VR Enbekon® eG

Intelligent energy concepts

Installation Instruction & Maintenance Manual

For Crystalline PV modules

Enbekon DIAMOND

240 – 250P

1. Introduction:

This installation instruction manual provides information about VR Enbekon eG crystalline solar photovoltaic modules. VR Enbekon eG provides the highest quality polycrystalline silicon solar photovoltaic modules with IEC61215 and IEC61730 certified in a range of sizes designed to meet the requirements of the most demanding energy and power users worldwide. This manual is valid for Enbekon DIAMOND 240 - 250P modules.

2. Power modules:

VR Enbekon eG solar photovoltaic modules consist of a series of electrically interconnected crystalline silicon solar cells, which are permanently encapsulated between a low iron toughened glass and backsheet. The entire laminate is secured within an anodized aluminum frame for structural strength; ease for installation and to protect the cells from the most severe environmental conditions.

3. Applications

VR Enbekon eG modules are a highly reliable, virtually maintenance-free direct current (DC) power source, designed to operate most efficiently in sunlight. VR Enbekon eG PV series modules are ideal for solar power stations, grid connected residential system and many other applications either with or without the use of storage batteries.

4. Permit:

Before installing your system, contact local authorities to determine the necessary permit, installation and inspection requirements.

5. Climate Condition

Install the VR Enbekon eG solar photovoltaic crystalline series modules in the following conditions:

Ambient temperature:	-20 °C to +40 °C
Operation temperature:	-40 °C to +85 °C
Storage temperature:	-40 °C to +85 °C
Humidity:	below 85RH%
Wind pressure:	130 km/h
Snow Load Pressure:	up to 5400 Pa

6. Site Selection:

In most applications, VR Enbekon eG PV modules should be installed in a location where they will receive maximum sunlight throughout the year. In the Northern Hemisphere, the module should typically face south, and in the Southern Hemisphere, the modules should typically face north. Modules facing 30 degrees away from true South (or North) will lose approximately 10 to 15 per cent of their power output. If the module faces 60 degrees away from true South (or North), the power loss will be 20 to 30 per cent.

When choosing a site, avoid trees, buildings or obstructions, which could cast shadows on the solar photovoltaic modules especially during the winter months when the arc of the sun is lowest over the horizon. Shading causes loss of output, even though the factory fitted bypass diodes of the module will minimize any such loss. Do not install the module near naked flame or flammable materials. Do not install the module in a location where it would be immersed in water or continually exposed to water from a sprinkler or fountain etc.

7. Module tilt angle:

VR Enbekon eG PV modules connected in series should be installed at same orientation and angle. Different orientation or angle may cause loss of output power due to difference of amount of sunlight exposed to the module.

VR Enbekon eG PV modules produce the most power when they are pointed directly at the sun. For installations where the modules are attached to a permanent structure, the modules should be tilted for optimum winter performance. As a rule, if the system power production is adequate in winter, it will be satisfactory during the rest of the year. The module tilt angle is measured between the solar modules and the ground (Figure 1). Optimal tilting of module is almost the same as the latitude of installation location.

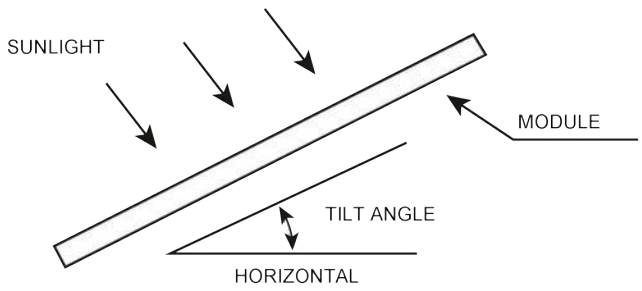


Figure 1

8. Mounting and notes:

Systems should be installed by qualified personnel only. It involves electricity, and can be dangerous if the personnel are not familiar with the appropriate safety procedures.

The module frame is made of anodized aluminum, and therefore corrosion can occur if the module is subject to a salt water environment with contact to a rack of another type of metal (Electrolysis Corrosion). If required, PVC or stainless steel washers can be placed between the module frame and support structure to prevent this type of corrosion. Module support structures that are to be used to support modules at correct tilt angles should be wind and snow load rated for use by the appropriate local and civil codes prior to installation.

VR Enbekon PV modules can be mounted as following method:

Method 1:
Using corrosion-proof screws on existing Installation

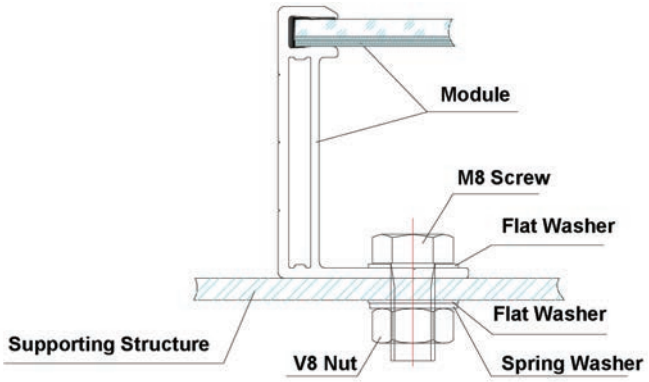


Figure 2a

Method 1: Using corrosion-proof screws (M8) on the existing installing holes in the module frame. The frame of each module has 4 mounting holes (12mm*8mm) used to secure the modules to supporting structure. The module frame must be attached to a supporting rack using M8 stainless steel hardware together with spring washers and flat washers in four places symmetrical on the module. See method a of figure 1. The applied torque is about 8 Newton-meters.

Method 2:
Using suitable module clamps on the module frame.

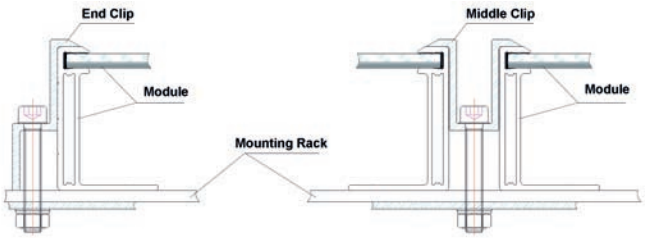


Figure 2a

Using suitable module clamps on the module frame, see figure 2, method b. The module frame must be attached to supporting rack using M8 stainless steel hardware together with corrosion-proof clips in four places on the module. The applied torque is about 8 Newton-meters.

Notes:
(1) The module clamps must not come into contact with the front glass and must not deform the frame. Avoid shadowing effects from the module clamps and the insertion systems. Is not permitted to modify the module frame under any circumstances it can cause the loss of waranty. Recommended distance between 2 Solar modules is 5mm considering linear thermal expansion of the module frames.

(2) Clearance between the module frame and mounting surface may be required to prevent the junction box from touching the surface, and to circulate cooling air around the back of the module.

(3) The modules are not designed for integral mounting as part of a roof or wall. The mounting design may have an impact on the fire resistance. If the modules are to be installed on the roof of a building, the fire resistance of roof covering or wall should be rated for the application. Here the standoff method or the rack method is recommended. The modules are supported parallel to surface of the building roof. Clearance between the module frames and surface of the building roof is required to prevent wiring damage and to allow air to circulate behind the module. The recommended standoff height is 115mm. Any slope less than 5in/ft (127mm/305mm) required to maintain a fire class rating. Do not mount module in such way that the drain holes of module are intended to block up.

(4) Do not step on the module, although modules are quite rugged, the glass can be broken (and the module will no longer work properly) if it is dropped or hit by tools or other objects.

9. Grounding:
All module frames and mounting racks must be properly grounded. Proper grounding is achieved by connecting the module frame(s) and structural members continuously one to another using a suitable grounding conductor. The grounding conductor or strap maybe copper, copper alloy, or other material acceptable for use as an electrical conductor. The grounding conductor must then make a connection to earth using a suitable earth ground electrode.

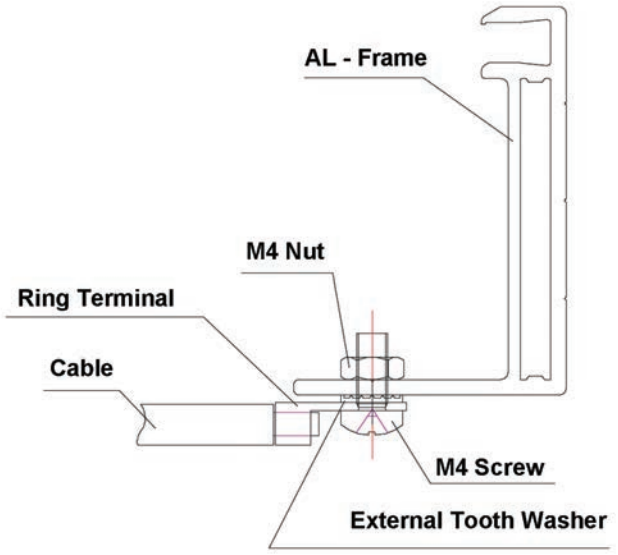


Figure 3 (Schematic drawing for module grounding)

The rack must also be grounded unless they are mechanically connected by nuts and bolts to the grounded modules. The array frame shall be grounded.

10. Bypass Diodes and Blocking Diodes
Partial shading of an individual module can cause a reverse voltage across the shaded module. Current is then forced through the shaded area by the other modules.

When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode and bypass the shaded module, thereby minimizing module heating and array current losses.

In system utilizing a battery, blocking diodes are typically placed between the battery and the module output to prevent battery discharge at night.

Diodes that are used as blocking diodes must: Have a Rated Average Forward Current [IF(AV)] above maximum system current at highest module operating temperature. Have a Rated Repetitive Peak Reverse Voltage [VRRM] above maximum system voltage at lowest module operating temperature.

11. Warning and notes:
The modules generate electricity when exposed to light. Array of many modules can cause lethal electrical shock and burn hazards. Only authorized and trained personnel should have access to these modules. To reduce the risk of electrical shock or burns, modules maybe covered with an opaque material during installation to avoid electrical shocks or burns. Do not touch live terminals with bare hands. Use insulated tools for electrical connections.

Use appropriate methods to mount modules. Fall of modules from high place will cause death, injury or damage.
The module has a pair of male and female waterproof connectors. For a series electrical connection, connect positive (+) connector of first module to negative (-) connector of the following module.
Do not short the positive and the negative. Do not disconnect under load. Be sure connectors have no gap between the insulators. In case there is a gap, a fire and/or an electrical shock may occur.

Notes:

(1) Artificially concentrated sunlight shall not be directed on the module. The rated electrical characteristics are within 10 percent of measured values under standard test conditions (Irradiance of 1000W/m2, AM 1.5 spectrum, and cell temperature of 25°C).

(2) Under normal conditions, a solar photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly the value of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes, and sizes of controls connected to the output.

(3) If you install modules in parallel electrically, each module (or series string of modules so connected) shall be provided with the maximum series fuse as specified.

12. Modules Wiring
Each module has two #12 AWG type standard 90°C sunlight resistant output cables each terminated with plug & ply connectors. This cable is suitable for applications where wiring is exposed to the direct rays of the Sun. We recommend that all wiring and electrical connections are done in accordance with national electrical rules and regulations.

For field connections, use the minimum No. #12 AWG copper wires insulated for a minimum of 90°C and sunlight resistant as well. The cable cross section should be 4 mm. Refer to table 1 for the maximum electrical rating of series fuse.

13. Type of product Application:
"The modules are qualified for application class A: Hazardous voltage (IEC61730: higher than 50V DC; EN61730: higher than 120V), hazardous power applications (higher than 240W) where general contract access is anticipated (modules qualified for safety through EN IEC61730-1 and EN IEC61730-2 within this application class are considered to meet the requirements for safety class II)"

14. Maintenance:
Under most weather conditions, normal rainfall is sufficient to keepthe module glass surface clean. If dirt build-up becomes excessive, clean the glass only with a soft cloth using mild detergent and ionized water. Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will not "elf clean" as effectively as modules mounted at a 15° tilt or greater. Once a year, check the tightness of terminal screws and the general condition of the wiring. Also, check to be sure that mounting hardware is tight. Loose connections will result in damage for array. Changed module must be the same kind and type. Do not touch live parts of cables and connectors. Use appropriate safety equipment (insulated tools, insulating gloves, etc.), when touching them.

Cover the front surface of the module by an opaque or other material when repairing. The modules when exposed to sunlight generate high voltage and are dangerous.

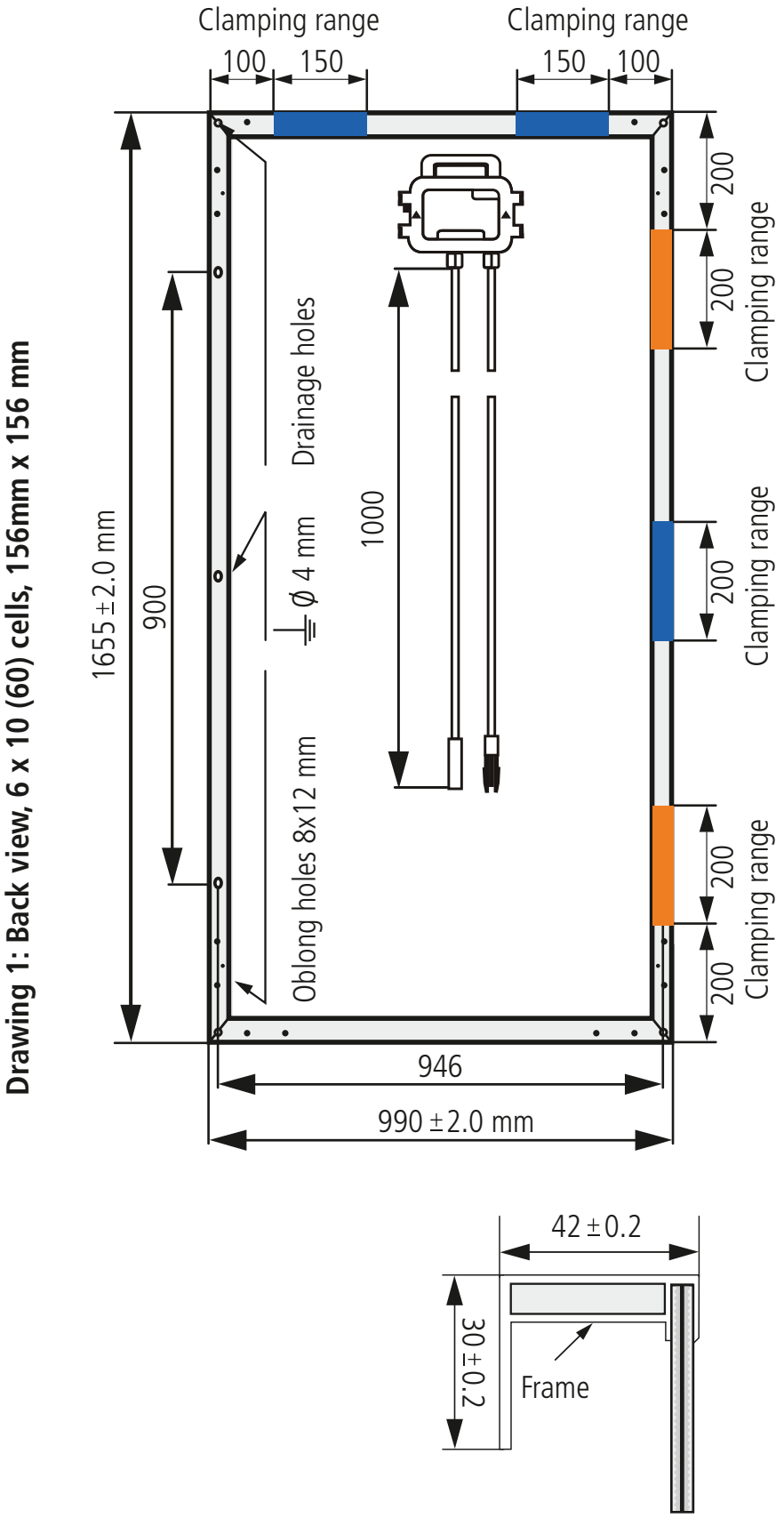
15. Specifications: see sketches 1
1. Standard Test Condition(STC) of Irradiance of 1000W/m² AM1.5 Solar Spectrum & 25°C cell temperature
2. Nominal Operating Cell Temperature (NOCT): 46±2°C
3. See module drawing for mounting and grounding holes locations

16. Regulations
When installing PV-systems, local requirements such as:

- Application norms
- Construction regulations
- Accident prevention regulations
- Technical connection conditions
- Etc.

must be borne in mind.

17. Sketch and drawings



Drawing 1: Back view, 6 x 10 (60) cells, 156mm x 156 mm

Remark: For electrical data consult the data-sheet or module labels!

vr-enbekon.de

VR Enbekon® eG
Intelligent energy concepts

Dauchinger Strasse 5, 78652 Deisslingen
+49(0) 7420 920 18-0
+49(0) 7420 920 18-20
service@vr-enbekon.de
vr-enbekon.de

Stand 07/2013 | VRE 02097