

# INSTALLATION, SAFETY & OPERATION MANUAL FOR YINGLI SOLAR PHOTOVOLTAIC MODULES: UNITED STATES AND CANADA

This document is applicable for the following Yingli modules:

|            |            |            |            |            |
|------------|------------|------------|------------|------------|
| YL165P-23b | YL190P-26b | YL215P-29b | YL235P-32b | YL260P-35b |
| YL170P-23b | YL195P-26b | YL220P-29b | YL240P-32b | YL265P-35b |
| YL175P-23b | YL200P-26b | YL225P-29b | YL245P-32b | YL270P-35b |
| YL180P-23b | YL205P-26b | YL230P-29b | YL250P-32b | YL275P-35b |
| YL185P-23b | YL210P-26b | YL235P-29b | YL255P-32b | YL280P-35b |

 Yingli photovoltaic modules conform to UL Standard 1703

This document is a draft and is subject to change.

**Product Sales:**  
Yingli Green Energy Americas, Inc.  
[www.yinglisolar.com](http://www.yinglisolar.com)  
[us-info@yinglisolar.com](mailto:us-info@yinglisolar.com)  
+1 (888) 686-8820

## GENERAL INFORMATION

- Installation or maintenance shall only be performed by qualified professionals in accordance with local requirements.
- Read this instruction manual in its entirety before handling, installing, and operating Yingli modules. Failure to comply with these instructions will invalidate the module warranty.
- All applicable international, national, and local regulations, standards and requirements shall be followed.
- Use only electrical and mechanical components qualified for PV systems. Follow all safety instructions of other used components.

## APPLICATION INSTRUCTIONS

- Yingli PV modules are designed for integration and use in grid-tied PV systems and shall not be used for other purposes.
- Yingli PV modules shall be mounted on appropriate mounting structures situated on either building roofs or the ground.
- Follow local and national regulations for building construction.
- Artificial light must not be directed on Yingli PV modules as it could cause the equipment to overheat and cause a fire.
- Yingli PV modules are designed for stationary use, and shall not be used on vehicles of any kind. Secure modules in a safe position.
- Yingli PV modules must not be submerged in water.
- Yingli PV modules shall not be mounted in locations where corrosive substances could harm them. Salt and salt-water (not limited to) of any concentration are assumed to be corrosive.

## TRANSPORTATION, HANDLING, AND PREPARATION INSTRUCTIONS

- **SHOCK HAZARD!** PV Modules are vulnerable to breakage. Handle them with appropriate care. PV modules with broken glass cannot be repaired and must not be used. Broken glass could cause injury. Contact with any part of broken PV modules can result in lethal electrical shock. Broken or damaged PV modules must be handled carefully and disposed of properly.
- Transportation of Yingli modules shall be in the supplied boxes. Protect boxes/pallets from shifting during transportation. Keep boxes away from moisture.

- Warning: pallets of boxes could fall. Do not exceed maximum height of boxes stacked on top of each other.
- Test each PV module's Voc and Isc prior to installation. Contact your local sales representative regarding modules with a suspected electrical problem.
- Do not use the junction box or the cables to hold or transport the module.
- Do not stand or step on the module. Secure modules in a safe position; do not drop module or allow objects to fall on the module.
- Do not damage, scratch or apply paint or adhesive to the PV module surface.
- Do not disassemble, modify, or remove any part of the module or labeling. Doing so will void the warranty.
- Do not drill holes in the frame or glass of the module. Doing so will void the warranty.

## INSTALLATION SAFETY

- **SHOCK HAZARD FROM ELECTRICALLY LIVE PARTS.** PV modules produce almost their full voltage when exposed to light of any intensity. Current and power increase with light intensity.
- Contact with DC voltage of 30V or more is potentially hazardous.
- Work according to the applicable safety standards when working with PV modules on roofs.
- Do not handle or install modules in adverse conditions like periods of strong winds or wet or frosted roofs.
- PV modules can only be switched off by removing them entirely from light or covering them with an opaque material. Refer to safety regulations for live electrical equipment when working with uncovered PV modules.
- Do not touch electrical terminals or the ends of any wire while the PV module is exposed to light.
- To avoid arcing, do not disconnect electrical connections under load. Keep connectors dry and clean.
- Use personal protection equipment as required by regulations. Always use insulated tools and rubber gloves approved for working on electrical installations.
- Do not wear metallic jewelry during installation.
- Keep unauthorized people, including children, away from the system and PV modules during installation.

## FIRE SAFETY

- Refer to your local authority for guidelines and regulations for building fire protection.
- The installation of a PV system on a building may affect the fire safety of a building.
- Roof application PV systems must be mounted over fire resistant roof covering rated for the application.
- In case of a fire in a building, Yingli PV modules on the roof are likely to produce dangerous DC voltage, even in the case of:
  - Low light intensity
  - Modules being disconnected from the inverter
  - Modules being partly or entirely destroyed
  - Wiring being compromised or destroyed
- During and after a fire stay away from all elements of the PV system. Have your installer perform the necessary steps to bring the PV system back into a safe condition.
- Do not install or use PV modules near hazardous locations with flammable gas.

## MECHANICAL INSTALLATION

- PV modules shall be mounted in a way that maximizes direct exposure of sunlight to the solar cells.
- PV modules must be secured in a safe position using a mounting structure or racking system intended for PV applications.
- Mounting structures and mechanical parts must be designed and approved for the maximum applicable loads determined by local requirements and ASCE.
- Yingli modules have been approved by UL 1703 to withstand positive and negative design loads of 50 pounds per square foot when mounted according to installation instructions.
- Yingli modules can be mounted in either landscape or portrait position with a minimum tilt of 10 degrees to allow proper self-cleaning by rain.
- For roof mounted systems, allow a minimum 4 inch gap between the module and the roof surface to allow for proper cooling.
- Allow a 0.25 inch gap between module frames to avoid tension from thermal expansion.
- Yingli modules shall not be subjected to forces from the substructure. Keep in mind thermal expansions.

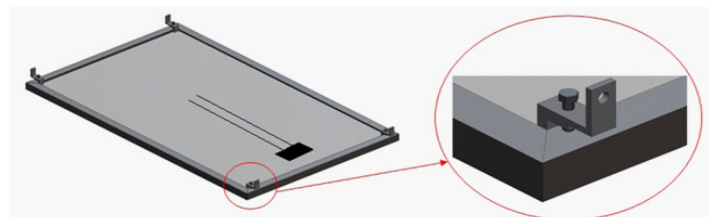
### Standard mounting methods:

**Method A:** Modules shall be mounted using 4 or 8 holes located on the rear side of the long frame parts. Use 4 or 8 M6 stainless steel bolts per PV module, with nuts, washers, and lock washers (see drawing on page 8 to determine which modules require 4 or 8 connections).

**Method B:** Modules shall be fastened using 4 or 8 clamps applied to the top side of the long frame parts. A clamp holds 2 PV modules except for the PV module at the beginning and end of a row. The centerline of the clamps shall be in line with the mounting hole position. The user supplied clamps, bolts, nuts, and washers, as well as the fastening torque must be approved in writing by Yingli prior to installation. Do not apply excessive pressure on the frame (see drawing on page 8 to determine which modules require 4 or 8 connections).

### PanelClaw™ Attachment System:

Support structures manufactured by PanelClaw, Inc. employ a special clamp, or "claw" (P/N 500-0005), designed to attach to the flange of the module frame at each of the four corners, on the two short frame members as illustrated in Figure 1 below:



For proper attachment, place a claw over the module frame flange at one of the four designated locations and tighten the 3/8-16 x 1.25" 18-8 S/S hex head cap screw to between 18 and 20 ft·lbf. Repeat this for each of the four designated locations. Ensure that the claws are flush with both the long and short lengths of the module flange as shown in Figure 2 above.

Mounting Yingli modules to the PanelClaw™ attachment system according to this method is UL listed to standard 1703. The UL 1703 test is performed at 1.5 times the design load of 30 psf, or 45 psf, in both the positive and negative directions.



Power Your Life

## ELECTRICAL INSTALLATION

- Do not use PV modules of different characteristics and electrical properties in the same system.
- Cover PV modules with an opaque material before making or breaking electrical connections.
- All Yingli PV modules are equipped with installation ready wires and quick connectors for modules to be interconnected in series. Each module has a positive (+) and negative (-) stranded sunlight-resistant output cable.
- The positive (+) terminal has a female connector while the negative (-) terminal has a male connector. The module wiring is for series connections only (i.e. female (+) to male (-) interconnections).
- Module voltage will be summed when modules are connected in series. The maximum number of modules connected in series must follow 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 reported for the area.
- Rated electrical characteristics are within 10 percent of measured values at Standard Test Conditions: 1000W/m<sup>2</sup>, 25°C, and irradiation of AM1.5 spectrum.
- Under normal operating conditions, a photovoltaic module may experience conditions that produce more current than reported at Standard Test Conditions. Accordingly, the values of short-circuit current (Isc) and open-circuit voltage (Voc) marked on the module label shall be multiplied by a factor of 1.25 when determining component voltage ratings, conductor capacities, fuse sizes, and size of controls connected to the module output.
- Refer to Section 690.8 of the National Electric Code for an additional multiplying factor of 1.25 which may be applicable.
- Do not connect PV modules or strings in parallel without using a properly rated over-current device. The rating of the over-current device shall not exceed the value of the maximum fuse rating on the PV module label (15 Amps).
- Use cables qualified for DC wiring in PV systems per UL 1703 standard. The minimum lead cross-section shall be 12 AWG. Wiring details shall be in accordance with the NEC.
- Under no circumstances shall the junction box be opened. Opening the junction box will void the warranty.

- The module contains bypass diodes located inside the junction box.
- Attach loose electrical cables to the mechanical sub-structure, without applying any stress to the cables.

## GROUNDING

- All equipment shall be grounded in accordance with local regulations and the NEC, Article 250.
- Proper grounding of the PV modules is achieved by connecting the module frame(s) and structural members continuously to one another using a suitable copper equipment grounding conductor. The grounding conductor must make a connection to earth using a suitable earth ground electrode.
- Yingli recommends the following grounding method:
  - A 10 or 12 AWG equipment grounding conductor (EGC) shall be attached to the module frame at the designated grounding location. Do not drill additional holes into the frame.
  - A stainless steel cup washer is required between the copper EGC and aluminum module frame.
  - A stainless steel backing nut is required to secure the grounding hardware to the frame.
  - A stainless steel tooth lock washer is required to engage the frame and penetrate the nonconductive anodized layer of the aluminum frame. The tooth lock washer can either be integrated with or independent of the backing nut.
  - All screws and nuts used for grounding shall have a thread count of 32 turns per inch per UL 1703 and shall be tightened to a torque of 35.4 in-lbf (4 N-m).
- Yingli modules can also be grounded using third party ground washers or clip devices as long as the products are approved for grounding metallic frames of PV modules.
- Alternate grounding options built into the racking system are acceptable so long as they have been UL approved.

## OPERATION AND MAINTENANCE

- Yingli recommends a yearly inspection of all PV systems performed by an installer. Special attention shall be paid to loose or corroded electrical or mechanical connections and correct grounding.
- In the unusual event that a module must be replaced, proceed with the same care as during the initial installation.

- Usually rain washes away the normal amount of dust and dirt that accumulates on the modules. Large amounts of dust, dirt, and other deposits can compromise the performance of a PV system and shall be removed.
- Do not clean hot modules with cold water. This could cause the glass to break from thermal shock.
- If the modules need to be cleaned, use water with a soft sponge or brush. Remaining deposits can be treated with a mild and non-alkaline detergent.

## **DISCLAIMER OF LIABILITY**

Yingli does not assume responsibility and expressly disclaims liability for loss, damage, or expenses resulting from improper installation, handling, operation or maintenance.

Yingli assumes no responsibility for any infringement of patents or other rights of third parties which may result from use of the module. No license is granted by implication or under any patent or patent rights. The information in this manual is believed to be reliable, but does not constitute an expressed and implied warranty. Yingli reserves the right to make changes to the product, specifications, or user manual without prior notice.

Yingli and its subsidiaries and system installation partners are not liable for damages, caused by inappropriate use and installation, especially without limitation by non-observance of the instructions of this manual or caused in connection with products of other manufacturers.

# INSTALLATION, SAFETY & OPERATION INSTRUCTIONS FOR YINGLI SOLAR PHOTOVOLTAIC (PV) MODULES UNITED STATES AND CANADA



This guide contains electrical and mechanical performance information, with which you should be familiar before using your Yingli photovoltaic modules. Your Yingli partner can provide additional sizing and system design information if necessary.

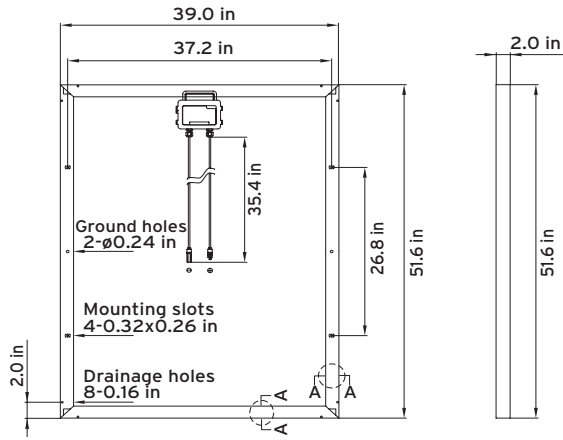
| Module Series | Module Type  | Certificates         |                    |                      |     |          | Electrical Performance         |                                    |   |                                       |  |  |                                       |   |   |  |   |                                     |                 |  |
|---------------|--------------|----------------------|--------------------|----------------------|-----|----------|--------------------------------|------------------------------------|---|---------------------------------------|--|--|---------------------------------------|---|---|--|---|-------------------------------------|-----------------|--|
|               |              | IEC 61215, Edition 2 | IEC 61730, Class A | TÜV, Safety Class II | CE  | ISO 9001 | Maximum Power @ STC, $P_{mpp}$ | Production Tolerances of $P_{max}$ | Maximum Power Voltage, @ STC, $V_{mpp}$ | Open-Circuit Voltage, @ STC, $V_{oc}$ | Short-Circuit Current, @ STC, $I_{sc}$ | Nominal operating photovoltaic cell temperature, @ NOCT conditions, NOCT | Maximum Power, @ NOCT, $P_{max,NOCT}$ | Maximum Power Voltage, @ NOCT, $V_{max,NOCT}$ | Open-Circuit Voltage, @ NOCT, $V_{oc,NOCT}$ | Short-Circuit Current, @ NOCT, $I_{sc,NOCT}$ | Reduction of Efficiency from 1,000 to 200 W/m <sup>2</sup> following EN 60904-1 | Cable length, positive and negative | Glass thickness | Maximum amount of modules to be connected in series [s] / parallel [p] |
|               |              |                      |                    |                      |     | W        | %                              | V                                  | V                                       | A                                     | °C                                     | W  | V                                     | V   | A   | %  | mm  | mm                                  | s/p             |  |
| YL185P-23b    | YL165P-23b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 165.0                          | +/- 3                              | 23.0                                    | 29.0                                  | 7.90                                   | 46 +/- 2   | 119.5                                 | 20.7  | 26.5  | 6.40   | 5.0   | 900                                 | 3.2             | 16 / 2   |
|               | YL170P-23b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 170.0                          | +/- 3                              | 23.0                                    | 29.0                                  | 8.10                                   | 46 +/- 2   | 123.1                                 | 20.7  | 26.5  | 6.56   | 5.0   | 900                                 | 3.2             | 16 / 2   |
|               | YL175P-23b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 175.0                          | +/- 3                              | 23.0                                    | 29.0                                  | 8.20                                   | 46 +/- 2   | 126.8                                 | 20.7  | 26.5  | 6.64   | 5.0   | 900                                 | 3.2             | 16 / 2   |
|               | YL180P-23b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 180.0                          | +/- 3                              | 23.0                                    | 29.5                                  | 8.30                                   | 46 +/- 2   | 130.4                                 | 20.7  | 27.0  | 6.72   | 5.0   | 900                                 | 3.2             | 16 / 2   |
|               | YL185P-23b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 185.0                          | +/- 3                              | 23.5                                    | 29.5                                  | 8.45                                   | 46 +/- 2   | 134.0                                 | 21.1  | 27.0  | 6.85   | 5.0   | 900                                 | 3.2             | 16 / 2   |
| YL210P-26b    | YL190P-26b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 190.0                          | +/- 3                              | 25.8                                    | 32.8                                  | 8.03                                   | 46 +/- 2   | 137.6                                 | 23.2  | 30.0  | 6.50   | 5.0   | 1,200                               | 3.2             | 14 / 2   |
|               | YL195P-26b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 195.0                          | +/- 3                              | 26.0                                    | 33.0                                  | 8.15                                   | 46 +/- 2   | 141.3                                 | 23.4  | 30.2  | 6.60   | 5.0   | 1,200                               | 3.2             | 14 / 2   |
|               | YL200P-26b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 200.0                          | +/- 3                              | 26.3                                    | 33.3                                  | 8.22                                   | 46 +/- 2   | 144.9                                 | 23.7  | 30.4  | 6.66   | 5.0   | 1,200                               | 3.2             | 14 / 2   |
|               | YL205P-26b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 205.0                          | +/- 3                              | 26.5                                    | 33.5                                  | 8.33                                   | 46 +/- 2   | 148.5                                 | 23.8  | 30.6  | 6.75   | 5.0   | 1,200                               | 3.2             | 14 / 2   |
|               | YL210P-26b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 210.0                          | +/- 3                              | 26.6                                    | 33.6                                  | 8.45                                   | 46 +/- 2   | 152.1                                 | 23.9  | 30.7  | 6.85   | 5.0   | 1,200                               | 3.2             | 14 / 2   |
| YL235P-29b    | YL215P-29b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 215.0                          | +/- 3                              | 29.0                                    | 36.0                                  | 8.10                                   | 46 +/- 2   | 155.7                                 | 26.1  | 32.9  | 6.56   | 5.0   | 1,200                               | 3.2             | 13 / 2   |
|               | YL220P-29b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 220.0                          | +/- 3                              | 29.0                                    | 36.5                                  | 8.15                                   | 46 +/- 2   | 159.4                                 | 26.1  | 33.4  | 6.60   | 5.0   | 1,200                               | 3.2             | 13 / 2   |
|               | YL225P-29b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 225.0                          | +/- 3                              | 29.5                                    | 36.5                                  | 8.28                                   | 46 +/- 2   | 163.0                                 | 26.5  | 33.4  | 6.71   | 5.0   | 1,200                               | 3.2             | 13 / 2   |
|               | YL 230 P-29b | Yes                  | Yes                | Yes                  | Yes | Yes      | 230.0                          | +/- 3                              | 29.5                                    | 37.0                                  | 8.40                                   | 46 +/- 2   | 166.6                                 | 26.5  | 33.8  | 6.80   | 5.0   | 1,200                               | 3.2             | 12 / 2   |
|               | YL 235 P-29b | Yes                  | Yes                | Yes                  | Yes | Yes      | 235.0                          | +/- 3                              | 29.5                                    | 37.0                                  | 8.54                                   | 46 +/- 2   | 170.2                                 | 26.5  | 33.8  | 6.92   | 5.0   | 1,200                               | 3.2             | 12 / 2   |
| YL255P-32b    | YL235P-32b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 235.0                          | +/- 3                              | 32.0                                    | 40.5                                  | 8.00                                   | 46 +/- 2   | 170.2                                 | 28.8  | 37.0  | 6.48   | 5.0   | 1,200                               | 4.0             | 11 / 2   |
|               | YL240P-32b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 240.0                          | +/- 3                              | 32.2                                    | 40.5                                  | 8.15                                   | 46 +/- 2   | 173.9                                 | 29.0  | 37.0  | 6.60   | 5.0   | 1,200                               | 4.0             | 11 / 2   |
|               | YL245P-32b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 245.0                          | +/- 3                              | 32.2                                    | 40.8                                  | 8.22                                   | 46 +/- 2   | 177.5                                 | 29.0  | 37.3  | 6.66   | 5.0   | 1,200                               | 4.0             | 11 / 2   |
|               | YL250P-32b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 250.0                          | +/- 3                              | 32.3                                    | 40.9                                  | 8.33                                   | 46 +/- 2   | 181.1                                 | 29.1  | 37.4  | 6.75   | 5.0   | 1,200                               | 4.0             | 11 / 2   |
|               | YL255P-32b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 255.0                          | +/- 3                              | 32.5                                    | 41.0                                  | 8.40                                   | 46 +/- 2   | 184.7                                 | 29.2  | 37.5  | 6.80   | 5.0   | 1,200                               | 4.0             | 11 / 2   |
| YL280P-35b    | YL260P-35b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 260.0                          | +/- 3                              | 35.0                                    | 44.6                                  | 8.04                                   | 46 +/- 2   | 188.3                                 | 31.5  | 40.8  | 6.51   | 5.0   | 1,200                               | 4.0             | 10 / 2   |
|               | YL265P-35b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 265.0                          | +/- 3                              | 35.3                                    | 44.6                                  | 8.15                                   | 46 +/- 2   | 192.0                                 | 31.8  | 40.8  | 6.60   | 5.0   | 1,200                               | 4.0             | 10 / 2   |
|               | YL270P-35b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 270.0                          | +/- 3                              | 35.3                                    | 44.8                                  | 8.20                                   | 46 +/- 2   | 195.6                                 | 31.8  | 40.9  | 6.64   | 5.0   | 1,200                               | 4.0             | 10 / 2   |
|               | YL275P-35b   | Yes                  | Yes                | Yes                  | Yes | Yes      | 275.0                          | +/- 3                              | 35.5                                    | 45.0                                  | 8.30                                   | 46 +/- 2   | 199.2                                 | 31.9  | 41.1  | 6.72   | 5.0   | 1,200                               | 4.0             | 10 / 2   |
| YL280P-35b    | Yes          | Yes                  | Yes                | Yes                  | Yes | 280.0    | +/- 3                          | 35.5                               | 45.0                                    | 8.35                                  | 46 +/- 2                               | 202.8  | 31.9                                  | 41.1  | 6.76  | 5.0  | 1,200   | 4.0                                 | 10 / 2          |  |

## General characteristics for all module types

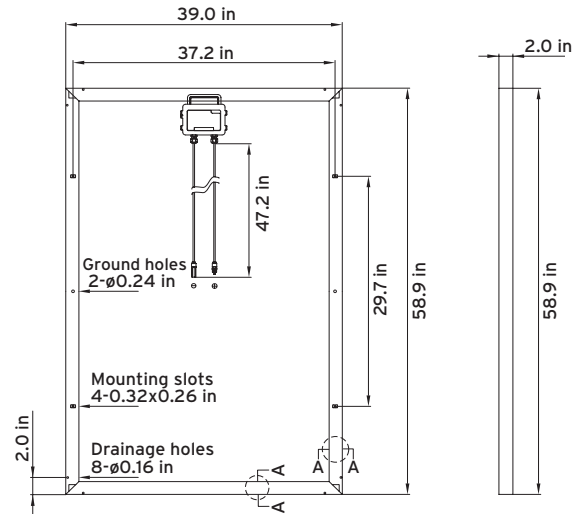
|                                     |                           |                |
|-------------------------------------|---------------------------|----------------|
| Limiting reverse current, $I_R$     | [A]                       | 15             |
| Temperature coefficient of $V_{oc}$ | [%/K]                     | -0.37 +/- 0.02 |
| Temperature coefficient of $I_{sc}$ | [%/K]                     | 0.06 +/- 0.01  |
| Cell type and material              | mc-Si, poly, 156 x 156 mm |                |
| Frame material                      | anodized aluminium        |                |
| Front cover type                    | tempered glass            |                |

# Rear and side view and dimensions of module series

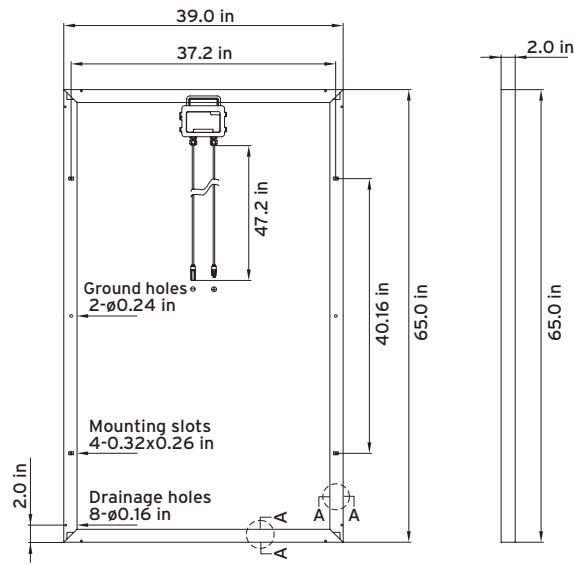
## YL185P-23b Series



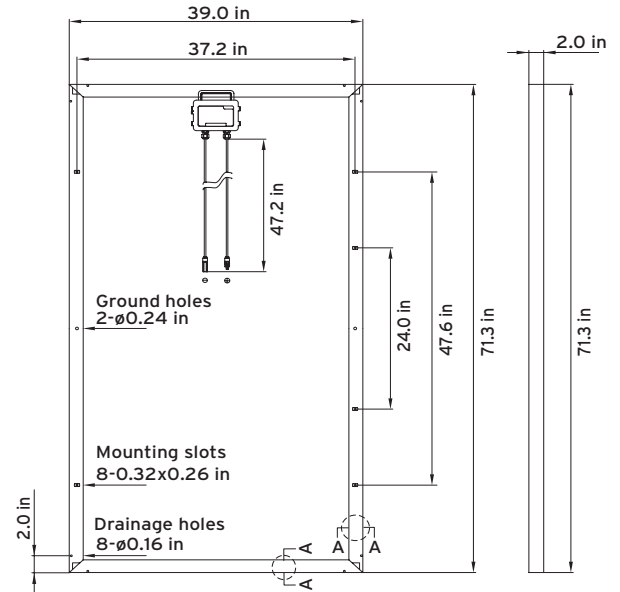
## YL210P-26b Series



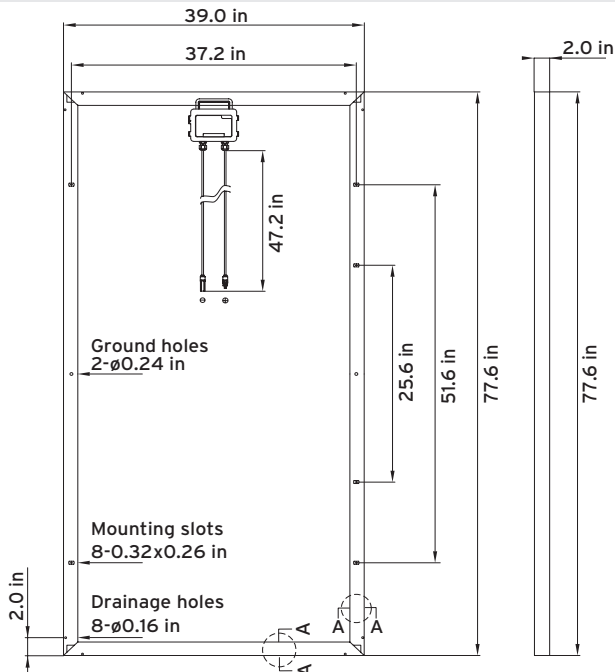
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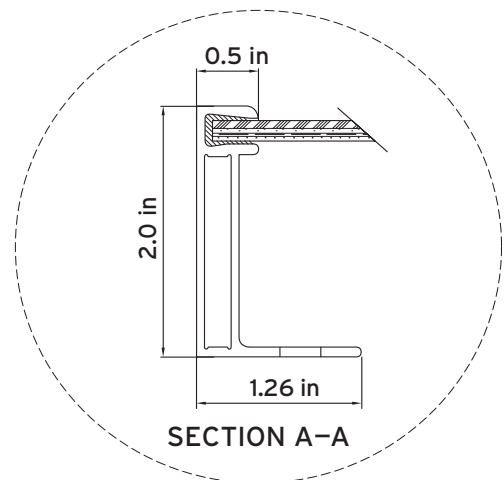
## YL255P-32b Series



## YL280P-35b Series



## Frame Cross Section A-A



# Standard mounting methods

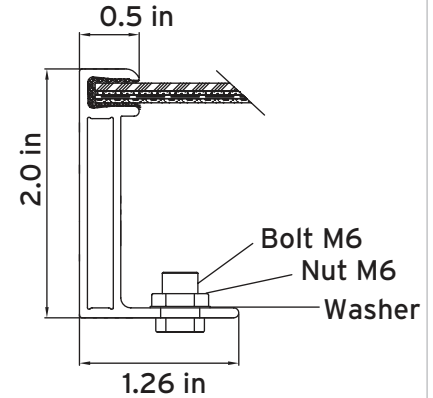
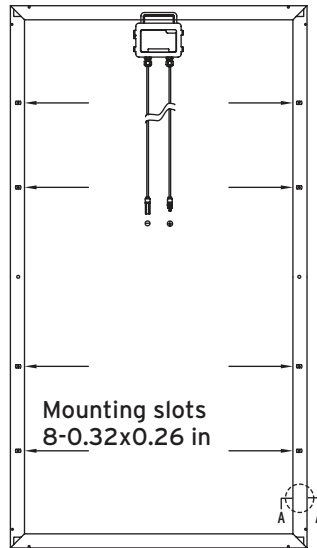
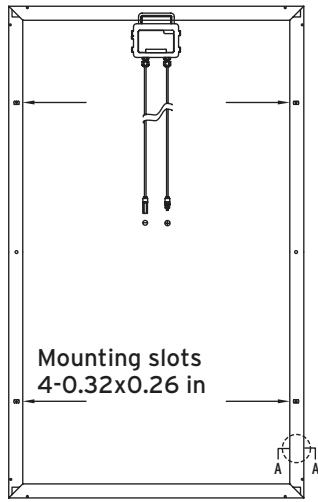
Series: YL185P-23b, YL210P-26b, YL235P-29b  
Four connection points required

Series: YL255P-32b, YL280P-35b  
For high wind and snow load conditions use 8 mounting holes

Frame Cross Section Detail

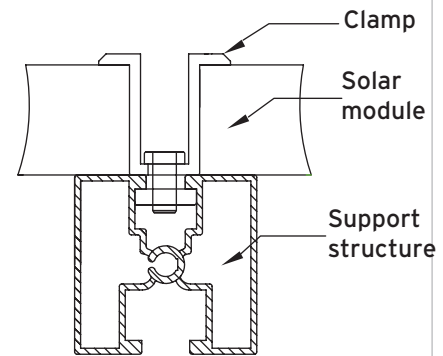
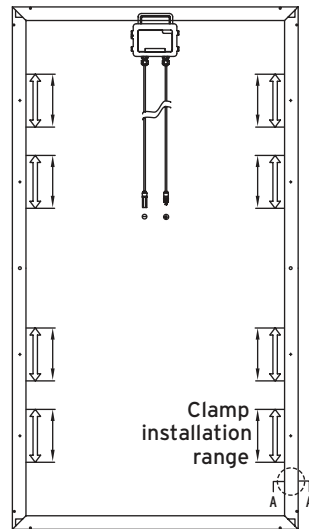
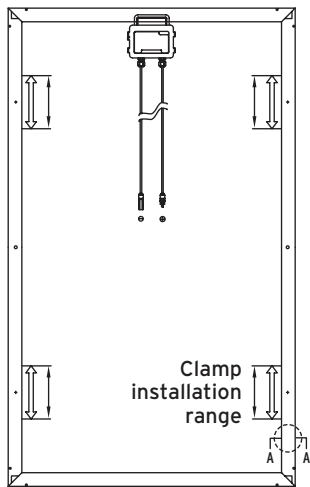
## Method A: Frame Screw Mounting

Modules shall be mounted using the holes located on the rear side of the long frame parts. Use M6 stainless steel bolts with nuts, washers, and lock washers



## Method B: Clamp Mounting

Modules shall be fastened using clamps applied to the top side of the long frame parts. A clamp holds 2 PV modules except for the PV module at the beginning and end of a row. The centerline of the clamps should be in line with the mounting hole position. The user supplied clamps, bolts, nuts, and washers, as well as the fastening torque must be approved in writing by Yingli prior to installation.



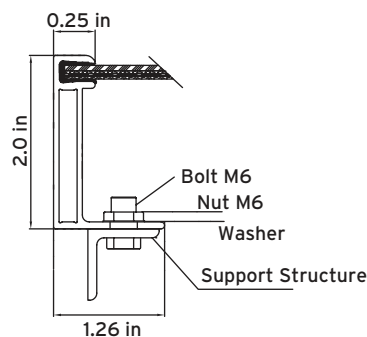
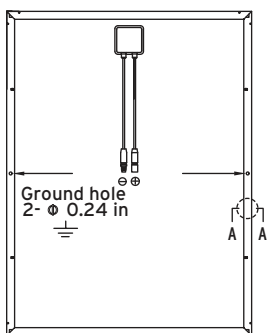
### ATTENTION

- The clamp installation tolerance is 2.0 in, centered from the screw mounting slot. Do not apply excessive pressure on the frame

## Grounding

Grounding hole size and location

Frame cross-section and schematic



## Cable/Connector Specifications

|                   | Pre-mounted cables  | Pre-mounted connectors                           |
|-------------------|---|--|
| Type              | USE-2   | MC4 Connectors<br>UV resistance and self-locking |
| Wire gauge        | 12 AWG  | N/A  |
| Max. current      | 15 A  | 30 A   |
| Rated voltage     | 600 V DC  | 600 V DC   |
| Temperature range | -40°C up to +90°C   | -40°C up to +90°C                                |
| Notes             | When bending or looping cable minimum bend radius must be greater than 5 x cable diameter | Polarity marked on connectors                    |