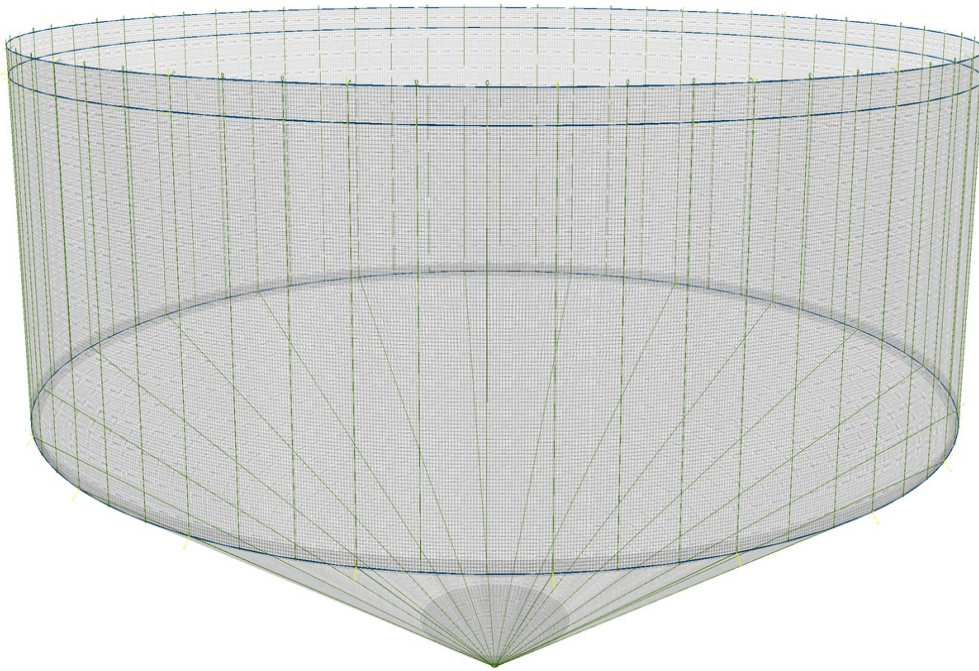


Environmental product declaration

in accordance with ISO 14025 and EN 15804+A2

Enclosure ENC 160 1530 60



AKVAGROUP™
EGERSUND NET

The Norwegian EPD Foundation

Owner of the declaration:

AKVA group ASA

Product:

Enclosure ENC 160 1530 60

Declared unit:

1 pcs

This declaration is based on Product Category Rules:

CEN Standard EN 15804:2012+A2:2019 serves as core PCR

NPCR 031:2023 Part B for sea-based aquaculture infrastructure and components

Program operator:

The Norwegian EPD Foundation

Declaration number:

NEPD-5461-4772-EN

Registration number:

NEPD-5461-4772-EN

Issue date:

01.12.2023

Valid to:

01.12.2028

EPD Software:

LCA.no EPD generator ID: 57288

General information

Product

Enclosure ENC 160 1530 60

Program operator:

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

Declaration number:

NEPD-5461-4772-EN

This declaration is based on Product Category Rules:

CEN Standard EN 15804:2012+A2:2019 serves as core PCR
NPCR 031:2023 Part B for sea-based aquaculture infrastructure and components

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 information, life cycle assessment data and evidences.

Declared unit:

1 pcs Enclosure ENC 160 1530 60

Declared unit with option:

A1,A2,A3,A4,C1,C2,C3,C4,D

Functional unit:

1 piece of impregnated enclosure manufactured and delivered at the sea-farm, including waste treatment at end-of-life.

General information on verification of EPD from EPD tools:

Independent verification of data, other environmental information and the declaration according to ISO 14025:2010, § 8.1.3 and § 8.1.4. Verification of each EPD is made according to EPD-Norway's guidelines for verification and approval requiring that tools are i) integrated into the company's environmental management system, ii) the procedures for use of the EPD tool are approved by EPD-Norway, and iii) the process is reviewed annually by an independent third party verifier. See Appendix G of EPD-Norway's General Programme Instructions for further information on EPD tools

Verification of EPD tool:

Independent third party verification of the EPD tool, background data and test-EPD in accordance with EPDNorway's procedures and guidelines for verification and approval of EPD tools. Approval number: NEPDT65.

Third party verifier:

Elisabet Amat, GREENIZE projects

(no signature required)

Owner of the declaration:

AKVA group ASA
Contact person: Trude Olafsen
Phone: +47 91557400
e-mail: tolafsen@akvagroup.com

Manufacturer:

AKVA group ASA

Place of production:

AKVA group ASA
Plogfabrikkvegen 11
4353 Klepp Stasjon, Norway

Management system:

Organisation no:

931 693 670

Issue date:

01.12.2023

Valid to:

01.12.2028

Year of study:

2021

Comparability:

EPD of construction products may not be comparable if they not comply with EN 15804 and seen in a building context.

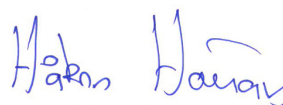
Development and verification of EPD:

The declaration is created using EPD tool lca.tools ver EPD2022.03, developed by LCA.no. The EPD tool is integrated in the company's management system, and has been approved by EPD Norway.

Developer of EPD: Karen Kvalheim

Reviewer of company-specific input data and EPD: Elisabet Amat - GREENIZE projects

Approved:



Håkon Hauan

Managing Director of EPD-Norway

Product

Product description:

A net that is a complete bag of netting, used to contained farmed fish. The net consists primarily of netting and ropes. The ropes create the structure and are designed to absorb the loads applied to the net.

Product specification

Components described in NS 9415 included: netting in polyamide, rope in PP and HDPE, Rope in polyamide and ABS, Thread in polyamide, rundslings in polyester, centre ring in titanium, and copper based anti-fouling.

Components described in NS 9415 not included: floater, raft and anchoring.

Materials	kg	%
Metal - Titanium	1,70	0,06
Paint, water-based	585,00	20,22
Plastic net - Nylon 6	1683,00	58,16
Plastic rope - PP and HDPE	524,00	18,11
Plastic yarn - Nylon 6	96,47	3,33
Textile - Polyester (PE)	3,60	0,12
Total	2893,77	

Packaging	kg	%
Packaging - Plastic	17,50	41,18
Packaging - Wood	25,00	58,82
Total incl. packaging	2936,27	

Technical data:

ENC 160 1530 60: Straight-wall circular net. 160 indicates circumference. 1530 indicates depth measured from main rope to bottom rope and to centre bottom. 60 indicates number of side ropes. The nets are produced according to the requirements of the Norwegian Standard (NS) 9415 and the NYTEK Regulations.

Market:

Aquaculture

Reference service life, product

The validity period for a new net is 24 months. The product certificate's validity period begins when the net is placed in seawater, which must be no later than 12 months of the issue date. After 24 months, a net must have a supplemental valid service history card. A service history card can extend the net's validity period by a maximum of 24 months, provided that the net meets the required durability and condition.

Reference service life, building or construction works

There is no standard service life for sea-based aquaculture farm. Each components have different service life and are repaired/replaced according to the regulations in NS9415-2021.

LCA: Calculation rules

Declared unit:

1 pcs Enclosure ENC 160 1530 60

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.

Allocation:

The allocation is made in accordance with the provisions of EN 15804. Incoming energy and water and waste production in-house is allocated equally among all products through mass allocation. Effects of primary production of recycled materials is allocated to the main product in which the material was used. The recycling process and transportation of the material is allocated to this analysis.

Data quality:

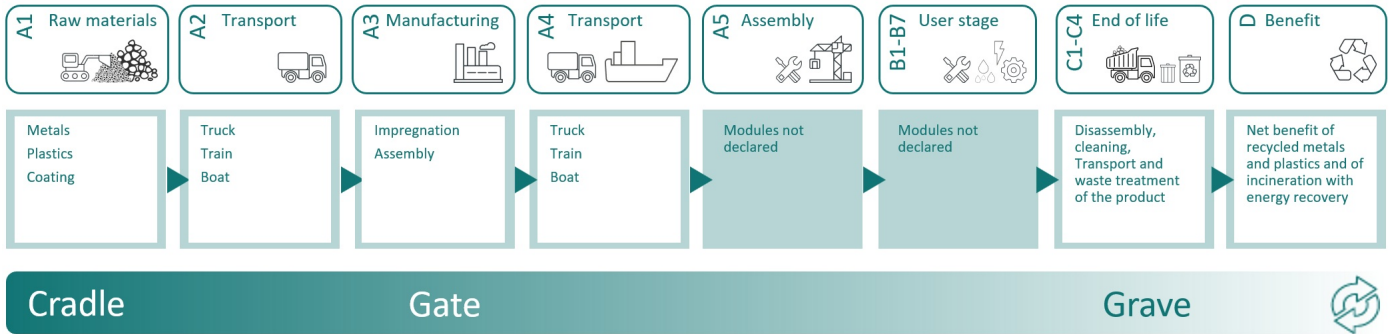
Specific data for the product composition are provided by the manufacturer. The data represent the production of the declared product and were collected for EPD development in the year of study. Background data is based on EPDs according to EN 15804 and different LCA databases. The data quality of the raw materials in A1 is presented in the table below.

Materials	Source	Data quality	Year
Metal - Titanium	ecoinvent 3.6	Database	2019
Packaging - Plastic	ecoinvent 3.6	Database	2019
Paint, water-based	ecoinvent 3.6	Database	2019
Packaging - Wood	Modified ecoinvent 3.6	Database	2019
Textile - Polyester (PE)	Modified ecoinvent 3.6	Database	2019
Plastic rope - PP and HDPE	Production data + ecoinvent 3.6	Company specific dataset + database	2021
Plastic net - Nylon 6	Production data + ecoinvent 3.6	Supplier data + database	2021
Plastic yarn - Nylon 6	Production data + ecoinvent 3.6	Supplier data + database	2021

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

Product stage			Construction installation stage	Use stage								End of life stage				Beyond the system boundaries
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:



Additional technical information:

LCA: Scenarios and additional technical information

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

Module A4 = a default travel distance of 300 km by truck is added to ensure distribution between the manufacturing site and the dock near the production location at sea. In addition, a default travel distance of 1 Nm (1.852 km) of sea freight is added to cover the transport between the dock and the production location at sea. Enclosures are transported onboard the vessel and not dragged in the sea.

Module C1 = deconstruction of the enclosure from the farm is estimated to require two hours of work boat aquaculture operations. In addition, a default travel distance of 1 Nm (1.852 km) of sea freight is added to cover the transport between the production location at sea and the nearest dock. Enclosures are transported onboard the vessel and not dragged in the sea.

Module C2 = a default travel distance of 300 km by truck is added to ensure transport between the dock and the waste treatment facility.

Modules C3 and C4 = Waste treatment of the product follows the default values provided in NPCR 031 part B for aquaculture infrastructure and components, table 3. This table specified how different types of product categories and raw materials will likely be treated during the end-of-life phases. Waste treatments in C3 include material recycling and incineration with and without energy recovery and fly ash extraction. Disposal in C4 consist of landfilling of different waste fractions and of ashes.

Module D = The recyclability of plastics and metals allows the producers a credit for the net scrap that is produced at the end of a product's life. The benefits from recycling of net scrap are described in formula from EN 15804:2012+A2:2019. Substitution of heat and electricity generated by the incineration with energy recovery of plastics is also calculated in module D.

Transport from production place to user (A4)	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy Consumption	Unit	Value (Liter/tonne)
Ship, aquaculture transport, work boat, 14 meters, without tugging (km) - Global	20,0 %	2	1,790	l/tkm	3,32
Truck, 16-32 tonnes, EURO 6 (km) - Europe	36,7 %	300	0,043	l/tkm	12,90
De-construction demolition (C1)	Unit	Value			
Aquaculture operation, work boat, 14 meter, product de-construction (per hour) - Global	h/DU	2,00			
Ship, aquaculture transport, work boat, 14 meters, without tugging (kgkm) - Global	kgkm/DU	5407,41			
Transport to waste processing (C2)	Capacity utilisation (incl. return) %	Distance (km)	Fuel/Energy Consumption	Unit	Value (Liter/tonne)
Truck, 16-32 tonnes, EURO 6 (km) - Europe	36,7 %	300	0,043	l/tkm	12,90
Waste processing (C3)	Unit	Value			
Nylon 6 to recycling (kg)	kg	996,50			
Plastic compound, PP and HDPE, to recycling (kg)	kg	366,80			
Polyester to recycling (kg)	kg	2,52			
Titanium to recycling (kg)	kg	1,53			
Waste treatment of hazardous waste, incineration with energy recovery and fly ash extraction (kg)	kg	585,00			
Waste treatment of plastic mixture, incineration with energy recovery and fly ash extraction (kg)	kg	862,11			
Waste treatment per kg of impregnated aquaculture components, washing process (kg) - Norway	kg	2893,77			
Disposal (C4)	Unit	Value			
Landfilling of ashes from incineration of Hazardous waste, process per kg ashes and residues (kg)	kg	110,57			
Landfilling of ashes from incineration of Plastic mixture, process per kg ashes and residues (kg)	kg	30,15			
Landfilling of plastic mixture (kg)	kg	79,14			
Landfilling of titanium (kg)	kg	0,17			
Benefits and loads beyond the system boundaries (D)	Unit	Value			
Substitution of electricity, in Norway (MJ)	MJ	1325,11			
Substitution of polyamide, nylon 6, granulate (kg)	kg	996,50			
Substitution of polyethylene terephthalate, PET, amorphous (kg)	kg	2,52			
Substitution of Polyethylene, HDPE granulate (kg)	kg	91,70			
Substitution of Polypropylene, PP granulate (kg)	kg	275,10			
Substitution of primary titanium with net scrap (kg)	kg	1,29			
Substitution of thermal energy, district heating, in Norway (MJ)	MJ	20047,66			

LCA: Results

The LCA results are presented below for the declared unit defined on page 2 of the EPD document.

Environmental impact											
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D	
 GWP-total	kg CO ₂ -eq	2,95E+04	3,93E+02	1,48E+03	1,75E+02	1,99E+02	1,44E+02	4,18E+03	5,75E+01	-1,07E+04	
 GWP-fossil	kg CO ₂ -eq	2,81E+04	3,93E+02	1,46E+03	1,75E+02	1,99E+02	1,44E+02	4,17E+03	5,74E+01	-1,07E+04	
 GWP-biogenic	kg CO ₂ -eq	4,96E+01	1,45E-01	7,98E+00	6,57E-02	4,19E-02	5,96E-02	7,35E+00	2,00E-02	-1,28E+01	
 GWP-luluc	kg CO ₂ -eq	1,40E+03	1,71E-01	4,79E+00	6,37E-02	9,06E-02	5,12E-02	1,91E+00	4,84E-03	-4,27E+00	
 ODP	kg CFC11 -eq	1,44E-03	8,60E-05	2,56E-04	3,94E-05	4,32E-05	3,26E-05	2,49E-04	2,60E-06	-8,47E+00	
 AP	mol H+ -eq	1,72E+02	4,62E+00	1,10E+01	1,49E+00	6,83E+00	4,14E-01	6,34E+00	1,02E-01	-3,99E+01	
 EP-FreshWater	kg P -eq	6,81E-01	2,66E-03	2,23E-02	1,24E-03	6,00E-04	1,15E-03	5,22E-02	4,77E-04	-1,32E-01	
 EP-Marine	kg N -eq	3,12E+01	1,11E+00	2,40E+00	3,42E-01	1,65E+00	8,18E-02	1,35E+00	3,65E-02	-9,07E+00	
 EP-Terrestrial	mol N -eq	2,82E+02	1,24E+01	2,71E+01	3,76E+00	1,80E+01	9,15E-01	1,55E+01	3,16E-01	-9,03E+01	
 POCP	kg NMVOC -eq	9,57E+01	3,41E+00	7,53E+00	1,10E+00	4,74E+00	3,51E-01	4,80E+00	9,02E-02	-3,16E+01	
 ADP-minerals&metals ¹	kg Sb -eq	2,51E-01	8,42E-03	2,28E-02	4,12E-03	1,02E-03	3,97E-03	3,88E-02	8,83E-05	-7,35E-02	
 ADP-fossil ¹	MJ	3,83E+05	5,67E+03	2,29E+04	2,60E+03	2,71E+03	2,18E+03	1,77E+04	2,44E+02	-1,41E+05	
 WDP ¹	m ³	3,59E+06	4,33E+03	7,57E+05	2,18E+03	4,76E+02	2,10E+03	8,48E+04	5,94E+03	-4,89E+04	

GWP-total = Global Warming Potential total; 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; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

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







*INA Indicator Not Assessed

1. 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

Remarks to environmental impacts

Risk of leaching hazardous materials to water: Antifouling is marked with the hazard statement H410: Very toxic to aquatic life with long lasting effects.

Risk of plastic pollution: Ropes used for installing the net at sea must be cut, risk of ropes falling into the sea. Pay attention to this.











Additional environmental impact indicators											
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D	
 PM	Disease incidence	1,30E-03	2,01E-05	5,84E-05	1,63E-05	4,74E-05	8,81E-06	7,84E-05	7,71E-07	-4,23E-04	
 IRP ²	kgBq U235 -eq	5,26E+02	2,47E+01	1,44E+02	1,14E+01	1,17E+01	9,51E+00	5,64E+01	1,35E+00	-2,76E+01	
 ETP-fw ¹	CTUe	2,06E+05	3,95E+03	1,72E+04	1,84E+03	1,46E+03	1,61E+03	4,63E+04	6,79E+02	-2,14E+04	
 HTP-c ¹	CTUh	2,20E-05	0,00E+00	5,52E-07	2,18E-08	1,53E-07	0,00E+00	2,63E-06	3,56E-08	-1,30E-06	
 HTP-nc ¹	CTUh	1,95E-04	4,43E-06	1,75E-05	1,96E-06	1,29E-06	1,76E-06	2,73E-05	1,30E-06	-3,04E-05	
 SQP ¹	dimensionless	1,50E+05	3,11E+03	1,22E+04	1,58E+03	3,53E+02	1,52E+03	9,43E+03	7,10E+02	-1,22E+04	

PM = Particulate Matter emissions; IRP = Ionizing radiation – human health; ETP-fw = Eco toxicity – freshwater; HTP-c = Human toxicity – cancer effects; HTP-nc = Human toxicity – non cancer effects; SQP = Potential Soil Quality Index (dimensionless)

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

*INA Indicator Not Assessed




1. 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
2. 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.

Resource use											
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D	
 PERE	MJ	4,41E+04	6,92E+01	1,68E+04	3,31E+01	1,34E+01	3,11E+01	5,76E+03	2,86E+01	-1,13E+04	
 PERM	MJ	3,47E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	
 PERT	MJ	4,45E+04	6,92E+01	1,68E+04	3,31E+01	1,34E+01	3,11E+01	5,76E+03	2,86E+01	-1,13E+04	
 PENRE	MJ	3,64E+05	5,67E+03	2,29E+04	2,60E+03	2,71E+03	2,18E+03	1,77E+04	2,44E+02	-1,29E+05	
 PENRM	MJ	9,00E+04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	-8,95E+04	0,00E+00	-1,29E+04	
 PENRT	MJ	3,85E+05	5,67E+03	2,29E+04	2,60E+03	2,71E+03	2,18E+03	-7,18E+04	2,44E+02	-1,42E+05	
 SM	kg	1,13E+01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,69E-03	-4,01E-01	
 RSF	MJ	5,66E+02	2,38E+00	1,49E+02	1,11E+00	0,00E+00	1,11E+00	3,26E+01	5,21E-01	-2,37E+01	
 NRSF	MJ	8,50E+01	7,71E+00	5,74E+01	3,98E+00	0,00E+00	3,98E+00	1,15E+02	5,10E+00	-6,11E+02	
 FW	m ³	3,17E+02	5,19E-01	1,06E+02	2,51E-01	1,22E-01	2,33E-01	4,52E+01	4,24E-01	-8,94E+01	

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 materials; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

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






*INA Indicator Not Assessed

End of life - Waste											
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D	
	HWD	kg	3,02E+01	2,76E-01	7,20E+00	1,25E-01	8,59E-02	1,12E-01	6,71E+02	8,02E-01	-1,59E+00
	NHWD	kg	3,85E+03	2,06E+02	4,73E+02	1,06E+02	4,21E+00	1,06E+02	8,43E+02	1,91E+02	-1,50E+02
	RWD	kg	5,71E-01	3,89E-02	1,24E-01	1,78E-02	1,91E-02	1,48E-02	3,64E-02	1,24E-04	-2,35E-02

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed

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

*INA Indicator Not Assessed

End of life - Output flow											
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D	
	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+00
	MFR	kg	3,38E-02	0,00E+00	2,34E+01	0,00E+00	0,00E+00	0,00E+00	1,37E+03	7,10E-03	-2,17E-01
	MER	kg	7,33E-03	0,00E+00	5,13E-04	0,00E+00	0,00E+00	0,00E+00	1,45E+03	1,74E-04	-9,05E-01
	EEE	MJ	6,84E-02	0,00E+00	1,44E+01	0,00E+00	0,00E+00	0,00E+00	1,33E+03	1,13E-02	-1,51E+00
	EET	MJ	1,04E+00	0,00E+00	2,18E+02	0,00E+00	0,00E+00	0,00E+00	2,00E+04	1,70E-01	-2,29E+01

CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported energy electrical; EET = Exported energy thermal

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

*INA Indicator Not Assessed

Biogenic Carbon Content		
Indicator	Unit	At the factory gate
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in accompanying packaging	kg C	1,03E+01

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO₂

Additional requirements

Greenhouse gas emissions from the use of electricity in the manufacturing phase

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 process (A3).

Electricity mix	Data source	Amount	Unit
Electricity, Lithuania (kWh)	ecoinvent 3.6	373,46	g CO ₂ -eq/kWh
Electricity, Norway (kWh)	ecoinvent 3.6	24,33	g CO ₂ -eq/kWh

Dangerous substances

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

Indoor environment

Additional Environmental Information

Additional environmental impact indicators required in NPCR Part A for construction products										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
GWPIOBC	kg CO ₂ -eq	2,96E+04	3,93E+02	1,57E+03	1,75E+02	1,99E+02	1,44E+02	4,18E+03	5,09E+01	-1,07E+04

GWPIOBC: Global warming potential calculated according to the principle of instantaneous oxidation. 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 instantaneous oxidation. GWP-IOBC is also referred to as GWP-GHG in context to Swedish public procurement legislation.

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