Parameter	Unit	A1-A3	A4	C1	C2	C3~C4	D
GWP-IOBC	kg	-2.57E+00	-1.15E-06	0.00E+00	5.18E-02	9.84E-01	4.38E+00

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

Hazardous substances

There aren't any dangerous substances about REACH and SVHC in the MGF production of DS SYSTEM Co., Ltd.

Indoor environment

There aren't relevant impact on the indoor environment






Carbon footprint

Carbon footprint has been worked out for the product.

Parameter	A1	A2	A3	A4	C1	C2	C3~C4	D	TOTAL
GWP-TOTAL (kg CO2eq)	2.37E+03	2.18E+00	1.68E+02	1.24E-02	0.00E+00	9.96E+01	4.71E+01	-1.19E+03	1.50E+03

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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