



Solar Modules Installation and Maintenance Guide



Version: JUNE 2026

Content

1. General Information	3
2. General Safety Rules.....	3
3. Product Identification	4
4. Transportation, Storage and Unpacking.....	5
4.1 Transportation	5
4.2 Storage.....	5
4.3 Unpacking (Step-by-step)	5
5. Installation Environment.....	6
6. Mechanical Installation	7
6.1 General Rules.....	7
6.2 Bolt Mounting	8
6.3 Clamp Mounting	9
6.4 Tracker Installation	10
7. Electrical Installation.....	10
7.1 General Rules.....	10
7.2 Series/Parallel Sizing & Examples	10
7.3 Grounding	12
7.4 PID Mitigation	12
8. Maintenance and Cleaning.....	13
8.1 Regular Inspections (every 6 months).....	13
8.2 Cleaning Guidelines	13
8.3 Robot Cleaning	13
9. Disposal	14
10. Disclaimer of Liability	14

1. General Information

Oakridge Power photovoltaic modules are high-efficiency crystalline silicon solar panels designed for residential, commercial, and utility-scale outdoor installations. They are certified to UL 61730 and UL 61215 and are rated for Application Class A, suitable for systems operating above 50 V DC or 240 W where general access is anticipated.

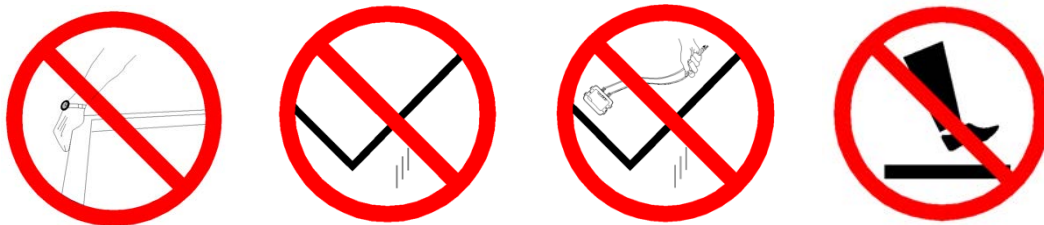
This manual provides comprehensive instructions for safe handling, unpacking, mechanical mounting, electrical wiring, grounding, maintenance, and troubleshooting. All instructions must be read and understood before installation. If any information is unclear, contact Oakridge Power Technical Support at tech-support@oakridge-power.com.

Fire rating: Single-glass modules – Type 1; Dual-glass modules – Type 29 (per UL 61730). The fire rating is valid only when the module is mounted in accordance with the mechanical mounting instructions in this manual. For roof-mounted systems, the module must be installed over a fire-resistant roof covering rated for the application.

Maximum system voltage: 1500 V DC as per label. Always verify the system voltage does not exceed the rating of any component (inverter, connectors, cables, etc.).

2. General Safety Rules

- Modules generate DC electricity when exposed to sunlight or any light source. Always cover modules with opaque material during installation.
- Use insulated tools and wear personal protective equipment (insulating gloves, safety shoes, hard hat, and safety glasses).
- Do not wear metallic jewelry, rings, watches, or other conductive items during installation.
- Do not disconnect connectors under load – arcing may occur and cause burns or fire.
- Do not install damaged modules; broken glass can cause electric shock and fire hazards.
- Keep children and unauthorized persons away from the installation area.
- Do not artificially concentrate sunlight on the module (e.g., using mirrors or lenses).
- Never drill additional holes in the frame or modify the module in any way.
- Do not lift the module by the junction box or cables – always use the frame.

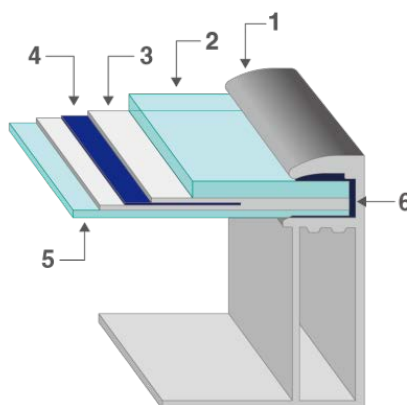
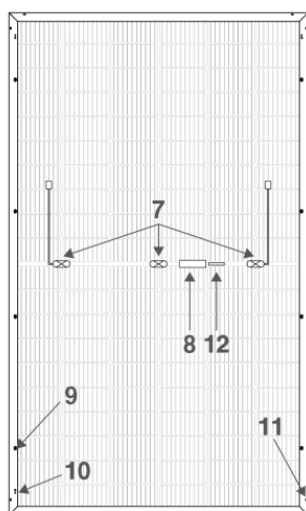


3. Product Identification

Each module has a durable nameplate on the rear side listing the following key parameters:

- Model type and power class
- Rated maximum power (P_{max} , W)
- Open-circuit voltage (V_{oc} , V) and short-circuit current (I_{sc} , A)
- Voltage and current at maximum power (V_{mp} , I_{mp})
- Maximum system voltage (V_{sys})
- Maximum series fuse rating (A)
- Weight and dimensions
- For bifacial modules: BNPI (bifacial nameplate irradiance) values

Each module carries a unique serial number (21-digit barcode) laminated under the front glass, with a duplicate sticker on the frame. Use this number for traceability and warranty claims.



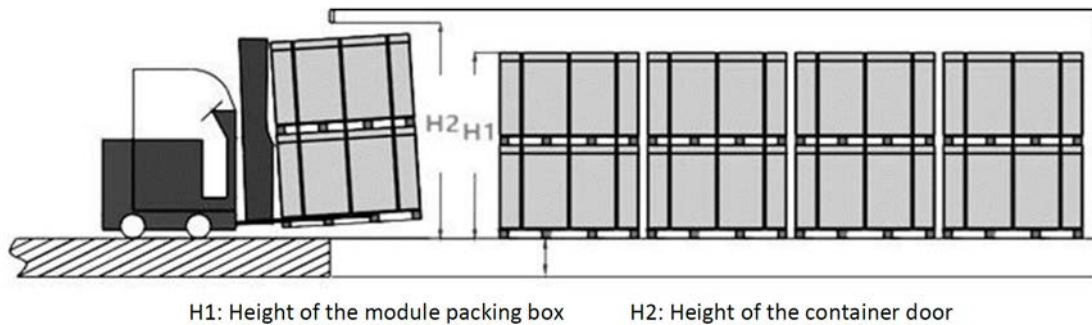
1. Aluminium frame	5. Back glass	9. Mounting hole
2. Low iron glass	6. Silica gel	10. Grounding hole
3. Encapsulation EVA	7. Junction box	11. Drainage hole
4. Solar Cell	8. Name plate	12. Bar code

4. Transportation, Storage and Unpacking

4.1 Transportation

Modules are shipped on pallets with protective packaging. Follow these guidelines:

- Keep modules in original packaging until installation.
- Pallet stacking: maximum **two high** for landscape-oriented packages; portrait-oriented packages **must not** be stacked.
- When unloading from a container, use a forklift with fork length ≥ 1250 mm (49.21 in) for large modules and fork thickness ≤ 80 mm (3.15 in) to avoid damaging the pallet or container door frame.
- Secure pallets inside the container with airbags and polyester strapping to prevent shifting during transport.



4.2 Storage

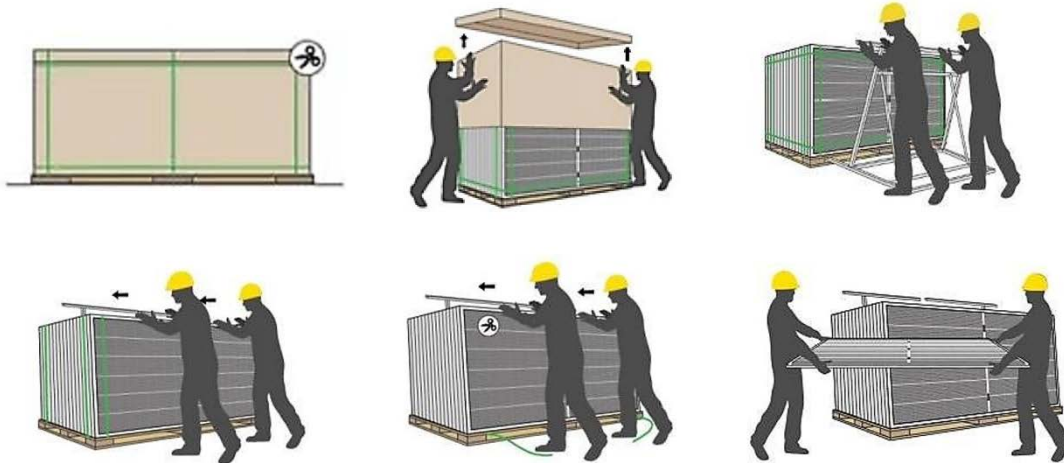
Store modules in a dry, well-ventilated area, away from direct sunlight, rain, and moisture. Recommended conditions:

- Temperature: -20°C to $+50^{\circ}\text{C}$ (-4°F to $+122^{\circ}\text{F}$)
- Relative humidity: $<85\%$
- Do not stack other items on modules or pallets.
- If modules are stored for more than 3 months, inspect packaging for damage and ensure connectors are protected with dust caps.

4.3 Unpacking (Step-by-step)

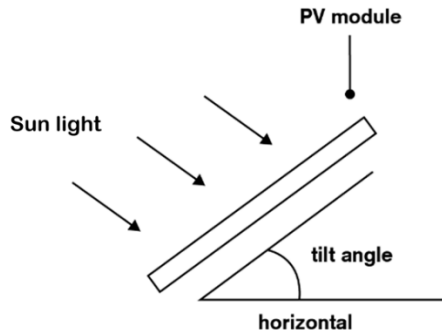
1. Place pallet on a flat, dry surface near a stable vertical support (e.g., wall or unpacking rack).
2. Cut all the straps outside the carton, and remove the cover.
3. Carefully remove side packaging by opening the diagonal of the package.

4. Remove the horizontal straps; leave vertical straps in place to keep modules bundled.
5. Lean the bundled modules against the support, and then cut remaining straps.
6. Two workers work together to remove modules one by one by gripping the frame – **never** lift by the junction box or cables.



5. Installation Environment

- **Operating temperature:** -40 °C to +85 °C (-40 °F to +185 °F), module surface may exceed ambient in sunlight.
- **Altitude:** ≤2000 m (6561.7 ft) above sea level (for higher altitudes, consult Oakridge Power).
- **Mechanical loads (test values):** Front (push) up to 5400 Pa, back (pull) up to 2400 Pa, depending on mounting method. Design loads = test load / 1.5 (safety factor).
- **Shading:** Avoid permanent shading from trees, buildings, chimneys, or other structures. Partial shading can cause hot-spots and reduce output; bypass diodes mitigate but do not eliminate the risk.
- **Ventilation:** Maintain at least 10 cm (4 in) clearance between module backside and roof/wall to allow air circulation and prevent overheating.
- **Facing:** 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 true south.
- **Minimum tilt angle:** 10° to allow self-cleaning by rain and avoid water pooling.



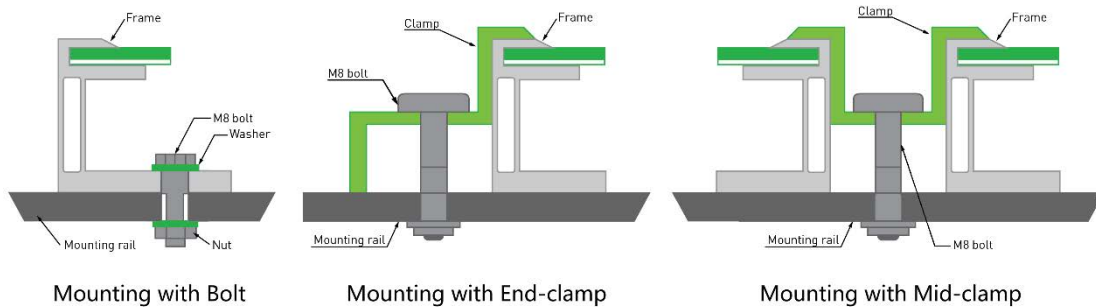
Recommended fixed tilt based on latitude:

Latitude range	Recommended tilt angle	Example regions
25° – 35°	Latitude +5°	Texas, Florida, Arizona
35° – 45°	Latitude +10°	Colorado, Tennessee, Virginia
>45°	Latitude +15°	Minnesota, New York, Washington

6. Mechanical Installation

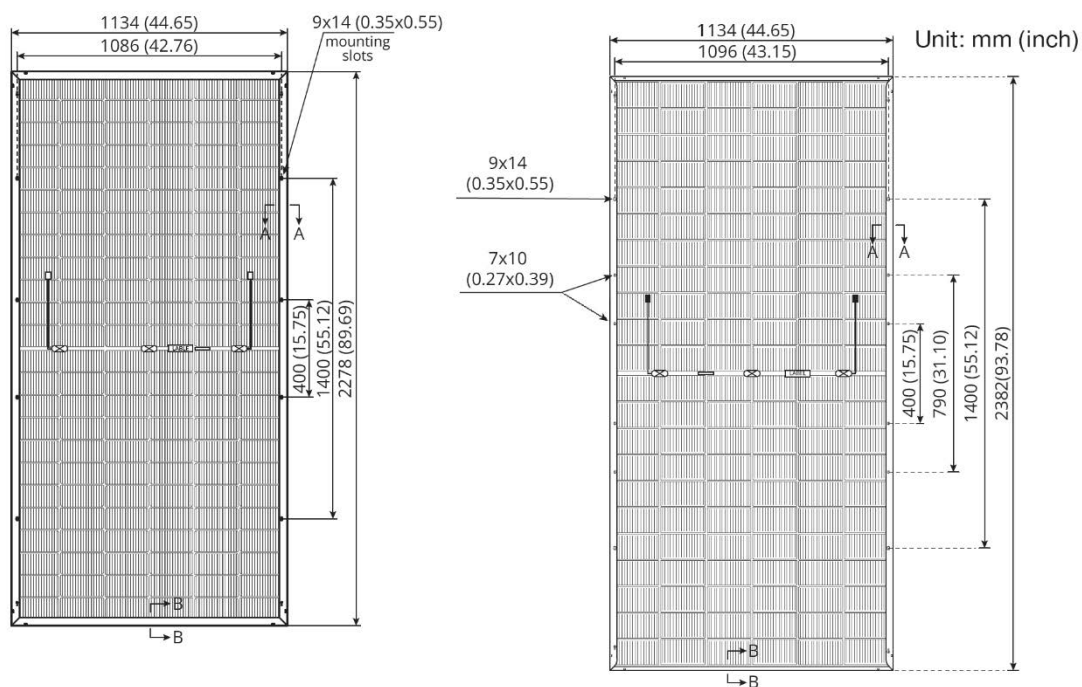
6.1 General Rules

- Modules can be installed in either portrait or landscape orientation.
- All mounting hardware (bolts, nuts, washers, clamps) must be made of corrosion-resistant materials (stainless steel or hot-dip galvanized steel).
- Use only the factory-drilled holes provided in the frame – **do not drill additional holes**.
- Frame holes are sized as follows: 9 mm × 14 mm (0.35 in × 0.55 in) for M8 bolts; 7 mm × 10 mm (0.27 in × 0.29 in) for M6 bolts.
- Tightening torque (reference values):
 - M8 bolt: 16–20 N·m (11.8–14.8 ft-lbs)
 - M6 bolt: 6–9 N·m (4.4–6.6 ft-lbs)
- Maintain a minimum gap of 10 mm between adjacent modules to accommodate thermal expansion.
- In high wind or snow regions, use additional mounting points (e.g., 6 or 8 clamps/bolts) to meet local building code requirements.
- Modules feature either **8 or 12 mounting holes** (refer to the product mechanical drawing). The hole patterns allow flexibility for different rail configurations.



6.2 Bolt Mounting

Oakridge Power modules are equipped with either 8 or 12 mounting holes on the aluminum frame (arranged symmetrically along the long sides).



The following table summarizes the approved bolt mounting configurations and corresponding test loads.

Hole configuration	Holes used	Max test load (front/back) [Pa]
8-hole	Outer 4 (near corners)	+5400 / -2400
8-hole	All 4 per side (8 total)	+5400 / -2800
12-hole	Outer 4 + middle 2 per side (8 total)	+5400 / -2800

12-hole	All 6 per side (12 total)	+5400 / -3600*
---------	---------------------------	----------------

**All-12 configuration provides enhanced back-side load capacity for extreme wind uplift. Consult Oakridge Power for specific project load calculations.*

Position bolts symmetrically to ensure uniform load distribution. Use flat washers, spring washers, and nuts. Ensure bolt length does not exceed the combined thickness of the frame, rail, and washers; excessive bolt length may touch the glass or backsheet.

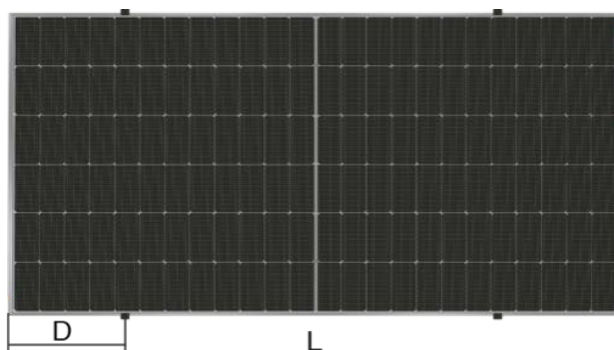
6.3 Clamp Mounting

Use at least four clamps per module, positioned symmetrically on the long sides. For 12-hole modules, additional clamps (6 total) can be used to increase back load capacity.

- Clamp overlap on the frame (front side): 8–11 mm (0.31-0.43 in).
- Clamp length (along the frame): 50 mm (1.97 in) for uplift loads ≤ 2400 Pa; ≥ 80 mm (3.15 in) for uplift loads > 2400 Pa.
- Clamp thickness: ≥ 3 mm (0.12 in) (material should be anodized aluminum or stainless steel).
- Clamp position (distance from the long side edge) – see table below.

Module length (L) [in]	Clamping position D (from edge) [in]	Max test load (front/back) with 4 clamps [Pa]
≤ 70	$L/5 \pm 1.97$	+5400 / -2400
70–90	$L/4 \pm 1.97$	+5400 / -2400
> 90	$L/4 \pm 1.97$ (use ≥ 3.15 in clamp)	+5400 / -2400

When using 6 clamps (3 per long side), the back load can be increased to -3600 Pa with proper positioning. Ensure clamps do not touch the front glass, do not block drainage holes, and do not deform the frame. Apply torque per clamp manufacturer's recommendation (typically 11.8–14.8 ft-lbs for M8 bolts).



6.4 Tracker Installation

For tracker installations, module mounting must comply with the general mechanical and electrical requirements outlined in Sections 6 and 7. All mounting hardware used with trackers shall be corrosion-resistant. Ensure that, at all tracker rotation angles, the module junction box does not make contact with any part of the tracker structure. Tracker systems impose dynamic loads and torsional stresses on the modules during operation; secure fastening must be maintained at all times. Under severe weather conditions (e.g., high winds), the tracker controller shall automatically stow modules to the protective tilt angle defined by the tracker manufacturer.

7. Electrical Installation

7.1 General Rules

⚠ All electrical work must be performed by licensed electricians and comply with National Electrical Code (NEC) 2023 and all local regulations.

- Use UL 4703 PV wire, minimum 4 mm² (0.0062 in²) (12 AWG), 90 °C wet-rated, copper conductors only.
- Connectors must be UL 6703 certified and of the same type and brand – do not intermix connectors from different manufacturers.
- Keep connectors clean and dry; mate them immediately after removing protective dust caps.
- Do not expose connectors to direct sunlight or standing water; use UV-resistant cable ties to secure cables.
- Minimum bending radius for cables: 4× cable outer diameter (recommended ≥60 mm (2.36 in)).
- Secure cables to the mounting structure to prevent mechanical stress and chafing.

7.2 Series/Parallel Sizing & Examples

Maximum number of modules in series (N):

$$N = V_{\max} / [V_{\text{oc}} \times (1 + \beta \times (T_{\min} - 25))]$$

where:

$V_{\max}$ = maximum system voltage

β = voltage temperature coefficient (negative value, e.g., -0.25 %/°C)

$T_{\min}$ = lowest expected ambient temperature at the site (°C)

Example:

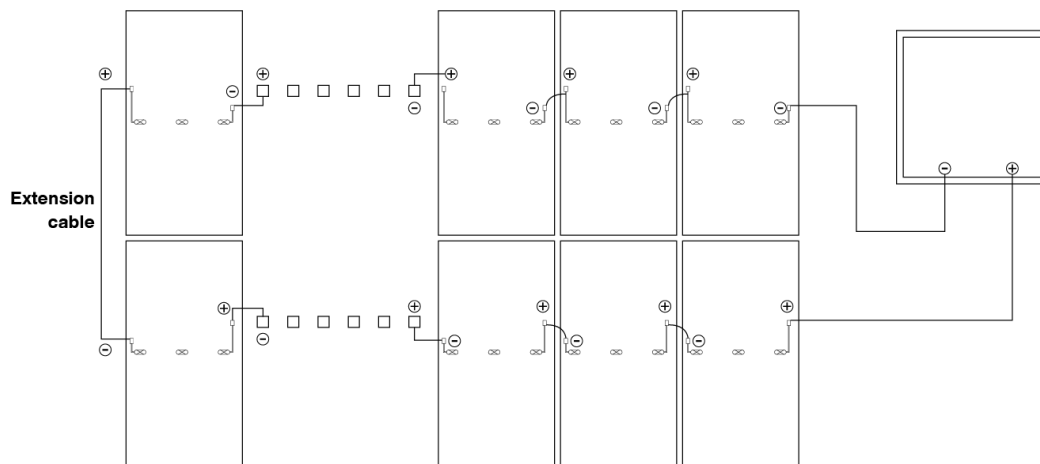
For a module with $V_{\text{oc}} = 50 \text{ V}$, $\beta = -0.25 \text{ \%/}^\circ\text{C}$, $T_{\min} = -20 \text{ }^\circ\text{C}$, and $V_{\max} = 1500 \text{ V}$:

$V_{oc,adj} = 50 \times (1 + (-0.0025) \times (-20 - 25)) = 50 \times (1 + 0.1125) = 55.625 \text{ V}$
 $N = 1500 / 55.625 \approx 26.96 \rightarrow \text{round down to } \mathbf{26 \text{ modules per string.}}$

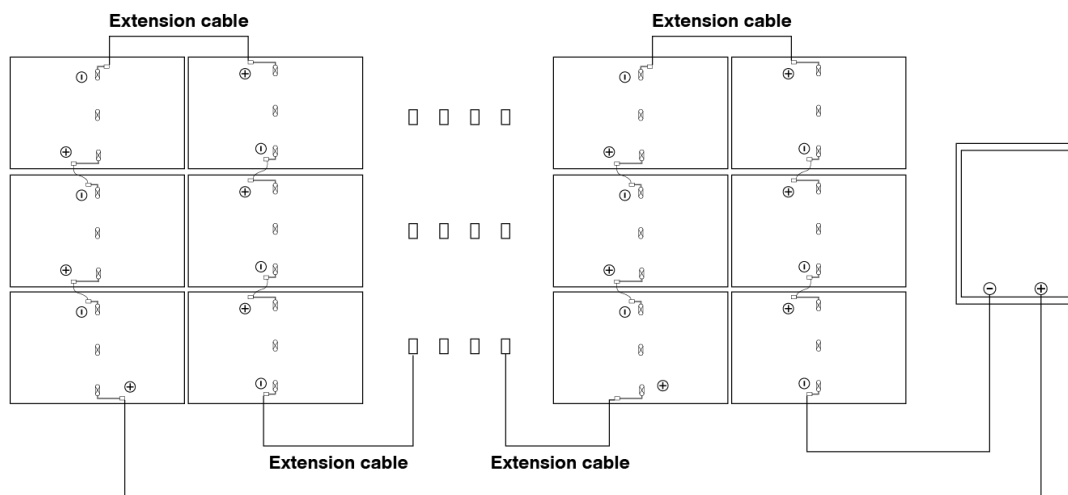
Maximum parallel strings: Each string must be protected by a fuse rated $\leq$ the module's maximum series fuse rating (printed on label). The number of parallel strings is limited by the fuse rating and the array short-circuit current. As a rule of thumb:

Max parallel strings = (fuse rating) / ($I_{sc} \times 1.25$) - round down.

For example, if fuse = 30 A and $I_{sc} = 14 \text{ A}$, then $30 / (14 \times 1.25) = 30 / 17.5 = 1.71 \rightarrow$ maximum **1 string** without additional string fuses. If more strings are needed, each string must have its own fuse.



Vertical Installation

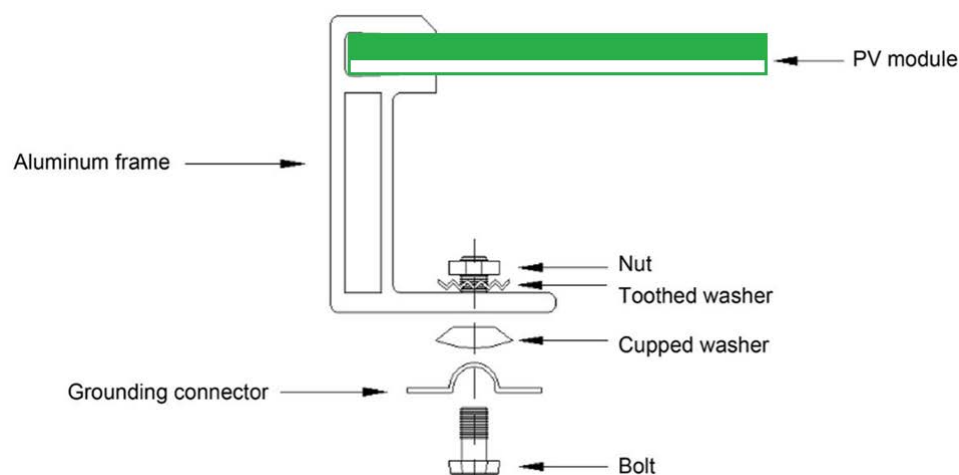


Horizontal Installation

7.3 Grounding

Prior to system energization, all module frames must be properly grounded to eliminate the risk of electric shock and fire hazards. All grounding and installation work shall comply with NEC Article 250. Use the designated grounding holes (marked with a grounding symbol) on the frame.

An effective grounding configuration typically connects non-current-carrying metallic parts—such as module frames—to earth either through a dedicated grounding electrode or via support structures that are themselves equipped with integral grounding provisions. For the physical connection, use stainless-steel grounding bolts, washers, and nuts. The grounding conductor, formed into an Ω -shaped loop, shall be secured between the bolt head and the washer, with the screw passed through the designated grounding hole on the frame. To ensure a low-resistance, durable electrical bond with the anodized aluminum surface, a toothed washer must be used to penetrate the insulating oxide layer.



7.4 PID Mitigation

To reduce Potential Induced Degradation (PID), Oakridge Power recommends:

- Implementing negative grounding of the array (for transformer-based inverters), or
- Using an isolation transformer with virtual grounding for transformerless inverters, or
- Using inverters with integrated PID recovery function. Consult your inverter supplier for compatible solutions.

8. Maintenance and Cleaning

Qualified personnel should inspect electrical and mechanical connections at least every six months. Clean modules at least once a year, especially in low rainfall areas, using soft sponge/cloth and water (non-abrasive cleaners like ethyl alcohol for stubborn dirt). Do not use high-pressure or high-mineral water. Avoid cleaning during strong sunshine. Do not touch glass with bare hands. If snow accumulates, do not scrape forcibly. Do not clean broken modules or with exposed cables. If issues arise, arrange qualified personnel.

8.1 Regular Inspections (every 6 months)

- Check all electrical connections and grounding for corrosion or looseness.
- Inspect clamps/bolts for tightness and signs of wear.
- Look for glass cracks, backsheet damage, or moisture ingress.

8.2 Cleaning Guidelines

Safety: Clean only during cool hours (morning/evening) to avoid thermal shock. Do not clean broken modules or when cables are exposed.

Recommended method:

- Use low-pressure water (≤ 4 MPa, 40 bar) with a soft sponge or cloth.
- Water pH between 6 and 8, hardness ≤ 600 mg/L (0.005 lb/gal) CaCO_3 .
- For stubborn dirt (bird droppings, tree sap), use a mild, non-abrasive detergent (e.g., isopropyl alcohol) locally.
- **Avoid** high-pressure washers, abrasive tools, and alkaline/acidic solvents.
- For bifacial modules, clean the rear side gently with similar tools if needed.

8.3 Robot Cleaning

If a cleaning robot is used, ensure it does not place excessive weight on the module surface. The brush material must be non-abrasive to avoid scratching the glass. Any module damage or performance degradation resulting from improper robot usage is not covered under Oakridge Power's warranty. Refer to the cleaning robot manufacturer's instructions for safe operation guidelines.

Oakridge Power recommends documenting all inspections and maintenance activities. Please retain these records as proof of adherence to the

recommended maintenance schedule, which may support any future warranty claim investigations.

9. Disposal

Dispose of modules in accordance with all applicable federal, state, and local regulations. Do not dispose of photovoltaic modules as unsorted municipal waste.

Oakridge Power encourages responsible scrapping management. Please contact your local waste management bureau or qualified recycling service provider to learn about the disposal plan in your area.

10. Disclaimer of Liability

Because the use of this manual and the conditions or methods of installation, operation, use, and maintenance of Oakridge Power photovoltaic modules are beyond Oakridge Power's control, Oakridge Power does not accept any responsibility and expressly disclaims liability for any loss, damage, or expense arising out of or in any way connected with such installation, operation, use, or maintenance, including but not limited to property damage, personal injury, power loss, or any other incidental or consequential damages.

The information contained in this manual is based on Oakridge Power's knowledge and experience at the time of publication and is believed to be reliable. However, such information, including product specifications (without limitation) and suggestions, does not constitute a warranty, express or implied, including any warranty of merchantability or fitness for a particular purpose. Oakridge Power reserves the right to modify this manual, the PV modules, electrical specifications, or product information sheets without prior notice.

OAKRIDGE POWER LLC

Address: 7901 South Fwy, Fort Worth, TX 76134

Website: www.oakridge-power.com

E-mail: info@oakridge-power.com | LinkedIn: Oakridge Power

© 2026 Oakridge Power – All rights reserved. Specifications subject to change without notice.