

Ronma Solar Technology (Jinhua) Co., Ltd.



ENVIRONMENTAL PRODUCT DECLARATION

Mono-Crystalline Photovoltaic Module

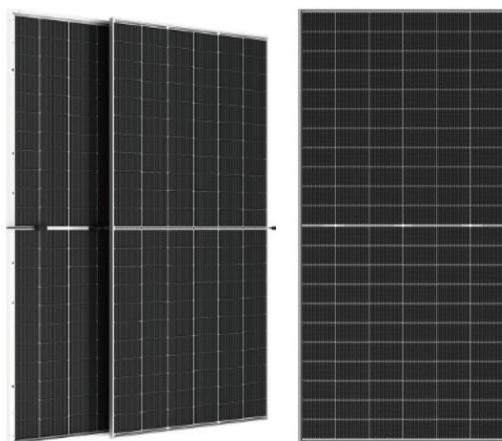
**No. 588 North Jinwu Road, Jiangdong
Town, Jindong District, Jinhua City,
Zhejiang, PEOPLE'S REPUBLIC OF
CHINA**

in compliance with ISO 14025 and EN15804

Program Operator	The Norwegian EPD Foundation
Publisher	EPDItaly

Declaration Number	NEPD-17234-21575
Registration Number	MR-EPDITALY0166

Issue Date	17/ 08/ 2026
Valid to	17/ 08 / 2031

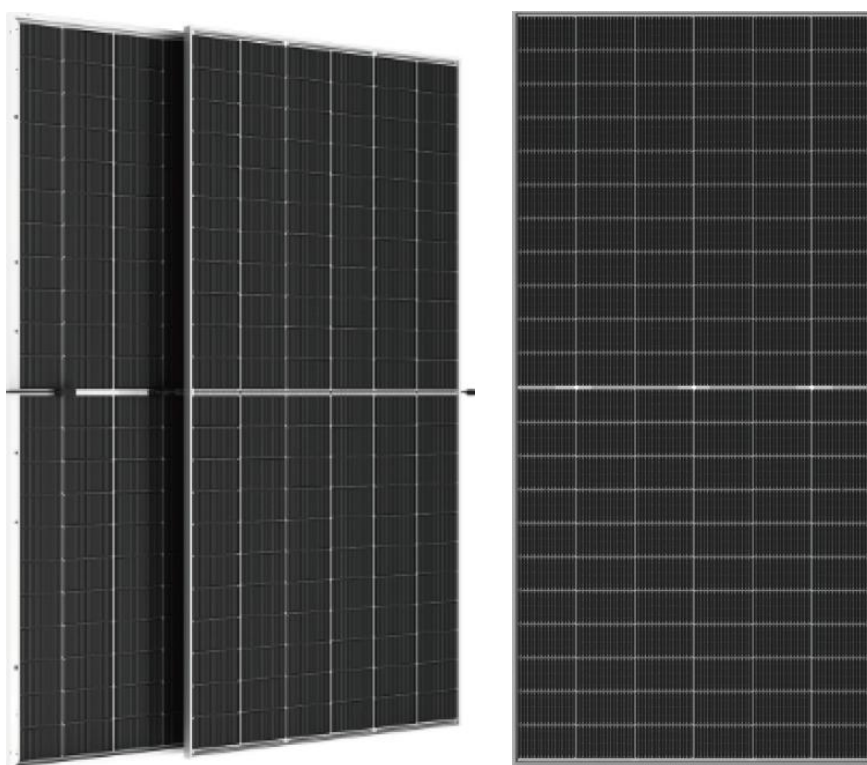


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Norwegian EPD Foundation.
www.epditaly.it

Environmental Product Declaration

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

TOPCon Double Glass Photovoltaic Module



Owner of the declaration:
Ronma Solar Technology (Jinhua) Co., Ltd.

Product name:
Mono-Crystalline Photovoltaic Module
RM-182R-132TB and RM-182M-144TB

Functional unit:
1 Wp

Product category /PCR:
NPCR 029 Part B Version: 1.2

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-17234-21575

Registration number:
NEPD-17234-21575

Issue date: 17.08.2026

Valid to: 17.08.2031

General information

Product:

RM-182R-132TB and RM-182M-144TB

Program operator:

EPD-Global

Post Box 5250 Majorstuen, 0303 Oslo, Norway

Tlf: +47 23 08 80 00

web: www.epd-global.com/

Declaration number:

NEPD-17234-21575

This declaration is based on Product Category Rules:

NPCR PART A: Construction products and services
Version 2.0

NPCR 029 Part B Version: 1.2 for photovoltaic modules used in the building and construction industry, including production of cell, wafer, ingot block, solar grade silicon, solar substrates, solar superstrates and other solar grade semiconductor materials.

Statement of liability:

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

Functional unit:

1 Wp of manufactured photovoltaic module, from cradle-to-grave and module D, with activities needed for a reference service life (RSL) of 30 years ($\geq 80\%$ of the labelled power output)

Verification:

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

internal ☐

external ☒



Lucas Pedro Berman

Lucas Pedro Berman - Senda Environmental & Energy Consulting

Independent verifier approved by EPD Global

Owner of the declaration:

Ronma Solar Technology (Jinhua) Co., Ltd.

Contact person: Lin Lin

e-mail: lin.lin@ronmasolar.com

Manufacturer:

Ronma Solar Technology (Jinhua) Co., Ltd.

Room 202, 2nd floor, No. 168 Jinxian Road,

Jiangdong Town, Jindong District, Jinhua City,

Zhejiang, PEOPLE'S REPUBLIC OF CHINA

Place of production:

No. 588 North Jinwu Road, Jiangdong Town,

Jindong District, Jinhua City, Zhejiang, PEOPLE'S

REPUBLIC OF CHINA

Management system:

ISO 9001, ISO 14001, ISO 45001

Organisation no:

91330703MAC7P4184C

Issue date:

17.08.2026

Valid to:

17.08.2031

Year of study:

2025.01-2025.12

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:

Siyang Sun, TÜV SÜD Certification and
Testing (China) Co., Ltd. Shanghai Branch



Approved



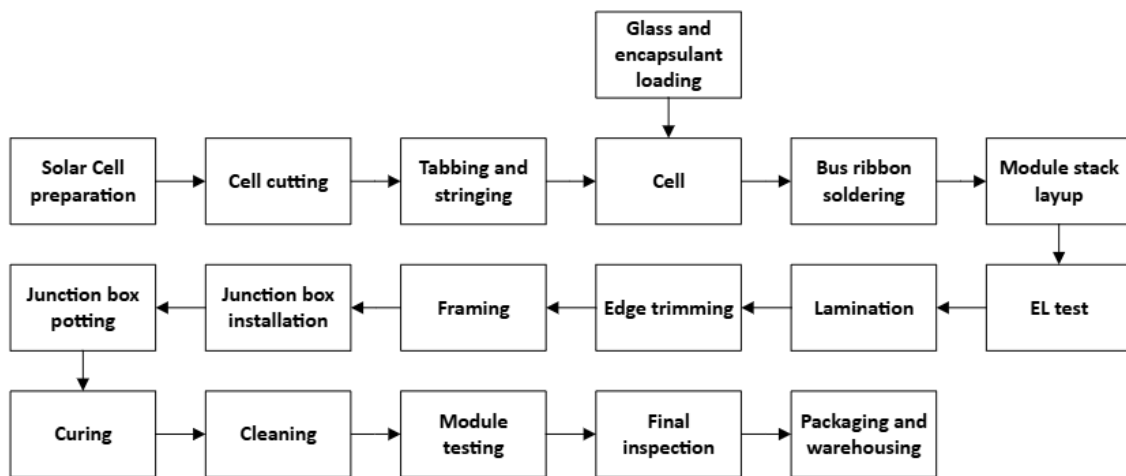
Manager of EPD Global

Product

Product description:

Ronma Solar Technology (Jinhua) produces series of crystalline silicon photovoltaic (PV) modules. In this report, two types of TOPCon Double Glass Photovoltaic Module are included. Function of PV module is to generate electricity. For Building-Integrated-PV (BIPV) applications there is an additional function of providing roofing to the building.

The manufacturing processes of PV modules production of Ronma Solar Technology (Jinhua) is presented as below.



Step 1: Solar cell preparation

Solar cells are prepared according to the production order, module type, cell specification, power class and layout requirements.

Step 2: Cell cutting

Solar cells are cut into the required size, such as half-cells or other divided-cell formats, usually by laser cutting.

Step 3: Tabbing and stringing

Individual solar cells are electrically connected in series by soldering interconnect ribbons to the front and rear electrodes of the cells. The connected cells form cell strings.

Step 4: Cell

The soldered cell strings are arranged on the glass and encapsulant according to the required module circuit design. During this step, the spacing between strings, edge distance, polarity direction and busbar position are controlled to ensure correct electrical connection and appearance.

Step 5: Bus ribbon soldering

The cell strings are interconnected by soldering bus ribbons or busbars.

Step 6: Module stack layup

The module materials are stacked in the required sequence before lamination. A typical structure includes front glass, front encapsulant, cell strings, rear encapsulant and back glass.

Step 7: EL test

Electroluminescence inspection is conducted before lamination to identify cell cracks, micro-cracks, broken fingers, poor soldering, inactive areas, misalignment or other hidden defects.

Step 8: Lamination

The laid-up module stack is placed into a laminator. Under vacuum, heat and pressure, the encapsulant film melts and cures, bonding the glass, solar cells and backsheet or rear glass into an integrated laminate.

Step 9: Edge trimming

Excess encapsulant, backsheet or other materials overflowing from the module edge after lamination are trimmed.

Step 10: Framing

An aluminum alloy frame is installed around the laminated module.

Step 11: Junction box installation

The lead-out ribbons or busbars of the module are soldered to the terminals of the junction box. The junction box is then fixed to the rear side of the module.

Step 12: Junction box potting

Potting compound, commonly silicone-based encapsulant or sealant, is filled into the junction box.

Step 13: Curing

The sealant or potting compound applied during framing and junction box installation is cured under controlled conditions.

Step 14: Cleaning

The module surface, frame, glass and junction box area are cleaned to remove dust, residual sealant, fingerprints, particles and other contaminants.

Step 15: Module testing

The finished module undergoes electrical and safety-related testing.

Step 16: Final inspection

A final quality inspection is performed to confirm the module's appearance, electrical performance, label information, frame condition, junction box condition, dimensions, barcode and overall compliance with customer or internal quality requirements.

Step 17: Packaging and warehousing

Qualified modules are packed according to customer, product and transportation requirements. After packaging, the finished modules are transferred to warehouse storage or prepared for delivery.

Product specification:

Raw material and auxiliary material	Weight amount			
	RM-182R-132TB		RM-182M-144TB	
	kg/FU	%	kg/FU	%
Solar Cell	1.13E-03	2.25	1.14E-03	2.23
Interconnector ribbon	2.89E-04	0.57	2.86E-04	0.56
Busbar ribbon	5.31E-05	0.11	5.52E-05	0.11
Back glass	2.09E-02	41.55	2.12E-02	41.41
Front glass	2.09E-02	41.55	2.12E-02	41.41
Long aluminum	2.55E-03	5.07	2.23E-03	4.36
Short aluminum	1.04E-03	2.07	1.11E-03	2.17
Junction box	1.33E-04	0.26	1.53E-04	0.30
Front encapsulant	1.62E-03	3.22	1.59E-03	3.11
Rear encapsulant	1.61E-03	3.20	1.69E-03	3.30
Light guide film	2.34E-05	0.05	2.62E-05	0.05
Flux	3.13E-05	0.06	3.31E-05	0.06
Junction box gel	2.34E-05	0.05	2.48E-05	0.05
Frame gel	4.53E-04	0.90	4.79E-04	0.94
Sealing gel	3.33E-05	0.07	3.52E-05	0.07
Net Product Weight	5.03E-02	100.00	5.12E-02	100.00

Packaging material	Weight amount			
	RM-182R-132TB		RM-182M-144TB	
	kg/FU	%	kg/FU	%
Wooden Pallet	1.30E-03	60.47	1.56E-03	63.93
Paperboard side panel	1.74E-04	8.09	1.84E-04	7.54
Paperboard top cover	3.49E-05	1.62	3.36E-05	1.38
Paperboard base pad	3.23E-05	1.50	2.53E-05	1.04
Edge protector	4.45E-04	20.70	4.71E-04	19.30
Kraft paper corner	1.11E-05	0.52	1.17E-05	0.48
Carbon ribbon	7.81E-09	0.00	8.26E-09	0.00
PET strapping band	9.33E-05	4.34	8.90E-05	3.65
Label	1.49E-06	0.07	1.57E-06	0.06
Stretch film	3.20E-05	1.49	3.83E-05	1.57
Packaging bag	6.25E-06	0.29	6.61E-06	0.27
Nameplate	4.10E-07	0.02	4.34E-07	0.02
Positioning tape	2.87E-07	0.01	3.04E-07	0.01
Sealing tape	1.95E-05	0.91	1.92E-05	0.79
Package Weight	2.15E-03	100.00	2.44E-03	100.00

Technical data:

Technical parameters	RM-182R-132TB	RM-182M-144TB
Power output (W)	615-640	580-605
Dimension (mm)	2382×1134×30	2278×1134×30
Weight (kg)	33.5	32.0
Area (m ²)	2.70	2.58
Converting factor (Wp/m ²)	237.04	234.50
Solar cells	TOPCon	TOPCon
Cell configuration	132 cells (6×11+6×11)	144 cells (6×12+6×12)

Technical parameters	RM-182R-132TB	RM-182M-144TB
First year degradation rate (%)	1	1
Yearly degradation rate (%)	≤0.4	≤0.4

Market:

Global

Reference service life, product:

30 years (based on ≥80% of the labelled power output)

Additional technical information

None

LCA: Calculation rules

Functional unit:

1 Wp of manufactured photovoltaic module, from cradle-to-grave and module D, with activities needed for a reference service life (RSL) of 30 years ($\geq 80\%$ of the labelled power output).

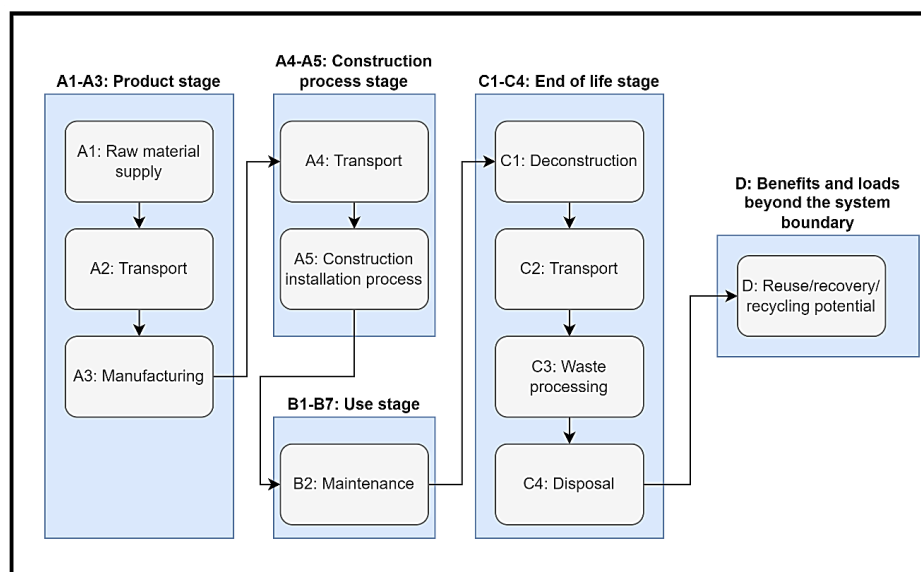
Cut-off criteria:

LCI data shall according to EN 15804 include a minimum of 95% of total inflows (mass and energy) per module. For the processes within the system boundary, all available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts.

Allocation:

The allocation is made in accordance with the provisions of EN 15804 and the principles of "modularity" and "polluter pays" were followed. Incoming energy and water and waste production in-house is allocated equally among all products through power output allocation. For the end-of-life allocation of background data (energy and materials), the model "allocation cut-off by classification (ISO standard)" is used. As for the end-of-life stage of the solar PV modules, the load and benefit of reuse, recycling, and recovery processes is reported separately following the PCR's recommendation.

System boundary:



The following steps/stages are not included in the system boundary due to the reason that the elements below are considered irrelevant or not within the boundary to the LCA study:

- Production, transportation and installation of capital goods (buildings, infrastructure, machinery, internal transport packaging) and general operations (staff travel, marketing and communication actions).
- Emissions during the PV module installation and operation due to no obvious emission observable.
- Storage phases and sales of PV products due to no observable impact. Product losses due to abnormal damage such as natural disasters or fire accidents would occur at a rather low frequency.
- Handling operations at the distribution center and retail outlet due to small contribution and negligible impact.
- Research and development activities.
- Long-term emissions are excluded due to high modelling uncertainty and limited data availability.

Data quality:

The inventory is based on the collection of measured data in the manufacturer plant from 2025-01-01 to 2025-12-30. A high accuracy and quality are expected for specific data. Missing data are completed by data from secondary database, wafer and ingot production are from IEA PVPS Task 12, 2020 report. Cell production is from primary data source from raw material supplier. Consistency checks are performed. Data quality of the main contributors are improved when possible. Generic data related to the life cycle impacts of the material or energy flows that enter and leave the production system is sourced from Ecoinvent 3.12 "EN15804" database.

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	X	X	X	X	X	X	X	X	X	X	X	X	X

LCA: Scenarios and additional technical information

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

Transport from production place to assembly/user (A4)

For road transportation, lorry of EURO6, 16-32 metric ton is used for modelling, while container ship is used for sea transportaion. The inventory of Ronma Solar Technology (Jinhua) includes the transportation from the factory to departure port, departure port to arriving ports and arriving port to purchaser.

Assembly (A5)

According to NPCR 029 Part B, the waste treatment of packaging, energy use during installation shall be included. The electricity consumption during installation stage is scaled up based on the data from Ecoinvent database value (1.02kWh/3kWp) according to the power rating of PV modules. The compositions of the packing waste are mainly waste pallet, waste corrugated sheet, waste kraft paper, plastic film and other PET. The disposal is assumed 100% incineration for plastic film, corrugated sheet and kraft paper. 25% incineration for the wooden pallet. 75% recycling for the wooden pallet. The transportation distance to disposal site is assumed as 200km.

	Unit	RM-182R-132TB	RM-182M-144TB
Water consumption	m ³	-	-
Electricity consumption	kWh	2.18E-01	2.06E-01
Other energy carriers	MJ	-	-
Material loss	Kg	-	-
Output materials from waste treatment	Kg	1.38E+00	1.48E+00

Use (B1)

There are no material or energy inputs, no emissions during the use phase (B1) of the PV module.

Maintenance (B2)/Repair (B3)

In the maintenance stage (B2), it is assumed that each module is cleaned with 0.23L of water each time, and the cleaning frequency is twice a year. It is assumed that a small handheld device is used to spray water onto the panel, consuming no electricity during the cleaning process. And the PV modules do not require maintenance during RSL.

	Unit	RM-182R-132TB	RM-182M-144TB
Water consumption	m ³	13.8	13.8
Electricity consumption	kWh	0	0

Replacement (B4)/Refurbishment (B5)

It is assumed that the PV module itself does not require replacement and refurbishment during its RSL.

Operational energy (B6) and water consumption (B7)

There is no operational energy and water consumption needed in life stage B6 and B7 respectively. The energy produced by a PV module depends on the installed power peak [Wp], degradation factor, geographic location, and direction/placement of the installation. The calculation formula of energy production are as follows:

- S_{rad} = Site specific annual average solar radiation on module (shadings not included), kWh/kWp/year. The annual radiation must take into consideration the specific inclination (slope, tilt) and orientation.
- A = Area of module, from functional unit (FU), m² (stated in the EPD).
- y = Module yield: electrical power, kWp for standard test conditions (STC) of the module divided by the area of the module (stated in the EPD).
- deg = yearly degradation rate (stated in the EPD).
- RSL = Reference service life for energy-producing unit, from functional unit (FU), stated in the EPD.
- PR = Performance ratio, coefficient for losses. Site specific performance ratio can be modelled with PV simulation software tools, such as PVSyst or similar.

Energy production in the first year of operation:

$$E1 = S_{rad} \cdot A \cdot y \cdot PR \cdot (1 - deg)$$

Energy production over reference service life of module:

$$E_{RSL} = E1 \cdot (1 + \sum_{n=1}^{RSL-1} (1 - deg)^n)$$

End of Life (C1, C3, C4)

For the end-of-life stage, default scenarios in section 6.3.8.4 of NPCR 029 version 1.2 of EPD Global are used. De-construction (C1) is assumed mainly energy use for onsite dismantling and the energy use is assumed to be the same as the construction stage (A5). The electricity consumption for demolition of PV modules and sorting of waste (C3) is assumed to be the same as the manufacture

stage (A3) of PV modules. For the end-of-life disposal stage (C4), this study refers to legal requirements issued by Waste Electrical and Electronic Equipment (WEEE) under the EU scenario. The required recycling rate for waste PV modules is 85% according to 2012/19/EU-Article 11 & ANNEX V. The recycling rate for waste glass is assumed as 85%, while the refused parts are disposed of with landfilling. The silicon cell and solder are assumed as 100% landfill. And the waste aluminum and waste copper are assumed to be 100% recycled. Waste EVA, junction box, waste silicon adhesive and tape end up with 100% incineration.

	Unit	RM-182R-132TB	RM-182M-144TB
Hazardous waste disposed	kg/FU	-	-
Collected as mixed construction waste	kg/FU	-	-
Reuse	kg/FU	-	-
Recycling	kg/FU	3.95E-02	3.97E-02
Energy recovery	kg/FU	3.89E-03	4.00E-03
To landfill	kg/FU	7.41E-03	7.50E-03

Transport to waste processing (C2)

Transport distance of 50 km is assumed for transporting to waste processing site (C2).

Benefits and loads beyond the system boundaries (D)

	Unit	RM-182R-132TB	RM-182M-144TB
Energy recovery	MJ	3.55E-02	3.67E-02
Electricity recovery	MJ	1.78E-02	1.85E-02
Interconnector ribbon	kg	2.89E-04	2.86E-04
Busbar ribbon	kg	5.31E-05	5.52E-05
Back glass	kg	1.78E-02	2.12E-02
Front glass	kg	1.78E-02	2.12E-02
Long aluminum frame	kg	2.55E-03	2.23E-03
Short aluminum frame	kg	1.04E-03	1.11E-04
Wood pallet	kg	9.77E-04	1.17E-03

LCA: Results

The core environmental impact results are calculated basing on the highest rating of the module type and expressed per functional unit (1 Wp). The highest power of RM-182R-132TB is 640Wp and of RM-182M-144TB is 605Wp, which is served as representative. The LCA results been calculated by using SimaPro 10.2.0.3 LCA software.

Core environmental impact indicators

	Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
RM-182R-132TB	GWP-total	kg CO ₂ eq.	3.87E-01	5.65E-03	2.34E-03	2.59E-05	0.00E+00	2.83E-04	5.18E-04	2.13E-02	4.17E-05	-4.76E-02
	GWP-fossil	kg CO ₂ eq.	3.88E-01	5.64E-03	7.67E-04	2.58E-05	0.00E+00	2.84E-04	5.17E-04	2.14E-02	4.16E-05	-4.82E-02
	GWP-biogenic	kg CO ₂ eq.	-1.94E-03	1.26E-06	1.58E-03	1.80E-08	0.00E+00	-1.64E-06	1.23E-07	-6.91E-05	7.25E-08	5.65E-04
	GWP-LULUC	kg CO ₂ eq.	3.36E-04	2.57E-06	1.95E-07	3.20E-08	0.00E+00	1.47E-07	2.33E-07	6.34E-06	1.01E-08	-2.96E-05
	ODP	kg CFC11 eq.	4.26E-08	8.20E-11	2.56E-12	4.99E-12	0.00E+00	8.79E-13	7.52E-12	4.05E-11	1.51E-12	-5.23E-10
	AP	mol H ⁺ eq.	2.52E-03	1.64E-05	2.23E-06	1.38E-07	0.00E+00	1.72E-06	1.24E-06	7.56E-05	2.73E-07	-6.38E-04
	EP-freshwater	kg P eq.	1.79E-04	6.03E-07	7.86E-08	9.20E-09	0.00E+00	6.35E-08	5.64E-08	2.74E-06	2.39E-09	-1.85E-05
	EP-marine	kg N eq.	5.81E-04	4.52E-06	5.63E-07	2.90E-08	0.00E+00	3.51E-07	2.98E-07	1.62E-05	1.19E-07	-7.64E-05
	EP-terrestrial	mol N eq.	4.96E-03	4.88E-05	5.71E-06	2.97E-07	0.00E+00	3.74E-06	3.18E-06	1.70E-04	1.30E-06	-9.24E-04
	POCP	kg NMVOC eq.	1.45E-03	2.22E-05	1.64E-06	8.88E-08	0.00E+00	9.93E-07	1.72E-06	4.49E-05	4.91E-07	-2.65E-04
	ADP-M&M	kg Sb eq.	8.96E-06	1.87E-08	1.74E-09	1.17E-10	0.00E+00	1.39E-09	1.74E-09	5.98E-08	5.36E-11	-3.63E-06
	ADP-fossil	MJ	4.68E+00	7.77E-02	4.51E-03	3.20E-04	0.00E+00	3.08E-03	7.15E-03	1.33E-01	1.08E-03	-5.39E-01
	WDP	m ³	2.34E-01	4.33E-04	7.78E-05	9.23E-04	0.00E+00	3.09E-05	4.04E-05	1.77E-03	5.22E-05	-1.38E-02

RM-182M-144TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
	GWP-total	kg CO ₂ eq.	3.90E-01	5.50E-03	2.51E-03	2.73E-05	0.00E+00	2.85E-04	5.23E-04	2.18E-02	4.22E-05	-5.46E-02
	GWP-fossil	kg CO ₂ eq.	3.92E-01	5.50E-03	7.94E-04	2.73E-05	0.00E+00	2.87E-04	5.23E-04	2.19E-02	4.21E-05	-5.52E-02
	GWP-biogenic	kg CO ₂ eq.	-2.34E-03	1.25E-06	1.71E-03	1.90E-08	0.00E+00	-1.77E-06	1.24E-07	-7.55E-05	7.33E-08	6.83E-04
	GWP-LULUC	kg CO ₂ eq.	3.43E-04	2.50E-06	1.84E-07	3.38E-08	0.00E+00	1.31E-07	2.35E-07	5.70E-06	1.02E-08	-3.20E-05
	ODP	kg CFC11 eq.	4.48E-08	7.99E-11	2.71E-12	5.27E-12	0.00E+00	8.39E-13	7.60E-12	3.93E-11	1.53E-12	-5.94E-10
	AP	mol H ⁺ eq.	2.53E-03	1.49E-05	2.30E-06	1.46E-07	0.00E+00	1.75E-06	1.25E-06	7.74E-05	2.76E-07	-7.07E-04
	EP-freshwater	kg P eq.	1.81E-04	5.92E-07	7.79E-08	9.71E-09	0.00E+00	6.09E-08	5.70E-08	2.66E-06	2.42E-09	-1.92E-05
	EP-marine	kg N eq.	5.88E-04	3.95E-06	5.85E-07	3.07E-08	0.00E+00	3.57E-07	3.01E-07	1.66E-05	1.21E-07	-8.77E-05
	EP-terrestrial	mol N eq.	5.00E-03	4.25E-05	5.94E-06	3.14E-07	0.00E+00	3.81E-06	3.22E-06	1.75E-04	1.32E-06	-1.06E-03
	POCP	kg NMVOC eq.	1.46E-03	2.04E-05	1.71E-06	9.38E-08	0.00E+00	1.01E-06	1.74E-06	4.60E-05	4.97E-07	-3.03E-04
	ADP-M&M	kg Sb eq.	8.72E-06	1.83E-08	1.78E-09	1.24E-10	0.00E+00	1.39E-09	1.76E-09	6.04E-08	5.42E-11	-3.67E-06
	ADP-fossil	MJ	4.75E+00	7.58E-02	4.68E-03	3.38E-04	0.00E+00	3.08E-03	7.22E-03	1.34E-01	1.09E-03	-6.13E-01
	WDP	m ³	2.46E-01	4.24E-04	7.97E-05	9.74E-04	0.00E+00	2.99E-05	4.08E-05	1.75E-03	5.28E-05	-1.54E-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

RM-182R-132TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
	PM	Disease incidence	2.92E-08	4.03E-10	3.18E-11	1.92E-12	0.00E+00	2.30E-11	3.78E-11	9.92E-10	6.94E-12	-4.87E-09
	IRP	kBq U235 eq.	2.10E-02	6.08E-05	1.63E-05	2.14E-06	0.00E+00	1.50E-05	5.66E-06	6.41E-04	1.01E-06	-1.39E-03
	ETP-fw	CTUe	5.90E+00	1.75E-02	2.63E-03	9.86E-05	0.00E+00	9.76E-04	1.63E-03	5.99E-02	9.25E-05	-5.62E-01
	HTP-c	CTUh	1.63E-09	9.07E-13	1.30E-13	1.83E-14	0.00E+00	3.81E-14	8.20E-14	2.42E-12	5.52E-15	-3.60E-11
	HTP-nc	CTUh	1.21E-07	4.67E-11	7.01E-12	7.91E-13	0.00E+00	2.56E-12	4.37E-12	1.37E-10	1.58E-13	-2.96E-09
RM-182M-144TB	SQP	Dimensionless	1.58E+00	4.56E-02	1.54E-03	6.63E-05	0.00E+00	7.57E-04	4.30E-03	3.28E-02	2.20E-03	-2.25E-01

RM-182M-144TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
	PM	Disease incidence	2.93E-08	3.96E-10	3.34E-11	2.03E-12	0.00E+00	2.36E-11	3.82E-11	1.03E-09	7.02E-12	-5.63E-09
	IRP	kBq U235 eq.	2.18E-02	5.96E-05	1.56E-05	2.26E-06	0.00E+00	1.42E-05	5.72E-06	6.14E-04	1.02E-06	-1.50E-03
	ETP-fw	CTUe	6.03E+00	1.72E-02	2.74E-03	1.04E-04	0.00E+00	9.91E-04	1.65E-03	6.15E-02	9.35E-05	-6.18E-01
	HTP-c	CTUh	1.65E-09	8.79E-13	1.36E-13	1.93E-14	0.00E+00	3.80E-14	8.29E-14	2.45E-12	5.58E-15	-3.67E-11
	HTP-nc	CTUh	1.22E-07	4.59E-11	7.34E-12	8.36E-13	0.00E+00	2.57E-12	4.42E-12	1.39E-10	1.60E-13	-2.99E-09
RM-182M-144TB	SQP	Dimensionless	1.65E+00	4.49E-02	1.65E-03	7.00E-05	0.00E+00	7.66E-04	4.35E-03	3.35E-02	2.22E-03	-2.50E-01

PM: Particulate matter emissions; **IRP:** Ionising radiation, human health; **ETP-fw:** Ecotoxicity (freshwater); **HTP-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

RM-182R-132TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
	RPEE	MJ	8.98E-01	1.09E-03	4.38E-04	3.32E-05	0.00E+00	4.12E-04	1.01E-04	1.77E-02	2.03E-05	-4.00E-02
	RPEM	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+00	0.00E+00
	TPE	MJ	8.98E-01	1.09E-03	4.38E-04	3.32E-05	0.00E+00	4.12E-04	1.01E-04	1.77E-02	2.03E-05	-4.00E-02
	NRPE	MJ	4.69E+00	7.77E-02	4.51E-03	3.20E-04	0.00E+00	3.08E-03	7.15E-03	1.33E-01	1.08E-03	-5.39E-01
	NRPM	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+00	0.00E+00
	TRPE	MJ	4.69E+00	7.77E-02	4.51E-03	3.20E-04	0.00E+00	3.08E-03	7.15E-03	1.33E-01	1.08E-03	-5.39E-01
	SM	kg	1.61E-03	3.50E-05	1.41E-06	8.49E-07	0.00E+00	4.72E-07	3.20E-06	2.17E-05	2.63E-07	3.95E-02
	RSF	MJ	7.40E-04	4.41E-07	1.51E-08	6.55E-10	0.00E+00	3.59E-09	4.16E-08	2.06E-07	6.38E-09	-2.32E-05
	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+00	0.00E+00
	W	m ³	6.32E-03	1.05E-05	2.06E-06	2.15E-05	0.00E+00	9.57E-07	9.84E-07	5.12E-05	1.22E-06	-3.35E-04

RM-182M-144TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
	RPEE	MJ	9.19E-01	1.06E-03	4.36E-04	3.51E-05	0.00E+00	4.08E-04	1.02E-04	1.76E-02	2.06E-05	-4.43E-02
	RPEM	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+00	0.00E+00
	TPE	MJ	9.19E-01	1.06E-03	4.36E-04	3.51E-05	0.00E+00	4.08E-04	1.02E-04	1.76E-02	2.06E-05	-4.43E-02
	NRPE	MJ	4.76E+00	7.58E-02	4.68E-03	3.38E-04	0.00E+00	3.08E-03	7.22E-03	1.34E-01	1.09E-03	-6.13E-01
	NRPM	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+00	0.00E+00
	TRPE	MJ	4.76E+00	7.58E-02	4.68E-03	3.38E-04	0.00E+00	3.08E-03	7.22E-03	1.34E-01	1.09E-03	-6.13E-01
	SM	kg	1.66E-03	3.41E-05	1.51E-06	8.96E-07	0.00E+00	4.72E-07	3.23E-06	2.20E-05	2.66E-07	4.60E-02
	RSF	MJ	8.48E-04	4.34E-07	1.63E-08	6.92E-10	0.00E+00	3.60E-09	4.20E-08	2.09E-07	6.45E-09	-2.74E-05
	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+00	0.00E+00

	W	m ³	6.61E-03	1.03E-05	2.11E-06	2.27E-05	0.00E+00	9.34E-07	9.94E-07	5.10E-05	1.24E-06	-3.74E-04
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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

RM-182R-132TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
	HW	KG	1.87E-01	5.42E-04	1.06E-04	5.66E-06	0.00E+00	7.70E-05	5.02E-05	3.44E-03	2.81E-06	-5.74E-02
	NHW	KG	9.61E+00	6.98E-03	2.05E-03	4.84E-04	0.00E+00	3.10E-04	6.57E-04	3.82E-02	9.16E-03	-1.26E-01
	RW	KG	5.11E-06	1.45E-08	3.92E-09	5.15E-10	0.00E+00	3.60E-09	1.36E-09	1.54E-07	2.31E-10	-3.41E-07

RM-182M-144TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
	HW	KG	1.86E-01	5.30E-04	1.09E-04	5.98E-06	0.00E+00	7.79E-05	5.07E-05	3.52E-03	2.84E-06	-5.81E-02
	NHW	KG	9.72E+00	6.86E-03	2.33E-03	5.11E-04	0.00E+00	2.97E-04	6.63E-04	3.83E-02	9.32E-03	-1.31E-01
	RW	KG	5.31E-06	1.43E-08	3.76E-09	5.44E-10	0.00E+00	3.40E-09	1.37E-09	1.47E-07	2.33E-10	-3.67E-07

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

End of life – output flow

RM-182R-132TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	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	0.00E+00	0.00E+00
	MR	kg	5.76E-04	4.54E-06	5.61E-07	5.13E-08	0.00E+00	5.17E-07	1.92E-07	2.21E-05	3.04E-08	-2.49E-04
	MER	kg	6.40E-07	5.03E-09	2.35E-10	2.14E-11	0.00E+00	1.25E-10	4.72E-10	5.56E-09	1.48E-11	-1.90E-07
	EEE	MJ	1.09E-03	6.62E-06	4.54E-07	2.10E-07	0.00E+00	3.00E-07	6.17E-07	1.31E-05	1.89E-07	-1.39E-04
	ETE	MJ	1.89E-03	1.15E-05	4.70E-07	3.26E-08	0.00E+00	1.94E-07	1.08E-06	8.76E-06	4.64E-08	-2.30E-04

RM-182M-144TB	Indicator	Unit	A1-A3	A4	A5	B2	B6	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	0.00E+00	0.00E+00
	MR	kg	5.84E-04	3.55E-06	5.70E-07	5.42E-08	0.00E+00	5.21E-07	1.94E-07	2.25E-05	3.07E-08	-2.37E-04
	MER	kg	6.71E-07	4.94E-09	2.46E-10	2.26E-11	0.00E+00	1.23E-10	4.77E-10	5.54E-09	1.49E-11	-2.26E-07
	EEE	MJ	1.12E-03	6.49E-06	3.11E-07	2.22E-07	0.00E+00	1.40E-07	6.23E-07	6.38E-06	1.91E-07	-1.50E-04
	ETE	MJ	1.92E-03	1.13E-05	5.02E-07	3.44E-08	0.00E+00	1.96E-07	1.10E-06	8.95E-06	4.69E-08	-2.71E-04

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	RM-182R-132TB	RM-182M-144TB
Biogenic carbon content in product	kg C / FU	0	0
Biogenic carbon content in the accompanying packaging	kg C / FU	9.25E-04	1.06E-03

Additional requirements

Location based electricity mix from the use of electricity in manufacturing

National production mix from import, low voltage (production record from workshop meter) of applied electricity for the manufacturing process (A3). Both products had same energy consumption per functional unit. And there is no GoO used in A3.

National electricity grid	Data source	Foreground / core [kWh]	GWP _{total} [kg CO ₂ - eq/kWh]	SUM [kg CO ₂ - eq]
Electricity, low voltage {CN-ECGC} market for electricity, low voltage EN15804, U	Ecoinvent 3.12 database	0.0113	0.7703	8.32E-03
Electricity, low voltage {CN-ZJ} electricity production, photovoltaic, 3kWp slanted-roof installation, single-Si, panel, mounted EN15804, U	Ecoinvent 3.12 database	0.0005	0.0939	4.56E-05

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

None

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 instantaneous oxidation. GWP-IOBC is also referred to as GWP-GHG in context to Swedish public procurement legislation.

RM-182R-132TB

Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
GWP-IOBC	kg CO ₂ eq.	3.89E-01	5.64E-03	7.67E-04	2.59E-05	0.00E+00	2.85E-04	5.17E-04	2.14E-02	4.16E-05	-4.82E-02

RM-182M-144TB

Indicator	Unit	A1-A3	A4	A5	B2	B6	C1	C2	C3	C4	D
GWP-IOBC	kg CO ₂ eq.	3.92E-01	5.50E-03	7.94E-04	2.73E-05	0.00E+00	2.87E-04	5.23E-04	2.19E-02	4.21E-05	-5.53E-02

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

Hazardous substances

RM-182R-132TB and RM-182M-144TB has been tested according to European Directive 2011/65/EU and amendment (EU) 2015/863 on the restriction of the use of certain hazardous substances in electrical equipment & EN IEC 63000:2018 Technical documentation for the assessment of electrical

and electronic products with respect to the restriction of hazardous substances and European Regulation (EC) No.1907/2006 (REACH) Article 59(10) on the candidate list of Substances of Very High Concern (SVHC) for authorization (253 items till 04-February-2026). The PV modules passed the tests. Test reports are available on request to the EPD owner.

Indoor environment

Not relevant for outdoor products.

Carbon footprint (A1-C4)

Product name	Unit	Norway (Irad=833 kWh-m ⁻² -year ⁻¹)	Italy (Irad=1702 kWh-m ⁻² -year ⁻¹)
RM-182R-132TB	g CO ₂ eq./kWh	20.98	10.42

Product name	Unit	Norway (Irad=1042 kWh-m ⁻² -year ⁻¹)	Italy (Irad=1451 kWh-m ⁻² -year ⁻¹)
RM-182M-144TB	g CO ₂ eq./kWh	18.98	13.62

Note: the carbon footprint (per kWh) results do not include the impacts caused by electrical equipment and mounting structures, and the distribution losses.

EPD results in conversion factors of various power output ranges

RM-182R-132TB

Rated power output range (Wp)	635	630	625	620	615
Conversion factor	1.008	1.016	1.024	1.032	1.041

RM-182M-144TB

Rated power output range (Wp)	600	595	590	585	580
Conversion factor	1.008	1.017	1.025	1.034	1.043

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