



SunModo PV Rack Mount System
UL2703 Compliant

Please read carefully before installing

Product is tested to and recognized to UL 2703 standards for safety grounding and bonding equipment and meets UL1703 fire standards.

SunModo PV Rack Mount System can be used to mount photovoltaic (PV) panels in a wide variety of locations. All installations shall be in accordance with NEC requirements in the USA.

The self-grounding and bonding system is for use with PV modules that have a maximum series fuse rating of less than 30A. Maximum downward pressure: 90 psf (4310Pa); Maximum upward pressure: 40 psf (1915 Pa), Maximum down-slope: 35 psf (1675 Pa) tested in accordance with IEC 61646.

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Document Number D10007-V005
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ETL CLASSIFIED

 Intertek
 5001753

Installer Responsibility:

Before ordering and installing materials, all system layout dimensions should be confirmed by field measurements. SunModo reserves the right to alter, without notice, any details, proposals or plans. Any inquiries that you may have concerning installation of the PV system should be directed to your SunModo Sales representative. Consult SunModo Sales for any information not contained in this manual. This manual is intended to be used as a guide when installing SunModo's EZ Tile Hook Mount System on pitched roofs. It is the responsibility of the installer to ensure the safe installation of this product as outline herein.

- Installer shall employ only SunModo products detail herein. The use of non SunModo components can void the warranty and cancel the letters of UL compliance.
- Installer shall adhere to the torque values are called out in this Instruction Manual.
- Installer shall use anti-seize compound, such as Permatex anti-seize, for all threaded parts.
- Installer shall guarantee that screws and anchors have adequate pullout strength and shear capacities.
- Installer shall adhere to all relevant local or national building codes. This takes account of those that supplant this document's requirements.
- Installer shall guarantee safe placement of all electrical details of the PV array.
- Installer is responsible to install EZ Tile Hook Mount over a Fire Resistant roof covering rated for the application.
- Installer is responsible to determine that the roof, its rafters, connections, and other architectural support components can sustain the array under all code level loading conditions.
- Installer shall comply with all applicable local or national building codes, including periodic re-inspection of the installation for loose components, loose fasteners and any corrosion, such that if found, the affected components are to be immediately replaced.

Safety:

Review relevant OSHA and other safety standards before following these instructions. The installation of solar PV systems is a dangerous procedure and should be supervised by trained and experienced personnel.

It is not possible for SunModo to be aware of all the possible job site situations that could cause an unsafe condition to exist. The installer of the roof system is responsible for reading these instructions and determining the safest way to install the roof system. These instructions are provided only as a guide to show a knowledgeable, trained erector the correct part placement one to another. If following any of the installation steps would endanger a worker, the erector should stop work and decide upon a corrective action. Provide required safety railing, netting, or safety lines for crew members working on the roof.

Lag Pull-Out Capacities:

Sources: American Wood Council, NDS 2005, Table 11.2 A, 11.3.2 A

Lag pull-out (withdrawal) capacities (lbs.) in typical lumber:	Specific Gravity	5/16" Shaft per 1" thread depth	5/16" Shaft per 2-1/2" thread depth
Douglas Fir, Larch	.50	266	665
Douglas Fir, South	.46	235	588
Engelmann Spruce, Lodgepole Pine (MSR 1650 f & higher)	.46	235	588
Hem, Fir	.43	212	530
Hem, Fir (North)	.46	235	588
Southern Pine	.55	307	768
Spruce, Pine, Fir	.42	205	513
Spruce, Pine, Fir (E of 2 million psi and higher grades of MSR and MEL)	.50	266	665

SunModo Self-Grounding System

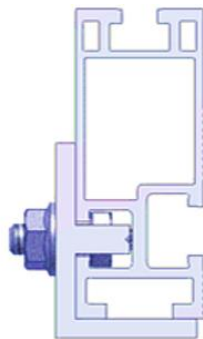
SunModo offers a proprietary grounding and bonding system that is designed into the mounting hardware for rails, clamps and splices. All hardware meet UL 2703 Grounding and Fire Standards tested by ETL.

The basis of the system is our patented stainless steel floating grounding pin which is designed to be captive in the mounting components and provides a bonding path from the PV panel frames to the rails and rail splices, and finally to the ground lug.

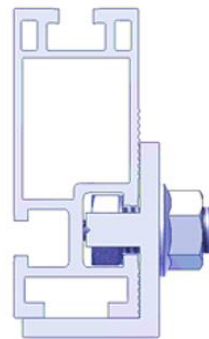


Mid Clamp with Ground Pins

Similarly, the rail splices the grounding pins, eliminating the need for extra bonding components.



1/4-20 Splice Kit



3/8-16 Splice Kit



Rail Splices with Grounding Pins

List of Compliant PV Modules

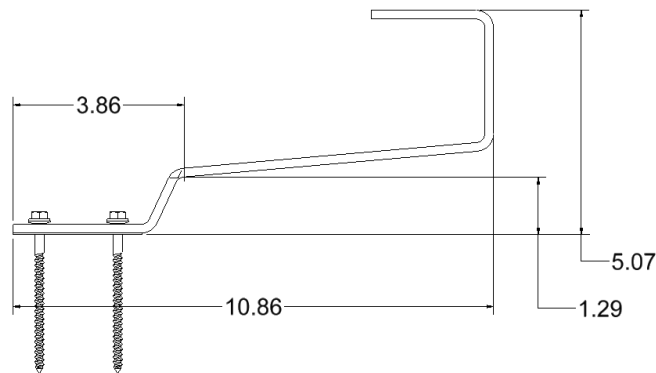
UL 2703 Qualified Modules for use with SunModo PV Racking Systems

Evaluated PV Modules	
Module manufacturer	Model numbers
C-Sun	CSUN290-72P, CSUN295-72P, CSUN300-72P, CSUN305-72P, CSUN310-72P, CSUN285-72M, CSUN290-72M, CSUN295-72M, CSUN300-72M, CSUN305-72M, CSUN310-72M, CSUN315-72M, CSUN320-72M, CSUN235-60M, CSUN240-60M, CSUN245-60M, CSUN240-60P, CSUN245-60P, CSUN250-60P, CSUN255-60P, CSUN260-60P
Canadian Solar	CS6X-300P, CS6X-305P, CS6X-310P, CS6X-315P, CS6X-320P, CS6P-255P, CS6P-260P, CS6P-265P, CS6P-260M, CS6P-265M, CS6V-210P, CS6V-215P, CS6V-220M, CS6V-225M, CS6K-265M, CS6K-270M
ET Solar	ET-P672300WW, ET-P672305WW, ET-P672310WW, ET-P672315WW
Hanwha Q Cells	Q.PRO L-G2 305, Q.PRO L-G2 310, Q.PRO L-G2 315
Hareon	HR-280P-24/Ba, HR-285P-24/Ba, HR-290P-24/Ba, HR-295P-24/Ba, HR-300P-24/Ba, HR-305P-24/Ba, HR-310P-24/Ba
Itek Energy (50mm frame)	IT250HE, IT255HE, IT260HE, IT265HE, IT270HE, IT275HE, IT280HE, IT285HE, IT290HE, IT295HE, IT300HE, IT305HE, IT310HE
LG	LG275S1C-G4, LG280S1C-G4, LG285S1C-G4, LG300N1C-G4, LG300N1K-G4, LG305N1C-G4, LG310N1C-G4, LG315N1C-G4, LG320N1C-G4, LG335S2W-G4, LG340S2W-G4, LG360N2W-B3, LG365N2W-B3, LG365N2W-G4, LG370N2W-G4, LG375N2W-G4
Panasonic	VBHN285J40
Phono Solar Tech	PS255M-20/U, PS260M-20/U, PS265M-20/U, PS270M-20/U, PS275M-20/U, PS280M-20/U, PS300P-24T, PS305P-24T, PS310P-24T, PS315P-24T, PS320P-24T, PS325P-24T

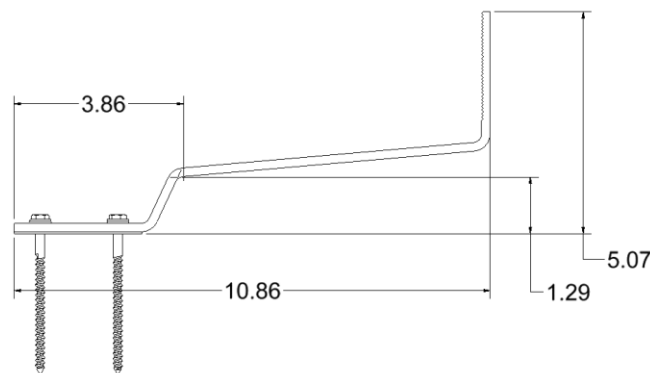
Sanyo	HIP-190BA3, HIP-195BA3, HIP-200BA3, HIP-205BA3, HIT-N215A01, HIT-N220A01, HIT-N225A01
SolarWorld (V2.5 frame)	Sunmodule SW series: SW 220 mono and poly, SW 225 poly, SW 230 poly, SW 235 poly, SW 240 mono and poly, SW 245 mono and poly, SW 250 mono, SW 255 mono, SW 260 mono, SW 265 mono, SW 270 mono Sunmodule Plus series: 285W mono, 280W mono, 275W mono, 270W mono, 265W mono, 260W mono, 255W mono, 250W mono Sunmodule Protect 275W mono Sunmodule Protect 270W mono Sunmodule Protect 265W mono Sunmodule SW 245 - 255 poly / Pro-Series
SolarWorld (33mm frame)	Sunmodule Pro-Series: 250W poly, 255W poly, 260W poly 315W XL mono, 320W XL mono, 325W XL mono, Sunmodule Plus: 260W mono, 270W mono, 275W mono, 280W mono, 285W mono
Stion	STO-135A, STO-140A, STO-145A, STO-150A
SunEdison	F310EzD, F315EzD, F320EzD, F325EzD, F330EzD, F335EzD, F310EzC, F315EzC, F320EzC, F325EzC, F330EzC, F335EzC, R330EzC, R335EzC, R340EzC, R345EzC, R350EzC, R355EzC
SunPower	X21-355-BLK, X21-345, SPR-E20-327, SPR-E19-320
Trina	TSM-225 PC/PA05, TSM-230 PC/PA05, TSM-235 PC/PA05, TSM-240 PC/PA05, TSM-245 PC/PA05
Yingli	YL230P-29b, YL235P-29b, YL240P-29b, YL245P-29b

EZ Tile Hook Mount Series:

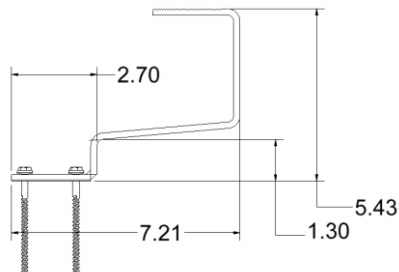
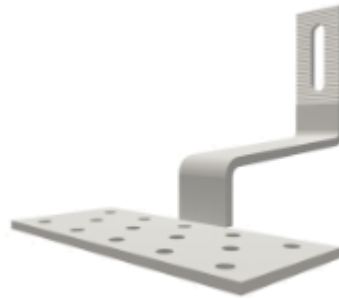
SunModo offer 4 choices of tile hooks for vertical rail orientations and 4 hooks for flat mounting for strut type rails. The hook provide a nominal 110 pound load and uplift capability when mounted into roof trusses with two lag bolts. Another feature of the tile hook is the tile hook base, a gasket underneath the hook. The EZ Tile Hook Mounts includes Roof Hook with EPDM Hook Base Gasket (attached) and two 1/4 x 3-1/2" Lag Bolts with Sealing Washers.



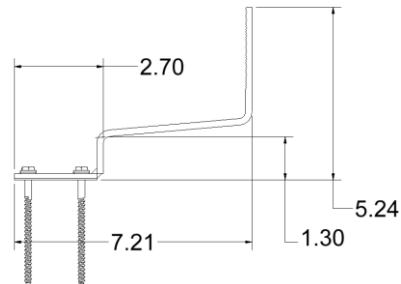
K10167-001 | Strap Tile Hook Kit, Horizontal



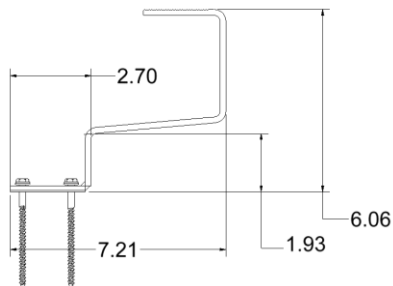
K10168-001 | Strap Tile Hook Kit, Vertical



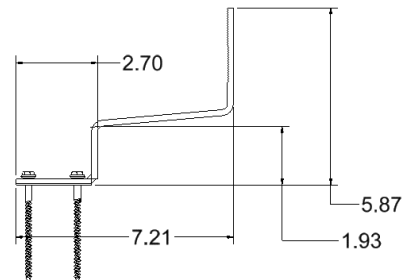
K10169-001 | Multi-Screw Tile Hook Kit, Horizontal



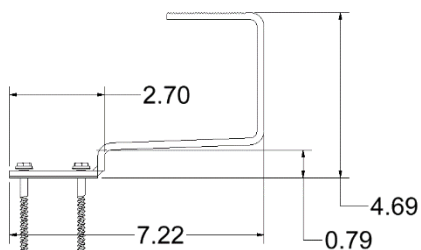
K10170-001 | Multi-Screw Tile Hook Kit, Vertical



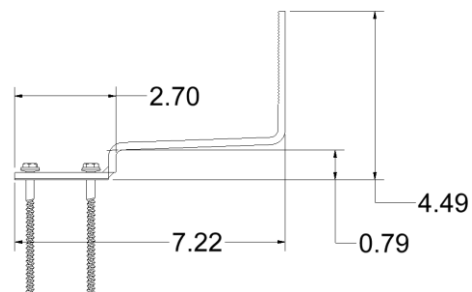
K10171-001 | Spanish Tile Multi-Screw Hook Kit, Horizontal



K10172-001 | Spanish Tile Multi-Screw Hook Kit, Vertical



K10173-001 | Flat Tile Multi-Screw Hook Kit, Horizontal



K10174-001 | Flat Tile Multi-Screw Hook Kit, Vertical

Additional Components:



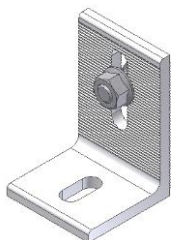
1/4 X Stainless Steel Lag Bolts

B15033-002
1/4 X 3-1/2" Stainless Steel Lag Bolt



Sealing washer

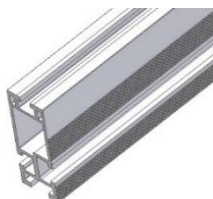
B15019-001
1/4 Sealing Washer



Aluminum L-Foot available in clear and black. 3/8" Flange Nut and Bolt included.

K10066-XXX
Standard L-Foot Kit

K10096-XXX
Tall L-Foot Kit

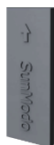


Helio Rails: Features both 1/4" and 3/8" side slots, and 1/4" top slot for clamping PV panels. Available in 84", 124", 164" and 206" lengths. Last 3 digits denote rail length. 4 stock sizes in clear and black.

A20144-XXX (Clear)
A20144-XXX-BK (Black)
HR250 (Standard Rail)

A20145-XXX (Clear)
A20145-XXX-BK (Black)
HR350 (Heavy Rail)

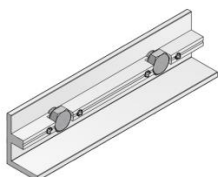
A20146-XXX (Clear)
A20146-XXX-BK (Black) HR500 (Super Rail)



Rail End Caps available for Helio Standard and Heavy rails (optional)

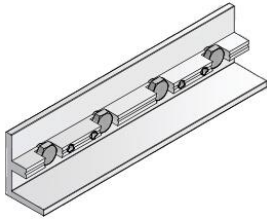
C10017-001 (Black)
C10017-001-GR (Gray)
HR250 (Helio Standard)

C10021-001 (Black)
C10021-001-GR (Gray)
HR350 (Helio Heavy)



3/8" Slot Rail Splice Kit with 2X 3/8-16 hex bolts and flange nuts with integral grounding.
May be repositioned until torqued to final value.

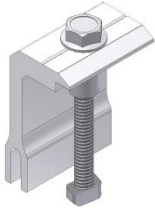
K10178-001
HR250/HR350 3/8" Splice
For single-use only



1/4" Slot Rail Splice Kit with 4X bolts and flange nuts with integral grounding. **May be repositioned until torqued to final value.**

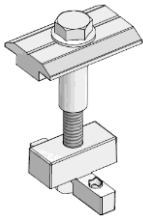
K10177-001
K10177-BK1
HR250/HR350 1/4" Splice
For single-use only

K10248-001
K10248-001-BK
HR500 1/4" Splice
For single-use only



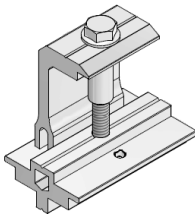
End Clamp Kit, fits panel height from 31 to 50 mm. For last 3 digits, see Table on last page.

K10224-1XX



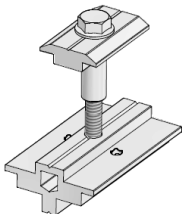
Grounding Mid Clamp Kit fits panel height from 31 to 50 mm. **May be repositioned until torqued to final value.**

K10180-001
For single-use only



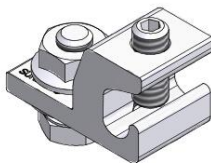
Grounding End Clamp Kit with shared rail adaptor for standard rail; fits panel height from 31 to 50 mm. For last 3 digits, see table on last page. **May be repositioned until torqued to final value.**

K10183-1XX
For single-use only



Grounding Mid Clamp Kit with shared rail adaptor for standard rail; fits panel height from 31 to 50 mm. **May be repositioned until torqued to final value.**

K10182-001
For single-use only



Grounding Lug Kit with Grounding Spacer and 1/4-20 T-Bolt. **May be repositioned until torqued to final value.**

K10179-001
For single-use only



HR150 (Open Rail): Features wire management channel and both 1/4" and 3/8" side slots, and 1/4" top slot for clamping PV panels. Available in 84", 124", 164" and 206" lengths. Last 3 digits denote rail length. 4 stock sizes in clear and black.

A20242-XXX (Clear)
A20242-XXX-BK (Black)
HR150 (Open Rail)



1/4" Slot Open Rail Splice Kit with 4X 1/4-20 Bolts and Flange Nuts with integral grounding. ***May be repositioned until torqued to final value.***

K10236-001
HR150 Splice Kit
For single-use only



Rail End Caps available for HR150 rails (optional)

A20250-001 (Clear)
A20250-BK1 (Black)
HR150 Rail End Cover



HR150 Channel Clip: snaps into the open rail to manage wire bundles where needed. Available in clear and black.

A20252-001 (Clear)
A20252-BK1 (Black)
HR150 Wire Cover



The HR150 family of products are shown assembled above. Two HR150 Rails are spliced together with an HR150 Rail Splice. PV electrical wires are shown routed in the channels of the HR150 Rails, retained with two HR150 Channel Clips snapped into place.

Tools Required for Installation

Electric Drill or Impact Driver.

Note that the use of an impact driver is strongly discouraged for all stainless nut and bolt hardware.



Roofing Bar



Drill Bit for lag bolts, pilot hole 7/32" diameter for 5/16" lag bolt



3/8" Socket wrench



Sockets for 3/8" drive sockets, 7/16", 1/2", 9/16" and 1-1/16"



Torque Wrench 3/8" drive, 0 to 35 ft. lbs.



Anti-seize compound (Permatex 80071 or equivalent).



Caulk gun and silicon sealant

- ChemLink M1 (or equivalent) for wood and composite roofs.
- ChemLink DuraLink (or equivalent) for metal roofs.



Tape measure



Saws for cutting aluminum posts and rails as necessary



Torque Values:

These values must be adhered to for mechanical strength. It is required that a torque wrench be used to measure the bolt torque during final assembly, and it is recommended that anti-seize compound, such as Permatex, be applied to the screw threads.

Hardware	Torque
1/4-20 Bolts and Hex Flange Nut	7.5 ft. lbs.
1/4-20 Ground Lug, Flange Nut with 7/16 Hex Head	7.5 ft. lbs.
1/4-20 Ground Lug, Setscrew with 1/8 Allen drive	4.2 ft. lbs. (50 in. lbs.)
1/4-20 Mid or End Clamp, Female Standoff with 7/16" Hex Head Collar Nut	7.5 ft. lbs.
1/4 Lag Bolt	12 ft. lbs.
5/16 Lag Bolt	25 ft. lbs.
3/8" Bolts and Hex Flange Nuts	15 ft. lbs.
3/8" T-Bolts and Hex Flange Nuts	15 ft. lbs.
1-1/16" HEX Cap	15 ft. lbs.

Installation Instructions:

Step 1: Attaching

1. Using a roofing bar, gently remove the tile from the desired location gaining access to the interior of the roof. Locate and mark the center of the rafter.
2. Rest the base of the EZ Tile Hook over the center of the rafter and mark center of holes. Drill two 11/64" pilot holes in accordance with the NDS guidelines.
3. Clean away any roof debris and fill the two pilot holes with structural sealant, ChemLink M1 or equivalent.
4. Attach the EZ Tile Hook using the two 1/4 x 3-1/2" Lag Bolts with Sealing Washers, torque to 12ft-lbs.

Step 2: Waterproofing (Materials not provided)

5. Because of the EPDM gaskets design, separate flashing is NOT required.
6. If your local code agency requires a secondary waterproof flashing proceed with waterproofing using three-course method or lapped paper method.
7. For additional waterproofing install a long strip of EPDM foam gasket between the EZ Tile Hook and the top edge of the lower tile. Place a short strip of EPDM foam gasket on top of the EZ Tile Hook to insure water does not travel up the hook and onto the underlayment of the roof.

Step 3: Finishing

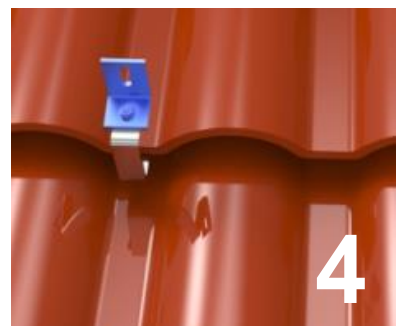
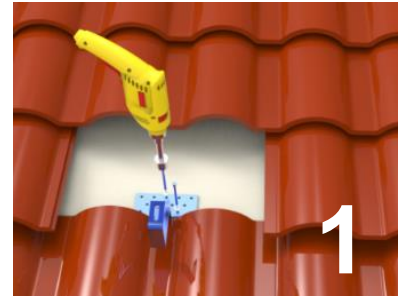
8. To ensure the tile sits flush with the roof it may be necessary to notch the bottom of the tile to make space for the raised EZ Tile Hook.
9. Reinstall the tile.

Step 4: L-Foot Assembly

10. Attach an L-Foot to the EZ Tile Hook using a 3/8" Bolt and Flange Nut, torque to 15ft-lbs.

Step 5: Rail Assembly

11. Install AL Rail to L-Foot then tighten 3/8" Flange Nut to 15 ft-lbs. torque.

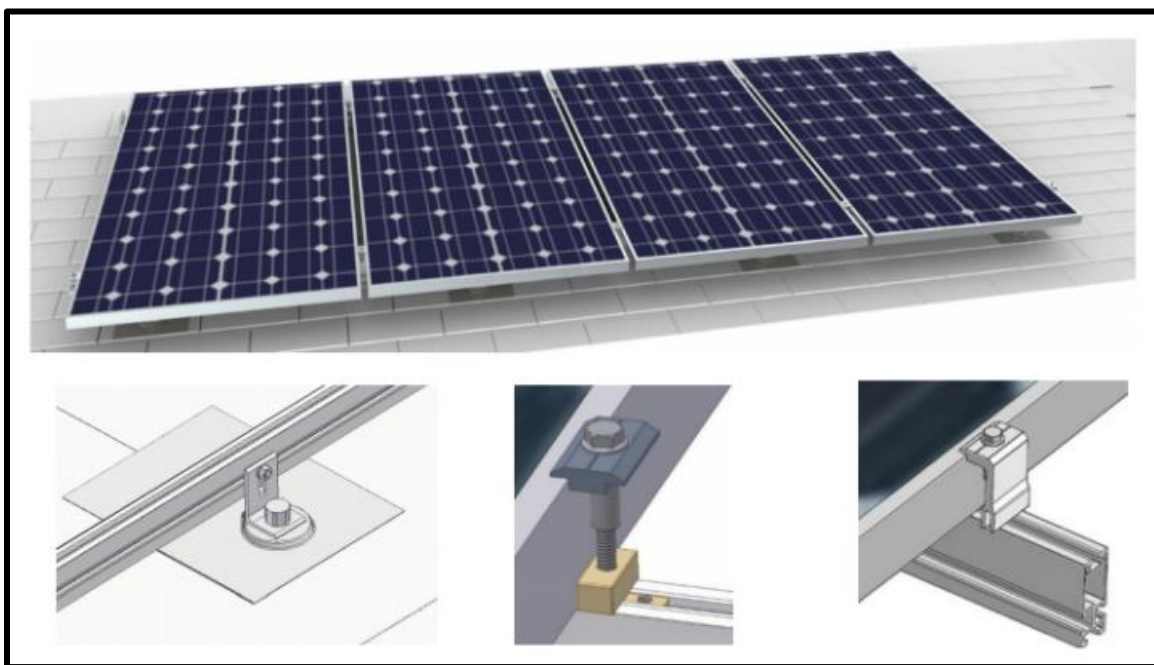


Portrait Panel Configuration:

With a full range of components the Pitch Roof System can be configured in an endless variety of designs. The system is IBC compliant for roof waterproofing tested by IAPMO, UL 1703 compliant for Class-A Fire Rated for Type 1 and 2 PV Modules and UL 2703 compliant for electrical bonding tested by ETL.

Proceed with the mounting of the PV panels using the Mid and End Clamps. Specific mounting instructions are shown in the following sections for portrait mounting.

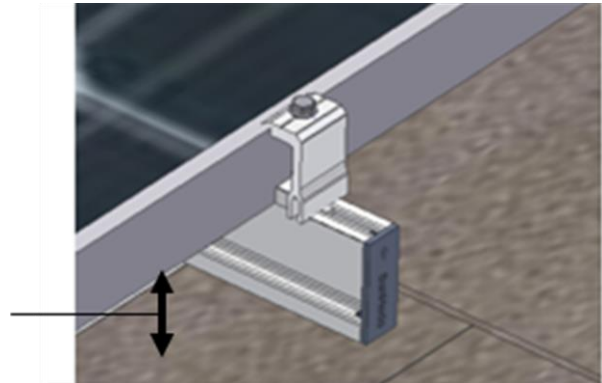
A typical portrait roof layout features two East-West rails mounted to North-South roof rafters with an L-Foot. Mid Clamps are used between PV panels, they will produce 1/2" spacing between PV panel frames. End Clamps are used to secure PV panels at the ends of a row.



Minimum Panel Height

Minimum leading edge height to meet a UL1703 PV module fire standard is 3 inches.

3 inch minimum
from bottom of PV module
frame to the roof covering

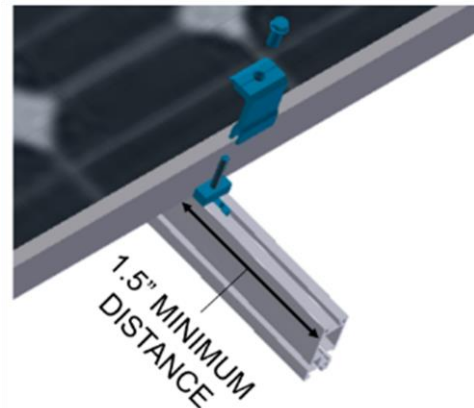


End Clamp Attachment

There must be a minimum of 1.5 inches of Rail extending beyond the PV panel frame.

Clamp the PV panel frame by inserting the T-Bolt into the Rail slot. Position the End Clamp firmly against the PV panel frame and secure using the 1/4-20 Collar Bolt. Using a 7/16" socket, torque to 7.5 ft. lbs.

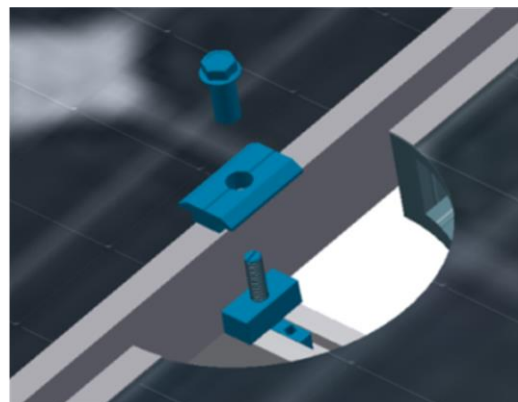
Note: When two or more PV panels are installed grounding via the End Clamp is optional. For a single panel configuration (shown), insert the T-Bolt into a T-Bolt Holder for grounding the panel to the Rails.



Mid Clamp Attachment

Insert the T-Bolt in the Rail slot and turn clockwise 90° to engage the head into the slot. Insert Grounding T-Bolt Holder to lock T-Bolt in place.

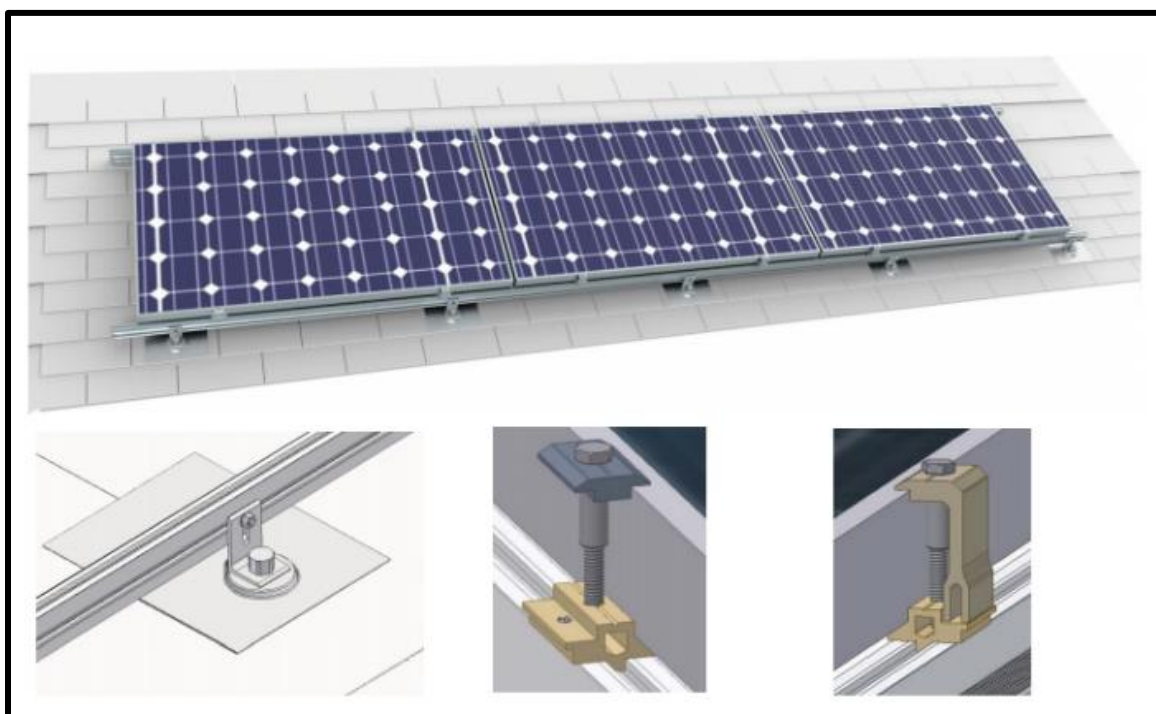
Thread the 1/4-20 Collar Bolt onto the top of the T-Bolt as shown. After positioning the Mid Clamp firmly against the PV panel frame, using a 7/16" socket, tighten to 7.5 ft. lbs.



Landscape Panel Configuration:

The Pitched Roof System conveniently accommodates landscape configurations to minimize roof time and parts required. The system is IBC compliant for roof waterproofing tested by IAPMO, UL 1703 compliant for Class-A Fire Rated for Type 1 and 2 PV Modules and UL 2703 compliant for electrical bonding tested by ETL.

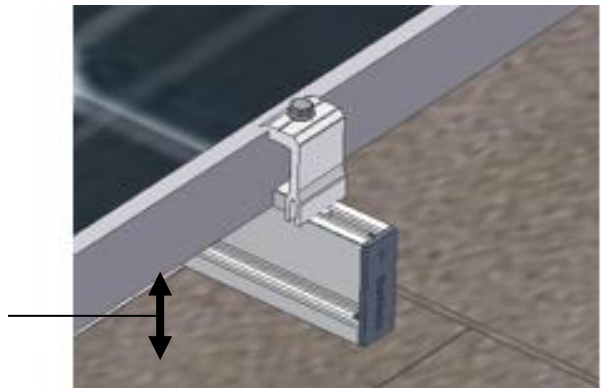
Proceed with the mounting of the PV panels using the Mid and End Clamps. Specific mounting instructions are shown in the following section for landscape mounting. Mid Clamps are used between PV panels, they will produce 1/2" spacing between PV panel frames. End Clamps are used to secure PV panels at the ends of a row. Note that the PV panels are clamped on the long edges as required by most manufacturers.



Minimum Panel Height

Minimum leading edge height to meet a UL1703 PV module fire standard is 3 inches.

3 inch minimum
from bottom of PV module
frame to the roof covering

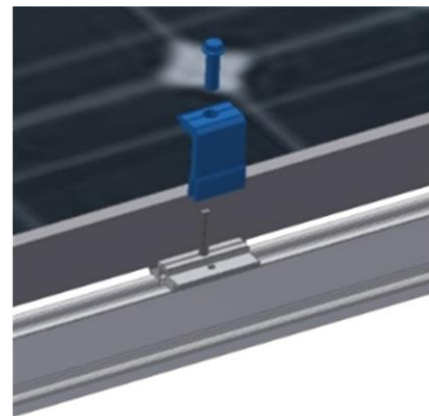


End Clamp Attachment

End Clamps are used at the ends of a row of PV panels.

Insert the T-Bolt in the Rail slot and turn clockwise 90° to engage the head into the slot. Insert Grounding T-Bolt Holder to lock T-Bolt in place.

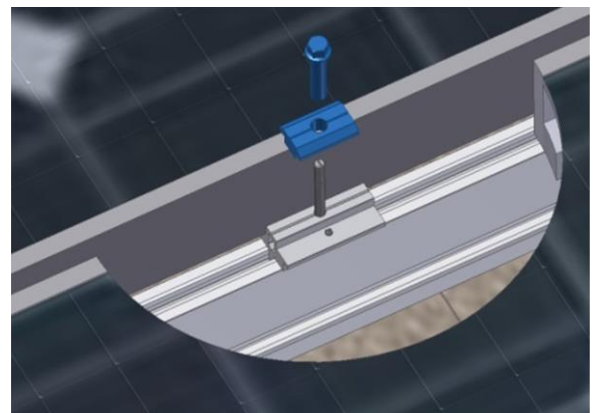
Thread the 1/4" Collar Bolt onto the top of the T-Bolt as shown. After positioning the End Clamp firmly against the PV panel frame, using a 7/16" socket, tighten to 7.5 ft. lbs.



Mid Clamp Attachment

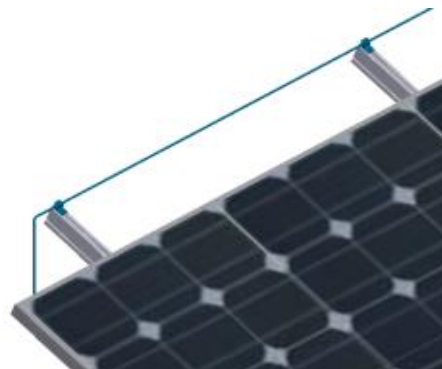
Insert the T-Bolt in the Rail slot and turn clockwise 90° to engage the head into the slot. Insert Grounding T-Bolt Holder to lock T-Bolt in place.

Thread the 1/4" Collar Bolt onto the top of the T-Bolt as shown. After positioning the Mid Clamp firmly against the PV panel frame, using a 7/16" socket, tighten to 7.5 ft. lbs.



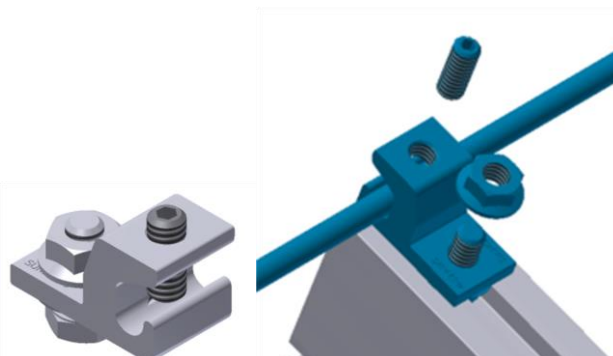
Ground Wire Attachment

The picture shows a grounding lug mounted on both Rails at the end of each row and a #6 solid copper grounding wire connecting the Ground Lugs to the building ground per NEC 690.47.



Ground Lug Installation

At the end of each row both Rails should have a Ground Lug for fastening the ground conductor to the array. The Ground Lug is mounted on the top or side of the Rail using a special 1/4" T-Bolt, Grounding Spacer, and Flange Nut. Grounding Lugs K10179-001, and detailed installation document D10003 are available from SunModo separately.



Rail End Covers

Rail End Covers can be attached to the mounting rails as shown.

Rail End Covers are also available for the SunBeam Rail not shown.

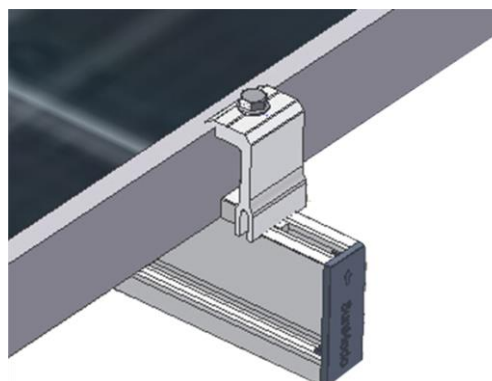


Table of Clamp Bolt Lengths and Part Numbers

Clamps	Part # End	Part # Mid	Size	"T" Bolt in.	"T" Bolt PN
Portrait	K10224-131	K10180-001	31 mm	1.77	B20015-012
Portrait	K10224-133	K10180-001	33 mm	1.77	B20015-012
Portrait	K10224-140	K10180-001	40 mm	1.77	B20015-012
Portrait	K10224-142	K10180-001	42 mm	1.77	B20015-012
Portrait	K10224-144	K10180-001	44 mm	1.77	B20015-012
Portrait	K10224-146	K10180-001	46 mm	1.77	B20015-012
Portrait	K10224-150	K10180-001	50 mm	1.77	B20015-012

Clamps	Part # End	Part # Mid	Size	"T" Bolt in.	"T" Bolt PN
Landscape	K10183-131	K10182-001	31 mm	2.10	B20015-002
Landscape	K10183-133	K10182-001	33 mm	2.10	B20015-002
Landscape	K10183-140	K10182-001	40 mm	2.10	B20015-002
Landscape	K10183-142	K10182-001	42 mm	2.10	B20015-002
Landscape	K10183-144	K10182-001	44 mm	2.10	B20015-002
Landscape	K10183-146	K10182-001	46 mm	2.10	B20015-002
Landscape	K10183-150	K10182-001	50 mm	2.10	B20015-002

Collar Nut					B20025-001
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This table shows the nominal T-Bolt lengths for various PV Panels commonly used in the industry.

See www.sunmodo.com for current warranty documents and information.

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