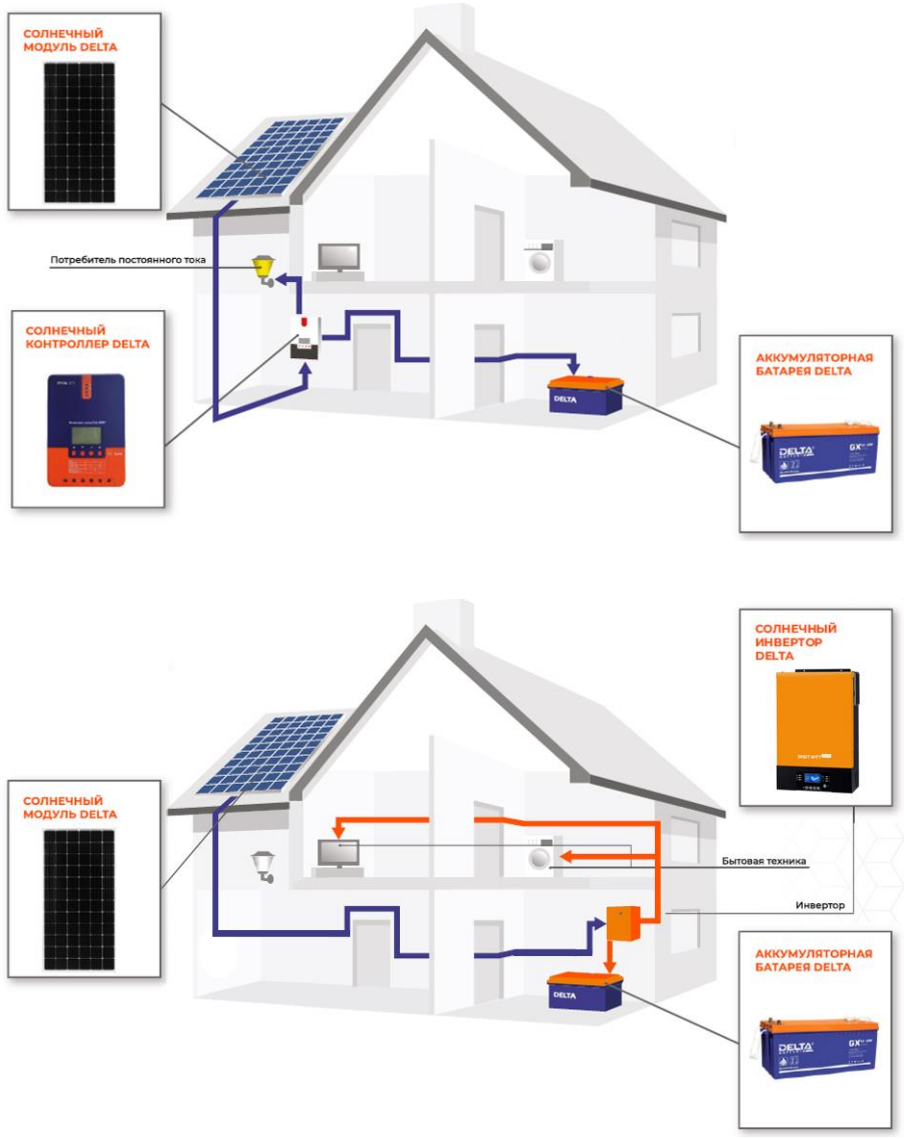
ENERGON

SOLAR POWER PLANTS
GENERAL INFO

СОДЕРЖАНИЕ

WHAT IS A SOLAR POWER PLANT

- Generating part – Photovoltaic module
- Converting part – Charge controller, Solar Inverter
- Storing part – Battery
- Components, fasteners, hardware, protective equipment



SOLAR POWER PLANT PARTS

Solar panels
6 - 670 Вт

SMARTWATT
Controllers

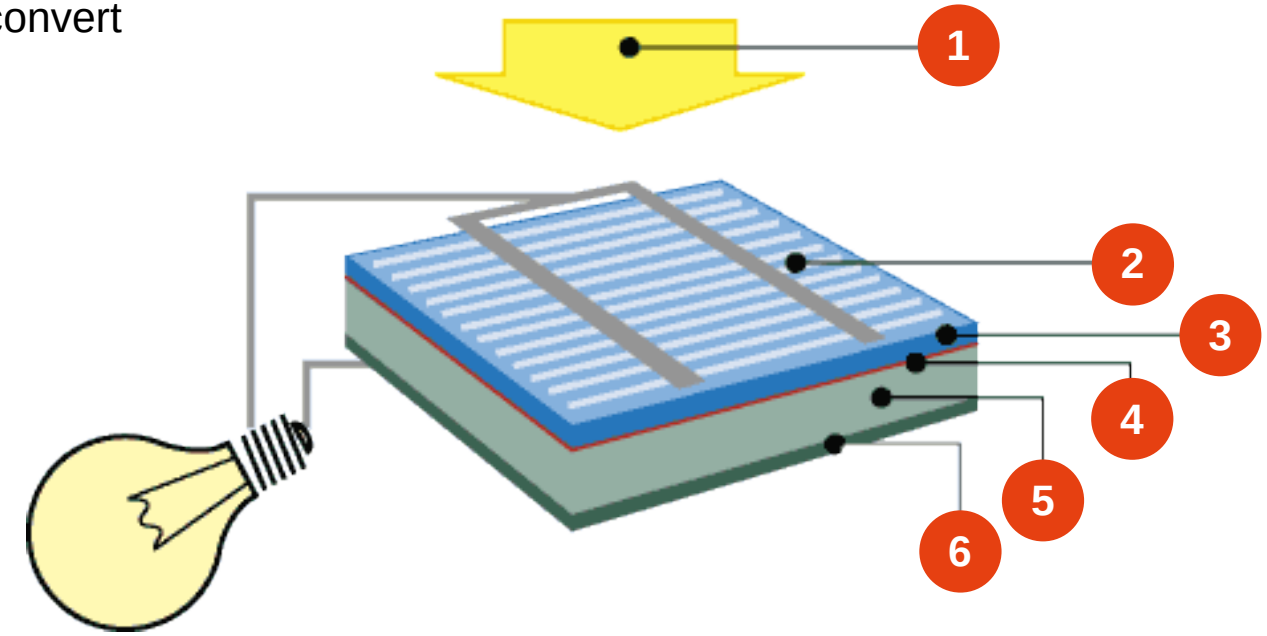
SMARTWATT
Inverters

Components and
fasteners

SOLAR MODULES

THE OPERATION OF SOLAR MODULE

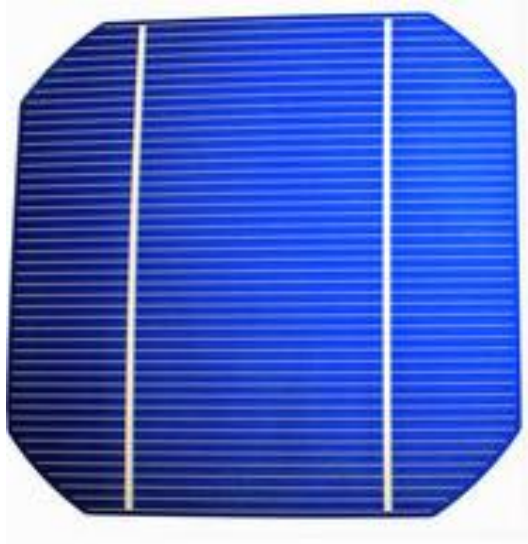
A **solar module** is a combination of photovoltaic converters (photocells) that are semiconductor devices that directly convert solar energy into direct electric current.



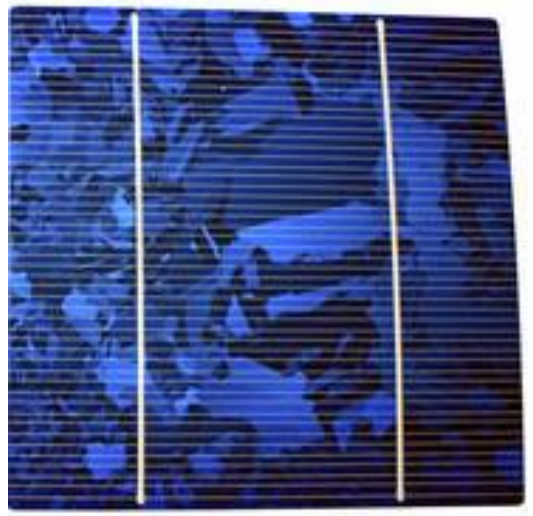
1. Light (photons)
2. Front contact
3. Negative layer
4. P-n transition layer
5. Positive layer
6. Rear contact

PHOTOVOLTAIC MODULES

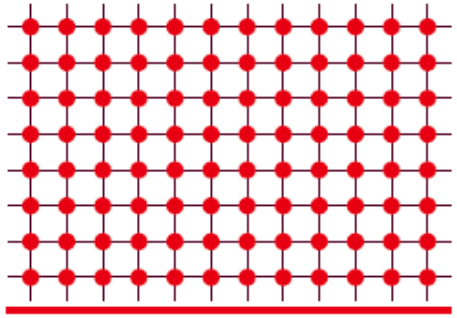
The high efficiency, availability of raw materials and simplicity of the manufacturing process of silicon elements have made them popular — especially mono – and polycrystalline.



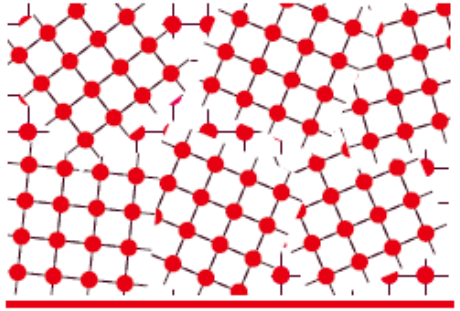
Monocrystalline silicon



Polycrystalline silicon



Mono silicon



Multi silicon

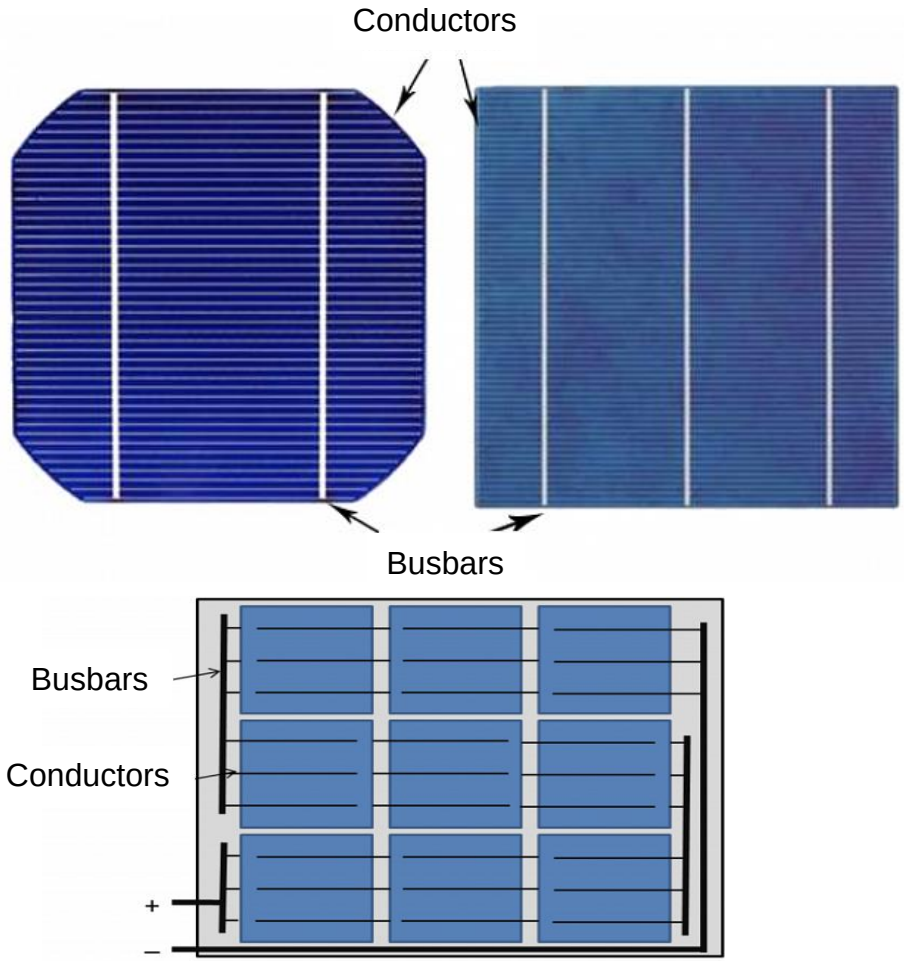
DIFFERENCES IN MONO- AND POLYCRYSTALLINE SOLAR ELEMENTS

Element type	Efficiency	Generation for 1m2	Power of element
Monocrystalline silicon solar cells	≈ 22%	220 W	+(20 – 25) %
Polycrystalline silicon cells	≈ 18%	180 W	-

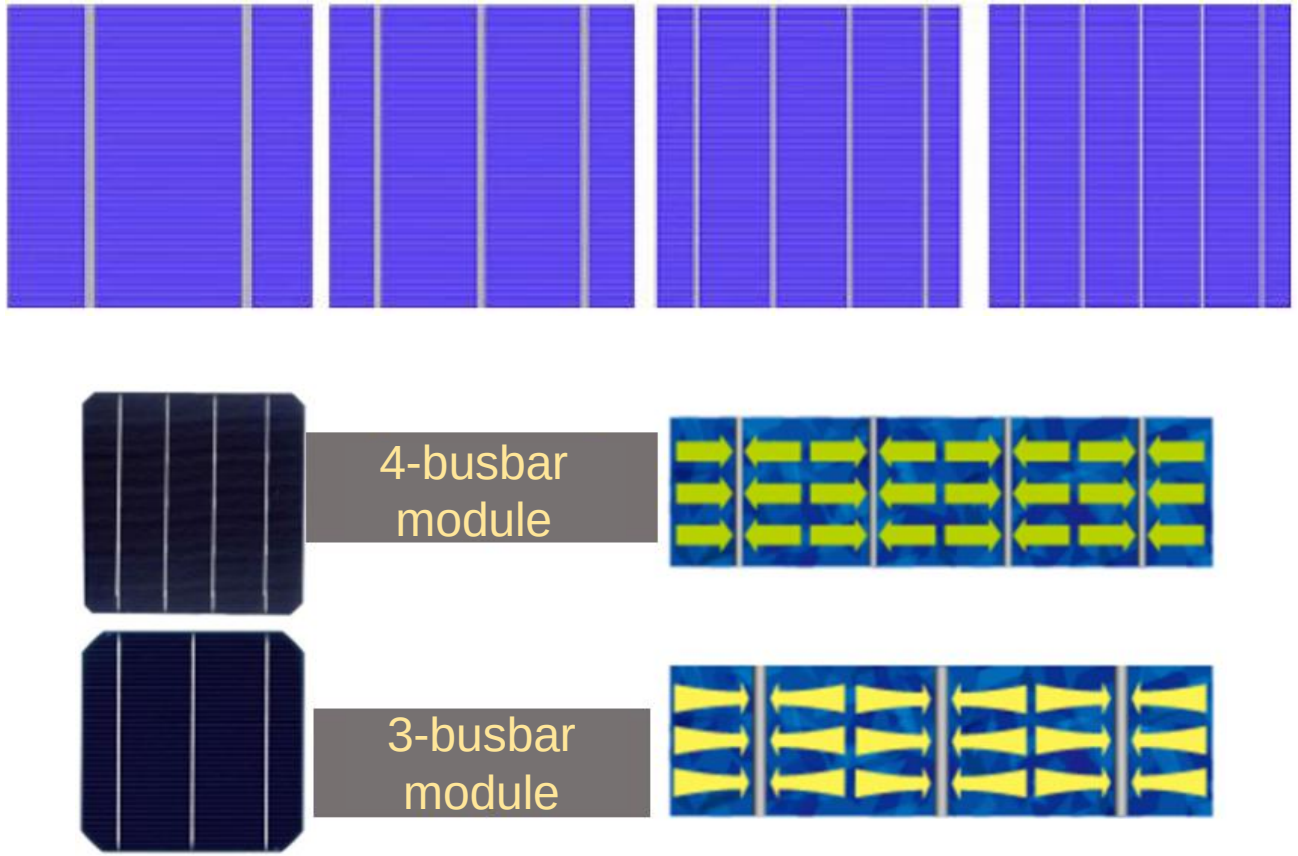
Model	Technology	Number of cells	Pmax, W	Weight, kg	Dimensions, mm
DELTA BST 360-24 M	Mono-Si	72 (6x12)	360	22,5	1956*992*35
DELTA BST 340-72 P	Poly-Si	72 (6x12)	340	22,5	1956*992*35
DELTA SM 310-24 P	Poly-Si	72 (6x12)	310	24	1956*992*35

SILICON PHOTOVOLTAIC MODULES

Busbars and conductors



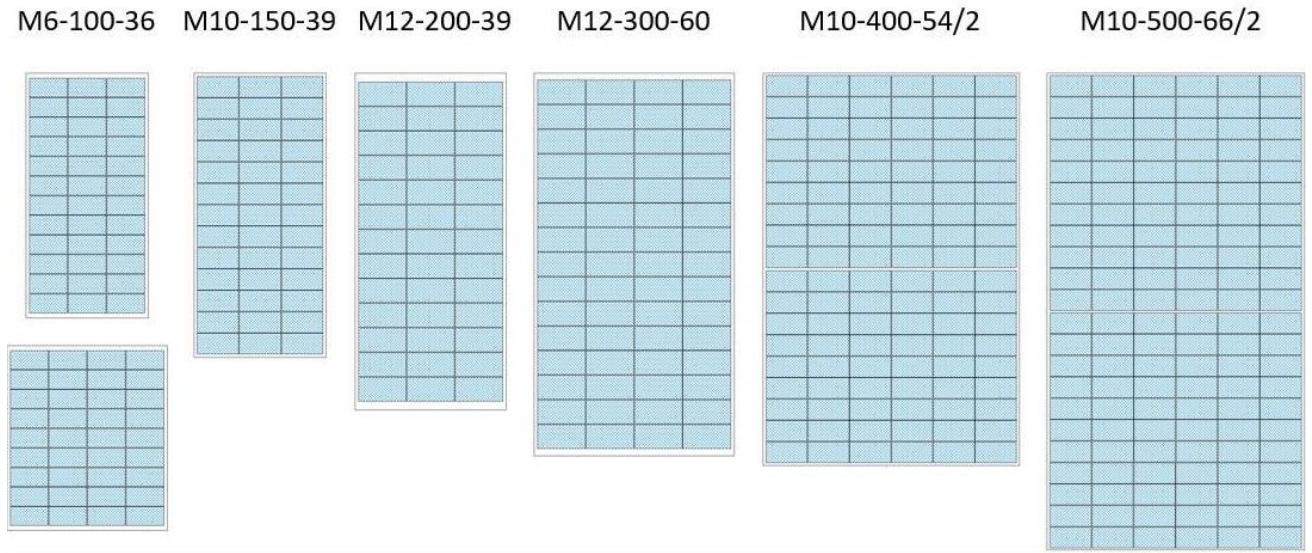
Number of busbars on elements (BusBar [BB])



SILICON PHOTOVOLTAIC MODULES

Standard cell sizes

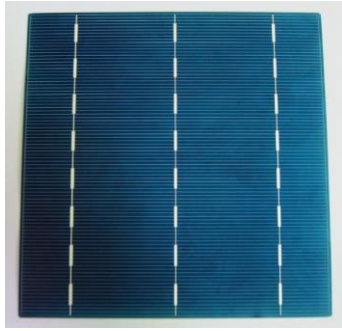
Examples of modules from different elements



SILICON PHOTOVOLTAIC MODULES

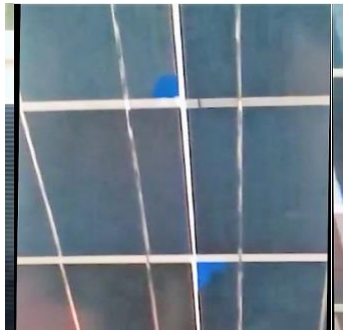
After manufacture, the photovoltaic cells are classified according to several parameters that affect their final cost.

There are four levels of quality of solar cells — **A, B, C and D.** Elements of different classes differ in their microstructure, which, in turn, affects their parameters and durability.



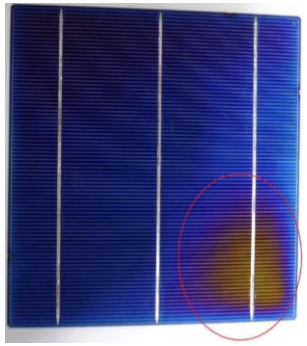
Grade A

They are elements of the highest quality. The fill factor of such elements is more than 0.7.



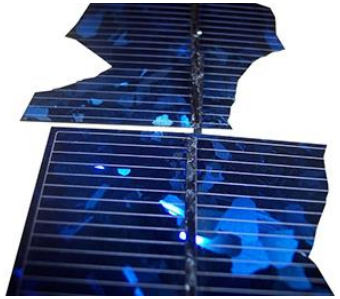
Grade B

Have hidden defects and a lower fill factor of 0,4-0,7. Their price is usually slightly lower than that of Grade A elements.



Grade C

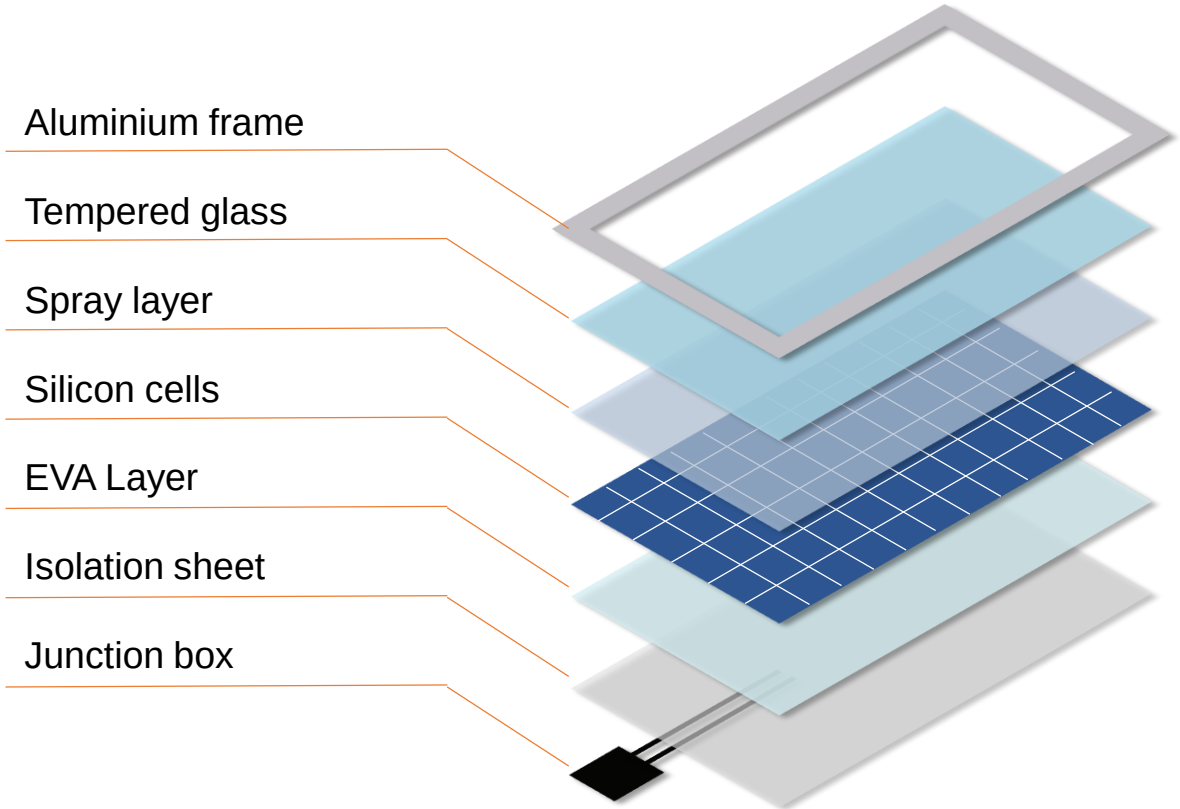
They have visible defects that affect their operation and productivity. The energy production of these elements is lower than that of Grade A or B elements. The price is much less.

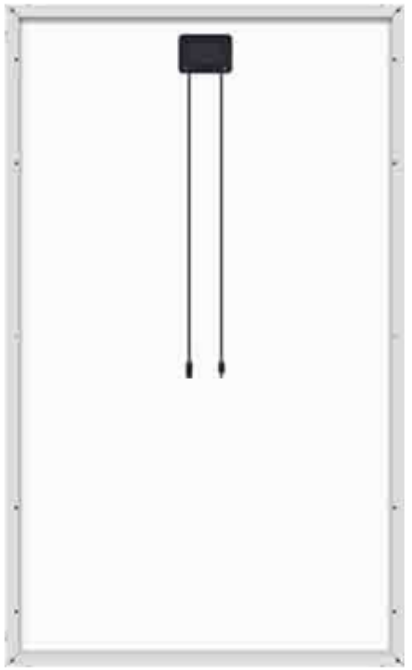


Grade D

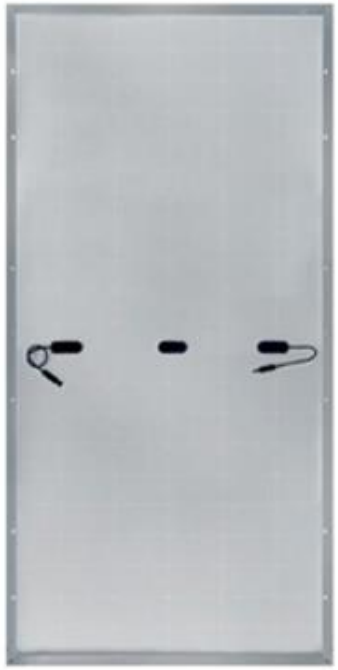
They have visible defects that affect their operation and productivity. The energy production of these elements is lower than that of Grade A or B elements. The price is much less.

THE CLASSIC STRUCTURE OF THE SOLAR PANEL





Standard panel



540 HC

Connector mc4

SOLAR PANELS

Testing

Industrial standards and requirements

STC - (Standard Test Conditions)

NOCT - (Nominal Operating Cell Temperature)

Characteristic	STC	NOCT
Irradiance, W/m2	1000	800
Cell temperature, °C	25	43-50
Environment temperature, °C	—	20
Wind velocity, m/s	—	1
Height above ground level, m	—	—
Air mass	1,5	1,5
Light spectrum	ASTM G173-03	

SOLAR PANELS

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Cells

Technology	PERC Polycrystalline 5BB
Cell thickness	220 µm
Number of cells	72 (6x12)
Cell size	156 x 156
Quality class	Grade A

Temperature coefficients

NOCT*	45±2°C
Of power (P_{max})	-0,41 %/°C
Of voltage (U_{oc})	-0,33 %/°C
Of current (I_{sc})	0,06 %/°C
Operating and storage temperature	-40 ÷ 85°C

**NOCT - normal operating temperature of solar module*

Electrical parameters (STC)*

Peak electrical power (P_{max})	340 W
Tolerance	+3 %
Nominal voltage (U_{nom})	24 V
Voltage at maximum power point (U_{mp})	38,2 V
Current at maximum power point (I_{mp})	8,9 A
Short-circuit current (I_{sc})	9,37 A
Open-circuit voltage (U_{oc})	46,4 V
Maximum system voltage	1000 V
Maximum series fuse rating	15 A
Cell efficiency	19,22 %
Module efficiency	17,61 %

Mechanical characteristics

Module dimensions	1950 x 990 x 35 mm
Weight	22,5 kg
Front glass	Tempered non-reflecting glass 3.2 mm
Frame	Anodized aluminum
Terminal box	IP 68
Connectors	MC4
Cable length	900 mm
Output cable	4 mm²
Number of diodes	3
Wind load	5400 Pa

**Standard measurement conditions (STC): light density 1000 W/m2, air mass AM = 1.5, nominal temperature 25°C*

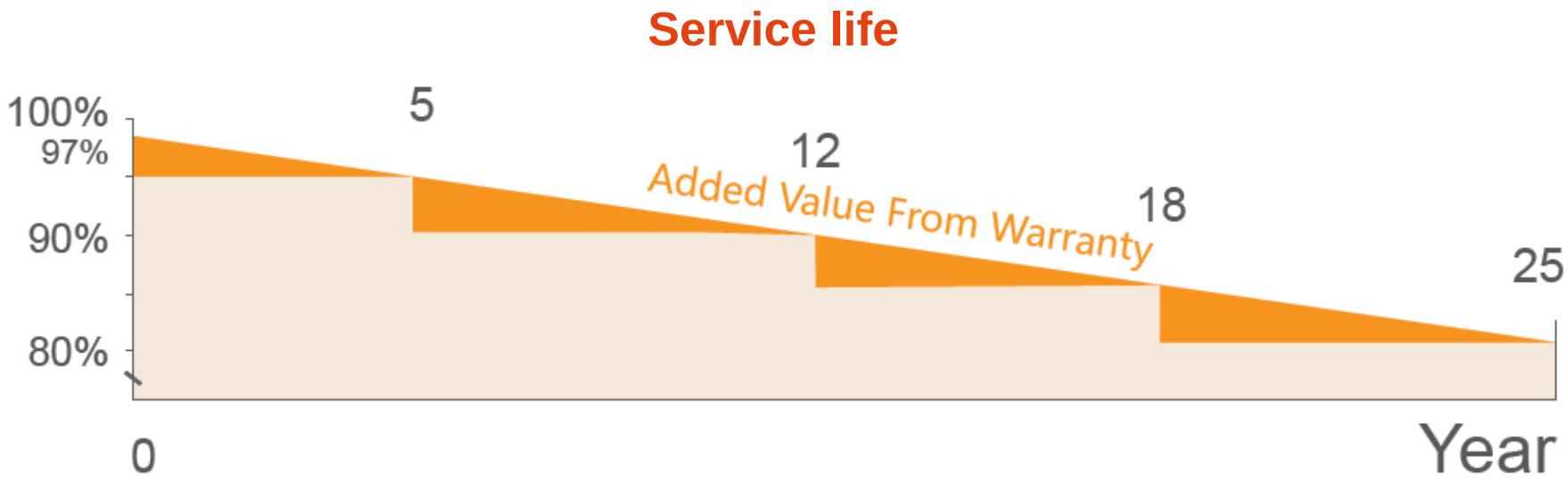
SOLAR PANELS

Claimed parameters

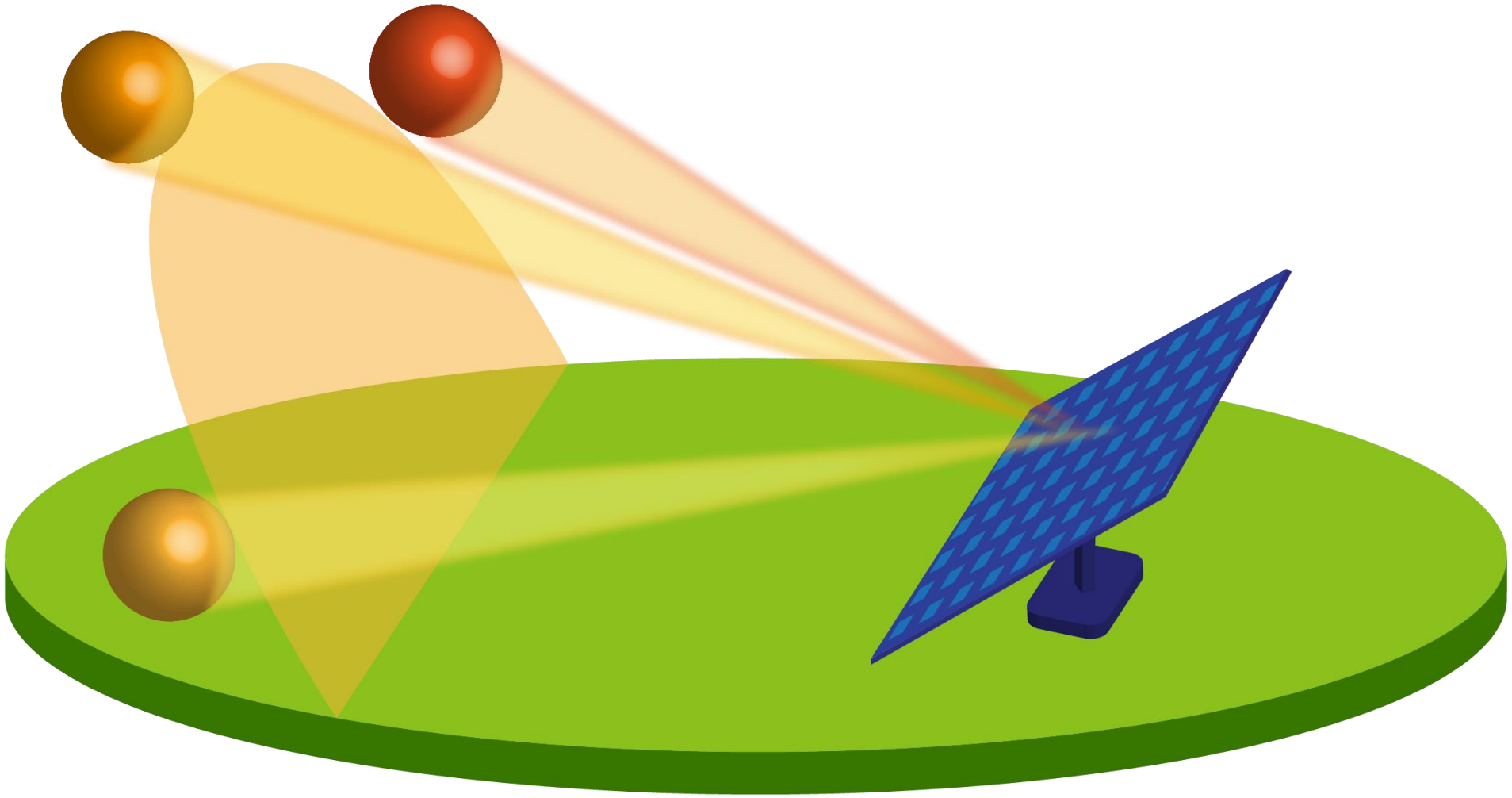
The vast majority of manufacturers give similar guarantees for the service life of solar modules.

It looks like this:

- Power reduction up to 90% after 10 (12) years of operation;
- Power reduction up to 80% after 25 years of operation;
- Warranty on materials and build quality: SM (10 years), BST (12 years), Vostok (1 year)



FACTORS AFFECTING THE OPERATION OF THE PANEL



CONTROLLERS

PWM AND MPPT CONTROLLERS

PWM

Pulse width modulation method (Pulse-width modulation).

Easy to implement, power loss up to 30%, low cost

MPPT

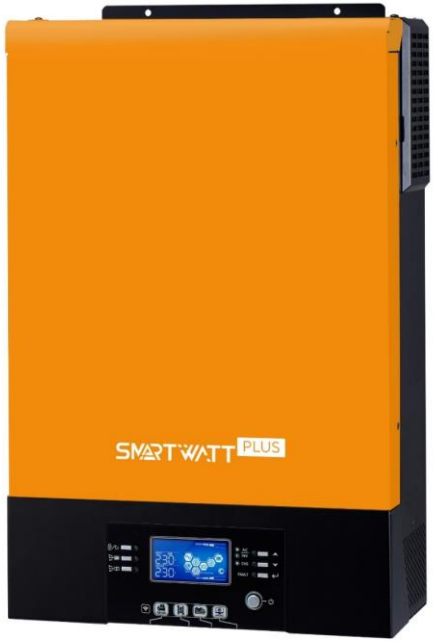
Max Power Point Tracking

Maximizes the power of solar modules, provides a larger charge current, energy utilization factor up to 99%

SMARTWATT INVERTERS

ALL INVERTER SERIES

ECO



PLUS

HYBRID

GRID

SOLAR POWER PLANT COMPONENTS

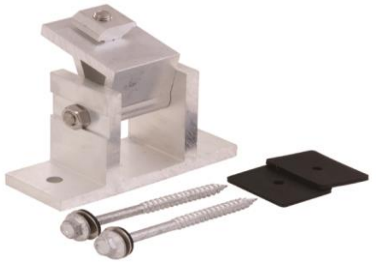
FASTENERS

L-shaped universal mount

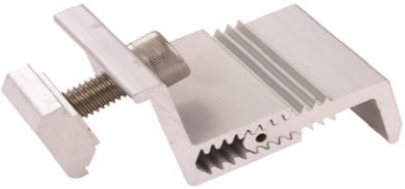
Rear stand with adjustable angle

Grounding clamp

Universal front stand



Adjustable clamp 30-45 mm



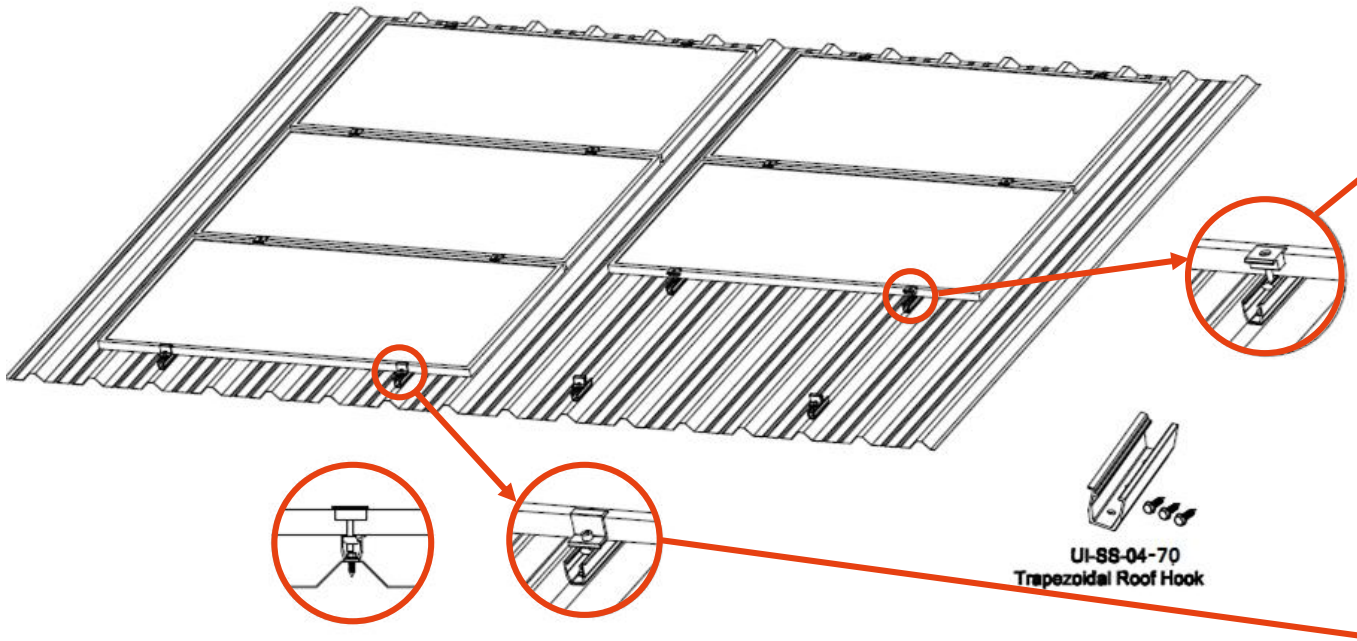
Universal clamp

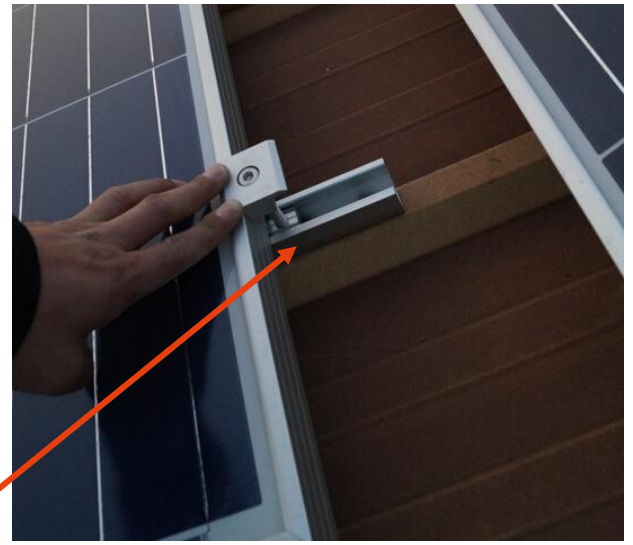
Mini - rail

Mounting profile 2.1/3.1/3.4 meters

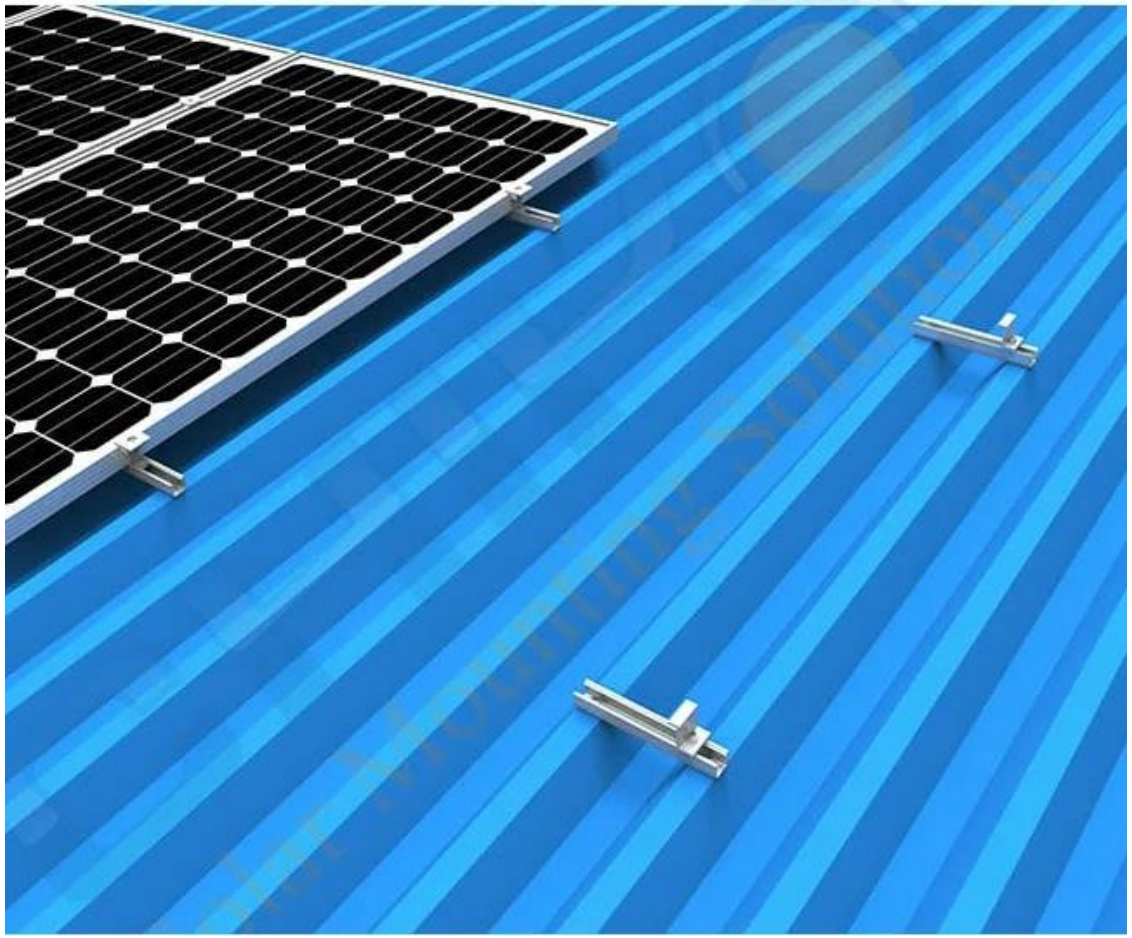
Seam connector 190 mm

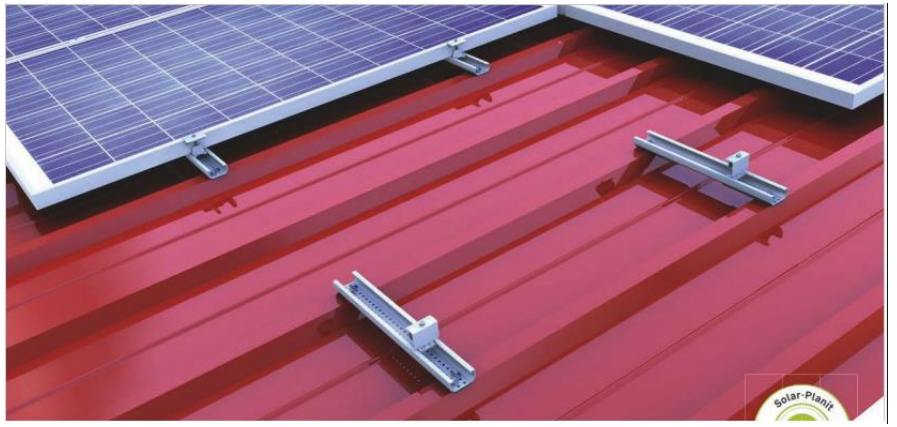
PANEL INSTALLATION: LANDSCAPE





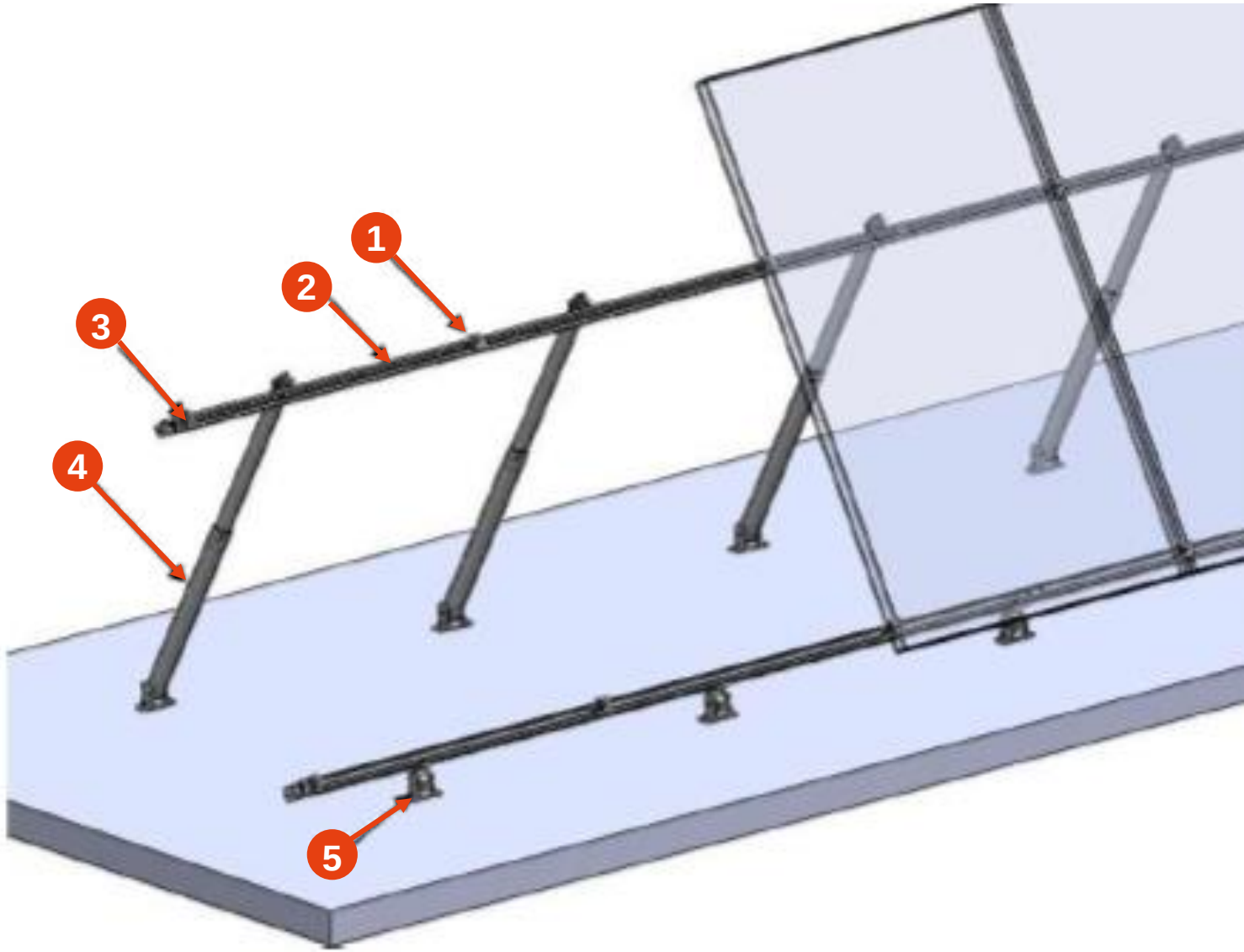
PANEL INSTALLATION: PORTRAIT





FASTENERS

1. Universal middle clamp
2. Mounting profile
3. Adjustable clamp
4. Adjustable tilt rear leg
5. Universal front leg



CONNECTORS

MC4 AB
a set of two

MC4 AB 10mm
a set of two for 10 mm2
cable section

MC4Y AB
a set of two (Old name
Connector MB4 AB)

MC4Y Cable
a set of two

MC4Y 3in1
a set of two

Connector MC4Y 4in1
a set of two

Connector MC4Y 4in1
Cable a set of two

Connector MC4Y 5in1
a set of two

MC4 Fuse
10A/15A/20A/30A

MC4 Diode

CABLE FOR SOLAR POWER PLANTS

In solar power plants, it is necessary to use a specialized cable to connect the modules.

The cable must meet the following conditions:

Fire resistance – the shell should not burn in a short-term open flame;

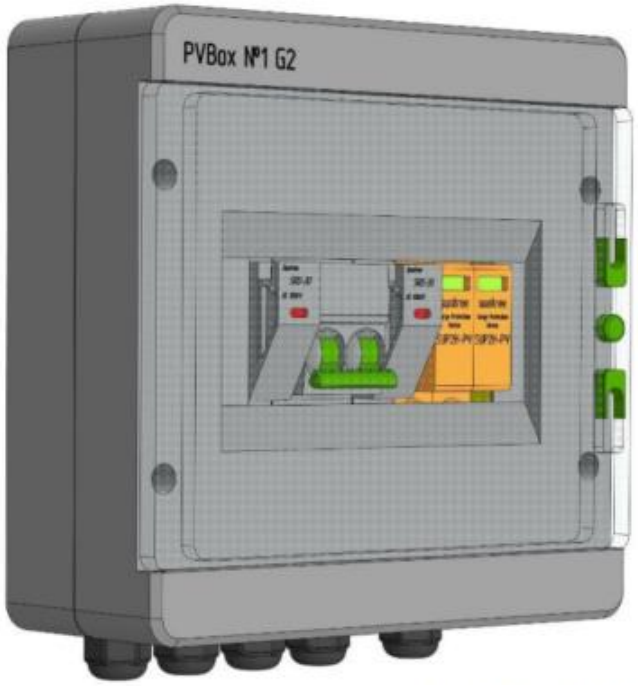
Heat resistance – conductive cores are not damaged during long-term operation in the temperature range from -30 ° C to +120 ° C;

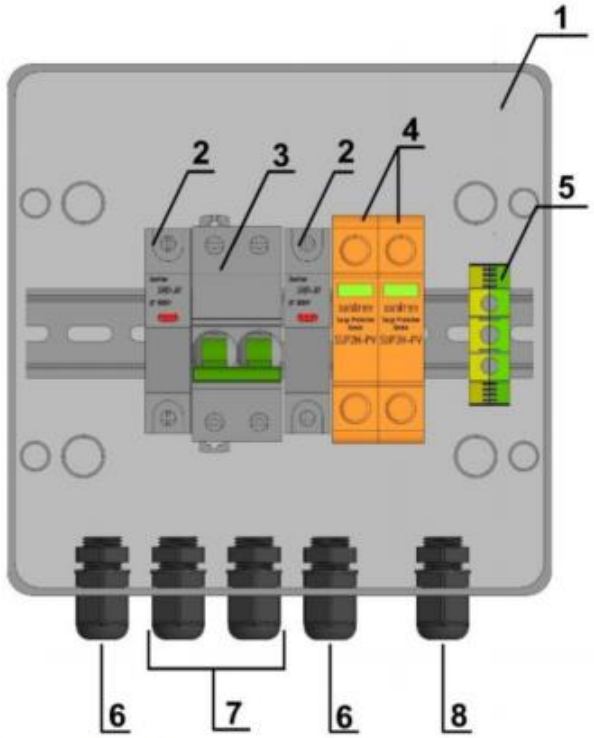
Resistance to environmental factors (frost, rain, snow, wind, ultraviolet radiation), while the service life should at least equal the period of the entire installation;

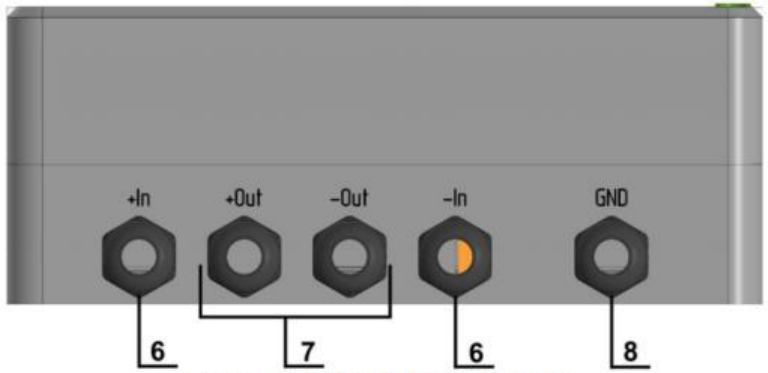
Required electrical properties.

PROTECTIVE EQUIPMENT

PVBox – this is a direct current switchboard (DCT) with a set of fuses, a surge protection device and an automatic switch in a plastic case with a degree of protection of IP65 and with the output of MC4 connectors for quick connection of photovoltaic modules.







1. Plastic case
2. Cartridge with fuse
3. Automatic switch
4. Overvoltage protection device
5. Terminal block for grounding cable connection
6. Input fittings for connection to the PV module
7. Output fittings for inverter connection
8. Fitting for grounding cable connection

THANK YOU FOR YOUR ATTENTION