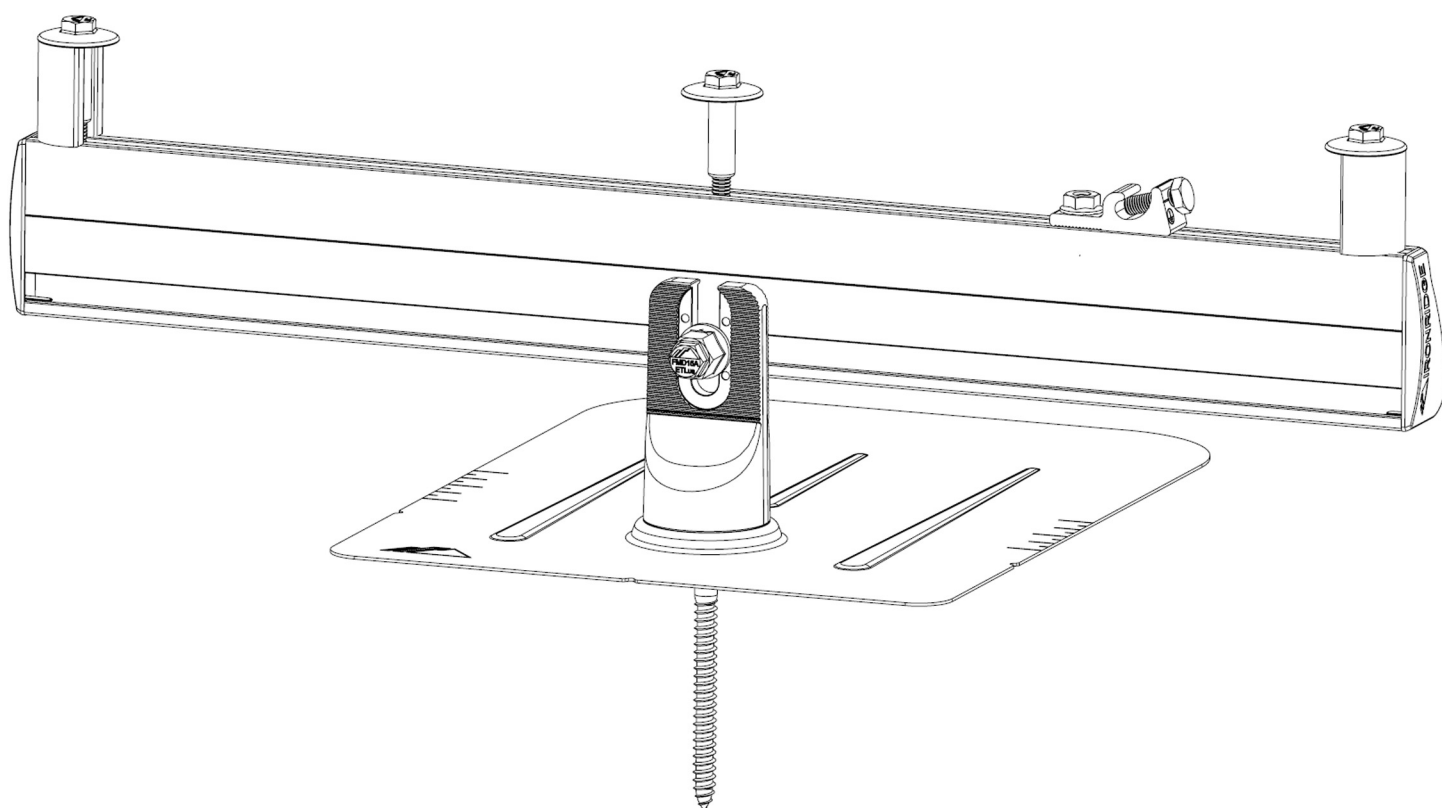


# FLUSH MOUNT



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## DISCLAIMER

This manual describes proper installation procedures and provides necessary standards required for product reliability. Warranty details are [available on website](#). All installers must thoroughly read this manual and have a clear understanding of the installation procedures prior to installation. Failure to follow these guidelines may result in property damage, bodily injury or even death.

### IT IS THE INSTALLER'S RESPONSIBILITY TO:

- Ensure safe installation of all electrical aspects of the array. All electrical installation and procedures should be conducted by a licensed and bonded electrician or solar contractor. Routine maintenance of a module or panel shall not involve breaking or disturbing the bonding path of the system. All work must comply with national, state and local installation procedures, product and safety standards.
- Comply with all applicable local or national building and fire codes, including any that may supersede this manual.
- Ensure all products are appropriate for the installation, environment, and array under the site's loading conditions.
- Use only IronRidge parts or parts recommended by IronRidge; substituting parts may void any applicable warranty.
- Review the [Design Assistant](#) and [Certification Letters](#) to confirm design specifications.
- Ensure provided information is accurate. Issues resulting from inaccurate information are the installer's responsibility.
- Ensure bare copper grounding wire does not contact aluminum and zinc-plated steel components, to prevent risk of galvanic corrosion.
- If loose components or loose fasteners are found during periodic inspection, re-tighten immediately. If corrosion is found, replace affected components immediately.
- Provide an appropriate method of direct-to-earth grounding according to the latest edition of the National Electrical Code, including NEC 250: Grounding and Bonding, and NEC 690: Solar Photovoltaic Systems.
- Disconnect AC power before servicing or removing modules, AC modules, microinverters and power optimizers.
- Review module manufacturer's documentation for compatibility and compliance with warranty terms and conditions.

## RATINGS

### UL 2703 LISTED



- Conforms to STD UL 2703 (2015) Standard for Safety First Edition: Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels.
- Certified to CSA STD LTR AE-001-2012 Photovoltaic Module Racking Systems.
- Max Overcurrent Protective Device (OCPD) Rating: 25A
- Max Module Size: 24ft<sup>2</sup>
- Max Frameless Module Size for Canadian LTR-AE: 19.5 ft<sup>2</sup>
- Module Orientation: Portrait or Landscape
- CAMO Specific Allowable Design Load Rating: 50 PSF downward, 50 PSF upward, 15 PSF lateral
- LTR AE Canadian Load Rating: 2400 PA
- System Level Allowable Design Load Rating: meets minimum requirements of the standard (10 PSF downward, 5 PSF upward, 5 PSF lateral). Actual system structural capacity is defined by PE stamped [certification letters](#).

### CLASS A SYSTEM FIRE RATING PER UL 2703

- Any Roof Slope with Module Types 1, 2, and 3
- Any module-to-roof gap is permitted, with no perimeter guarding required. This rating is applicable with any third-party attachment.
- Class A rated PV systems can be installed on Class A, B, and C roofs without affecting the roof fire rating.

### WATER SEAL RATINGS: UL 441 & TAS 100(A)-95 (FLASHFOOT2, ALL TILE HOOK, KNOCKOUT TILE)

- Tested and evaluated without sealant.
- Any roofing manufacturer approved sealant is allowed. Ratings applicable for roof slopes between 2:12 and 12:12

### STRUCTURAL CERTIFICATION

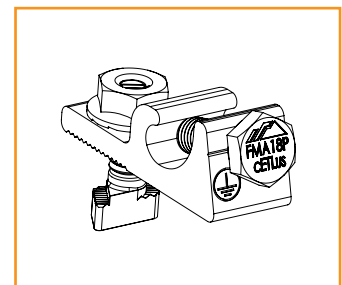
- Designed and Certified for Compliance with the International Building Code & ASCE/SEI-7

### FLORIDA PRODUCT APPROVAL #FL29843

- Conforms to TAS202, TAS100(A)
- Approved for installation both inside and outside High Velocity Hurricane Zones (HVHZ)
- Allowable design pressure up to +100/-100 PSF
- Additional details on Approval can be found [Here](#).

## MARKINGS

Product markings are located on the Grounding Lug bolt head.



# CHECKLIST

## PRE-INSTALLATION

- Verify module compatibility. See [Page 13](#) for info.

## TOOLS REQUIRED

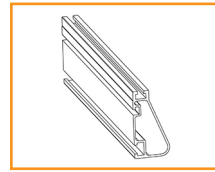
- Cordless Drill (non-impact)
- Impact Driver (for lag bolts)
- Torque Wrench (0-250 in-lbs)
- 5/16" Socket
- 7/16" Socket
- 1/2" Socket
- String Line

## TORQUE VALUES

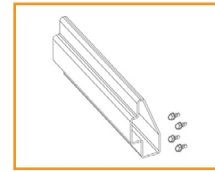
- FlashFoot2 Lag Bolts (7/16" Socket): Fully Seat
- Bonded Splice Screws (5/16" Socket): 20 in-lbs
- Grounding Lug Nuts (7/16" Socket): 80 in-lbs
- Grounding Lug Terminal Screws (7/16" Socket): 20 in-lbs
- Universal Fastening Object (7/16" Socket): 80 in-lbs
- Expansion Joint Nuts (7/16" Socket): 80 in-lbs
- Flush Standoffs (1/2" Socket): 132 in-lbs
- Microinverter Kit Nuts (7/16" Socket): 80 in-lbs
- Frameless Module Kit Nuts (7/16" Socket): 80 in-lbs
- 3/8" Bonding Hardware Nuts (7/16" Socket): 250 in-lbs
- All Tile Hook Lags (7/16" Socket): Fully Seat
- All Tile Hook Carriage Bolts (7/16" Socket): 132 in-lbs
- Knockout Tile Lags (1/2" Socket): Fully Seat
- Knockout Tile Nuts (1/2" Socket): 132 in-lbs
- Flat Roof Attachment Nuts (9/16" Socket): 250 in-lbs

💡 If using FlashVue or previous version of: FlashFoot, Integrated Grounding Mid Clamps, Grounding Lug, End Clamps, and Expansion Joints please refer to Alternate Components Addendum (Version 1.3).

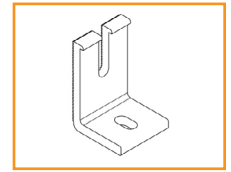
## IRONRIDGE COMPONENTS



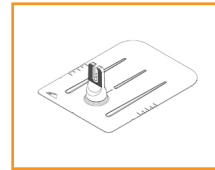
XR Rail



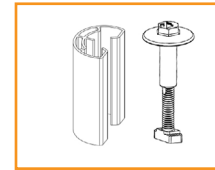
Bonded Splice



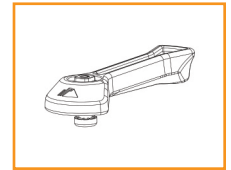
L-Foot



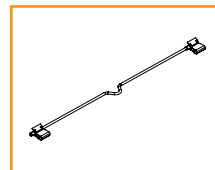
FlashFoot2



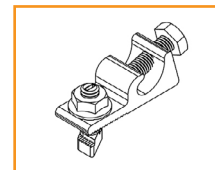
UFO and Stopper Sleeve



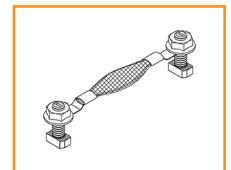
CAMO



8" Bonding Jumper



Grounding Lug



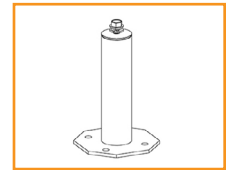
Expansion Joint



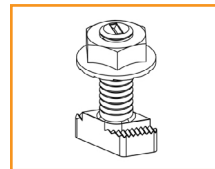
End Cap



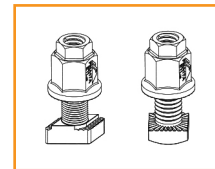
Wire Clip



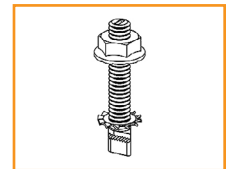
Flush Standoff



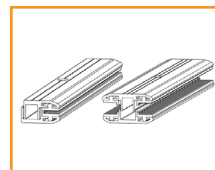
Microinverter Kit



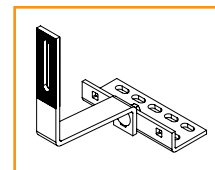
3/8" Bonding Hardware



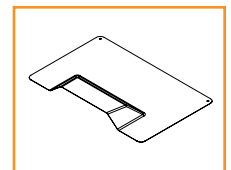
Frameless Module Kit



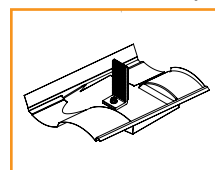
Frameless End/Mid Clamp



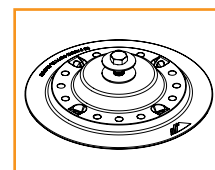
All Tile Hook



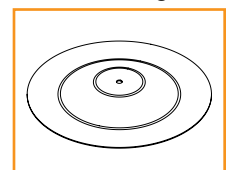
All Tile Hook Flashing



Knockout Tile



Flat Roof Attachment



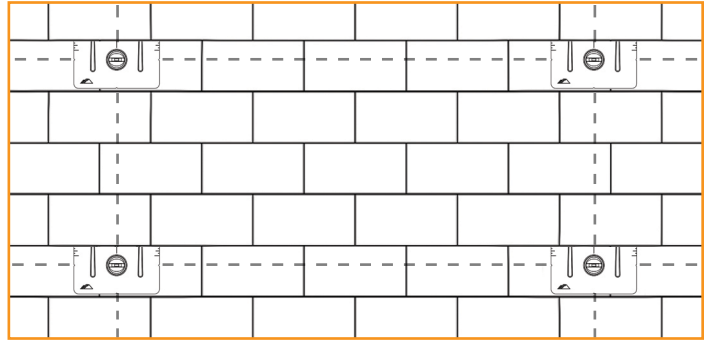
Membrane Flashing

# 1. ATTACH BASES

For composition roofs, refer to FlashFoot2 install instructions on [page 9](#). For tile roofs, refer to All Tile Hook and Knockout Tile install instructions on [page 9](#). For flat roofs, refer to Flat Roof Attachment install instructions on [page 10](#). When using approved third party attachments, refer to manufacturer's install instructions.

💡 **Tested or evaluated third-party roof attachments:**

- [Anchor Products](#) - U-Anchor
- [S-5! Standing Seam Metal Roof Clamps](#) - Certification of metal roof clamps includes bonding to both painted and galvalume metal roofs. Tighten S-5! and S-5! Mini set screws to 130-150 in-lbs ( $\geq 24$  gauge) or 160-180 in-lbs (22 gauge) roofs. Tighten S-5! M10 bolt to 240 in-lbs or S-5! Mini M8 bolt to 160 in-lbs. Use the following fastening guidelines for other S-5! roof clamps: ProteaBracket™ - firmly seat roof screws and tighten hinge bolt to 225 in-lbs; RibBracket™ - firmly seat roof screws and tighten M8 bolt (M8-1.25 x 22mm sold separately) to 160 in-lbs; and SolarFoot™ - firmly seat roof screws and tighten M8 flange nut to 160 in-lbs.
- [EcoFasten Green Fasten GF-1 Anchors](#)
- Rooftech RT-Mini - Attach to L-foot using 5/16-18 x 1.25" stainless steel bolt and nut torqued to 132 in-lbs.
- QuickMount PV [Roof Mounts](#) QMLM/QMLM - ST and [Tile Hooks](#) - Tile Hook attaches to XR Rail using 3/8" Bonding Hardware Kit torqued to 250 in-lbs.
- Quickscrews Solar Roof Hooks, Ejot Aluminum Roof Hooks, Unirac Creotecc Tile Hooks, or Solarhooks - Attach to XR Rails with L-Foot or 3/8" Bonding Hardware Kit torqued to 250 in-lbs.
- Pegasus Comp Mount - Attach to XR Rail using 3/8" Bonding Hardware kit torqued to 250 in-lbs.

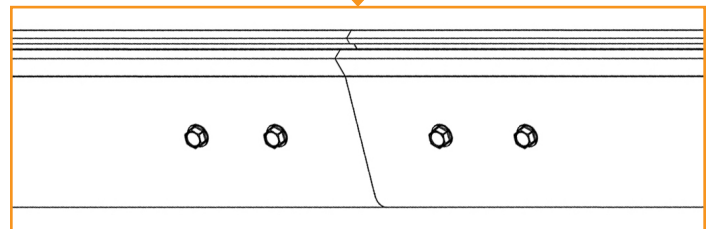
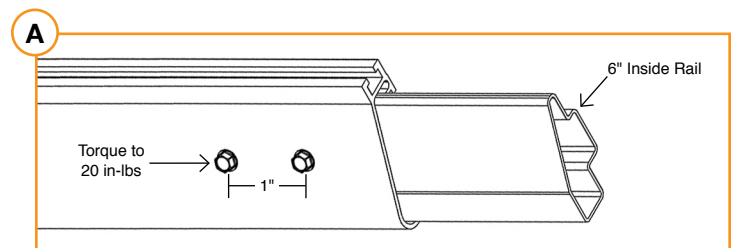


# 2. PLACE RAILS

## A. CONNECT SPLICES

Use Bonded Splices, when needed, to join multiple sections of rail. Insert Bonded Splice 6" into first rail and secure with two self-drilling screws, spacing them approximately 1" apart and tightening to **20 in-lbs**. Slide second rail over Bonded Splice and secure with two more self-drilling screws.

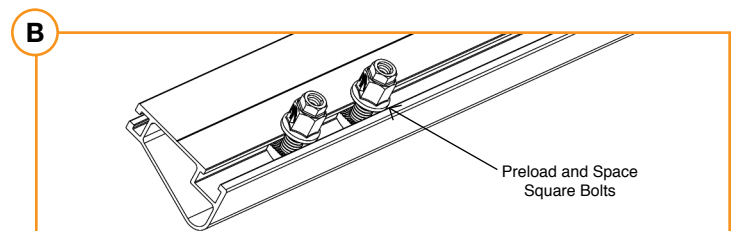
- 💡 Rows exceeding 100 feet of rail must use [Expansion Joints](#).
- 💡 For XR10 and XR100 rails, insert screws along the provided lines.
- 💡 Refer to Structural Certification letters for rail splice location requirements.
- 💡 Screws can be inserted on front or back of rails.



## B. PREPARE HARDWARE

Slide square-headed bolts into side-facing rail slot. Space out bolts to match attachment spacing.

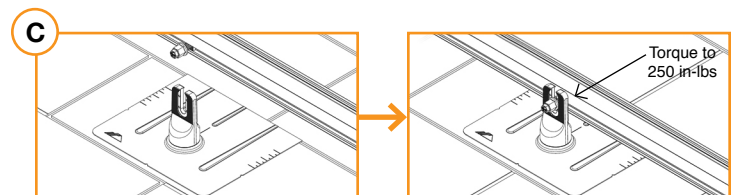
- 💡 Tape ends of rail, to keep bolts from sliding out while moving.
- 💡 If using T-bolts, carry hardware onto roof and proceed.



## C. ATTACH RAILS

Drop rail with hardware into roof attachment. Level rail at desired height, then torque to **250 in-lbs**.

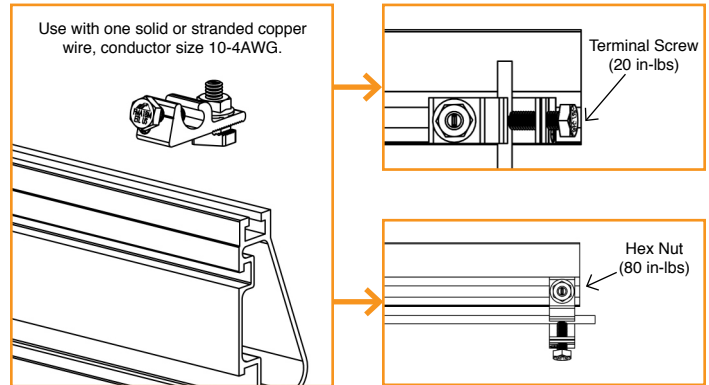
- 💡 Rail can face either upslope or downslope on roof.



### 3. SECURE LUGS

Insert T-bolt in top rail slot and torque hex nut to **80 in-lbs**. Install a minimum 10 AWG solid copper or stranded grounding wire. Torque terminal screw to **20 in-lbs**.

- 💡 Ground Lugs are only needed on one rail per continuous row of modules, regardless of row length (unless frameless modules are being used, see [Page 9](#)).
- 💡 If using Enphase microinverters or Sunpower AC modules, Grounding Lugs may not be needed. See [Page 9](#) for more info.
- 💡 Grounding Lugs can be installed anywhere along the rail and in either orientation shown. If installing lug underneath modules in areas with ground snow loads greater than 40 psf, place lug within 4 inches module frame edge.

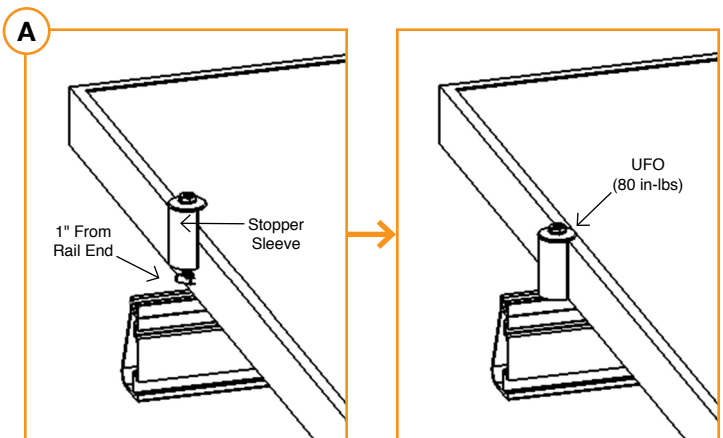


### 4. SECURE MODULES

#### A. SECURE FIRST END

Place first module in position on rails, a minimum of 1" from rail ends. Snap Stopper Sleeves onto UFO. Fasten module to rail using the UFO, ensuring that the UFO is hooked over the top of the module. Torque to **80 in-lbs**.

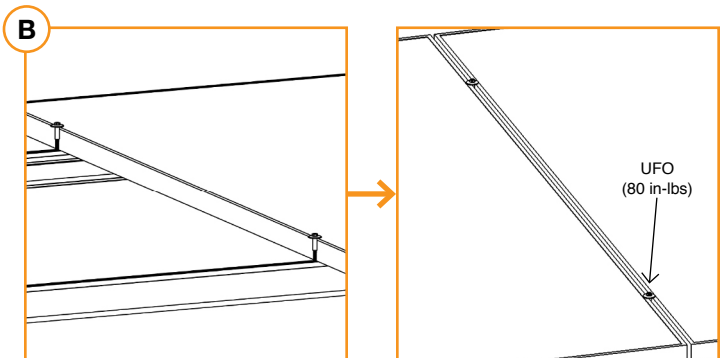
- 💡 Ensure rails are square before placing modules.
- 💡 Hold Stopper Sleeves on end while torquing to prevent rotation.
- 💡 If using CAMO instead of UFO + Stopper Sleeve, refer to [Page 6](#) for CAMO installation procedure.



#### B. SECURE NEXT MODULES

Place UFO into each rail, placing them flush against first module. Slide second module against UFO. Torque to **80 in-lbs**. Repeat for each following module.

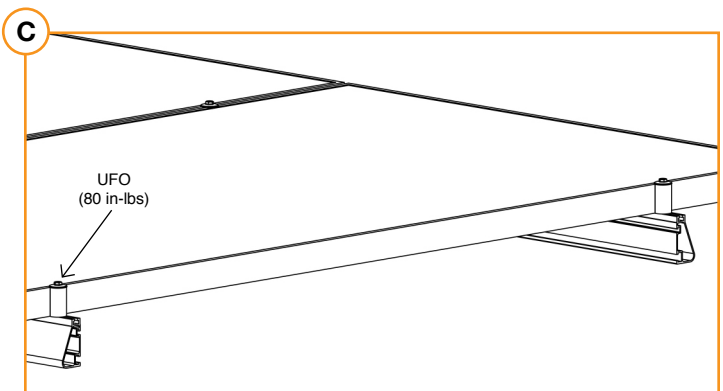
- 💡 When reinstalling UFO, move modules a minimum of 1/16" so UFOs are in contact with a new section of module frame.
- 💡 When UFOs are loosened and re-tightened, ensure UFO T-bolt bottoms out in rail channel before re-torquing UFO to achieve full engagement between T-bolt and rail.
- 💡 If using Wire Clips, refer to [Page 10](#).



#### C. SECURE LAST END

Place last module in position on rails, a minimum of 1" from rail ends. Snap Stopper Sleeves onto UFO. Secure UFO Clamps on rails, ensuring they are hooked over top of module. Torque to **80 in-lbs**.

- 💡 Hold Stopper Sleeves on end while torquing to prevent rotation.
- 💡 Repeat all steps for each following row of modules, leaving a minimum 3/8" gap between rows.
- 💡 If using CAMO instead of UFO + Stopper Sleeve, refer to [Page 6](#) for CAMO installation procedure.



## CAMO

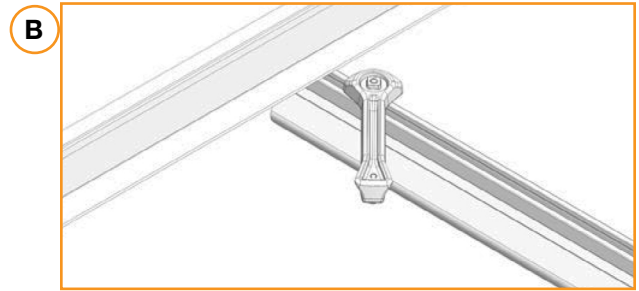
### A. SLIDE INTO RAIL

Slide CAMO into rail channel far enough to clear the module frame. CAMO requires 6" of clearance from end of rail.



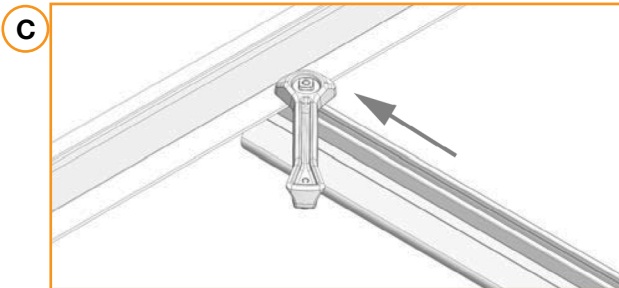
### B. PLACE MODULE

Place module on rails (module cells not shown for clarity). When installing CAMO the module can overhang the rail no more than 1/4".



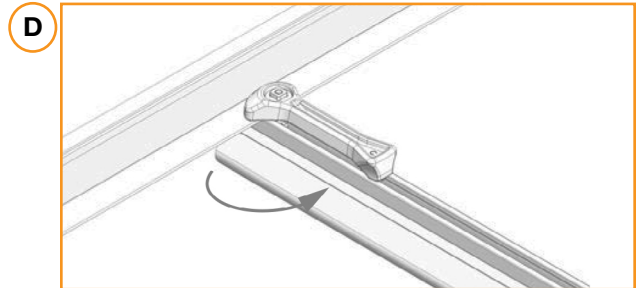
### C. PULL TOWARDS END

Pull CAMO towards rail ends, at 45 degree angle, so the bonding bolt contacts the module flange edge.



### D. SECURE TO FRAME

Rotate handle with an upwards motion until CAMO snaps into rail channel. Ensure CAMO bonding pins are fully seated on top of module frame.

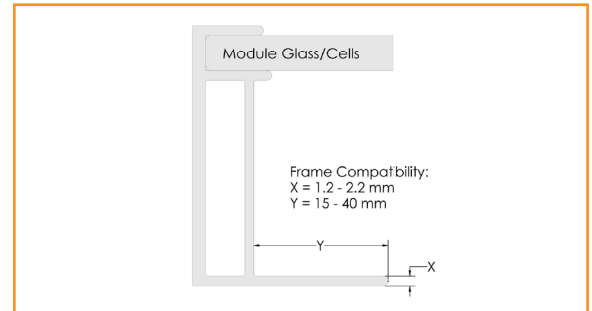


### FRAME COMPATIBILITY

CAMO has been tested or evaluated with all modules listed in the Module Compatibility section having frames within the referenced dimensions. Be sure the specific module being used meets the dimension requirements.

💡 For installations with Hanwha Q CELLS modules with 32 mm frame heights, the maximum ground snow is 45 PSF (33 PSF module pressure).

💡 CAMO is not compatible with Canadian Solar modules.



## 8" BONDING JUMPER

8" Bonding Jumper is an electrical bonding jumper that can be used on the Flush Mount System for row bonding; making the module frames the medium for the equipment ground path.

- 💡 Bonding jumper is pushed onto the bottom flange of the module.
- 💡 New jumpers should be used if re-installation of jumper is required.
- 💡 Supports bottom flange thicknesses from 1.2mm to 3.1mm.



## GROUNDING STRAP EXPANSION JOINT

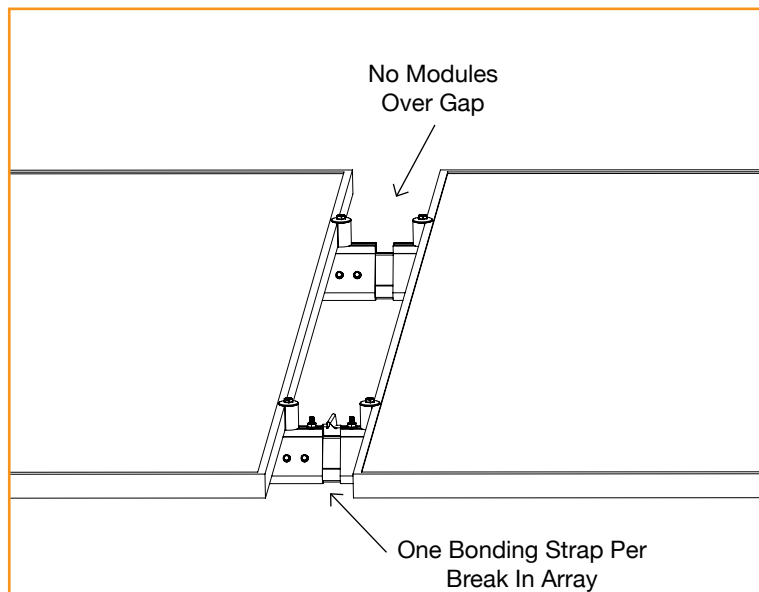
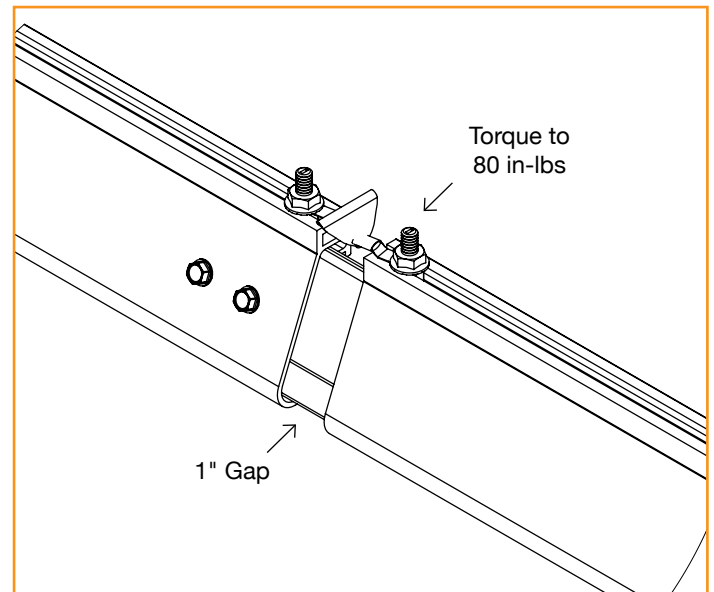
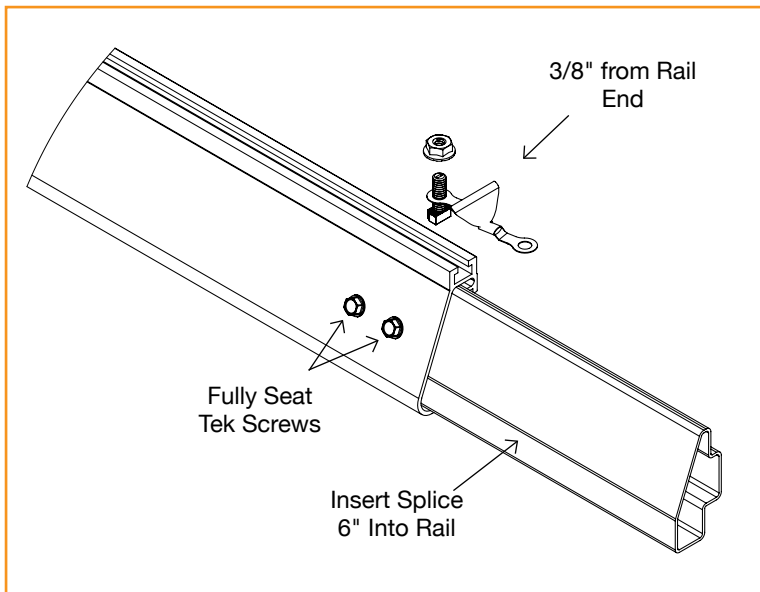
Grounding Strap Expansion Joints are required every 100' of continuous rail to allow for thermal expansion and contraction of the system.

Insert Bonded Splice 6" into first rail and secure with two self-drilling screws, spacing them approximately 1" apart and tightening to **20 in-lbs**. Assemble and secure Grounding Strap 3/8" from rail end. Slide second rail over Bonded Splice leaving 1" gap between rails. Attach other end of Grounding Strap with hardware and torque hex nuts to **80 in-lbs**.

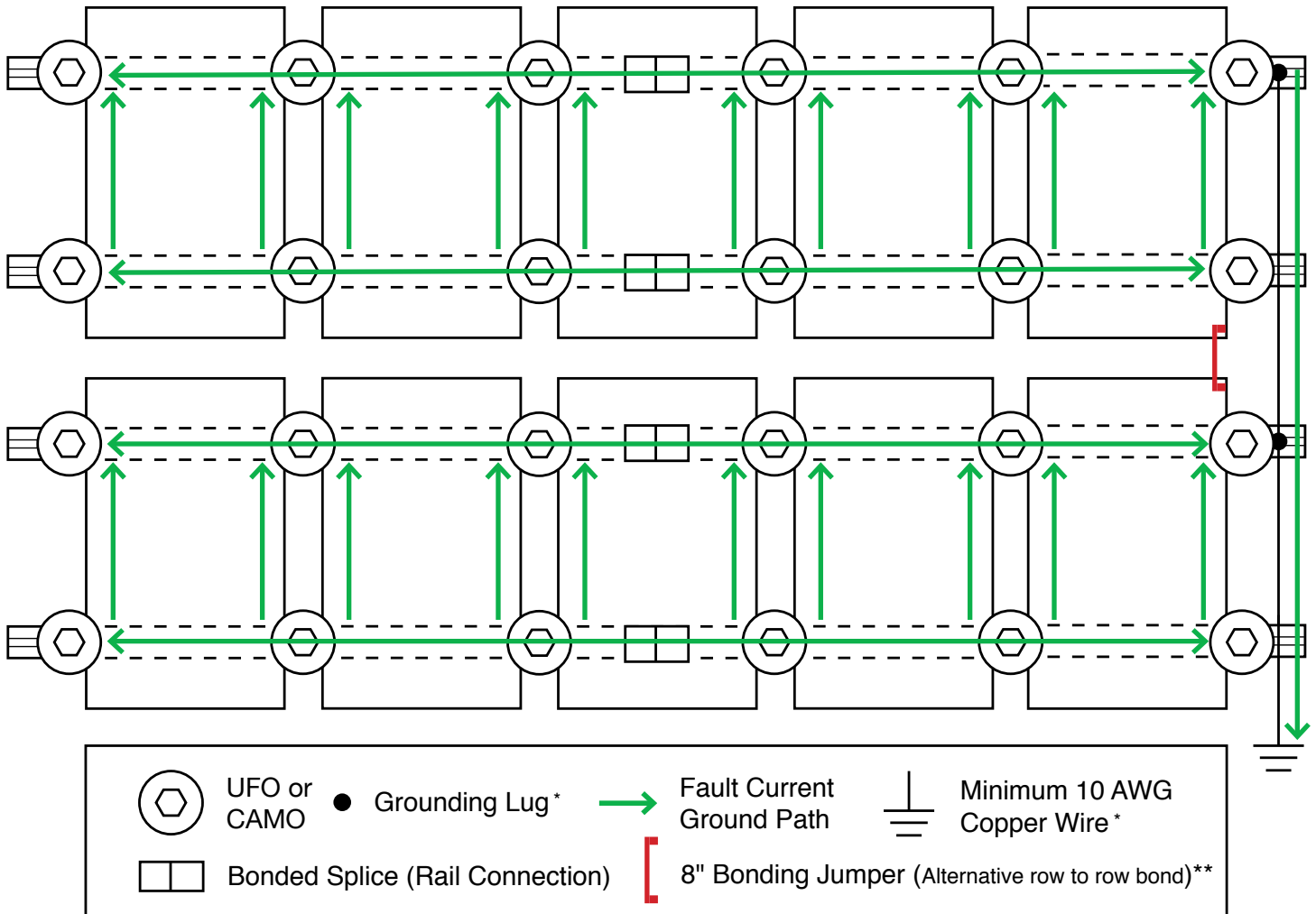
⚠ Remaining Bonded Splice screws are not used with Expansion.

⚠ Only one Grounding Strap is required per break in row of modules.

⚠ Do not install modules over expansion joints.







\*Grounding Lugs and wire are not required in systems using certain Enphase microinverters or certain Sunpower modules. Equipment grounding is achieved with the Engage cable for Enphase or the AC module cable system for Sunpower via their integrated EGC.

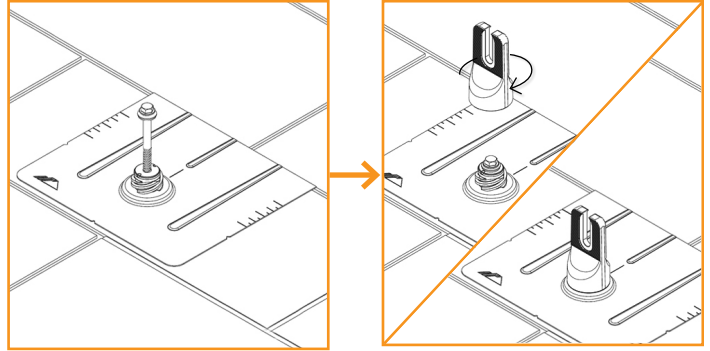
\*\* The use of the 8" Bonding Jumper eliminates the need for row to row bonding. A minimum of one grounding lug per continuous array is required for earth ground.

## FLASHFOOT2

Locate roof rafters and mark locations on roof. Drill 1/4" pilot holes and backfill with approved sealant. Slide flashing between 1st and 2nd course of shingles, ensuring flashing doesn't overhang the downhill shingle. Line up with pilot hole and insert supplied lag bolt with washer through flashing. Fully seat lag bolt. Place Cap onto flashing in desired orientation for E/W or N/S rails and rotate 180 degrees until it locks into place.

💡 Rail can be installed on either side of FlashFoot2 Cap.

💡 Standalone [FlashFoot2 manual](#) available on website.



## ALL TILE HOOK

Remove tile and mark rafter. Position base over rafter, adjust arm if necessary and torque hardware to **132 in-lbs (11 ft-lbs)**. Use base as guide to drill 1/4" pilot holes, back fill with roofing manufacturer's approved sealant, then insert lag bolts and tighten until fully seated. Replace tiles and notch as necessary to ensure proper fit. Attach rails to either side of slot using bonding hardware and torque to **250 in-lbs (21-ft-lbs)**.

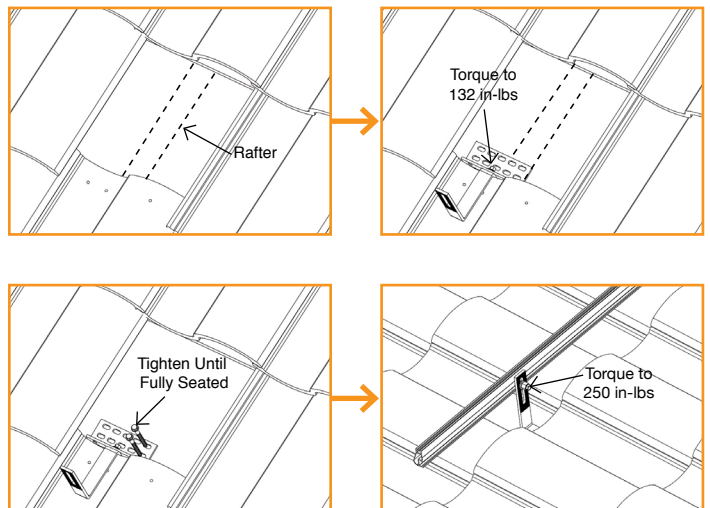
💡 Position arm near the center of valley for curved tiles.

💡 Position arm away from seam of joining flat tiles.

💡 Ensure top of hook does not extend above rail.

💡 IronRidge offers an optional aluminum deck flashing. Refer to [All Tile Hook Flashing Installation Manual](#). Other approved flashing methods include user supplied adhesive backed flexible flashing.

💡 Standalone [All Tile Hook manual](#) available on website.



## KNOCKOUT TILE

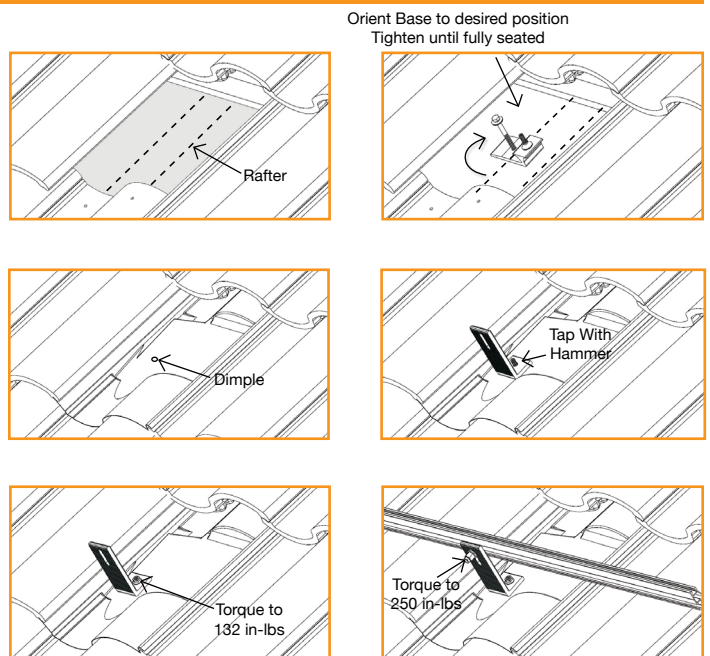
Remove tile and mark rafter. Use base as guide to drill 1/4" pilot hole and fill with roofing manufacturer's approved sealant. Insert lag bolt with bonded washer through base and drive until fully seated. Insert Tile Replacement Flashing, lower onto base and apply pressure over the threaded post until it dimples the flashing. Place L-Foot over dimple and tap with hammer to punch threaded post through the flashing. Ensure punched pieces of flashing are cleared away. Form flashing as needed to sit flush with surrounding tiles, position L-Foot in desired orientation and torque hardware to **132 in-lbs (11 ft-lbs)**. Attach rail to either side of L-Foot with bonding hardware and torque to **250 in-lbs (21 ft-lbs)**.

💡 Base can be installed in any orientation relative to rafter.

💡 Ensure L-Foot does not extend above rail.

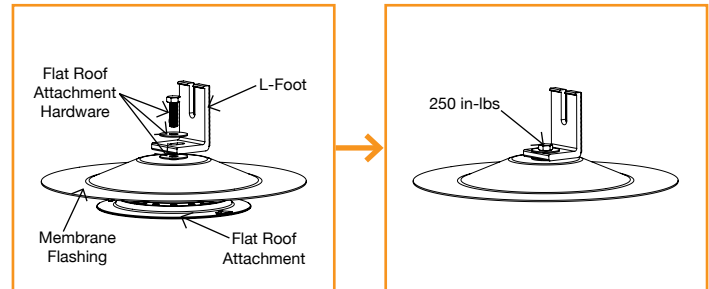
💡 If deck level flashing is required, approved flashing methods include user supplied adhesive backed flexible flashing.

💡 Standalone [Knockout Tile manual](#) available on website.



## FLAT ROOF ATTACHMENT

Flat Roof Attachment can be used with an L-foot for flush mounting modules on low sloped roofs. Mark locations for Flat Roof Attachment. Screws should be installed symmetrically to each other. If using a membrane flashing, remove the silicone washer's protective liner prior to attaching the membrane. Attach L-foot with washers and 3/8" hardware torqued to **250 in-lbs (21 ft-lbs)**. Seal attachment and/or membrane per roofing manufacturer's requirements.



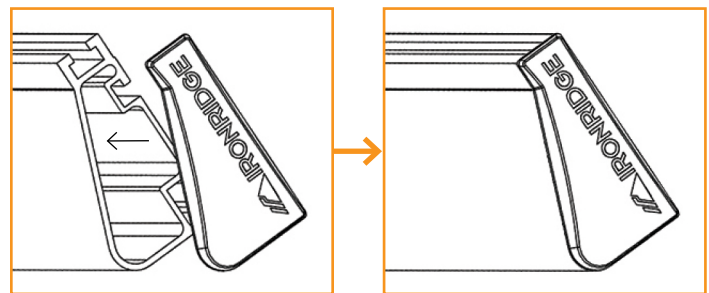
- 💡 Type, size, and quantity of roof screws to be specified by Structural Engineer. Fastener size not to exceed #15.
- 💡 Membrane flashing available for TPO, PVC, and KEE roofs. Ensure membrane flashing is compatible with existing roofing material.
- 💡 If membrane flashing is not used, only washer on top of L-Foot is required.
- 💡 Standalone [Flat Roof Attachment manual](#) available on website.

## END CAPS

End Caps add a completed look and keep debris and pests from collecting inside rail.

Firmly press End Cap onto rail end.

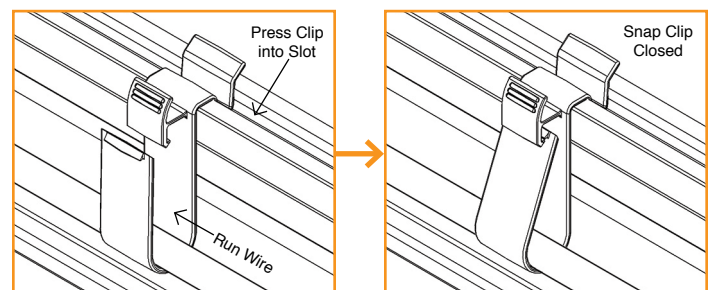
- 💡 End Caps come in sets of left and right. Check that the proper amount of each has been provided.



## WIRE CLIPS

Wire Clips offer a simple wire management solution.

Firmly press Wire Clip into top rail slot. Run electrical wire through open clip. Snap closed once all wires have been placed.



## FLUSH STANDOFFS

Attach Standoffs to roof locations with lag bolts (not included). Place flashing over Standoff. Attach L-Foot on Standoff washer with hardware. Torque to **132 in-lbs (11 ft-lbs)**.



## MICROINVERTER KITS

Use IronRidge's Microinverter Kit to bond compatible microinverters and power optimizers to the racking system.

Insert Microinverter Kit T-bolt into top rail slot. Place compatible microinverter or power optimizer into position and tighten hex nut to **80 in-lbs**.

💡 If installing in areas with ground snow loads greater than 40 psf, install MLPE devices directly next to module frame edge

### COMPATIBLE PRODUCTS

#### Enphase

M250-72, 250-60, M215-60, C250-72, S230, S280, IQ 6, IQ 6+, IQ IQ7, IQ 7A, IQ 7+, IQ 7X, Q Aggregator

#### Darfon

MIG240, MIG300, G320, G640

#### Solar Edge

P300, P320, P340, P370, P400, P405, P485, P505, P600, P700, P730, P800p, P800s, P850, P860

#### SMA

RoofCommKit-P2-US, TS4-R Module Retrofit Kits (TS4-R-S, TS4-R-O, TS4-R-F)

#### Tigo

##### Tigo Access Point (TAP)

TS4-R-X (where X can be F, M, O, or S)

TS4-R-X-DUO (where X can be M, O, or S)

TS4-A-X (where X can be F, 2F, O, O-DUO, or S)

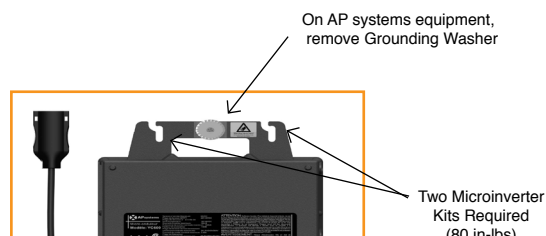
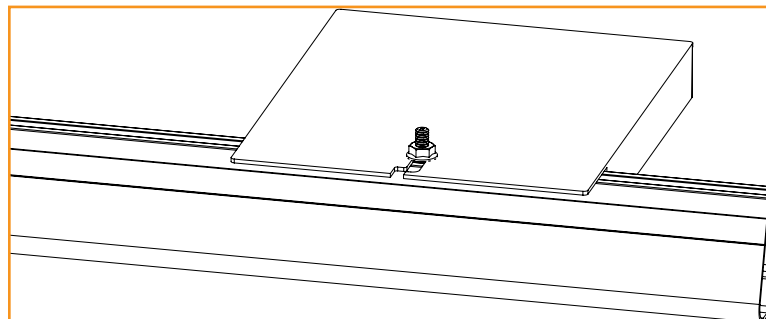
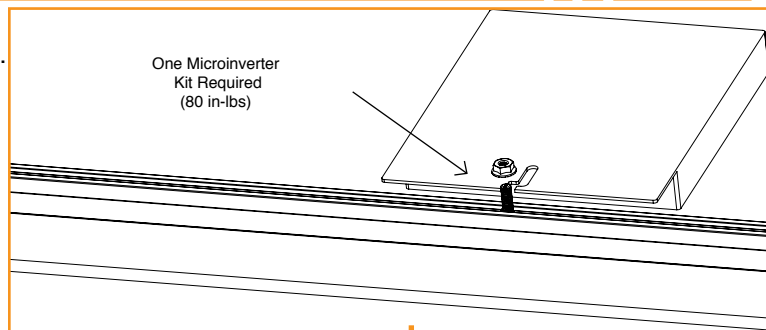
#### AP Systems

QS1, YC600

💡 Remove Grounding Washer on AP Systems QS1 and YC600 inverters before installing to XR rails.

💡 Remove the Stainless Steel Clip on Tigo-"A" MLPE Devices before attaching to XR rails.

💡 Use the number of IronRidge Microinverter kits allowed by the MLPE mounting flange. Some will require 1 kit and others 2 kits.



## SYSTEMS USING ENPHASE MICROINVERTERS OR SUNPOWER AC MODULES

IronRidge systems using approved Enphase products or SunPower modules eliminate the need for lay-in lugs and field installed equipment grounding conductors (EGC). This solution meets the requirements of UL 2703 for bonding and grounding and is included in this listing.

### COMPATIBLE PRODUCTS

#### Sunpower

Modules with model identifier Ab-xxx-YY and InvisiMount (G5) 46mm frame; where "A" is either E, or X; "b" can be 17, 18, 19, 20, 21, or 22; and "YY" can be C-AC, D-AC, BLK-C-AC, or BLK-D-AC.

#### Enphase

Microinverters M250-72, M250-60, M215-60, C250-72, and Engage cables ETXX-240, ETXX-208, ETXX-277.

💡 A minimum of two inverters mounted to the same rail and connected to the same Engage cable are required.

💡 The microinverters or Sunpower AC modules must be used with a maximum 20 A branch rated overcurrent protection device (OCPD).

💡 If an AC module is removed from a circuit for maintenance, you must first disconnect AC power and then install a temporary EGC to bridge the gap by inserting an AC extension cable (or via other NEC-compliant means), in order to maintain effective ground continuity to subsequent modules.

## SYSTEMS USING MICROSTORAGE PRODUCTS

Use IronRidge's Microinverter Kit to bond compatible microstorage devices to the racking system. Insert Microinverter Kit T-bolt into top rail slot. Place compatible microstorage into position and tighten hex nut to **80 in-lbs**.

### COMPATIBLE PRODUCTS

#### PHAZR

PHAZR Devices PHAZR-X, where X is 6-12.

#### Solpad

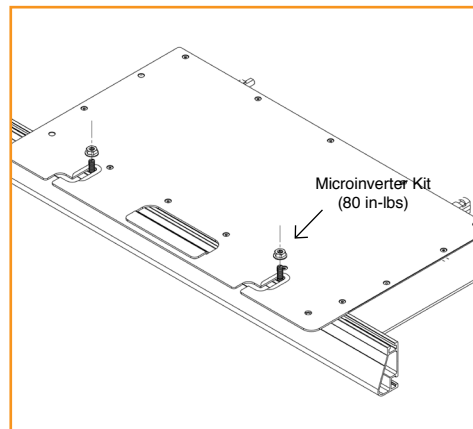
Solpad Inverter model SI-1k

Solpad Battery Storage model SB-2K

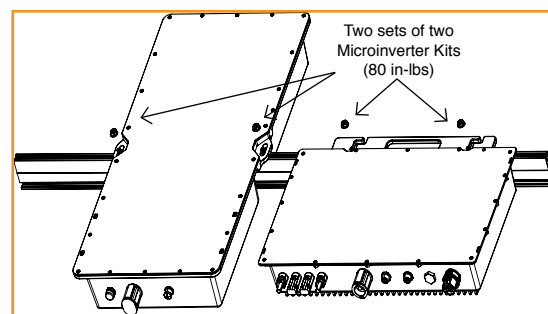
Solpad Junction Box model SJB-4k

- 💡 Running a separate equipment grounding conductor to the PHAZR or Solpad devices is not required.
- 💡 If installing in areas with ground snow loads greater than 40 psf and underneath a module, install PHAZR and Solpad devices as close as possible to module frame edge.
- 💡 Solpad may only be installed on XR-100 and XR-1000
- 💡 Solpad may only be installed with modules having a frame thickness of 35mm or greater.
- 💡 Use the number of IronRidge Microinverter kits allowed by the microstorage mounting flange. Some will require 1 kit and others 2 kits.

PHAZR



Solpad



## FRAMELESS MODULE KITS

Insert Frameless Kit T-bolt in top rail slot. Place star washer over T-bolt, allowing it to rest on top of rail. Secure module clamps with a hex nut and torque to **80 in-lbs**.

### COMPATIBLE PRODUCTS

#### Sunforson

Sunforson silver or black SFS-UTMC-200(B) mid and SFS-UTEC-200(B) end clamps.

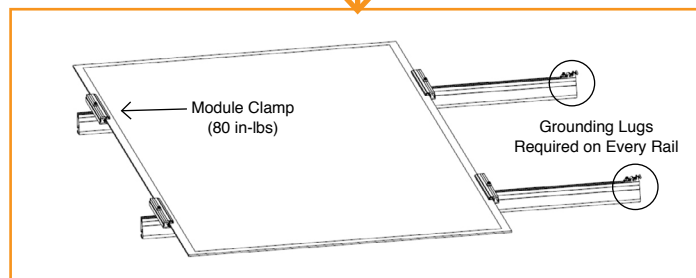
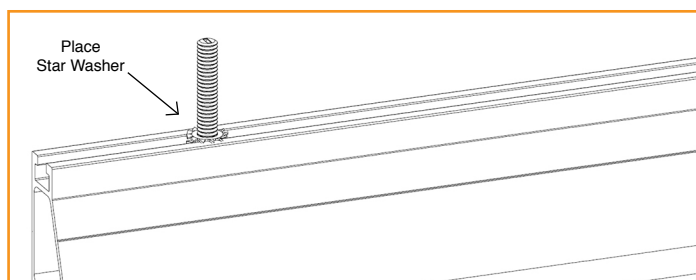
#### Sunpreme

Sunpreme silver or black mid and end clamps with part numbers 7500105X where "X" is 1, 5, 6 or 7.

#### Ironridge

IronRidge silver or black mid and end clamps with part numbers FMLS-XC-001-Y where "X" is E or M and "Y" is B or blank.

- 💡 Follow module manufacturer's installation instructions to install the module clamps.
- 💡 Frameless modules require using a Grounding Lug on every rail.
- 💡 For Sunpreme Modules Only: If required to use slide prevention hardware, see Module Slide Prevention Addendum (Version 1.10).



## MODULE COMPATIBILITY

The Flush Mount System may be used to ground and/or mount a PV module complying with UL 2703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions. Unless otherwise noted, “xxx” refers to the module power rating and both black and silver frames are included in the certification.

FRAMED MODULE LIST	
MAKE	MODELS
Amerisolar	Amerisolar modules with 35, 40 and 50 mm frames AS-bYxxxZ Where "b" can be 5 or 6; "Y" can be M, P, M27, P27, M30, or P30; and "Z" can be blank, W or WB
Aptos Solar	Aptos modules with 35 and 40 mm frames DNA-yy-zz23-xxx Where "yy" can be 120 or 144; and "zz" can be MF or BF
Astronergy Solar	Astronergy modules with 30, 35, 40, and 45 mm frames aaSMbbyyC/zz-xxx Where "aa" can be CH or A; "bb" can be 60, 66, or 72; "yy" can be blank, 10 or 12; "C" can be M, P, M(BL), M-HC, M(BL)-HC, P-HC, M(DG), or M(DGT); and "zz" can be blank, HV, F-B, or F-BH
ASUN	ASUN modules with 35 and 40 mm frames ASUN-xxx-YYZZ-aa Where "YY" can be 60 or 72; "ZZ" can be M, or MH5; and "aa" can be blank or BB
Auxin	Auxin modules with 40 mm frames AXN6y6zAxxx Where "y" can be M or P; "z" can be 08, 09, 10, 11, or 12; and "A" can be F or T
Axitec	Axitec Modules with 35 and 40 mm frames AC-xxxY/aaZZb Where "Y" can be M, P or MH; "aa" can be blank, 125- or 156-; "ZZ" can be 54, 60, 72, 120, or 144; "b" can be S
Boviet	Boviet modules with 35 and 40mm frames BVM66aaYY-xxxBB Where "aa" can be 9, 10 or 12; "YY" is M or P; and "BB" can be blank or L
BYD	BYD modules with 35 mm frames BYDxxxAY-ZZ Where "A" can be M6, P6, MH or PH; "Y" can be C or K; and "ZZ" can be 30 or 36
Canadian Solar	Canadian Solar modules with 30, 35 and 40 mm frames CSbY-xxxZ Where "b" can be 1, 3 or 6; "Y" can be H, K, P, U, V, W, or X; and "Z" can be M, P, MS, PX, M-SD, P-AG, P-SD, MB-AG, PB-AG, MS-AG, or MS-SD
CertainTeed	CertainTeed modules with 35 and 40 frames CTxxxYZZ-AA Where "Y" can be M, P, or HC; "ZZ" can be 00,01, 10, or 11; and "AA" can be 01, 02, 03, or 04
CSUN	Csun modules with 35 and 40 mm frames YYxxx-zzAbb Where "YY" is CSUN or SST; "zz" is blank, 60, or 72; and "A" is blank, P or M; "bb" is blank, BB, BW, or ROOF
Ecosolargy	Ecosolargy modules with 35, 40, and 50 mm frames ECOxxxYzza-bbD Where "Y" can be A, H, S, or T; "zz" can be 125 or 156; "A" can be M or P; "bb" can be 60 or 72; and "D" can be blank or B
ET Solar	ET Solar modules with 35, 40, and 50 mm frames ET-Y6ZZxxxAA Where "Y" can be P, L, or M; "ZZ" can be 60 or 72; and "AA" can be WB, WW, BB, WBG, WWG, WBAC, WBCO, WWCO, WWBCO or BBAC
Flex	Flex modules with 35, 40, and 50 mm frames FXS-xxxYY-ZZ; Where "YY" can be BB or BC; and "ZZ" can be MAA1B, MAA1W, MAB1W, SAA1B, SAA1W, SAC1B, SAC1W, SAD1W, SBA1B, SBA1W, SBC1B, or SBC1W

## MODULE COMPATIBILITY

GCL	GCL modules with 35 mm and 40 mm frames GCL-ab/YY xxx Where "a" can be M or P; "b" can be 3 or 6; and "YY" can be 60, 72, 72H, or 72DH
GigaWatt Solar	Gigawatt modules with 40 mm frames GWxxxYY Where "YY" can be either PB or MB
Hansol	Hansol modules with 35 and 40 frames HSxxxYY-zz Where "YY" can be PB, PD, PE, TB, TD, UB, UD, or UE; and "zz" can be AH2, AN1, AN3, AN4, HV1, or JH2
Hanwha Solar	Hanwha Solar modules with 40, 45, and 50 mm frames HSLaaP6-YY-1-xxxZ Where "aa" can be either 60 or 72; "YY" can be PA or PB; and "Z" can be blank or B
Hanwha Q CELLS	Hanwha Q CELLS Modules with 32, 35, 40, and 42 mm frames aaYY-ZZ-xxx where "aa" can be Q. or B.; "YY" can be PLUS, PRO, PEAK, LINE PRO, LINE PLUS, PLUS DUO or PEAK DUO; and "ZZ" can be G3, G3.1, G4, G4.1, L-G2, L-G2.3, L-G3, L-G3.1, L-G3y, L-G4, L-G4.2, L-G4y, LG4.2/TAA, BFR-G3, BLK-G3, BFR-G3.1, BLK-G3.1, BFR-G4, BFR-G4.1, BFR G4.3, BLK-G4.1, G4/SC, G4.1/SC, G4.1/TAA, G4.1/MAX, BFR G4.1/TAA, BFR G4.1/MAX, BLK G4.1/TAA, BLK G4.1/SC, EC-G4.4, G5, G5/SC, BLK-G5, BLK-G5/SC, L-G5, L-G5.1, L-G5.2, L-G5.2/H, L-G5.3, G6, G6/SC, G6+, BLK-G6, L-G6, L-G6.1, L-G6.2, L-G6.3, G7, BLK-G6+, BLK-G6+/AC, BLK-G6+/SC, BLK-G7, G7.2, G8, BLK-G8, G8+, BLK-G8+ L-G7, L-G7.1, L-G7.2, L-G7.3, L-G8, L-G8.1, L-G8.2, L-G8.3, L-G8.3/BFF, L-G8.3/BFG, ML-G9 or XL-G9.3
Heliene	Heliene modules with 40 mm frames YYZZxxxA Where "YY" can be 36, 60, 72, or 96; "ZZ" can be M, P, or MBLK; and "A" can be blank, HomePV, or Bifacial
HT-SAAE	HT-SAAE modules with 35 and 40 mm frames HTyy-156Z-xxx Where "yy" can be 60 or 72, "Z" can be M, P, M-C, P-C, M(S), M(VS), M(V), P(V), M(V)-C, P(V)-C
Hyundai	Hyundai modules with 33, 35, 40 and 50 mm frames HiY-SxxxZZ Where "Y" can be A, D, M or S; and "ZZ" can be HG, HI, KI, MI, MF, MG, RI, RG, RG(BF), RG(BK), SG, TI, or TG
Itek	Itek Modules with 40 and 50 mm frames IT-xxx-YY Where "YY" can be blank, HE, or SE, or SE72
JA Solar	JA Solar modules with 30, 35, 40 and 45 mm frames JAyzz-bbww-xxx/aa Where "yy" can be M, P, M6 or P6; "zz" can be blank, (K), (L), (R), (V), (BK), (FA), (TG), (FA)(R), (L)(BK), (L)(TG), (R)(BK), (R)(TG), (V)(BK), (BK)(TG), or (L)(BK)(TG); "bb" can be 48, 60, or 72; "ww" can be D09, S01, S02, S03, S06, S09, S10, or S12; and "aa" can be BP, MP, SI, SC, PR, 3BB, 4BB, 4BB/RE, 5BB
Jinko	Jinko modules with 35 and 40 mm frames JKMYxxxZZ-aa Where "Y" can either be blank or S; "ZZ" can be M, P, or PP; and "aa" can be blank, 60, 60B, 60H, 60L, 60BL, 60HL, 60HBL, 60-J4, 60B-J4, 60B-EP, 60(Plus), 60-V, 60-MX, 72, 72-V, 72H-V, 72L-V, 72HL-V, 72-MX, 72H-BDVP, or 72HL-TV
Kyocera	Kyocera Modules with 46mm frames KYxxxZZ-AA Where "Y" can be D or U; "ZZ" can be blank, GX, or SX; and "AA" can be LPU, LFU, UPU, LPS, LPB, LFB, LFBS, LFB2, LPB2, 3AC, 3BC, 3FC, 4AC, 4BC, 4FC, 4UC, 5AC, 5BC, 5FC, 5UC, 6BC, 6FC, 8BC, 6MCA, or 6MPA
LG	LG modules with 35, 40, and 46 mm frames LGxxxYaZ-bb Where "Y" can be A, E, N, Q, S; "a" can be 1 or 2; "Z" can be C, K, T, or W; and "bb" can be A3, A5, B3, G3, G4, J5, K4, or V5
Longi	Longi modules with 30, 35 and 40 mm frames LRa-YYZZ-xxxM Where "a" can be 4 or 6; "YY" can be blank, 60 or 72; and "ZZ" can be blank, BK, BP, HV, PB, PE, PH, HBD, HPB, or HPH

## MODULE COMPATIBILITY

Mission Solar	Mission Solar modules with 33 and 40 mm frames MSEbbxxxZZaa Where "bb" can be blank or 60A; "ZZ" can be blank, MM, SE, SO, SQ, SR, or TS; and "aa" can be blank, 1J, 4J, 4S, 5K, 5T, 60, 6J, 6S, 6W, 8K, 8T, or 9S
Mitsubishi	Mitsubishi modules with 46 mm frames PV-MYYxxxZZ Where "YY" can be LE or JE; and "ZZ" can be either HD, HD2, or FB
Motech	IM and XS series modules with 40, 45, and 50 mm frames
Neo Solar Power	Neo Solar Power modules with 35 mm frames D6YxxxZZaa Where "Y" can be M or P; "ZZ" can be B3A, B4A, E3A, E4A, H3A, H4A; and "aa" can be blank, (TF), ME or ME (TF)
Panasonic	Panasonic modules with 35 and 40 mm frames VBHNxxxYYzza Where "YY" can be either KA, RA, SA or ZA; "zz" can be either 01, 02, 03, 04, 06, 06B, 11, 11B, 15, 15B, 16, 16B, 17, or 18; and "A" can be blank, E, G, or N
Peimar	Peimar modules with 40 mm frames SbxxxYzz Where "b" can be G, M or P; "Y" can be M or P; and "zz" can be blank, (BF) or (FB)
Philadelphia Solar	Philadelphia modules with 35 and 40 mm frames PS-YzzAA-xxx Where "Y" can be M or P; "zz" can be 60 or 72; and "AA" can be blank or (BF)
Phono Solar	Phono Solar modules with 35, 40, and 45 mm frames PSxxxY-ZZ/A Where "Y" can be M, M1, MH, or M1H or P; "ZZ" can be 20 or 24; and "A" can be F, T, U, or TH
Recom	Recom modules with 35 and 40 mm frames RCM-xxx-6yy Where "yy" can be MA or MB
REC Solar	REC modules with 30, 38 and 45 mm frames RECxxxYYZZ Where "YY" can be AA, M, NP, PE, PE72, TP, TP2, TP2M, TP2SM, or TP2S; and "ZZ" can be blank, Black, BLK, BLK2, SLV, or 72
Renesola	ReneSola modules with 35, 40 and 50 mm frames AAxxxY-ZZ Where "AA" can be SPM(SLP) or JC; "Y" can be blank, F, M or S; and "ZZ" can be blank, Ab, Ab-b, Abh, Abh-b, Abv, Abv-b, Bb, Bb-b, Bbh, Bbh-b, Bbv, Bbv-b, Db, Db-b, or 24/Bb
Renogy	Renogy Modules with 40 and 50 mm frames RNG-xxxY Where "xxx" is the module power rating; and "Y" can be D or P
Risen	Risen Modules with 35 and 40 mm frames RSMyy-6-xxxZZ Where "yy" can be 60, 72, 120 or 144; and "ZZ" can be M or P
S-Energy	S-Energy modules with 40 frames SNxxxY-ZZ Where "Y" can be M or P; and "ZZ" can be 10, or 15
Seraphim Energy Group	Seraphim modules with 35 and 40 mm frames SEG-aYY-xxxZZ Where "a" can be blank, 6 or B; "YY" can be blank, MA, MB, PA, or PB; and "ZZ" can be blank, BB, BG, BW, HV, WB, WW, BMB, BMB-HV
Seraphim USA	Seraphim modules with 40 and 50 mm frames SRP-xxx-6YY Where "xxx" is the module power rating; and "YY" can be MA, MB, PA, PB, QA-XX-XX, and QB-XX-XX
Sharp	Sharp modules with 35 and 40 mm frames NUYYxxx Where "YY" can be SA or SC



## MODULE COMPATIBILITY

Silfab	Silfab Modules with 38 mm frames SYY-Z-xxxAb Where "YY" can be IL, SA, LA, SG or LG; "Z" can be blank, M, P, or X; "A" can be blank, B, H, M, or N; and "b" can be A, L, G, or T
Solaria	Solaria modules with 40 mm frames PowerXT xxxY-ZZ Where "Y" can be R or C; and "ZZ" can be AC, BD, BX, BY, PD, PM, PM-AC, PX, PZ, WX or WZ
Solarcity (Tesla)	Solarcity modules with 40 mm frames SCxxxYY Where "YY" can be blank, B1 or B2
SolarTech	SolarTech modules with 42 mm frames STU-xxxYY Where "YY" can be PERC or HJT
SolarWorld AG	SolarWorld Sunmodule Plus, Protect, Bisun, XL, Bisun XL, may be followed by mono, poly, duo, black, bk, or clear; modules with 31, 33 or 46 mm frames SW-xxx
SolarWorld Americas	SolarWorld Sunmodule Plus, Protect, Bisun, XL, Bisun XL, may be followed by mono, poly, duo, black, bk, or clear; modules with 33 mm frames SWA-xxx
Stion	Stion Thin film modules with 35 mm frames STO-xxx or STO-xxxA
SunEdison	SunEdison Modules with 35, 40 & 50 mm frames SE-YxxxZABCDE Where "Y" can be B, F, H, P, R, or Z; "Z" can be 0 or 4; "A" can be B,C,D,E,H,I,J,K,L,M, or N ; "B" can be B or W; "C" can be A or C; "D" can be 3, 7, 8, or 9; and "E" can be 0, 1 or 2
Suniva	Suniva modules with 35, 38, 40, 46, and 50 mm frames OPTxxx-AA-B-YYY-Z MVXxxx-AA-B-YYY-Z Where "AA" is either 60 or 72; "B" is either 4 or 5; "YYY" is either 100,101,700,1B0, or 1B1; and "Z" is blank or B
Sunpower	Sunpower standard (G3 or G4) or InvisiMount (G5) 40 and 46 mm frames SPR-Zb-xxx-YY Where "Z" is either A, E, P or X; "b" can be blank, 17, 18, 19, 20, 21, or 22; and "YY" can be blank, BLK, COM, C-AC, D-AC, E-AC, G-AC, BLK-C-AC, or BLK-D-AC
Sunspark	Sunspark modules with 40 mm frames SYY-xxxZ Where "YY" can be MX or ST; and "Z" can be M, P or W
Suntech	Suntech Modules with 35, 40 and 50mm frames STPxxxy-zz/aa Where "y" is blank or S; and "zz" can be 20, 24; and "aa" can be Vd, Vem, Vfw, Wdb, Wde or Wd
Talesun	Talesun modules with 35 and 40 frames TP6yZZaaxxx-b Where "yy" can be blank, F or H; "ZZ" can be 60 or 72; "aa" can be M or P; and "b" can be blank, B, T, or (H)
Trina	Trina Modules with 30, 35, 40 and 46mm frames TSM-xxxYYZZ Where "YY" can be DD05, DD06, DD14, DE14, DE15, DEG15, PA05, PC05, PD05, PD06, PA14, PC14, PD14, PE14, or PE15 ; and "ZZ" can be blank, .05, .08, .10, .18, .08D, .18D, 0.82, .002, .00S, 05S, 08S, A, A.05, A.08, A.10, A.18, A(II), A.05(II), A.08(II), A.082(II), A.10(II), A.18(II), H, H(II), H.05(II), H.08(II), HC.20(II), HC.20(II), or M
URE	URE modules with 35 mm frames DyZxxxHaa Where "y" can be 6 or 7; "Z" can be K or M; and "aa" can be H3A, H4A, or H8A
Vikram	Vikram solar modules with 40 mm frames VSyy.ZZ.AAA.bb Where "yy" can be M, P, MBB, MH, MS, MHBB, or PBB; "ZZ" can be 60 or 72; "AAA" is the module power rating; and "bb" can be 03.04 or 05

## MODULE COMPATIBILITY

VSUN	VSUN modules with 35 and 40 mm frames VSUNxxx-YYz-aa Where "YY" can be 60, 72, 120, or 144; "z" can be M, P, MH, PH, or BMH; and "aa" can be blank, BB, or DG
Winaico	Winaico modules with 35 and 40 mm frames Wsy-xxxZa Where "y" can be either P or T; "Z" can be either M, P, or MX; and "a" can be blank or 6
Yingli	Panda, YGE, YGE-U, and YLM series modules with 35, 40, and 50 mm frames
ZNShine	ZNShine Modules with 30, 35, and 40mm frames ZXy6-ZZaa-xxx/b Where "y" can be M or P; "ZZ" can be blank, H, HLD, HLDD, LD, LDD, NH, NHLD or NHLDD; "aa" can be 60, 72, 120 or 144; and "b" can be M or P

### FRAMELESS MODULE LIST

MAKE	MODELS
Astronergy Solar	Astronergy frameless modules CHSM6610P(DG)-xxx
Canadian Solar	Canadian Solar frameless modules CSbY-xxx-Z Where "b" can be 3 or 6; "Y" is K, P, U, or X; and "Z" can be M-FG, MS-FG, P-FG, MB-FG, or PB-FG
Jinko	Jinko frameless modules JKMxxxPP-DV
Prism Solar	Prism Solar frameless modules BiYY-xxxBSTC Where "YY" can be 48, 60, 60S, 72 or 72S
Risen	Risen frameless modules RSMyy-6-xxxZZ Where "yy" can be 60, 72, 120 or 144; and "ZZ" can be MDG or PDG
Stion	Stion frameless modules STL-xxx or STL-xxxA
Sunpreme	Sunpreme frameless modules GXB-xxxYY Where "YY" can be blank or SL
Trina	Trina frameless modules TSM-xxxYY Where "YY" can be either DEG5(II), DEG5.07(II), DEG5.40(II), DEG5.47(II), DEG14(II), DEG14C(II), DEG14C.07(II), DEG14.40(II), PEG5, PEG5.07, PEG5.40, PEG5.47, PEG14, or PEG14.40