

Photovoltaic solar panel: Liberta Solar

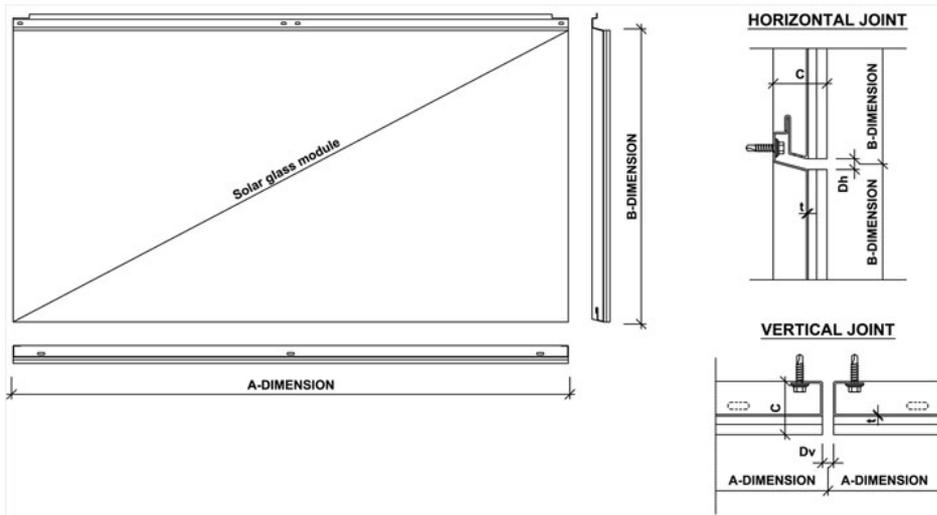


Energise your façade with architecturally impressive Liberta™ Solar panels for building integrated photo-voltaic panel systems.

Be inspired!

Experience the shape and its details on the finished facade surface. Energise your facade with Liberta Solar panels. Visualize the material and colours in different lightings and from various perspectives with the

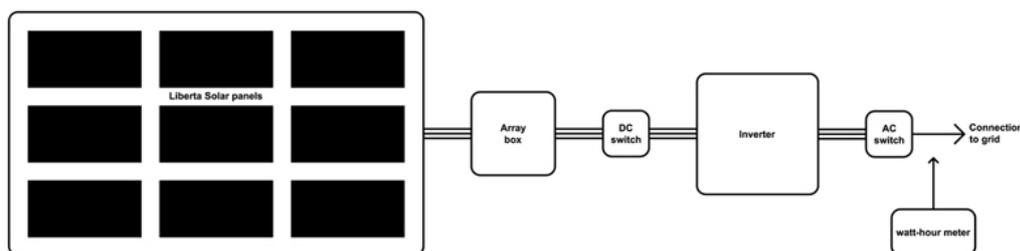
Dimensions & energy



Product	Liberta Solar panel
A-dimension:	1198 mm (glass module width 1190 mm)
B-dimension:	638 mm (glass module height 630 mm)
Depth (C):	39 mm
Horizontal joint (Dh):	8 mm
Vertical joint (Dv):	8 mm
Fastening holes:	Oval 5 x 10 mm
Ventilation holes (in panel lower edge):	Oval 5 x 15 mm
Fasteners:	Concealed
Starting fillet:	Required

Technical solution

- Liberta Solar panel is a fully integrated system (building integrated photovoltaic BIPV) to facade which converts solar radiation directly to electricity. System is not dependent on solar heating, only on radiation. It can produce electricity also in such conditions where there is no direct solar radiation for example on cloudy or foggy weather.
- Produced electricity is used directly to real-estate own purposes or fed to general grid.
- Used PV (photovoltaic) modules are based on CIGS (copper indium gallium selenide) film technology which is more and more prevailing technology in solar cells.
- Liberta Solar panels convert radiation directly to electricity. Electricity is gathered via cables behind the wall and it is transmitted to inverter which converts the electricity into alternating current (AC).
- No visible cables, no penetrations to wall (all cables are in space behind the panels)
- Two option for connection to grid:
 - When feed-in-tariff is in use, all energy is fed to the grid and bought back what needed
 - When feed-in-tariff is not in use, energy is fed for building own energy need or part of it



Power generation

Module power:	90 Wp
Power per m ² :	120 Wp
Net area for 1 kWp:	8,3 m ²

Case study:

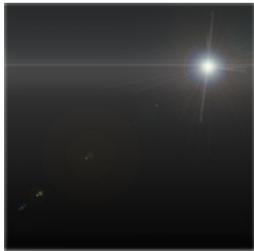
Calculations with Liberta Solar, in Finland - Helsinki region, integrated on facade to South

	per 1 m ²	per 100 m ²	per 400 m ²
Power:	0,12 kWp	12 kWp	48 kWp
Modules:	1,3 pcs	132 pcs	528 pcs
Grid feed-in/a:	76 kWh	8 070 kWh	32 280 kWh
CO2 emissions avoided/a:	67 kg	7 130 kg	28 510 kg

Colours and coatings

Colours and coatings

Solar glass module:	Nearly black surface, closest RAL colour is Traffic black 9017
Bonding components:	Black sealing
Panel frame (steel):	Colour RR45 Metallic graphite, coating PVDF matt



Nearly black glass



Metallic Graphite RR45
PVDF matt

Materials

Primary manufacturing materials

Material	Material thickness
Solar glass module	8 mm
Bonding components	6 mm
Steel frame with PVDF coating	1.2 mm (frame total depth 25 mm)

Accessories

Liberta Solar facade system completed with support studs, flashings, fasteners and electrical components provides a fully finished facade, as well as easy and quick installation.

Design Tools

General

Liberta Solar panel facade is building-integrated photovoltaic (BIPV) system - functionally and visually integrated to facade surface with no visible add-ons. Nearly black glass surface and slim 8 mm joints enable high architectural standards. Solar facade helps to fulfil new requirements for higher energy efficiency and obtaining and credits. It is suitable for new buildings as well as renovation, and can be used in office, commercial, industrial and residential construction.

Liberta Solar panel is standard size and part of the Ruukki Design Palette architectural claddings family, allowing for greater flexibility in design options when completing facade colours for the entire building. The area producing solar power does not need to stand out from the facade. To achieve a unified glass facade, Liberta Glass panels provide a visually consistent, free-sized complementary solution for corners and openings.

Liberta Solar system does not depend on the warmth of the sun, only on solar radiation. Optimum power production is from a south-facing wall. To maximize energy generation it is recommended to be installed on walls between southeast and southwest. On walls facing east or west some of the production capacity will be lost. Any obstacles casting a shadow, either on the building itself or other objects, should also be taken into consideration. Any solar radiation reflected from water or snow cover will increase the panels' output.

Liberta Solar panels are suitable for use in condition classes C2-C3 (EN 12944-2). If you are dealing with condition class C4, contact Ruukki's technical support.

Pre-designed delivery and inquiry

Ruukki will deliver a conceptual design for mechanical as well electrical delivery, which will set out the size and structure of the facade panel components and electrical system and components in more detail. Ruukki's experts will always examine the delivery content, material and design for each site on a case-by-case basis together with the customer. The conceptual design, feasibility study and inquiry will be based on the initial information on the site supplied by the customer (initial information form).

Panel area, sizes and joints

Size of the Liberta Solar panel is always a standard, 1190 mm x 630 mm (width x height). With 8 mm horizontal and vertical joints, the panel size from the middle of the joints is 1198 mm x 638 mm (A-dimension x B-dimension). The depth of the panel is 39 mm. To maximize the energy production it is recommended that the panel area is as solid and unified as possible. The number of square metres of the solar panels depends on the capacity required or the surface area available. The placement, potential and optimisation of the panels are always examined on a site-specific basis by Ruukki's experts.

Colour coated support studs should always be used at the vertical joints between the panels, because they will be visible for the width of the joint. Zinc coated support studs are used in the middle areas behind the panels.

Dimensioning

The highest characteristic wind load that can be applied to an individual panel is ± 2.4 kg/m². The panels are attached to the substructure using vertical support studs. The wind suction load will be transferred to the vertical studs via the attachment screws and the pressure load via surface pressure.

The substructure to which the support studs are attached must be sufficiently rigid. As a basic rule, the substructure's deflection limit is required to be $L/400$, where L is the span of the wall's load-bearing structure.

The weight of the Liberta Solar facade, including its support studs and other accessories, is 26 kg/m². Each panel weighs app. 17 kg. This must be taken into account when accessing the loading endurance of the substructure. The shiny glass facade also places strict restrictions on any measurement deviations in the positioning of the support studs. Since the panels are fastened directly to the support studs without any possibility for adjustment, the support studs must be positioned precisely.

Fastening

The panels have fastening holes at their top edge for the fastening screws: one hole at each corner and two in the middle. At least three screws must be used for each panel. In certain places, earthing screws will need to be fastened, as indicated in the electrical designs. Earthing screws are not counted as fastening screws.

The lower edges of the panels will be attached with a tongue-and-groove arrangement to the upper edges of the panels below. The lower edges of the lowest panels will be attached using separate starting fillets.

Ventilation

For the Liberta Solar facade structure to function properly, it is extremely important that its background is ventilated as well as possible, since electrical output can be hampered if the module's temperature rises too high. The support studs used as a standard are 35 mm in height.

It is extremely important that supply air and ventilation gaps of at least 25 mm are left at the top and bottom edges of the facade. This must be taken into account in any discontinuities and non-contiguous areas in the facade. When designing the wall structure, it is important that the ventilation gaps can be easily inspected and maintained annually.

Fire properties

In terms of fire resistance, Liberta Solar facade is comparable to a glass facade. The requirement concerning exterior surfaces applies to the panels. Glass and steel, the main components of the panels, are class A1 construction materials, and as such are suited to all types of buildings. Since the system contains "minor quantities" of other materials, the fire properties of these must always be assessed in collaboration with the local authorities.

Installation & maintenance

Installation

Main points of mechanical installation

- Installation principle is same as in Liberta elegant 500 panels
- Support studs are fastened to backing wall -> the surface is straightened if needed
- Starting fillets are fastened to the support studs
- Solar panels are fastened to the support studs by fastening screws
- Installation of panels is started from left lower corner
- Horizontal and vertical joints between the panels are standard 8 mm

Main points of electrical installation

- No visible cables, no penetrations to wall
- All cabling behind modules, ready wiring harness
- Reliable factory-made connectors
- Fast connection, connectors easy to use
- Wiring system easy to follow for an electrician
- Inverter fully automatic with all safety aspects
- Wiring and connection work is everyday work for an electrician

The electrical system must be installed by an electrician with the appropriate qualification for this class of work. The electrician must read the designs and safety guidelines delivered with the system. The installation itself is similar to any typical electrical installation work performed on buildings.

Installation instruction will be delivered with the Solar panel delivery package.

Maintenance

Liberta solar facade is nearly maintenance-free. However, regular visual inspections must be performed:

- Check the surface of Liberta Solar panels for possible dust and dirt accumulated and blocking.
- Check and ensure that the minimum ventilation gap (25 mm) at the bottom and the top is left and working in all conditions (for example check related flashing and if possible check the minimum ventilation cavity (35 mm) behind the panels left).

In case of Liberta Solar panel broken down on the wall installed, the broken panel needs to be replaced with new one. One individual panel can be replaced by dismantling other panels on the top of the panel to be replaced. The panels are dismantled one by one starting from the top.

If it is found that the normal electricity production has decreased substantially, it could be that some of the panels have broken down. Then the electrical circles shall be checked by electrician.

- Our sales and technical support are happy to give you more information. Visit www.ruukki.com/contact-us.

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