ZORLUENERJİ

ZES INSTALLATION MANUAL-v1.0

1. GENERAL INFORMATION

Firstly, thank you for choosing ZES Crystalline Photovoltaic Modules.

This document contains important information for the installation of ZES Crystalline Photovoltaic Modules. Please read this document before unpacking or installing the solar modules.

Prior to installation, it must be determined that the modules are applicable for the intended use. The interaction with other system components must be possible without damage to either the modules or components. All local, national and international codes, installation and inspection regulations shall be applied. Installation and connection of the modules must be performed by a qualified, authorized expert.

Zorlu Enerji recommends to talk with your installer such that the necessary forms and/or applications that are required by the local electric grid operator are filled out. Please retain this document for your records. This User Guide shall be applied for modules listed below.

ZES-440HC-166-01

ZES-445HC-166-01

ZES-450HC-166-01

2. LIMITATION OF LIABILITY

Zorlu Enerji expressly refuses to be responsible for any damage or injury that may occur during the assembly, installation and maintenance processes of photovoltaic (PV) products. However, the explanations and recommendations contained in the guide don't create any external or internal warranty. Zorlu Enerji reserves the right to change its products and information about the products without the prior knowledge of its customers.

3. TRANSPORTATION AND STORAGE

ZES Crystalline Photovoltaic Modules must be transported in the supplied packaging only and should be kept in the packaging until they are ready to be installed. Protect pallets against movement and exposure to damage during transportation, don't drop Pallets or PV modules. Do not exceed max. Number of pallets to be stored on each other as stack. Store PV modules in dry and ventilated areas. Do not install modules near flammable gas or vapors.

Remove PV modules from pallet one at each time with at least two people. Handle PV Modules with care. Carry PV modules only from frames, don't lift the module by its J-box or connection cables. Never step or walk on PV modules, don't drop or place heavy objects on them. Be careful when placing PV modules on hard surfaces, and secure them from falling. Broken glass can result personal injury. PV modules with broken glass cannot be repaired and must not be used. If there had been any problem occurred at modules during transportation please contact your transport company.

4. SAFETY

All installations must be performed in compliance with all applicable regional and local codes or other national or international electrical, fire and safety standards. Ensure that all personnel are aware of and adhere to accident prevention and safety regulations. Wear suitable protection (helmet, gloves, etc.) during the installation. Prevent direct contact with 30VDC or greater, and to protect your hands from sharp edges during the installation. Do not unplug connectors under load. Use dry and electrically insulated tools. Never install broken or damaged PV modules.

Moreover never open junction box or try to repair a module. Do not expose concentrated light to the PV module.

Never install modules on rainy and windy weather. Rooftop systems should only be installed if roof structure is capable of carrying extra weight and the wind load of PV system, this calculation must be done by a certified building specialist or construction engineer. Class of protection for electrical shock based on **Safety Class 2.**

5. PLANNING

Find out the optimum orientation and tilt of the PV modules for your region to achieve the maximum annual yield. PV modules should be oriented min 3° max 80° angle. At least 10° angle is suggested for self-clearance of the PV module.

Install the modules so that they face the sun which is necessary for the maximum energy output. Avoid modules from shadowing and partial shading.

Modules cannot be installed above an altitude of 2000 meters.

The solar modules are designed to use in operating temperatures between –40°C to +85°C, additionally wind loads up to maximum 2,400 Pa and snow loads up to max. 5,400 Pa.

The solar modules should be installed with an appropriate mounting system which is designed to be used at rooftop or ground. There should be a minimum 10mm gap between two modules. During normal operation, a module may generate a greater current or higher voltage than that determined under standardized test conditions (STC: 1000 W/m2, AM 1.5 and 25 °C cell temperature).

So please multiply open circuit voltage Voc and short circuit current Isc with a *1.25* safety factor for choosing the system components such as fuses and cables. Also please take into account local lowest and highest temperatures where PV module will be installed. Maximum **overcurrent** protection rating =20 A. ***The maximum number of PV modules that can be connected in a series string must be calculated in accordance with applicable regulations in such a way that the specified maximum system voltage of the PV module and all other electrical DC components will not be exceeded in open-circuit operation at the lowest temperature expected at the PV system location.***

The maximum system voltage is 1500V.

6. ELECTRICAL INSTALLATION

ZES Crystalline Photovoltaic Modules have up to 1200mm long solar cables, one negative (-) and one positive (+) connectors, with these connectors you can make serial wiring by connecting each positive and negative pole of near modules. Also only use connectors at parallel wiring the modules.

Please check the cable length with Sales team.

Only connect the modules which are same type and same power class. Cover the front side of the module during the installation to lower the risk of electrical hazard. Switch off the DC circuit breaker before disconnecting the PV modules. Never touch two poles of connectors at the same time.

Use coverings to prevent cables from direct sun shine or use special UV resistant solar cables during electrical installation. Furthermore use minimum 4mm^2 cable diameter size.

Never apply stress to the cables moreover always fix cables to the mounting structure or module frame with UV resistant tools.

Always check the local regulations before installation. Check the compatibility of the inverter with modules. Measure the open circuit voltage of the strings before plug in to inverter, if there is any unexpected difference at voltage, control the connections. Ensure that the modules are disconnected at the inverter prior to separation. Moreover wait for some time for discharging of inverter components after shut down for intervention.

Behind each ZES panel is a junction box with cables and connectors. The cross- sectional area of the cables used in the junction box is 4 mm^2; **conductor row material is copper**; voltage rating: 1800 V DC, and operating temperature range: -40 °C to + 90 ° C. Connectors used in the junction box; voltage rating: 1500 V DC, current rating: 15A (at 85 ° C ambient temperature) and operating temperature range: -40 ° C to + 90 ° C and protection rating IP68. Bypass diodes voltage rating is 1500V current rating is 20A. Therefore, if a cable and / or connector plug-in is required, you must select the cable and / or connector that matches these values. For this purpose, you must consult TS EN 61730-1 to determine the value of the conductors which comply with these specifications and meet your requirements.

7. MECHANICAL INSTALLATION

ZES Crystalline Photovoltaic Modules have been designed for max 5400Pa loads for snow, 2400Pa for wind.

Mounting system must be designed to hold on weight, wind, snow and thermal loads of the PV modules will be installed.

Don’t walk on the module or apply pressure to the back side of the module which may occur micro cracks at inner cells and deformation at the module, this kind of defects are out

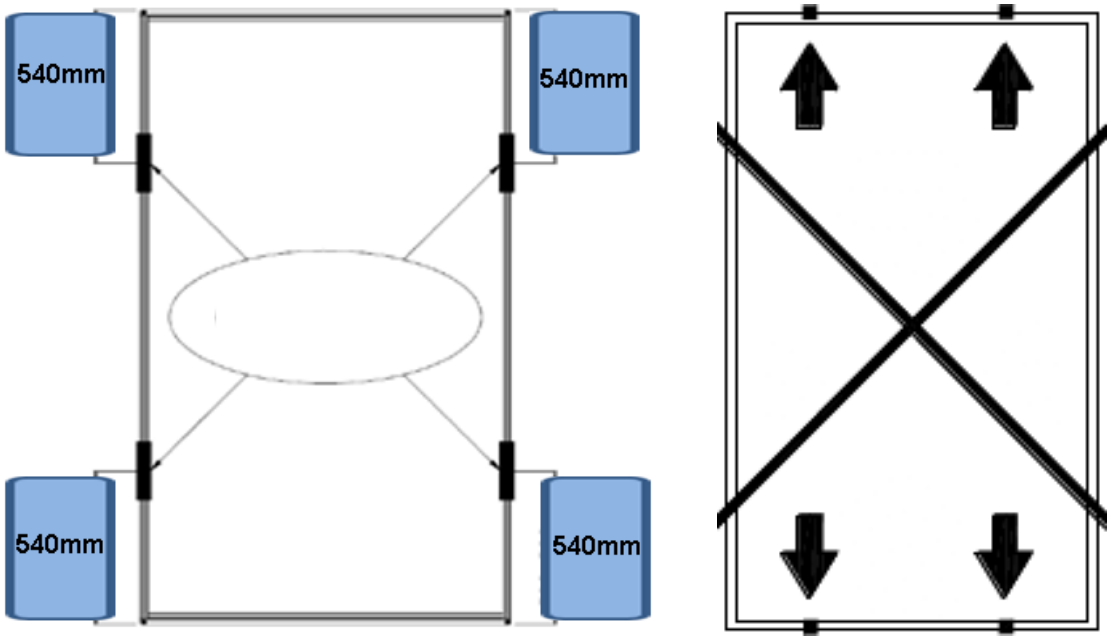
ZES Crystalline Photovoltaic Modules can install either vertical or horizontal.

PV Module frames are coated with anodized aluminum for corrosion resistant, please use grounding hole at frame an penetrate the coating. Use at least 4mm^2 copper wires to ground modules between each other.

High system voltages could be induced in the event of an indirect lightning strike, which could cause damage to PV system components. The open area of wire loops should be minimized, in order to reduce the risk of lightning induced voltage surges. Also install an external surge protection system for safety.

The clamp-on panel fasteners are fixed to the purlin profile starting from the outer part, with an inner part of both panels. The panel clamps must not touch the glass on the front surface or damage the panel frame. After fixing the last panel, the fixing of the array with an external fixing part is completed.

The panels should be fixed at the points indicated as shown below. When fixing parts are used in this arrangement, 5400 Pa strength will be provided.



The clamps distance from corner 540 mm for both 72 cells and 60 cells.

Important: The short-edge fixing of the ZES modules does not comply with the installation regulations.

8. MAINTENANCE AND CLEANING

Do not try to repair PV Module or J box, also do not change the diodes. Check the PV system annually if there is any corrosion at the parts and all connections are secured.

Clean modules only with a soft sponge otherwise there may occur micro scratch. Make cleaning when

modules are cool like early in the morning or late afternoon.

Do not use Isopropyl alcohol (IPA) or any corrosive chemical for cleaning. Do not clean snow from PV modules with force moreover do not use sharp objects to remove ice.

9. FIRE SECURİTY

Fire Class C.

* For building or structural fire safety, follow the local legislation and regulations.

* Since the structure and construction of roofs can have an impact on the fire safety of a building; the legislation

Do not install on unsuitable roof structures.

* Use system components such as earth, residual current fuse and phases specified by local authorities.

* Do not position