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Environmental Product Declaration

Average EPD based on average results

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021

Tunnel membrane

RTM 700-RP and RTM 450-RP

Renesco

Programme
EPD Square | www.epdsquare.com

Programme operator
EPD Square, s.r.o.

EPD Registration number
SQ 00-002

Publication date
25.6.2024

Valid until
24.6.2029

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General information

Product
Tunnel membrane RTM 700-RP and RTM 450-RP

Program operator
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Karadžičova 16, 811 09, Bratislava, Slovakia

Email: info@epdsquare.com

Registration number
SQ 00-002

Publication date
25.6.2024

Valid until date
24.6.2029

Owner of the declaration
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Manufacturer
Renesco Holding AG
Seedorffeldstrasse 21, CH-3302 Moosseedorf, Switzerland
Email: Enrico.Pavese@renesco.com

Place of production
Krefeld, Germany

Product Category Rules (PCR)
The CEN standard EN 15804 serves as the core PCR. In addition, EPD Square PCR v1.0, 2024 is used.

Declared/Functional unit
1 m^2 of waterproofing membrane with a thickness of 100 mm

Mass per DU
0,75 kg

UN CPC code
36390

Geographical scope
Europe

Year of study
2022

Comparability
EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in the context of the building.

EPD author
Silvia Vilčeková

Verification type
Independent verification of the declaration and data, according to ISO14025:2006
Internal: ☐
External: ☒

Verified by
Elisabet Amat

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

System boundaries

This EPD is based on system boundary cradle to gate (A1-A3) with modules C1-C4, module D and optional modules A4 and A5.

Modules declared and geographical scope

	Product stage			Construction process stage		Use stage							End of life stage				Beyond the system boundary
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	x	x	x	x	x	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x
Geography	EU	EU	EU	EU	EU	-	-	-	-	-	-	-	EU	EU	EU	EU	EU

MND = Modules not declared.

Description of Organization

Renesco is a leading international company, specialized in the field of structural waterproofing and injections/grouting services. Established in 1965, Renesco is part of the Marti Group in Switzerland, an owner-operated family business that specializes in underground construction. Marti is a multi-disciplined organization with services that range from building transportation tunnels as a contractor of record to performing specialty underground services on a subcontract basis through its wholly-owned Renesco Group subsidiary.

Renesco provides all kind of specialty services for sealing operations in underground structures against pressurized and non-pressurized water, as well as injection/grouting works. Main areas of application include national and international large-scale projects in tunnelling and infrastructure, as well as in the hydraulic, environmental and rehabilitation sectors.

Renesco has become an international leader in tunnel waterproofing, geomembrane application and specialty tunnel grouting services. The company currently has operating several divisions in different countries and we have ongoing projects in many more.

Product information

Product name
Tunnel membrane RTM-700RP, RTM 450-RP

Product description
Tunnel membranes are coated polyester reinforced sheet waterproofing membrane. The coating is polyvinylchlorid (PVC) with both sides acrylic lacquered. Designed for waterproofing of drill and blast tunnels and others underground structures.

Products are manufactured in dimensions: Height: 5-7 mm; Width: 240-320 mm and Length: 1m-4 km

Characteristic	Standard	Value
Reinforcement	DIN 60001	PES, Polyester, 1100dtex
Yarn (warp/weft)	-	11x11, linen weave
Coating	-	PVC, Polyvinylchloride
Lacquer	-	Both sides acrylic lacquered
Thickness	EN ISO 2286-3	0.55 - 0.60 mm
Mass per unit	EN ISO 2286-2	700 g/m2
Width	EN ISO 2286-1	250 or 300 cm
Tensile strength (warp/weft)	EN ISO 1421	3200/3000 N/5 cm
Tear resistance (warp/weft)	DIN 53363	350/350 N
Elongation (warp/weft)	-	≥ 18%
Adhesion	DIN 53357	≥ 100 N/5 cm
Colour	-	White matte or grey matte
Surface	-	One smooth, other textured
Fire resistance	EN 13823:2010+A1:2014 EN ISO 11925-2 EN 13501-1:2019	Fs < 150 mm in 60 s b-s2-d0
Room corner test according to N500:2016 Tunnel class A-F	ISO 9705:2016	Pass
Time to flash over	ISO 9705:2016	No flash over
Tolerances for above characteristics	-	± 10%

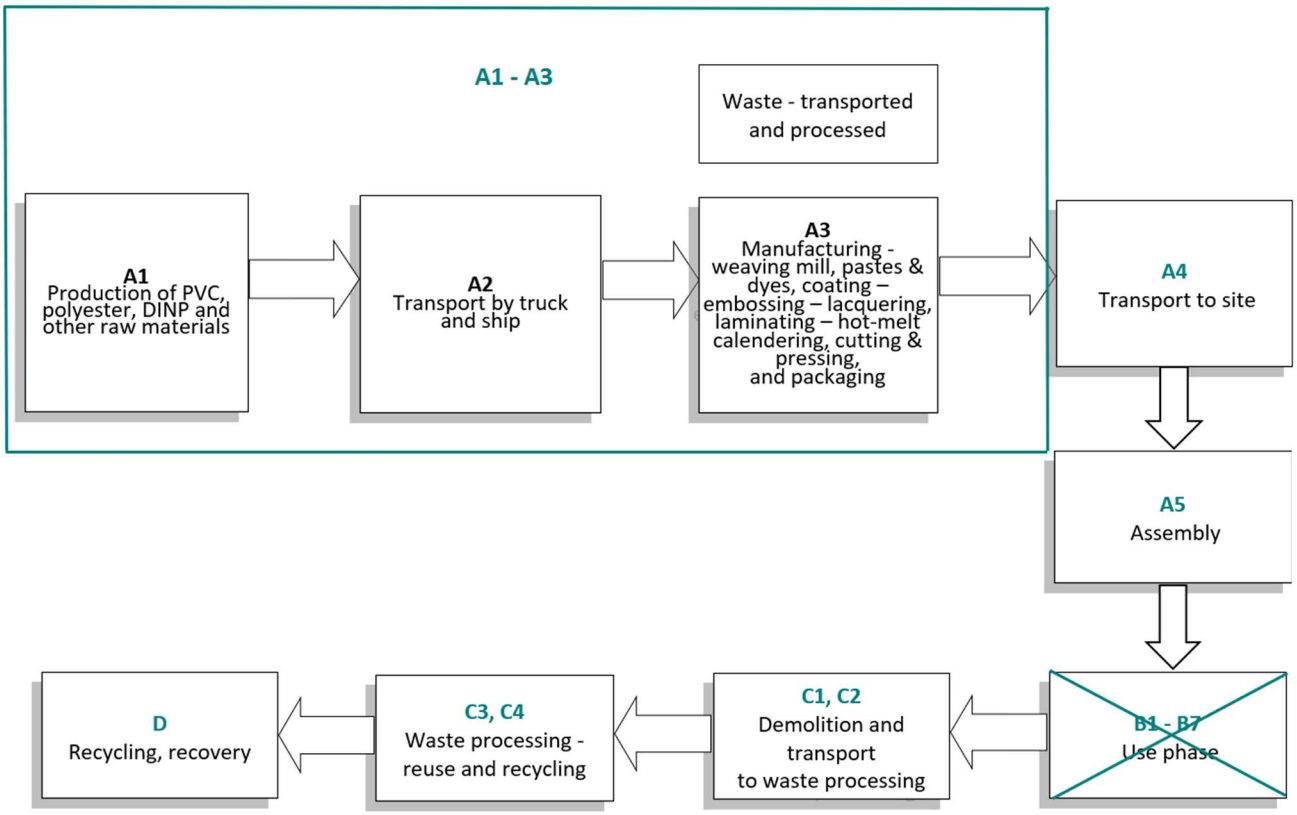
Product application
The product is intended to be installed as suspended membrane without direct contact to concrete, rock or similar surfaces. The product shall be installed in temperatures between 0 and 35 °C (RTM 450-RP) and +5 and +35 degrees Celsius (RTM 700-RP) and maximum 80% of relative humidity for installation outside these conditions, the product behaviour must be tested and observed first. The product is designed for underground use.

Geographical scope
Europe

Product contents information

Product components	Weight, %	Post-consumer material, weight-%	Renewable material, weight-%
Polyester	31	-	-
PVC	28	-	-
Plasticizer, stabilizer	14	-	-
Additives, filler, other	27	-	-
TOTAL	100	-	-

Packaging materials	Weight, kg	Weight-% (versus the product)
LDPE foil	0,0090	1,2
PE foil tape	0,0003	0,04
End caps	0,0016	0,21
Strapping	0,0039	0,52
Cardboard	0,01672	2,23
Wooden pallets and wedges	0,0788	10,51
TOTAL	0,1103	14,71



Manufacturing process

Life cycle assessment

Cut-off criteria

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

Allocation, estimations, and assumptions

Allocation is based on annual production rate and made with high accuracy and precision. The values for 1 m2 of the products which are used within this study are calculated by considering the total product weight per annual production. In the production plant, several kinds of products are produced; since the production processes of these products are similar, the annual production percentages are taken into consideration for allocation. According to the ratio of the annual production of the declared product to the total annual production at the factory, the annual total energy consumption, packaging materials and the generated waste per the declared product are allocated. Subsequently, the produced products output fixed to 1 m2 and the corresponding amount of product is used in the calculations.

Database(s) and LCA software

This EPD has been created using One Click LCA Pre-Verified EPD Generator. Ecoinvent v3.8 and One Click LCA databases were used as sources of environmental data.

LCA scenarios and additional environmental information

Manufacturing energy scenario

Electricity data source and quality	Electricity, Germany, residual mix
Electricity CO2e / kWh	0,88
Energy data source and quality	Heat and power co-generation, natural gas, conventional power plant, 100MW electrical (Reference product: heat, district, or industrial, natural gas)
Heating CO2e / MJ	0.0285

Transportation scenario (A4)

Vehicle type used for transport	Transport, freight, lorry 16-32 metric tonne, Euro 6
Distance to the construction site	730 km
Capacity utilization	50%
Capacity utilization factor	0.5

A5 Assembly

End of life of the packaging materials is considered in the study. It is assumed that the wooden pallets used for transportation of products are incinerated at the nearest municipal incineration plant for energy recovery. Packaging materials such as the polyethylene and cardboard are considered to be recycled.

C2 Transport

Transportation distance to the closest disposal area is estimated as 50 km and the transportation method is assumed as lorry (16-32 tonne; EURO 6) which is the most common.

Module D

There are declared benefits and loads regarding to energy recovery from incineration of waterproofing membrane, wooden pallets and recycling potential of polyethylene packaging material and cardboard.

End of Life (C1, C3, C4)

	Value	Unit
Collected separately	0,75	Kg
Collected as mixed construction waste	-	Kg
Reuse	-	Kg
Recycling	0,075	Kg
Energy recovery	0,3375	Kg
To landfill	0,3375	Kg

Additional environmental information

Declared unit is 1 m^2 of the waterproofing membrane. If it is necessary to quantify the results to a product weight of 1 kg, the conversion factor is 1,33.

LCA results

Core environmental impact indicators – EN 15804+A2, PEF

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	2,91E+00	1,02E-01	1,64E-01	0,00E+00	6,11E-03	8,04E-01	1,55E-01	-1,32E-01
GWP-fossil	kg CO2 eq.	3,03E+00	1,02E-01	3,59E-03	0,00E+00	6,11E-03	8,03E-01	1,55E-01	-1,04E-01
GWP-biogenic	kg CO2 eq.	-1,30E-01	4,14E-05	1,60E-01	0,00E+00	2,48E-06	1,77E-03	1,48E-04	-2,75E-02
GWP-LULUC	kg CO2 eq.	1,32E-02	4,08E-05	2,69E-06	0,00E+00	2,44E-06	1,11E-04	3,73E-05	-4,59E-05
ODP	kg CFC11 eq.	5,24E-06	2,37E-08	2,30E-10	0,00E+00	1,42E-09	2,54E-08	2,50E-09	-5,13E-09
AP	mol H^+ eq.	2,32E-02	2,90E-04	2,44E-05	0,00E+00	1,74E-05	6,02E-04	1,31E-04	-7,38E-04
EP-freshwater	kg P eq.	2,96E-04	7,29E-07	6,67E-08	0,00E+00	4,36E-08	2,73E-06	2,54E-07	-2,32E-06
EP-marine	kg N eq.	4,31E-03	5,79E-05	1,03E-05	0,00E+00	3,46E-06	1,50E-04	4,54E-05	-1,01E-04
EP-terrestrial	mol N eq.	5,05E-02	6,43E-04	1,07E-04	0,00E+00	3,85E-05	1,61E-03	4,71E-04	-1,15E-03
POCP	kg NMVOC eq.	1,57E-02	2,47E-04	2,81E-05	0,00E+00	1,48E-05	4,54E-04	2,48E-04	-3,55E-04
ADP-M&M	kg Sb eq.	4,15E-02	3,69E-07	2,57E-08	0,00E+00	2,21E-08	1,19E-06	1,05E-07	-4,34E-07
ADP-fossil	MJ	5,17E+01	1,52E+00	2,77E-02	0,00E+00	9,09E-02	1,24E+00	1,32E-01	-1,96E+00
WDP	m^3	1,70E+00	7,11E-03	7,36E-03	0,00E+00	4,25E-04	7,89E-02	7,01E-03	-3,79E-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 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*

Additional environmental impact indicators – EN 15804+A2, PEF

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	1,84E-07	8,23E-09	9,73E-10	0,00E+00	4,92E-10	7,43E-08	2,04E-06	-8,30E-09
IRP	kBq U235 eq.	2,51E-01	7,97E-03	1,10E-04	0,00E+00	4,77E-04	8,46E-03	8,44E-04	-2,01E-02
ETP-fw	CTUe	4,27E+02	1,27E+00	1,61E-01	0,00E+00	7,59E-02	4,48E+01	8,79E+00	-3,11E+00
HTP-c	CTUh	3,71E-09	3,90E-11	1,24E-11	0,00E+00	2,33E-12	1,86E-09	4,71E-08	-3,70E-11
HTP-nc	CTUh	1,37E-07	1,24E-09	2,72E-10	0,00E+00	7,43E-11	1,28E-08	9,24E-09	-1,10E-09
SQP	Dimensionless	2,36E+01	1,08E+00	2,34E-02	0,00E+00	6,46E-02	7,25E-01	1,60E-01	3,51E-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

Resource use indicators

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
RPEE	MJ	3,43E+00	2,21E-02	1,42E-03	0,00E+00	1,32E-03	1,13E-01	1,01E-02	-4,11E-01
RPEM	MJ	1,21E+00	0,00E+00	-3,23E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,25E-01
TPE	MJ	4,64E+00	2,21E-02	-3,23E+00	0,00E+00	1,32E-03	1,13E-01	1,01E-02	-1,86E-01
NRPE	MJ	4,25E+01	1,52E+00	2,77E-02	0,00E+00	9,09E-02	1,24E+00	1,32E-01	-1,34E+00
NRPM	MJ	1,39E+01	0,00E+00	-1,37E+00	0,00E+00	0,00E+00	-1,12E+01	0,00E+00	6,96E-01
TRPE	MJ	5,63E+01	1,52E+00	-1,35E+00	0,00E+00	9,09E-02	-9,94E+00	1,32E-01	-6,45E-01
SM	kg	6,14E-02	5,17E-04	8,95E-05	0,00E+00	3,09E-05	4,00E-04	4,60E-05	2,81E-02
RSF	MJ	2,90E-02	5,69E-06	5,21E-07	0,00E+00	3,41E-07	1,26E-04	1,06E-05	2,77E-07
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
W	m^3	4,29E-02	1,94E-04	-1,48E-05	0,00E+00	1,16E-05	3,51E-02	2,93E-03	-1,11E-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: Non-renewable primary energy resources used as energy carrier; NRPM: Non-renewable 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

Waste indicators

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HW	KG	2,54E-01	1,73E-03	1,92E-04	0,00E+00	1,03E-04	0,00E+00	1,74E-02	-5,30E-03
NHW	KG	2,05E+01	3,07E-02	1,07E-01	0,00E+00	1,84E-03	0,00E+00	4,31E-02	-2,64E-01
RW	KG	1,04E-04	1,05E-05	5,63E-08	0,00E+00	6,26E-07	0,00E+00	7,16E-07	-6,25E-06

HW: Hazardous waste disposed; NHW: Non-hazardous waste disposed; RW: Radioactive waste disposed

Output flow indicators

Indicator	Unit	A1-A3	A4	A5	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	0,00E+00
MR	kg	0,00E+00	0,00E+00	3,20E-02	0,00E+00	0,00E+00	7,50E-02	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,38E-01	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,19E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
ETE	MJ	0,00E+00	0,00E+00	1,02E+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 biogenic carbon content at factory gate

Biogenic carbon content	Value	Unit
Biogenic carbon content in product	0	kg C
Biogenic carbon content in the accompanying packaging	0,0775	kg C

Specific data (GWP-GHG) and data variation for A1-A3

Specific data and data variation	
Specific data	>90%
Variation - product	1%
Variation - site	-

Hazardous substances

☒ The product does not contain any REACH SVHC substances in amounts greater than 0.1 %.

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EN 15804:2012+A2:2019
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Flexible sheets for waterproofing', 2015, Technical Committee CEN/TC 264

LCA background report 21.04.2024

Annex

Environmental impact indicators – EN 15804+A1, CML/ISO 21930

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP	kg CO2 eq.	2,95E+00	1,01E-01	3,93E-03	0,00E+00	6,05E-03	8,01E-01	1,44E-01	-1,01E-01
ODP	kg CFC11 eq.	3,60E-06	1,87E-08	1,94E-10	0,00E+00	1,12E-09	2,34E-08	2,26E-09	-4,26E-09
AP	kg SO_2 eq.	1,88E-02	2,38E-04	1,78E-05	0,00E+00	1,42E-05	4,77E-04	9,94E-05	-6,24E-04
EP	kg PO_4 eq.	1,66E-02	5,13E-05	3,54E-05	0,00E+00	3,07E-06	4,33E-04	2,87E-03	-1,38E-04
POCP	kg C_2H_4 eq.	1,34E-03	1,20E-05	1,21E-06	0,00E+00	7,19E-07	3,44E-05	7,89E-05	-3,12E-05
ADP-M&M	kg Sb eq.	4,15E-02	3,61E-07	2,50E-08	0,00E+00	2,16E-08	8,58E-07	7,64E-08	-4,39E-07
ADP-fossil	MJ	5,59E+01	1,52E+00	2,77E-02	0,00E+00	9,09E-02	1,24E+00	1,32E-01	-1,94E+00

Environmental impact indicator – GWP-GHG

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP - GHG	kg CO2e	3,03E+00	1,02E-01	3,59E-03	0,00E+00	6,11E-03	8,03E-01	1,55E-01	-1,04E-01

GWP- GHG: Global Warming Potential, greenhouse gases