

INSTALLATION GUIDE FOR LDK SOLAR PHOTOVOLTAIC MODULES

Version: April 2011

1、 INTRODUCTION

This guide contains information regarding the installation and safe handling of LDK Solar photovoltaic module. All instructions should be read and understood before attempting to install. If there are any questions, please contact LDK Solar Technical Service department for further explanation. The following document refers to the following crystalline modules manufactured by LDK Solar:

Mono-crystalline:

- LDK-160D-24(s) to LDK-200D-24(s), LDK-200D-20(s) to LDK-250D-20(s).
- LDK-200D-20 to LDK-250D-20.

Poly-crystalline :

- LDK-160P-24(s) to LDK-200P-24(s), LDK-200P-20(s) to LDK-250P-20(s) and LDK-250P-24(s) to LDK-290P-24(s).
- LDK-200P-20 to LDK-250P-20 and LDK-250P-24 to LDK-290P-24.

1.1 Disclaimer of liability

Because the use of this manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) product are beyond LDK Solar's control, LDK Solar does not accept responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

No responsibility is assumed by LDK Solar for any infringement of patents or other rights of third parties, which may result from use of the PV product. No license is granted by implication or otherwise under any patent or patent rights.

The information in this manual is based on LDK Solar's knowledge and experience and is believed to be reliable; but such information including product specification (without limitations) and suggestions do not constitute a warranty, expresses or implied. LDK Solar reserves the right to change the manual, the PV product, the specifications, or product information sheets without prior notice.

1.2 Product identification

Each module provides the following information:

Nameplate: describes the product type, rated power, rated current, rated voltage, open circuit voltage, short circuit current, all as measured under standard test conditions, weight, dimension etc. the maximum system voltage is shown on the nameplate.

Bar code: each individual module has a unique serial number. There is only one bar code on module. It is permanently attached to the interior of the module visible when viewing from the front of the module. This bar code is inserted at the beginning of laminating.

LDK Solar Co., Ltd.

Module Type: LDK-XXXX-XX

Intertek
 3188234
 Conforms to UL STD NO.1703
 certificated to ULC/ORD-C1703-01

Rating Power at STC (Wp)	XXXW±3%
Rating Power Voltage (Vm)	XXXV
Rating Power Current (Im)	XXXA
Open Circuit Voltage (Voc)	XXXV
Short Circuit Current (Isc)	XXXA
Normal Operating Cell Temp (NOCT)	45 °C
All Technical Data at STC	
AM 1.5	T=25 °C E=1000W/m ²

Weight	XXXKG
Dimension	XXXmm*XXXmm*XXmm
Application Class	Class A
Performance Standard	IEC 61215 Ed.2 and EN 61730 ; UL1703

Factory address:No. 189 Dongyuan Road,High-tech Industrial Development Zone,Nanchang,JiangXi,China
 Tel: 86-791-8356481 Fax: 86-791-8356481

Figure 1. Example of LDK module label

1.3 Quality and Safety Standards

LDK Solar photovoltaic modules meet all the requirements by the following official *Standards* in terms of Quality and Safety:

- ✓ **IEC 61215:** Design qualification and type approval
- ✓ **IEC 61730-1 and 2:** Photovoltaic module safety qualification
- ✓ **UL1703-2002**
- ✓ **ULC/ORD-C1703-01**
- ✓ **ULand Canadian Standard** for safety flat-plate Photovoltaic modules and panels
- ✓ **ISO 9001:**Quality management system for manufacture and sales of Photovoltaic solar modules



1.4 Limited warranty

Module warranty conditions are described in the LDK Solar document: *LDK Solar Limited Warranty for PV Module*.

Ignoring the instructions and considerations described herewith can be a cause by LDK Solar to invalidate the warranty in case of provable negligence. Please contact to the Technical Support Service for any questions about warranties.

2、 SAFETY

LDK Solar PV modules have passed all required safety tests and certification according to the IEC 61730 with *Application Class A*, and as *Safety Class II* according to the IEC 61140. Fire safety has been rated as Class C, reaching all requirements to be mounted on Class A roofs.

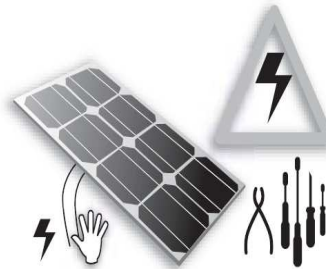
2.1 General Safety

- ✓ All PV modules should be installed according to all local and national applicable standards, codes and regulations.
- ✓ Installation should be performed only by qualified persons. Installers should assume the risk of all injury that might occur during installation, including, without limitation, the risk of electric shock.
- ✓ Check and follow all safety precautions specified for other components of the system.
- ✓ Rooftop installations should be placed over fire resistant roofs only.
- ✓ Do not attempt to disassemble the modules, and do not remove any attached nameplates or components from the modules.
- ✓ Do not apply paint or adhesive to module top surface.
- ✓ Do not use mirrors or other magnifiers to artificially concentrate sunlight on the modules. Do not expose back sheet foils directly to sunlight.



2.2 Handling Safety

- ✓ Do not stand or step on module.
- ✓ Do not drop module or allow objects to fall on module.
- ✓ To avoid glass breakage, do not place any heavy objects on the module.
- ✓ Do not set the module down hard on any surface.
- ✓ Inappropriate transport and installation may break module.



2.3 Installation Safety

- ✓ Installing solar photovoltaic systems requires specialized skills and knowledge.
- ✓ One individual module may generate DC voltages greater than 30 volts when exposed to direct sunlight. Contact with a DC voltage of 30V or more is potentially hazardous.
- ✓ Do not disconnect under load.
- ✓ It is recommended to completely cover the module with an opaque material during installation to keep electricity from being generated.
- ✓ Do not wear metallic rings, watchbands, ear, nose, lip rings or other metallic devices while installing

- or troubleshooting photovoltaic systems.
- ✓ Use only insulated tools that are approved for working on electrical installations. Abide with the safety regulations for all other components used in the system, including wiring and cables, connectors, charging regulators, inverters, storage batteries and rechargeable batteries, etc.
- ✓ Use only equipment, connectors, wiring and support frames suitable for a solar electric system. Always use the same type of module within a particular photovoltaic system.
- ✓ Do not attempt to repair any part of the PV module.

3、 INSTALLATION

3.1 Design considerations

LDK Solar PV modules should be installed in a location where they will receive the maximum amount of sunlight throughout the year. In the Northern Hemisphere modules should face south, while in the Southern Hemisphere modules should face north. Therefore, modules facing more than 30 degrees away from true South (or North) could lose approximately from 10% to 30% of their power output.

LDK Solar PV modules connected in series should be installed at same orientation and angle. Different orientation or angles may cause a loss of power output due to the change in sunlight exposure.

To develop the final distribution of the modules conforming the photovoltaic system, consider to keep suitable access to allow the maintenance and inspection works.

LDK Solar modules series must be installed in the following conditions:

Operating ambient temperature: -40°C to +85°C
Storage temperature: -40°C to +60°C
Humidity: below 85RH%

When installing a module on a roof or building, ensure that it is securely fastened and cannot fall as a result of wind or snow loads and provide adequate ventilation under a module for cooling (recommended 10cm minimum air space between module and mounting surface).

LDK Solar modules are not allowed to be mounted in mobile applications or in marine environments with direct contact with salty water, please avoid installing the modules on places directly exposed to the sea.



Figure 2. Provide adequate ventilation under a module

3.2 Mechanical installation

Use always structures and materials specifically developed and certified for photovoltaic modules installation.

The minimum distance between two modules for linear thermal expansion of the module frames should be 5mm, but recommended distance between two solar modules is 20mm to allow wind circulation to reduce loads and improve module ventilation. The PV module should not be mounted in such a way that the drain holes of PV module can incur blockage.

The PV modules are suitable for mechanical mounting both in portrait and landscape orientation. In choosing the orientation, please keep in mind the internal PV module by-pass diode configuration to ensure the optimum electrical behaviour from any potential shadings over the modules.

To prevent Electrolysis Corrosion due to the anodized aluminum in the module frame, PVC or stainless steel washers can be placed between the PV module frame and support structure. Additionally, all module support structures used to support PV modules at correct tilt angles should be wind and snow load rated by appropriate local and civil codes prior to installation.

Note: It is not allowed to dismount, drill or modify the frame or any other part of the PV module. This may cause the loss of warranty. Please contact LDK Technical Service Contact if module mounting procedure is not clear.

3.2.1 Frame holes mounting

Modules must be securely attached to the mounting structure using four mounting points(14mm*9mm). Use M8 stainless steel hardware, spring washers and flat washers with a torque of approximately 8 Newton-meters for normal installation. Refer to the drawings on the *Annex 1* to get more information about the use of mounting holes and load resistance of all module types.



Figure 3. Frame holes mounting

3.2.2 Pressure clips mounting

The modules should be fixed to the structure by pressure clips on the large side or short side of the frame according to instructions on *Annex 1*. The clips must be mounted at the position of the mounting hole, with a 10% of total length tolerance to the edge of the module. Note that always both sides should be mounted in a simetric position respect to the center. Refer to the drawings on the *Annex 1*.

The clips must only fix the modules by the contact with the frame. Do not allow contact between clip and glass.

Do not mount the modules by pressure clips out of the specified area. Module mechanical resistance could be affected.

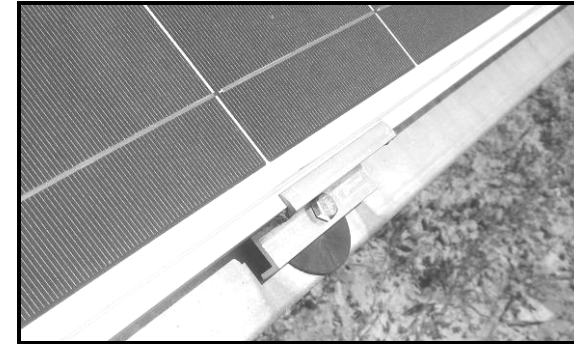


Figure 4. Clips mounting

3.2.3 Insertion systems

Insertion systems on the short sides of the module are allowed with a limitation on the load resistance of 2400 Pa. Insertion systems on the large side of the module are not affected by any limitation and are allowed with maximum of 5400 Pa for snow load. See *Annex 1* for more information.

3.2.3 Module load resistance

Wind Load:	2400 Pa
Snow Load:	5400 Pa
Wind speed:	130 Km/h

Note that information above provided could vary according to the mounting system and configuration as described on the *Annex 1*.

3.3 Electrical installation

The DC electrical energy generated by photovoltaic systems may be converted to AC and connected to a utility grid system. As local utilities' policies on connecting renewable energy systems to their grids vary from region to region, consult a qualified system designer or integrator to design such a system. Permits are normally required for installing such a system and the utility must formally approve and inspect such a system before it can be accepted.

Use only insulated tools that are approved for working on electrical installations. Abide with the safety regulations for all other components used in the system, including wiring and cables, connectors, charging regulators, inverters, storage batteries and rechargeable batteries, etc.

The electrical characteristics are within ± 5 percent of the indicated values of I_{sc} and V_{oc} under

standard test conditions (irradiance of 100mW/cm², AM 1.5 spectrums, and a cell temperature of 25°C (77°F)) and tolerance of the P_{max} is ±3%.

3.3.1 General considerations

Several modules are connected in series and then in parallel to form a PV array, especially for application with a high operation voltage. If modules are connected in series, the total voltage is equal to the sum of individual voltages. Do not use different type of modules in the same circuit. Modules are fitted with pre-assembled cable leads and safe plug & socket connectors to use for system electrical connections; these cable leads and connectors must not be removed or cut off

Consult rated local wiring regulations to determine system wire size, type, and temperature for your installation.

3.3.2 System Grounding

- ✓ All module frames and mounting racks must be properly grounded. The grounding wire must be properly fastened to the module frame to assure good electrical contact. Use the recommended type, or an equivalent, connector for this wire.
- ✓ If the support structure is made of metal, the surface of the structure must be electroplated and have excellent conductivity.
- ✓ Proper grounding is achieved by connecting the module frame(s) and structural members contiguously using a suitable grounding conductor
- ✓ The grounding conductor must then make a connection to earth using a suitable earth ground electrode. We recommend the lay-in lug when grounding. The rack must also be grounded unless it is mechanically connected by nuts and bolts to the grounded PV modules.

3.3.3 Bypass diode and blocking diode

Partial shading of an individual module can cause a reverse voltage across the shaded PV module; the 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 PV module, thereby minimizing module heating and array current losses. LDK Solar Photovoltaic modules are fitted with internal bypass diodes within the junction box to reduce the effects of partial shadings.

4、 Commission and maintenance

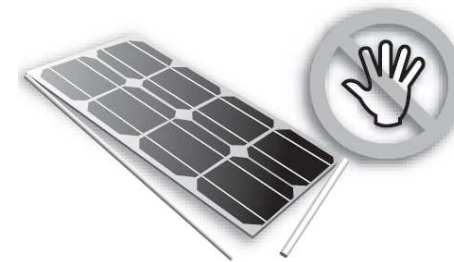
Test all electrical and electronic components of the system before using it. Follow the instructions in the guides supplied with the components and equipment. Commission and Maintenance works must be performed by specialized and properly formed personnel.

- ✓ Check the open-circuit voltage of every series module by a digital multimeter. The measured values should correspond to the sum of the open-circuit voltage of the individual module. You will find the rated voltage in the technical specifications of the type of the module used. If the measured value is significantly lower than the expected value, please proceed as described under "Troubleshooting an excessively low voltage".
- ✓ Check the short-circuit current of every series circuit. It can be measured directly by a digital multimeter connected in the two terminals of series circuit or module, or with any load such as PV illumination to make a rough measurement. Attention, the rated scale of the ammeter or the rated current of load should more than 1.25 times of the rated short-circuit current of series module. You will find the rated current in the technical specifications of the type of module used. The measured

value can vary significantly, depending on weather conditions, the time of day and shading of the module.

4.1 Troubleshooting low voltages

Identify the commonly low voltage and excessively low voltage. Commonly the low voltage mentioned here is the decrease of open-circuit voltage of the module, which is caused by the temperature rising of solar cells or lower irradiance. Excessively low voltage is typically caused by improper connections at the terminals or defective bypass diodes. Please, contact the LDK Solar Technical Service if the problem could not be resolved.



4.2 Maintenance

LDK Solar recommends the following maintenance in order to ensure optimum performance of the module:

- ✓ Under most weather conditions, normal rainfall is sufficient to keep the PV module glass surface clean. Clean the glass surface of the module as necessary and consider that lower inclination requires more cleaning frequency.
- ✓ Always use water and a soft sponge or cloth for cleaning. A mild, non-abrasive cleaning agent can be used to remove stubborn dirt.
- ✓ Check the electrical and mechanical connections every six months to verify that they are clean, secure and undamaged
- ✓ If any problem arises, have them investigated by a competent specialist.
- ✓ Attention, observe the maintenance instructions for all components used in the system, such as support frames, charging regulators, inverters, batteries etc.

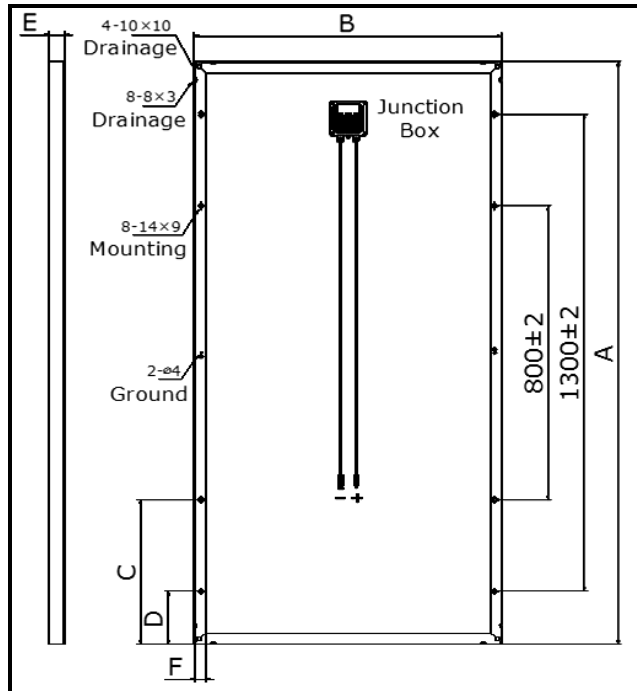
5、 Module end-of-life

LDK Solar is a member of the PV CYCLE Association, European association for voluntary take-back and recycling of photovoltaic modules.

The LDK membership guarantees that after the life span of the installation, all modules will be collected and recycled by a specialized organization which ensures that all PV process is under environmental care. All the services are according to European Commission and free of charge for final users (except incidences during installation).

Please visit PV Cycle web site for further information:
<http://www.pvcycle.org/>

6、 Module specifications



	LDK 160/200 D-24 (s)	LDK 160/200 P-24 (s)	LDK 200/250 D-20	LDK 200/250 D-20 (s)	LDK 200/250 P-20	LDK 200/250 P-20 (s)	LDK 250/290 P-24	LDK 250/290 P-24 (s)
A	1580	1580	1642	1630	1642	1630	1958	1946
B	808	808	994	976	994	976	994	976
C	390	390	421	415	421	415	579	573
D	140	140	171	165	171	165	329	323
E	40	40	40	40	40	40	50	50
F	30	30	30	30	30	30	40	40
Cable	950	950	1000	1000	1000	1000	1200	1200
Weight (kg)	15,6	15,6	20	19	20	19	30,5	27,3
Cell type	Mono 125	Multi 125	Mono 156	Mono 156	Multi 156	Multi 156	Multi 156	Multi 156
Num of Cells	72	72	60	60	60	60	72	72
Connector	MC4							
Max fuse rating	20 A							

Note: All dimension values are in mm

7、 Technical Service Contact

LDK Solar Hi-Tech (Nanchang) Co., Ltd

Add: No. 999 Torch Boulevard, Nanchang, Jiangxi, PRC

Post code: 330096

Tel: +86 791 8105313

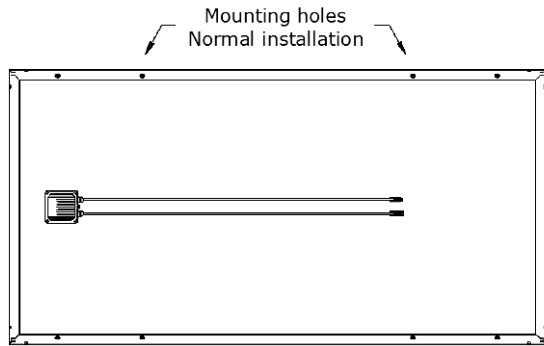
Fax: +86 791 8108260

Email: Service@ldksolar.com

Website: www.ldksolar.com

Annex 1: Module installation & load guide

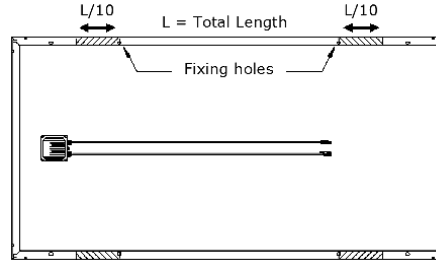
System 1: Installation with mounting holes



All module types
5400Pa
Normal Installation

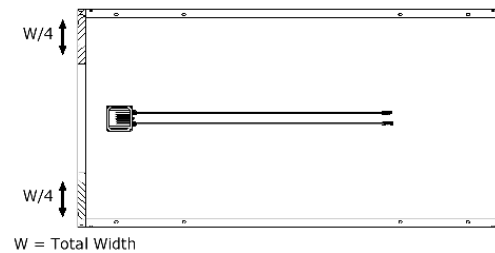
System 2: Installation with pressure Clips

A – Clips System on large side:



All module types
5400Pa
Installation according to drawing specification

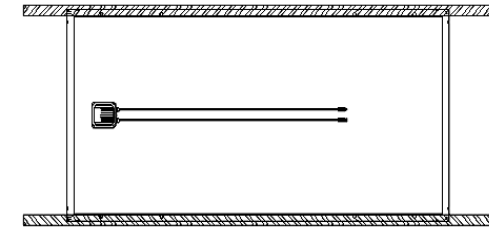
B – Clips System on short side:



All module types
2400Pa
Pressure clips on short side
All module types
Not allowed for 5400 Pa

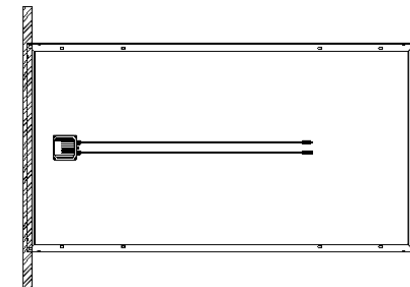
System 3: Insertion Systems

A – Insertion System on large side:



All module types
5400Pa
Insertion System on large side

B – Insertion System on short side:



All module types
2400Pa
Insertion System on short side
All module types
Not allowed for 5400 Pa