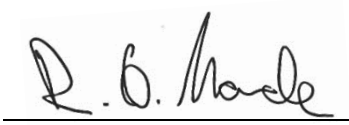
Environmental Product Declaration

as per ISO 14025 and EN 15804

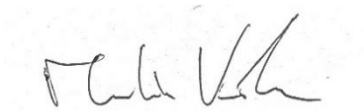
Owner of the declaration:	Officine Maccaferri S.p.A.
Publisher:	Kiwa-Ecobility Experts
Programme operator:	Kiwa-Ecobility Experts
Registration number:	EPD-Kiwa-EE-000415-EN
Issue date:	18.09.2024
Valid to:	18.09.2029

1. General information

Officine Maccaferri S.p.A.	GalMac STEEGRID and MACARMOUR
Programme operator: Kiwa-Ecobility Experts Kiwa GmbH, Ecobility Experts Wattstraße 11-13 13355 Berlin Germany	**Owner of the declaration:** Officine Maccaferri S.p.A. Via Alberico Albricci 9 20122 Milano (MI) Italy
Registration number: EPD-Kiwa-EE-000415-EN	**Declared product / declared unit:** 1 m^2 GalMac STEEGRID and MACARMOUR including distribution packaging.
This declaration is based on the Product Category Rules: PCR B – Product Category Rules for steel construction products, Requirements on the Environmental Product Declarations for steel construction products; Version 2020-03-13	**Scope:** The EPD is based on the composition of STEEGRID HR30 8127. The LCA results can also be scaled to other STEEGRID and MACARMOUR products by using weight for different rope spacing and applying the scaling function reported in section 7. The EPD type is Cradle to gate with options, modules C1-C4, and module D. Kiwa-Ecobility Experts assumes no liability for manufacturer's information, LCA data and evidence.
Issue date: 18.09.2024	**Verification** The European standard EN 15804+A2:2019 serves as the core PCR. Independent verification of the declaration and data according to ISO 14025: 2010. ☐internal ☒external
Valid to: 18.09.2029	



Raoul Mancke
(Head of programme operations, Kiwa-Ecobility Experts)



Martin Koehrer
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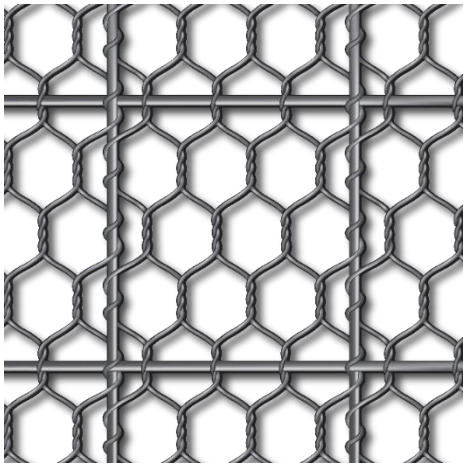
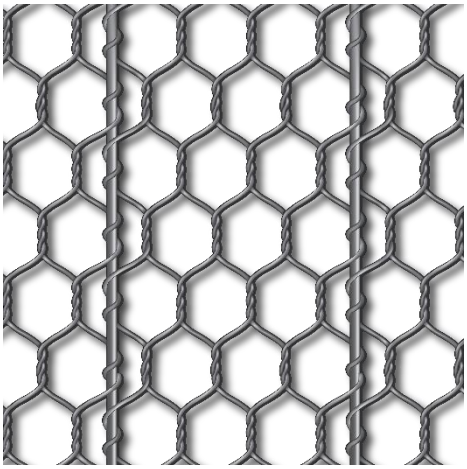
Dr.-Ing. Morteza Nikravan
(External verifier of Kiwa GmbH)

2. Product

2.1 Product description

GalMac STEEGRID and MACARMOUR are composites of double twisted steel wire hexagonal mesh with high tensile strength steel cables, woven into the mesh in longitudinal direction (STEELGRID) or both in longitudinal and transversal direction (MACARMOUR), during the manufacturing process.
GalMac STEEGRID and MACARMOUR are made from high quality steel wire and ropes, which are heavily galvanised GalMac C2 and GalMac C3 (Zinc-Aluminum alloy in accordance with EN 10244-2 and ISO 7989-2 - Class A).





2.2 Application (Intended Use of the product)

GalMac STEEGRID and MACARMOUR are engineered to fit the use as:

- drapery system controlling and preventing rock fall and loose debris flow;
- soil nailing system;
- erosion control system,

along relevant structures as roads, highways and railways, where higher level of tensile strength and punching resistance at low-strain, compared with standard double twist steel wire mesh, are requested.

GalMac STEEGRID and MACARMOUR are CE marked in compliance with Regulation (EU) 305/2011, according to EAD 230008-00-0106.

2.3 Reference Service Life (RSL)

The typical service life is up to 120 years, according to related Declaration of Performance. Durability of the products are defined as per EN 10223-3 and EAD 230008-00-0106 and tested accordingly.

2.4 Technical data

Characteristics (*)	Value	Unit
Nominal Longitudinal Tensile Strength (EAD 230008-00-0106)	50 - 255	kN/m
Nominal Transversal Tensile Strength (EAD 230008-00-0106) (**)	65 - 105	kN/m
Nominal Ultimate punching Load (EAD 230008-00-0106 and ISO 17746)	90 - 280	kN
Durability (EAD 230008-00-0106)	Depending on environmental conditions	

(*) Further Performances are detailed in Declaration of Performance according to Regulation (EU) 305/2011.

(**) MACARMOUR only

2.5 Substances of very high concern

GalMac STEEGRID and MACARMOUR double twist wire meshes do not contain SVHC.

2.6 Base materials / Ancillary materials

The composition with scrap for 1 m^2 of the reference products is reported in Table below. The products are implemented with galvanized steel wire (diameter 2.7 mm) and galvanized wire ropes (diameter 8mm), both GalMac coated.

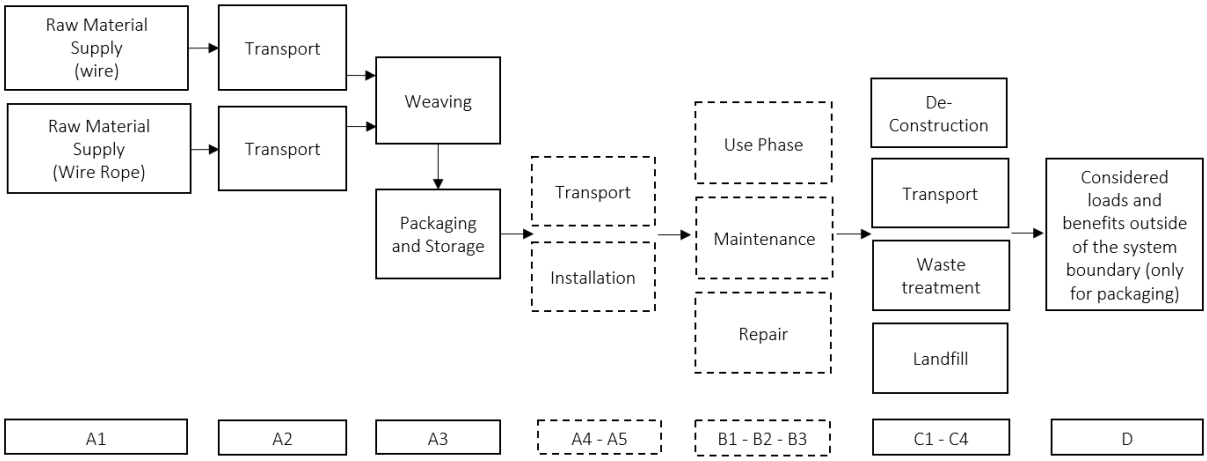
Raw material	Unit	Value
Steel (galvanized steel) - WIRE	kg	1.276
Steel (galvanized steel) - ROPE	kg	0.950

The reference CPC code is 412 “Products of iron or steel”.

2.7 Manufacturing

The manufacturing is managed in Senica plant (Slovakia) by Maccaferri Manufacturing Europe s.r.o., in Shijak plant (Albany) by Maccaferri Balkans Sh.p.k., in Montornés del Vallés plant (Spain) by A. Bianchini Ingeniero S.A., all subsidiaries of Officine Maccaferri S.p.A.

The production process includes the weaving of the double twist wire mesh, starting from GalMac steel wire, and GalMac wire rope, that can be inserted in longitudinal and transversal direction. The energy mix used in the Spanish plant includes a share of onsite generated electricity through a photovoltaic system that is entirely used internally.



2.8 Other Information

Further technical characteristics and information of the GalMac STEELGRID and MACARMOUR are detailed and available on the Maccaferri website (https://www.maccaferri.com/).

According to Construction Product Regulation (EU) 305/2011 the essential technical characteristics, as per Harmonized Documents EAD 230008-00-0106, are reported in the Declaration of Performances (DOP).

3. LCA: Calculation rules

3.1 Declared unit

In accordance with the PCR B, 1 m^2 of GalMac coated SteelGrid is chosen as the declared unit.

Product	Unit weight (g/m^2)	Conversion factor 1 kg
SteelGrid HR30 8127	**2168**	**0.461**

3.2 Scope of declaration and system boundaries

This a cradle to gate with modules C1-C4 and module D. More precisely, the following processes were accounted for each module:

A1 - Production of raw materials used in the products, as well as the production of energy carriers used in the production process.

A2 - Transport of raw materials to the manufacturing site and internal handling

A3 - Manufacturing of the STEELGRID and MACARMOUR GalMac coated double twist wire meshes which includes the manufacturing steps reported in section 2.7 as well as the production of the distribution packaging and of the ancillary material. In addition, the treatment of waste generated from the manufacturing processes are accounted for.

C1 - Dismantling of the packaging was considered to be negligible and equal to zero.

C2 - Transport from collection point to waste processing and disposal site.

C3 - Shredding and sorting of fractions for recycling.

C4 - Landfill of material fractions not recycled.

D - Benefit and load beyond the product system.

Description of the system boundary																
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 manufacturer to place of use	Construction-installation process	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	MND	MND	MND	MND	MND	X	X	X	X	X
X=Module declared | MND=Module not declared																

3.3 Geographical reference area

All process-specific data was collected for the operating year 2022-2023. Geographical reference area is global.

3.4 Cut-uff Criteria

The cut-off applied are related to the packaging of chemicals products and lubricating oil used in the production process.

3.5 Allocation

A mass allocation based on the weight of the production volumes has been applied.

3.6 Data collection and reference time period

Specific data were collected at Senica plant (Slovakia) at Shijak plant (Albania) and at Montornès del Vallès plant (Spain), considering an annual average referred to 2022-2023, whereas the most updated selected generic datasets available in the LCI databases were used for the other modules. Thus, in line with PCR A requirements, manufacturer-specific data is not older than 5 years and generic data is not older than 10 years.

3.7 Estimates and assumptions

The main assumptions are related to distances of inbound and background transportations. It was also assumed that liquid and gas auxiliaries are unpacked and supplied in tanker trucks.
A location-based approach has been selected for modeling the electricity mix of the Spanish, Slovakian and Albanian plants, which have the following GWP results:

- 0.27 CO_2 eq./kWh for Spain (use of photovoltaic electricity at the plant)
- 0.34 CO_2 eq./kWh for Slovakia
- 0.31 CO_2 eq./kWh for Albania

3.8 Comparability

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used , functional or declared unit, geographical reference, definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPDs programs may differ. A comparability needs to be evaluated. For further guidance see EN 15804+A2 (5.3 Comparability of EPD for construction products) and ISO 14025 (6.7.2 Requirements for comparability).

4. LCA: Scenarios and additional technical information

As these products are used as structural components for retaining of unstable slopes, erosion protection, drapery systems that control and prevent rock fall and the flow of loose debris, soil nailing systems and earth retaining structures: they are therefore intended to be embedded in a permanent manner in the engineering work in which they are used. For this reason, an end of life equal to zero was assumed. The results included in C2 and D modules are referred to the end of life of secondary packaging of the product used in the distribution phase for which a recycling scenario was applied**.**

Processes	Unit (expressed per FU or DU of components, products or materials and by type of material)	SteelGrid GL HR 30 8127
Collection process specified by type	Kg collected separately	Steel: 2.70E-02 kg
Recovery system specified by type	Kg for recycling	Steel: 2.70E-02 kg

5. LCA: Results

The following tables show the results of the impact assessment indicators, resource use, waste and other output streams. The results presented here refer to the declared average product.

LCA results - Indicators describing environmental impacts based on the impact assessment (LCIA): 1 m² SteelGrid HR30 8127 (EN 15804+A2)							
Parameter	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Core environmental impact indicators (EN 15804+A2)							
GWP-total	kg CO2 eqv.	5.99E+00	0.00E+00	2.26E-04	0.00E+00	0.00E+00	-1.10E-02
GWP-f	kg CO2 eqv.	5.97E+00	0.00E+00	2.24E-04	0.00E+00	0.00E+00	-1.10E-02
GWP-b	kg CO2 eqv.	9.77E-03	0.00E+00	5.21E-07	0.00E+00	0.00E+00	1.75E-05
GWP-luc	kg CO2 eqv.	4.06E-03	0.00E+00	2.11E-06	0.00E+00	0.00E+00	-4.64E-06
ODP	kg CFC 11 eqv.	2.06E-11	0.00E+00	1.99E-17	0.00E+00	0.00E+00	3.28E-14
AP	mol H+ eqv.	2.01E-02	0.00E+00	1.19E-06	0.00E+00	0.00E+00	-2.52E-05
EPfr	kg P eqv.	8.45E-06	0.00E+00	8.29E-10	0.00E+00	0.00E+00	-8.27E-10
EPmar	kg N eqv.	5.78E-03	0.00E+00	5.78E-07	0.00E+00	0.00E+00	-6.04E-06
EPter	mol N eqv.	6.27E-02	0.00E+00	6.43E-06	0.00E+00	0.00E+00	-6.54E-05
POCP	kg NMVOC eqv.	1.73E-02	0.00E+00	1.13E-06	0.00E+00	0.00E+00	-2.01E-05
ADP-e	kg Sb-eqv.	1.85E-04	0.00E+00	1.48E-11	0.00E+00	0.00E+00	-1.16E-10
ADP-f	MJ	6.63E+01	0.00E+00	3.09E-03	0.00E+00	0.00E+00	-8.27E-02
WU	m3 world eqv.	4.32E-01	0.00E+00	2.62E-06	0.00E+00	0.00E+00	-1.59E-04
Additional environmental impact indicators (EN 15804+A2)							
PM	disease incidence	3.32E-07	0.00E+00	5.59E-12	0.00E+00	0.00E+00	-3.68E-10
IR	kBq U235 eqv.	3.87E-01	0.00E+00	5.79E-07	0.00E+00	0.00E+00	1.62E-04
ETP-fw	CTUe	1.74E+01	0.00E+00	2.18E-03	0.00E+00	0.00E+00	-1.27E-02
HTP-c	CTUh	6.23E-09	0.00E+00	4.40E-14	0.00E+00	0.00E+00	-1.72E-11
HTP-nc	CTUh	4.79E-08	0.00E+00	1.94E-12	0.00E+00	0.00E+00	1.33E-11
SQP	Pt	4.77E+01	0.00E+00	1.29E-03	0.00E+00	0.00E+00	7.78E-03

ADP-e= Abiotic depletion potential for non-fossil resources | **ADP-f**=Abiotic depletion for fossil resources potential | **AP**= Acidification potential, Accumulated Exceedance | **EPfr** = Eutrophication potential, fraction of nutrients reaching freshwater end compartment | **EPmar**= Eutrophication potential, fraction of nutrients reaching marine end compartment| **EPter**= Eutrophication potential, Accumulated Exceedance | **GWP-b**=Global Warming Potential biogenic | **GWP-f**=Global Warming Potential fossil fuels | **GWP-luc**=Global Warming Potential land use and land use change |**GWP-total**=Global Warming Potential total| **ODP**=Depletion potential of the stratospheric ozone layer |**POCP**=Formation potential of tropospheric ozone | **WU**=Water (user) deprivation potential, deprivation- weighted water consumption | **ETP-fw**=Potential Comparative Toxic Unit for ecosystems | **HTP-c**=Potential Toxic Unit for Humans toxicity, cancer | **HTP-nc**= Potential Toxic Unit for humans, non-cancer | **IRP**=Potential Human exposure efficiency relative to U235, human health | **PM**=Potential incidence of disease due to Particulate Matter emissions | **SQP**=Potential soil quality index

Disclaimer on ADP-e, ADP-f, WU, ETP-fr, HTP-c, HTP-nc, SQP: The results of these environmental impact indicators must be used with caution, as the uncertainties in these results are high or as there is limited experience with the indicator.

Disclaimer on IR: This impact category mainly addresses the potential effect of low dose ionizing radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposures, nor does it consider radioactive waste disposal in underground facilities. Potential ionizing radiation from soil, radon, and some building materials is also not measured by this indicator.

LCA results - Indicators describing resource use and environmental information derived from life cycle inventory (LCI): 1 m² SteelGrid HR30 8127 (EN 15804+A2)							
Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	1.74E+01	0.00E+00	2.19E-04	0.00E+00	0.00E+00	1.38E-02
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.74E+01	0.00E+00	2.19E-04	0.00E+00	0.00E+00	1.38E-02
PENRE	MJ	6.67E+01	0.00E+00	3.10E-03	0.00E+00	0.00E+00	-8.36E-02
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	6.67E+01	0.00E+00	3.10E-03	0.00E+00	0.00E+00	-8.36E-02
SM	Kg	5.75E-01	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
FW	M3	1.89E-02	0.00E+00	2.41E-07	0.00E+00	0.00E+00	-7.14E-06
HWD	Kg	2.34E-06	0.00E+00	1.15E-14	0.00E+00	0.00E+00	-2.11E-13
NHWD	Kg	3.44E-01	0.00E+00	4.47E-07	0.00E+00	0.00E+00	-1.66E-04
RWD	Kg	3.04E-03	0.00E+00	4.01E-09	0.00E+00	0.00E+00	1.47E-06
CRU	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	Kg	1.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.70E-02
MER	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	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
PERE=Use of renewable primary energy excluding renewable primary energy resources used as raw materials | PERM= Use of renewable primary energy resources used as raw materials | PERT=Total use of renewable primary energy resources | PENRE= Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | PENRM= Use of non-renewable primary energy resources used as raw materials | PENRT= Total use of non-renewable primary energy resources | SM=Use of secondary material | RSF=Use of renewable secondary fuels | NRSF=Use of non-renewable secondary fuels | FW=Use of fresh water | HWD=Hazardous waste disposed | NHWD=Non-hazardous waste disposed | RWD=Radioactive waste disposed | CRU=Components for re-use | MFR=Materials for recycling | MER=Materials for energy recovery | EET=Exported energy, thermal | EE=Exported energy, electrical							

LCA results - information on biogenic carbon content at the factory gate: 1 m² SteelGrid HR30 8127 (EN 15804+A2)		
Parameter	**Unit**	**Value**
biogenic carbon content in product	kg C	0
biogenic carbon content in accompanying packaging	kg C	0
NOTE 1 kg biogenic carbon is equivalent to 44/12 kg CO2		

6. LCA: Interpretation

By analysing the contribution of each module to the impacts of SteelGrid HR30 8127, it can be observed that the impacts are driven by modules A1-A3, while the contribution of the other modules is about 1% for all impact categories analysed. The contribution of module D is negligible (<1%) compared to modules A1-A3.

7. Scaling

The environmental impacts for the production phase (Module A1-A3) of specific GalMac STEELGRID and MACARMOUR products, defined by spacing of ropes, are shown in the following tables. For other grades the scaling function in the last column can be used, where 'x' represents the nominal unit weight of the ropes in kg/m^2.

Product grade	Unit	SteelGrid			MACARMOUR		SteelGrid	MACARMOUR		Scaling Function
		HR 100	HR 50	HR 30	6060	3090	HR 20	3060	3030	
Nominal unit weight of ropes per square meters	**(kg/m²)**	**0.33**	**0.62**	**0.89**	**1.04**	**1.07**	**1.25**	**1.31**	**1.714**	**x**
Core environmental impact indicators (EN 15804+A2)										
GWP-total	kg CO_2 eqv.	4.12E+00	5.12E+00	5.99E+00	6.63E+00	7.00E+00	7.27E+00	8.06E+00	9.43E+00	3.88E+00x+2.72E+00
GWP-f	kg CO_2 eqv.	4.11E+00	5.11E+00	5.97E+00	6.61E+00	6.98E+00	7.25E+00	8.05E+00	9.41E+00	3.87E+00x+2.71E+00
GWP-b	kg CO_2 eqv.	7.49E-03	8.80E-03	9.77E-03	1.07E-02	1.14E-02	1.16E-02	1.29E-02	1.46E-02	5.27E-03x+5.51E-03
GWP-luc	kg CO_2 eqv.	2.96E-03	3.56E-03	4.06E-03	4.48E-03	4.75E-03	4.89E-03	5.42E-03	6.24E-03	2.41E-03x+2.07E-03
ODP	kg CFC 11 eqv.	1.58E-11	1.85E-11	2.06E-11	2.27E-11	2.41E-11	2.46E-11	2.73E-11	3.10E-11	1.12E-11x+1.16E-11
AP	mol H+ eqv.	1.27E-02	1.66E-02	2.01E-02	2.24E-02	2.36E-02	2.48E-02	2.75E-02	3.28E-02	1.46E-02x+7.59E-03
EP-fr	kg P eqv.	6.26E-06	7.47E-06	8.45E-06	9.30E-06	9.86E-06	1.01E-05	1.12E-05	1.29E-05	4.85E-06x+4.46E-06
EP-mar	kg N eqv.	3.55E-03	4.72E-03	5.78E-03	6.45E-03	6.78E-03	7.15E-03	7.92E-03	9.53E-03	4.33E-03x+2.04E-03
EP-ter	mol N eqv.	3.85E-02	5.12E-02	6.27E-02	7.00E-02	7.36E-02	7.76E-02	8.60E-02	1.03E-01	4.70E-02x+2.20E-02
POCP	kg NMVOCeqv	1.08E-02	1.42E-02	1.73E-02	1.93E-02	2.03E-02	2.14E-02	2.37E-02	2.84E-02	1.27E-02x+6.35E-03
ADP-e	kg Sb-eqv.	1.08E-04	1.48E-04	1.85E-04	2.07E-04	2.17E-04	2.30E-04	2.55E-04	3.10E-04	1.46E-04x+5.78E-05
ADP-f	MJ	4.65E+01	5.72E+01	6.63E+01	7.34E+01	7.76E+01	8.03E+01	8.91E+01	1.04E+02	4.18E+01x+3.13E+01
WU	m3 world eqv.	3.17E-01	3.80E-01	4.32E-01	4.76E-01	5.05E-01	5.19E-01	5.76E-01	6.62E-01	2.53E-01x+2.23E-01
Additional environmental impact indicators (EN 15804+A2)										
PM	disease incidence	1.95E-07	2.66E-07	3.32E-07	3.72E-07	3.90E-07	4.14E-07	4.58E-07	5.57E-07	2.61E-07x+1.04E-07
IR	kBq U235 eqv.	2.55E-01	3.26E-01	3.87E-01	4.31E-01	4.54E-01	4.74E-01	5.26E-01	6.22E-01	2.67E-01x+1.60E-01
ETP-fw	CTUe	1.23E+01	1.50E+01	1.74E+01	1.92E+01	2.04E+01	2.11E+01	2.34E+01	2.72E+01	1.09E+01x+8.29E+00
HTP-c	CTUh	4.27E-09	5.32E-09	6.23E-09	6.90E-09	7.28E-09	7.57E-09	8.39E-09	9.83E-09	4.06E-09x+2.81E-09
HTP-nc	CTUh	3.31E-08	4.11E-08	4.79E-08	5.30E-08	5.60E-08	5.81E-08	6.45E-08	7.53E-08	3.08E-08x+2.20E-08
SQP	Pt	2.98E+01	3.92E+01	4.77E+01	5.32E+01	5.59E+01	5.88E+01	6.52E+01	7.81E+01	3.50E+01x+1.76E+01

Product grade	Unit	SteelGrid			MACARMOUR		SteelGrid	MACARMOUR		Scaling Function
		HR 100	HR 50	HR 30	6060	3090	HR 20	3060	3030	
Nominal Unit weight of ropes per square meters	**(kg/m²)**	**0.33**	**0.62**	**0.89**	**1.04**	**1.07**	**1.25**	**1.31**	**1.714**	**x**
Indicators describing resource use and environmental information derived from life cycle inventory (LCI)										
PERE	MJ	1.25E+01	1.52E+01	1.74E+01	1.92E+01	2.03E+01	2.10E+01	2.33E+01	2.69E+01	1.06E+01x+8.63E+00
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+0.00E+00
PERT	MJ	1.25E+01	1.52E+01	1.74E+01	1.92E+01	2.03E+01	2.10E+01	2.33E+01	2.69E+01	1.06E+01x+8.63E+00
PENRE	MJ	4.67E+01	5.75E+01	6.67E+01	7.37E+01	7.80E+01	8.07E+01	8.96E+01	1.04E+02	4.20E+01x+3.15E+01
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+0.00E+00
PENRT	MJ	4.67E+01	5.75E+01	6.67E+01	7.37E+01	7.80E+01	8.07E+01	8.96E+01	1.04E+02	4.20E+01x+3.15E+01
SM	Kg	6.64E-01	6.33E-01	5.75E-01	6.04E-01	6.61E-01	6.17E-01	6.92E-01	6.43E-01	5.50E-03x+6.31E-01
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+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	0.00E+00	0.00E+00x+0.00E+00
FW	M3	1.33E-02	1.63E-02	1.89E-02	2.09E-02	2.21E-02	2.29E-02	2.54E-02	2.95E-02	1.19E-02x+8.98E-03
HWD	Kg	1.37E-06	1.87E-06	2.34E-06	2.62E-06	2.75E-06	2.91E-06	3.23E-06	3.92E-06	1.84E-06x+7.34E-07
NHWD	Kg	2.16E-01	2.83E-01	3.44E-01	3.83E-01	4.03E-01	4.24E-01	4.69E-01	5.62E-01	2.51E-01x+1.28E-01
RWD	Kg	2.13E-03	2.62E-03	3.04E-03	3.36E-03	3.55E-03	3.68E-03	4.08E-03	4.75E-03	1.92E-03x+1.43E-03
CRU	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+0.00E+00
MFR	Kg	1.01E-01	1.07E-01	1.08E-01	1.17E-01	1.26E-01	1.23E-01	1.38E-01	1.44E-01	3.33E-02x+1.43E-03
MER	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+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	0.00E+00	0.00E+00x+0.00E+00

The environmental impacts for the end-of life phase (Module C1-C4) of specific GalMac STEELGRID and MACARMOUR products, defined by spacing of ropes, are shown in the following tables. The end-of-life phase refers to packaging per m^2 of product only. For other GalMac STEELGRID and MACARMOUR, therefore, the scaling function in the last column, where 'x' represents the nominal unit weight of the ropes in kg/m^2, remains constant.

Product grade	Unit	SteelGrid			MACARMOUR		SteelGrid	MACARMOUR		Scaling Function
		HR 100	HR 50	HR 30	6060	3090	HR 20	3060	3030	
Nominal Unit weight of ropes per square meters	**(kg/m^2)**	**0.33**	**0.62**	**0.89**	**1.04**	**1.07**	**1.25**	**1.31**	**1.714**	**x**
Core environmental impact indicators (EN 15804+A2)										
GWP-total	kg CO_2 eqv.	2.26E-04	2.26E-04	2.26E-04	2.26E-04	2.26E-04	2.26E-04	2.26E-04	2.26E-04	0.00E+00x+2.26E-04
GWP-f	kg CO_2 eqv.	2.24E-04	2.24E-04	2.24E-04	2.24E-04	2.24E-04	2.24E-04	2.24E-04	2.24E-04	0.00E+00x+2.24E-04
GWP-b	kg CO_2 eqv.	5.21E-07	5.21E-07	5.21E-07	5.21E-07	5.21E-07	5.21E-07	5.21E-07	5.21E-07	0.00E+00x+5.21E-07
GWP-luluc	kg CO_2 eqv.	2.11E-06	2.11E-06	2.11E-06	2.11E-06	2.11E-06	2.11E-06	2.11E-06	2.11E-06	0.00E+00x+2.11E-06
ODP	kg CFC 11 eqv.	1.99E-17	1.99E-17	1.99E-17	1.99E-17	1.99E-17	1.99E-17	1.99E-17	1.99E-17	0.00E+00x+1.99E-17
AP	mol H+ eqv.	1.19E-06	1.19E-06	1.19E-06	1.19E-06	1.19E-06	1.19E-06	1.19E-06	1.19E-06	0.00E+00x+1.19E-06
EP-fw	kg P eqv.	8.29E-10	8.29E-10	8.29E-10	8.29E-10	8.29E-10	8.29E-10	8.29E-10	8.29E-10	0.00E+00x+8.29E-10
EP-m	kg N eqv.	5.78E-07	5.78E-07	5.78E-07	5.78E-07	5.78E-07	5.78E-07	5.78E-07	5.78E-07	0.00E+00x+5.78E-07
EP-T	mol N eqv.	6.43E-06	6.43E-06	6.43E-06	6.43E-06	6.43E-06	6.43E-06	6.43E-06	6.43E-06	0.00E+00x+6.43E-06
POCP	kg NMVOC eqv.	1.13E-06	1.13E-06	1.13E-06	1.13E-06	1.13E-06	1.13E-06	1.13E-06	1.13E-06	0.00E+00x+1.13E-06
ADP-e	kg Sb-eqv.	1.48E-11	1.48E-11	1.48E-11	1.48E-11	1.48E-11	1.48E-11	1.48E-11	1.48E-11	0.00E+00x+1.48E-11
ADP-f	MJ	3.09E-03	3.09E-03	3.09E-03	3.09E-03	3.09E-03	3.09E-03	3.09E-03	3.09E-03	0.00E+00x+3.09E-03
WU	m3 world eqv.	2.62E-06	2.62E-06	2.62E-06	2.62E-06	2.62E-06	2.62E-06	2.62E-06	2.62E-06	0.00E+00x+2.62E-06
Additional environmental impact indicators (EN 15804+A2)										
PM	disease incidence	5.59E-12	5.59E-12	5.59E-12	5.59E-12	5.59E-12	5.59E-12	5.59E-12	5.59E-12	0.00E+00x+5.59E-12
IR	kBq U235 eqv.	5.79E-07	5.79E-07	5.79E-07	5.79E-07	5.79E-07	5.79E-07	5.79E-07	5.79E-07	0.00E+00x+5.79E-07
ETP-fw	CTUe	2.18E-03	2.18E-03	2.18E-03	2.18E-03	2.18E-03	2.18E-03	2.18E-03	2.18E-03	0.00E+00x+2.18E-03
HTP-c	CTUh	4.40E-14	4.40E-14	4.40E-14	4.40E-14	4.40E-14	4.40E-14	4.40E-14	4.40E-14	0.00E+00x+4.40E-14
HTP-nc	CTUh	1.94E-12	1.94E-12	1.94E-12	1.94E-12	1.94E-12	1.94E-12	1.94E-12	1.94E-12	0.00E+00x+1.94E-12
SQP	Pt	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	1.29E-03	0.00E+00x+1.29E-03

Product grade	Unit	SteelGrid			MACARMOUR		SteelGrid	MACARMOUR		Scaling Function
		HR 100	HR 50	HR 30	6060	3090	HR 20	3060	3030	
Nominal Unit weight of ropes per square meters	**(kg/m²)**	**0.33**	**0.62**	**0.89**	**1.04**	**1.07**	**1.25**	**1.31**	**1.714**	**x**
Indicators describing resource use and environmental information derived from life cycle inventory (LCI)										
PERE	MJ	2.19E-04	2.19E-04	2.19E-04	2.19E-04	2.19E-04	2.19E-04	2.19E-04	2.19E-04	0.00E+00x+2.19E-04
PERM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+0.00E+00
PERT	MJ	2.19E-04	2.19E-04	2.19E-04	2.19E-04	2.19E-04	2.19E-04	2.19E-04	2.19E-04	0.00E+00x+2.19E-04
PENRE	MJ	3.10E-03	3.10E-03	3.10E-03	3.10E-03	3.10E-03	3.10E-03	3.10E-03	3.10E-03	0.00E+00x+3.10E-03
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+0.00E+00
PENRT	MJ	3.10E-03	3.10E-03	3.10E-03	3.10E-03	3.10E-03	3.10E-03	3.10E-03	3.10E-03	0.00E+00x+3.10E-03
SM	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+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	0.00E+00	0.00E+00x+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	0.00E+00	0.00E+00x+0.00E+00
FW	M3	2.41E-07	2.41E-07	2.41E-07	2.41E-07	2.41E-07	2.41E-07	2.41E-07	2.41E-07	0.00E+00x+2.41E-07
HWD	Kg	1.15E-14	1.15E-14	1.15E-14	1.15E-14	1.15E-14	1.15E-14	1.15E-14	1.15E-14	0.00E+00x+1.15E-14
NHWD	Kg	4.47E-07	4.47E-07	4.47E-07	4.47E-07	4.47E-07	4.47E-07	4.47E-07	4.47E-07	0.00E+00x+4.47E-07
RWD	Kg	4.01E-09	4.01E-09	4.01E-09	4.01E-09	4.01E-09	4.01E-09	4.01E-09	4.01E-09	0.00E+00x+4.01E-09
CRU	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+0.00E+00
MFR	Kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+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	0.00E+00	0.00E+00x+0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00x+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	0.00E+00	0.00E+00x+0.00E+00

8. References

EN 15804	EN 15804:2012+A2:2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products
ISO 14025	ISO 14025:2010 Environmental labels and declarations — Type III environmental declarations — Principles and procedures
ISO 14040	ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
ISO 14044	ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
PCR A	Kiwa-Ecobility Experts, Berlin, 2022: PCR A – General Program Category Rules for Construction Products from the EPD programme of Kiwa-Ecobility Experts; Version 2.1
PCR B	Kiwa-Ecobility Experts, Berlin, 2020: PCR B – Product Category Rules for steel construction products, Requirements on the Environmental Product Declarations for steel construction products; Version 2020-03-13 (draft)
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