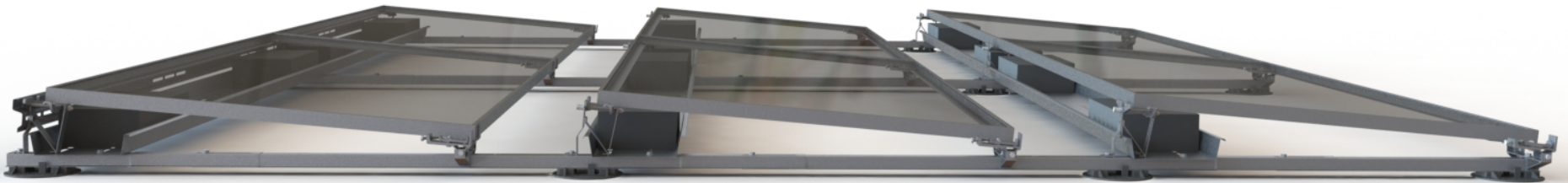




INSTALLATION GUIDE



UNIRAC Code-Compliant Installation Manual

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INSTALLATION GUIDE

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TECHNICAL SPECIFICATIONS:

Material Types: A380 cast aluminum and mill finish extruded aluminum (6005A-T61 or 6061-T6), G180 steel, Galvalume, PC/ASA

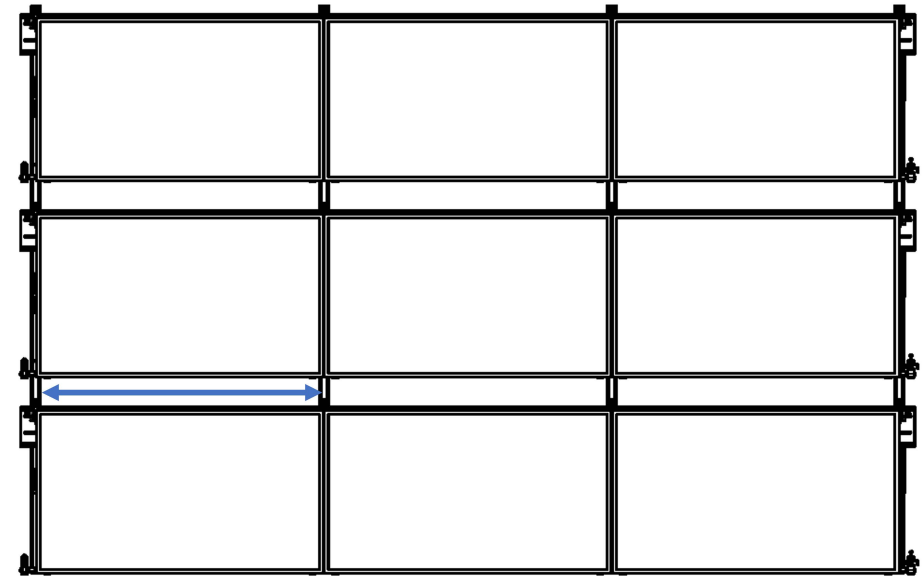
Hardware: Stainless steel

Bonding and Grounding: UL2703 Listed Continuous Bonding Path

TOOLS REQUIRED OR RECOMMEND FOR LAYOUT, ATTACHMENTS, AND INSTALLATION:

- Drill (Do Not Use an Impact Driver)
- 1/2" Socket
- Torque Wrench
- Tape Measure
- Chalk Reel
- Optional Spacers

All applicable OSHA safety guidelines should be observed when working on a PV installation job site. The installation and handling of PV solar modules, electrical installation and PV racking systems involves handling components with potentially sharp metal edges. Rules regarding the use of gloves and other personal protective equipment should be observed.

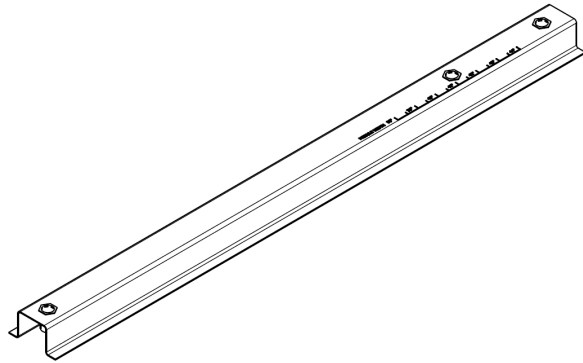


SPACER OPTIONAL:

Column Spacer

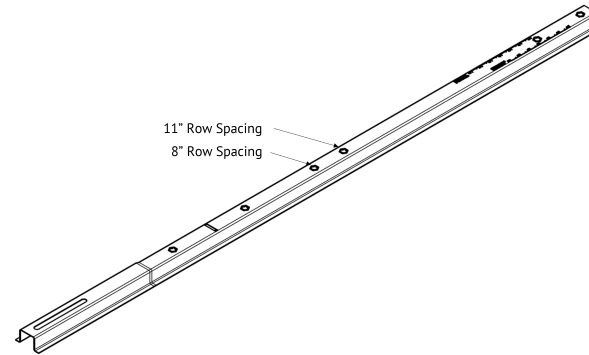


Rail center to center = Module Length + 1/4"



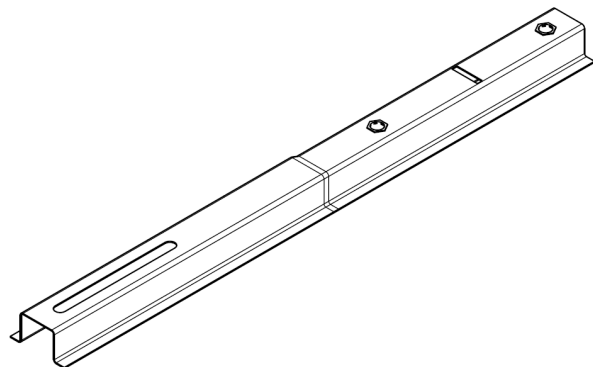
SOUTH RAIL:

The rail is made of Galvalume steel, pre-assembled with 5/16" SS Riv-Hex nuts. Module width scale is marked on rail, for overlap alignment.



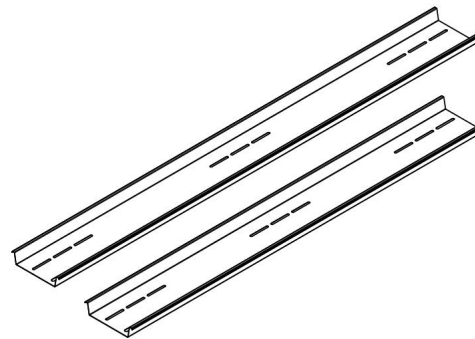
MID RAIL:

The rail is made of Galvalume, pre-assembled with 5/16" Riv-Hex nuts, SS. This rail is bulged at one end for overlapping rail connection.



NORTH RAIL:

The rail is made of Galvalume, pre-assembled with 5/16" Riv-Hex nut, SS. This rail is bulged at one end for overlapping rail connection.

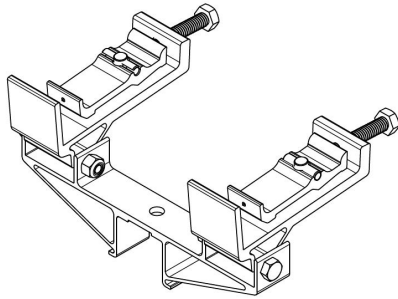


BALLAST TRAY:

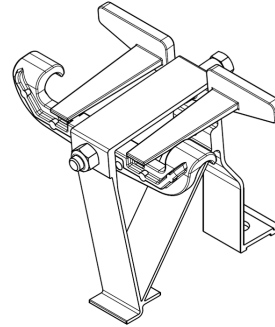
Ballast Trays made of G180 galvanized steel hold standard ballast blocks. Multiple lengths are available to accommodate different module lengths.

Two module width scales each corresponding 8" and 11" row spacing are printed on rail, so that rails are overlapped to achieve accurate module width.

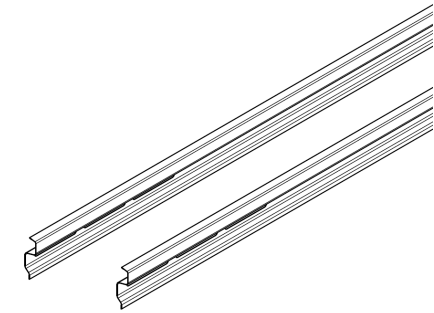
BALLAT TRAY NOTE:
Ballast tray can fit up to 4 standard 4"x8"x16" solid concrete cap blocks. See "Complete Ballast Placement" page of this document for more information. Block weight can range from 26 – 38lbs. The weight of the block will have a major impact on how many will be required for the project so be sure to verify your block weights before using the U-builder online tool.



SOUTH CLAMP: The south stanchion assembly is made of a mill finish Aluminum and engages the return flange underneath the panel to secure and electrically bond the module. This unique design attaches to the return flange and outside of the module frame creating a universal connection.

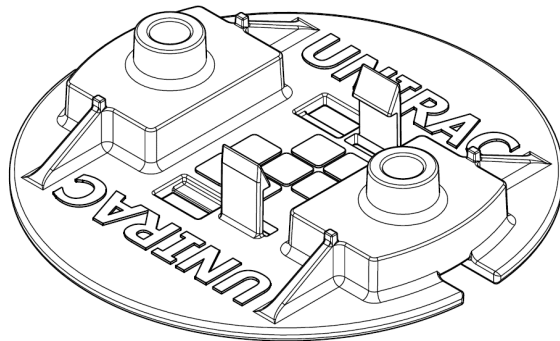


NORTH CLAMP: The north stanchion assembly is made of a mill finish Aluminum and engages the return flange underneath the panel to secure the module. This unique design takes advantage of the design of the module frame, attaching to the return flange of the frame creating a universal connection.



WIND DEFLECTORS: Wind deflectors are made of G180. Multiple lengths are available to accommodate different module lengths

IMPORTANT: WIND DEFLECTORS ARE REQUIRED ON NORTH EDGES OF ARRAYS TO MAINTAIN CLASS A FIRE RATING.



ROOF PAD: The Roof Pad provides a protective interface between the Rails and roofing material to protect the roof membrane.

HARDWARE:

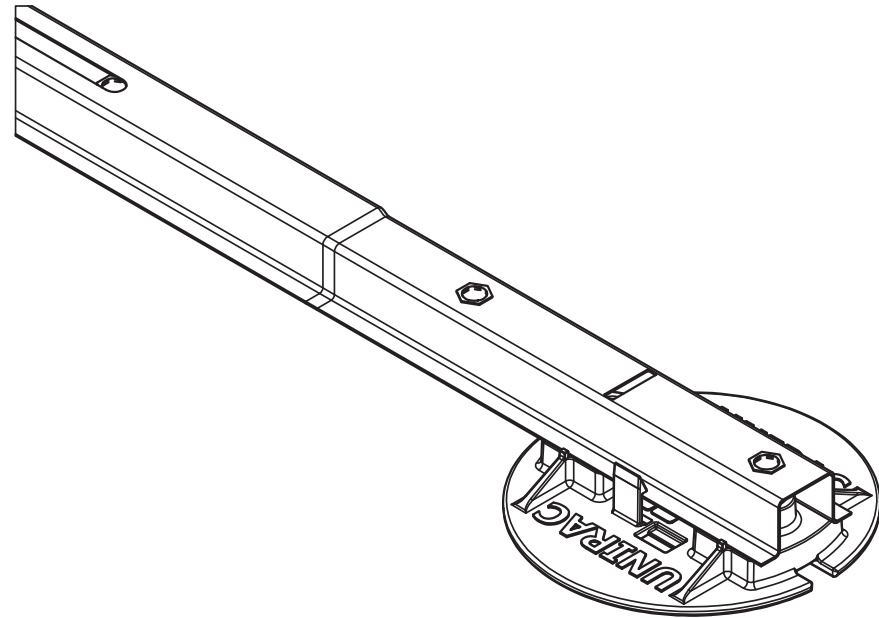
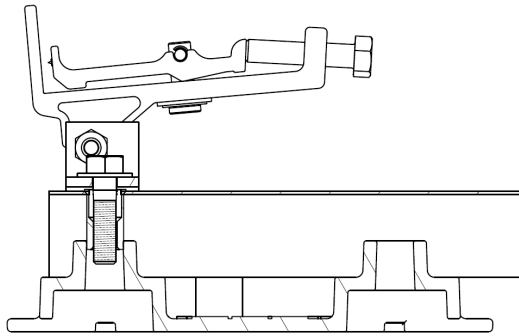
1. 5/16-18" X 1.25" Hex Head Bolt

2a. 5/16" Flat Washer 0.75" OD

2b. 5/16" Flat Washer, 1" OD, .125 thk.

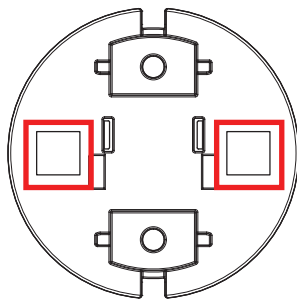
INSTALL ROOF PADS ON RAILS

Roof Pads snap onto Rails. Install a Roof Pad under every North Stanchion location and under every South Stanchion located at a south edge of an array. Ensure the stanchion bolt above each roof pad goes into the protruding boss in the roof pad.

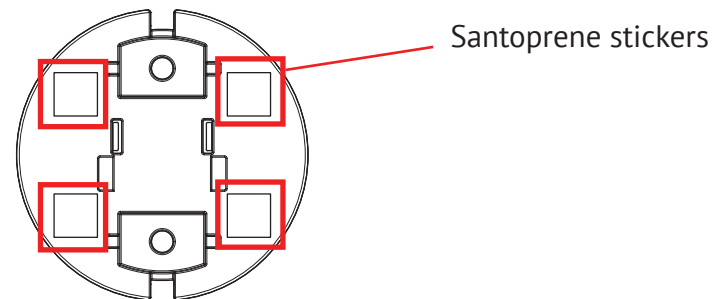


ROOF PAD PROVISION FOR GRAVEL AND MINERAL CAP SHEET ROOFS

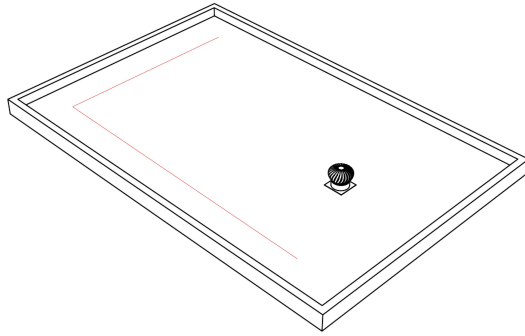
Systems installed on gravel or MCS roofs require Santoprene stickers be added to the Roof Pads. 2 for gravel and 4 for MCS as shown below.



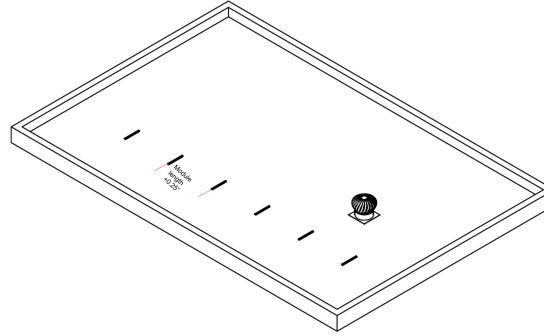
2 Stickers for Gravel



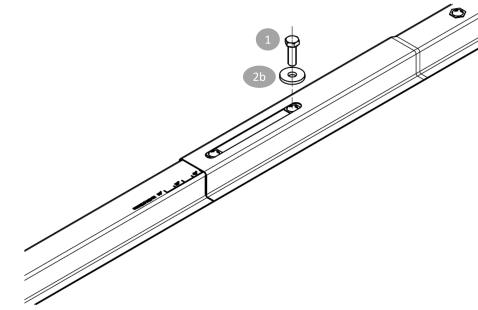
4 Stickers for Mineral Cap Sheet



MARK ROOF WHERE ARRAY WILL START: Use chalk line to mark distances from roof edge as called out in construction documents.



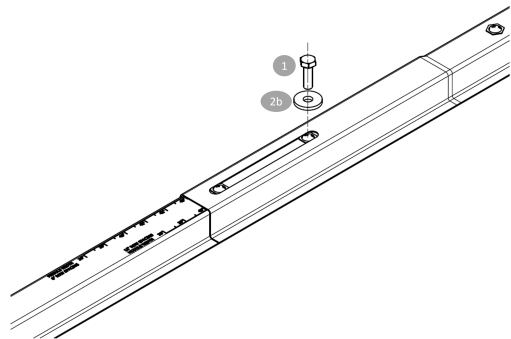
LOCATE ARRAY ON ROOF: Align South Rails with previous chalk lines. Rail Spacing center to center = $\text{Module Length} + .25"$. East and west side rails may be tucked in, under the module.



ATTACH SOUTH RAIL TO MID RAIL: Overlap Mid-Rails on top of South Rails, use the measurement scale printed on the rail to determine the overlap length. Match the value on scale to the module width. Insert hex bolt with 1" OD washer into riv-nut

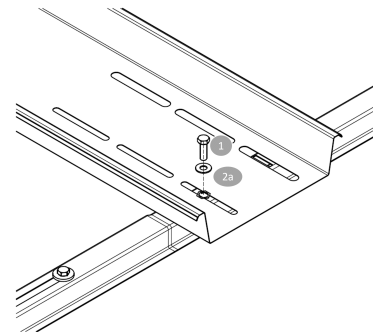
FOR HARDWARE CALL OUTS REFER TO PAGE 3

TORQUE VALUE – 10 FT-LBS



ATTACH MID-RAIL TO MID-RAIL/ MID-RAIL TO NORTH-RAIL : Overlap next Rail bulge on top of Rail laid on roof, use the measurement scale (8" or 11" row spacing) printed on the rail to determine the overlap length. Match the value on scale to the module width. Insert hex bolt into riv-nut through a 1" OD washer

TORQUE VALUE – 10 FT-LBS



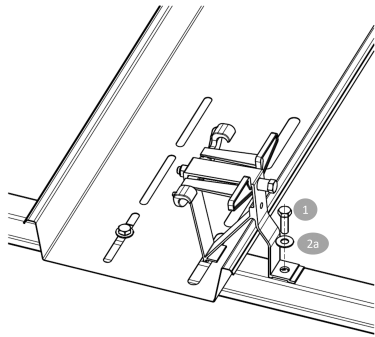
LAY BALLAST TRAY: With rails spaced apart the module length + .25", align the slots in the Ballast Tray with the holes on the Base Rail. Secure the Ballast Tray south direction with a hex head bolt with 0.75" OD washer and screw in the riv-nut

FOR HARDWARE CALL OUTS REFER TO PAGE 3

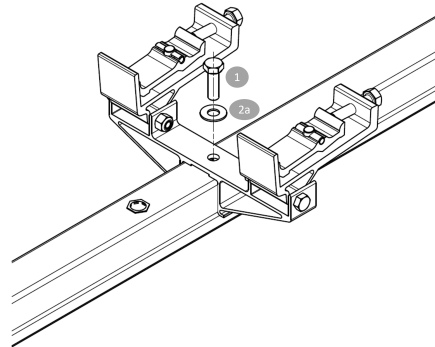
TORQUE VALUE – 10 FT-LBS

IMPORTANT:

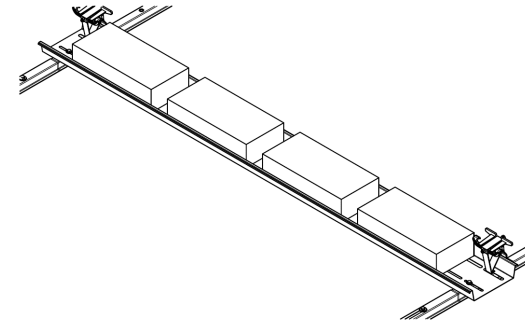
TO MEET THE SYSTEM'S MECHANICAL DESIGN LOAD RATINGS, THE MAXIMUM CANTILEVER FROM THE EDGE OF A MODULE TO THE CENTER OF A TUCKED STANCHION CLAMP IS 8"



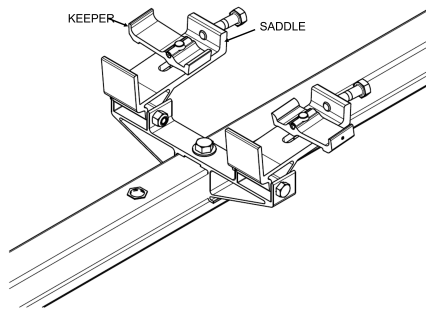
ATTACH NORTH STANCHION: Insert the front tab of the North Stanchion into the slot of the base rail and together. Secure with a hex head bolt with .75" OD washer through the rear hole into the riv-nut
FOR HARDWARE CALL OUTS REFER TO PAGE 3
TORQUE VALUE - 10 FT-LBS



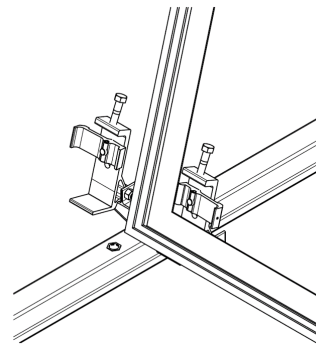
ATTACH SOUTH STANCHION: Depending on the row to row spacing (8in or 11in), place the south stanchion over the hole provided on the base rail and secure with a hex head bolt with .75" OD washer in to the riv-nut.
FOR HARDWARE CALL OUTS REFER TO PAGE 3
TORQUE VALUE - 10 FT-LBS



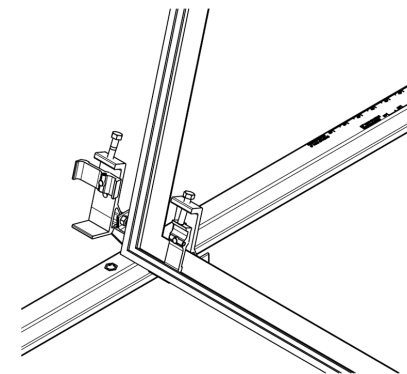
LAY BALLAST BLOCKS: Lay ballast blocks into ballast trays. Quantity of blocks to be placed should be as per appropriate engineering and U-Builder.



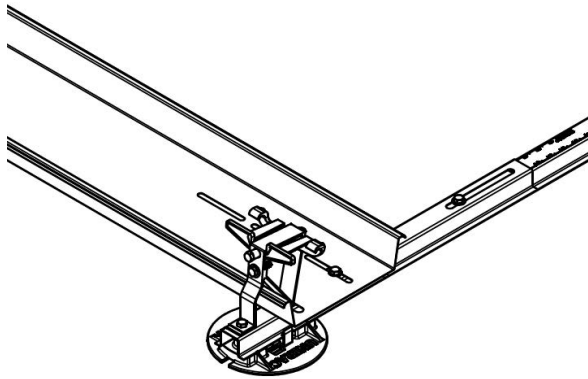
MODULE CONNECTION, STEP 1: Rotate the keeper perpendicular to saddle and pull it completely towards the hex bolt.



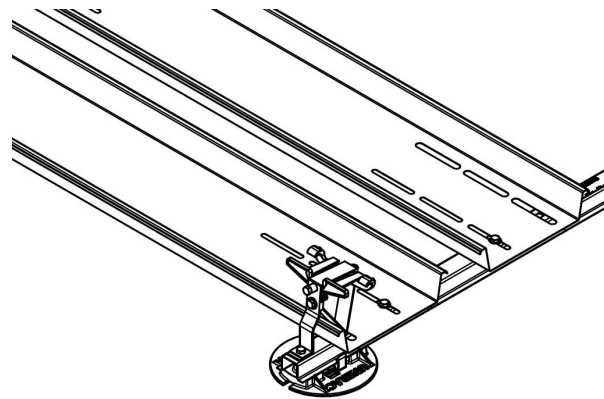
MODULE CONNECTION, STEP 2: Now keep the south clamp at 75 deg, and place one end of module into the clamp.



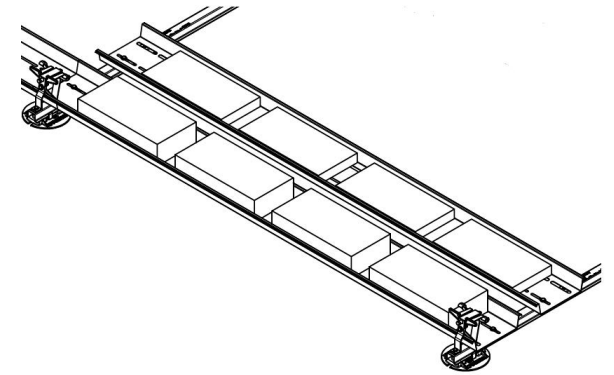
MODULE CONNECTION, STEP 3: Now rotate the keeper towards the module and tighten the hexagonal bolt such that the keeper touches the wall of vertical return flange.



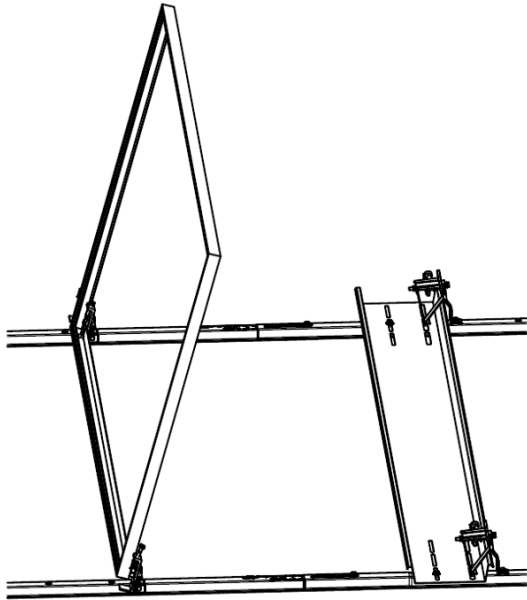
HIGHER BALLAST REQUIREMENT: An additional Ballast Tray can be installed in the connection between North rail to Mid rail /Mid rail to Mid rail to support for higher uplift. The Additional Ballast tray can only fit half blocks.



Align the smaller slots in Ballast Tray with the hole used for the rail overlap connection. Secure the ballast tray using the hex bolt and 1" OD washer provided for the rail overlap connection. For Hardware Call OUTS Refer to page 3.
TORQUE VALUE: 10 FT-LBS

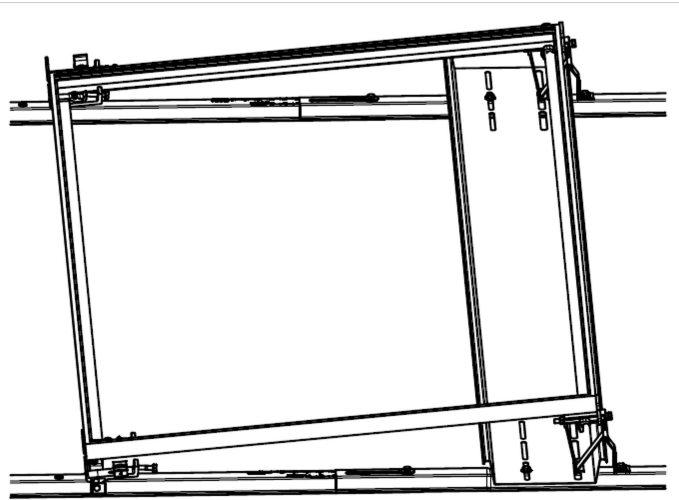


Place up to 4 half ballast blocks as needed.



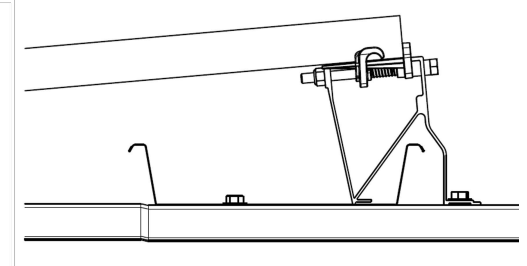
MODULE CONNECTION, STEP 4: Tighten the South Stanchion bolts and rotate the module down to rest on the North Stanchion as shown.

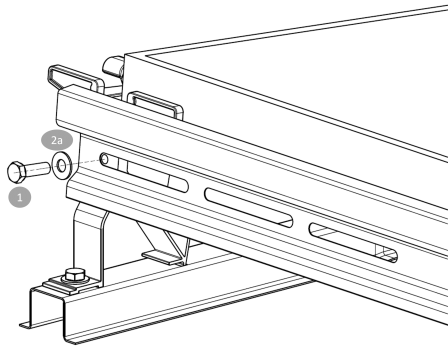
**SOUTH STANCHION CLAMP TORQUE
VALUE – 8 FT-LBS**



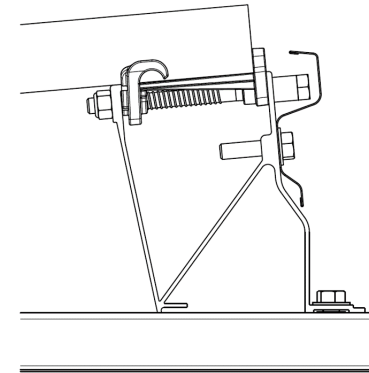
MODULE CONNECTION, STEP 5: Rest the north end of the module on the North Stanchion Clamp. Install the adjacent module and tighten the hexagonal bolt so the clamp engages the return flange of both modules firmly.

**NORTH STANCHION CLAMP TORQUE
VALUE – 2 FT-LBS**

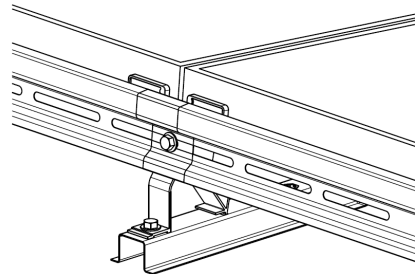




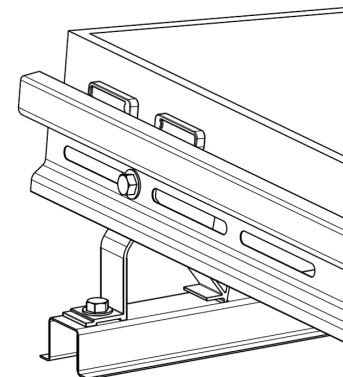
INSTALL WIND DEFLECTOR: Thread the bolts through the included 0.75" OD washer, then wind deflector, and into the threaded hole provided in north stanchion.



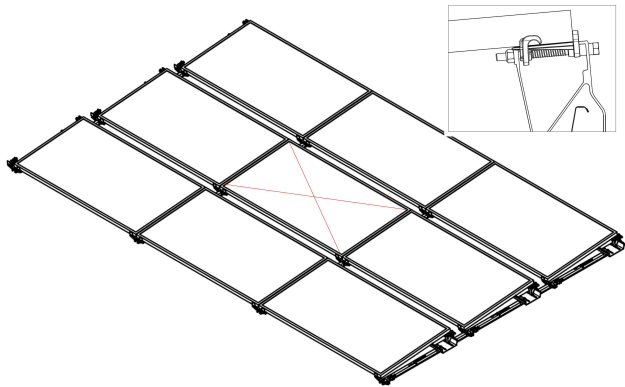
TIGHTEN BOLTS TO TORQUE:
Narrow side of the deflector will be on the bottom.
TORQUE VALUE: 6-8 FT-LBS



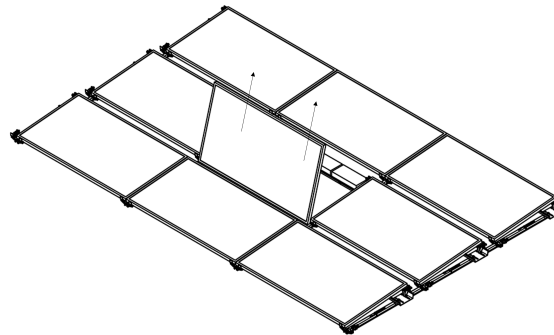
NOTE: Wind deflectors will overlap where modules meet.



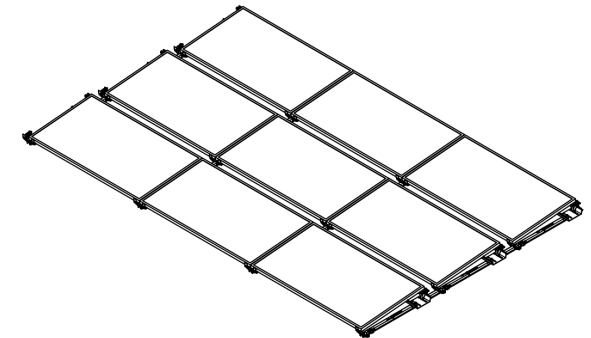
NOTE: For perimeter modules, align outside edge of wind deflectors with the exposed edge of module.



STEP 1: Locate the module to be replaced. Loosen the hexagonal bolt in both the north stanchions to which the module is connected.



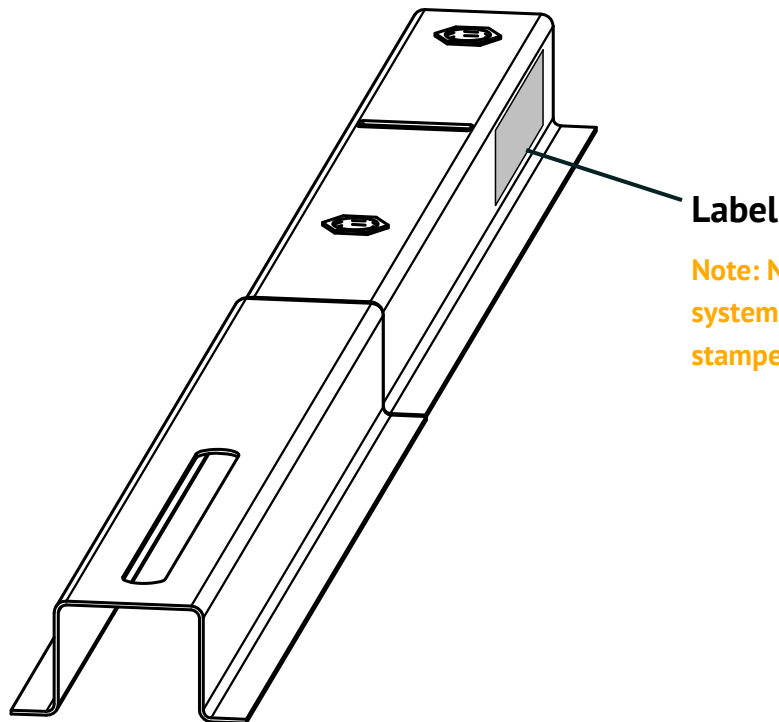
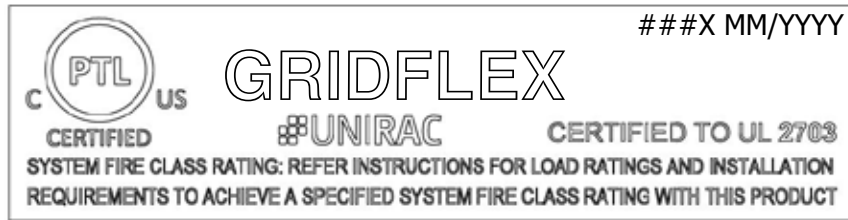
STEP 2: Now lift the module from north edge and rotate it 75deg towards south. Loosen the bolt in the south stanchion and rotate the keeper 90deg.



STEP 3: Remove the module and place the new module by following module attaching steps from page 5 and 6.

IMPORTANT: ANY LOOSE COMPONENTS OR FASTENERS SHALL BE RE-TIGHTENED IN ACCORDANCE WITH THESE INSTRUCTIONS. ANY COMPONENTS SHOWING SIGNS OF DAMAGE THAT COMPROMISE SAFETY SHALL BE REPLACED IMMEDIATELY.

UL2703 System Label: To document the UL2703 system rating, Installers must apply a label to each array during installation. The label should be applied to the easternmost North Rail at each array's north edge. Below is an example of the label and a diagram of where to place it.



Note: North Rail may be stamped by the manufacturer with the system label in the location shown in the diagram. If label is stamped on part there is no need to apply the sticker label

MECHANICAL LOAD TEST QUALIFICATION

The GridFlex™ system has been tested to the mechanical load provisions of UL2703 and covers the following basic parameters:

- PV module may have reduced load rating, independent of the GridFlex™ 5 rating. please consult the PV module manufacturer's installation guide for more information.
- Load rating may vary based on PV module area. Please Contact Unirac for more information.

Module Manufacturer	Model / Series	Area [sqft]	Design Load [PSF]
Hyundai	HiS-M305TI	21.06	16.7 up / 36 down
Q Cells	Q.PEAK DUO L-G8.3	23.06	17.3 up / 21.05 down
SunPower	P-19-330-COM	22.20	18.45 up / 36.5 down

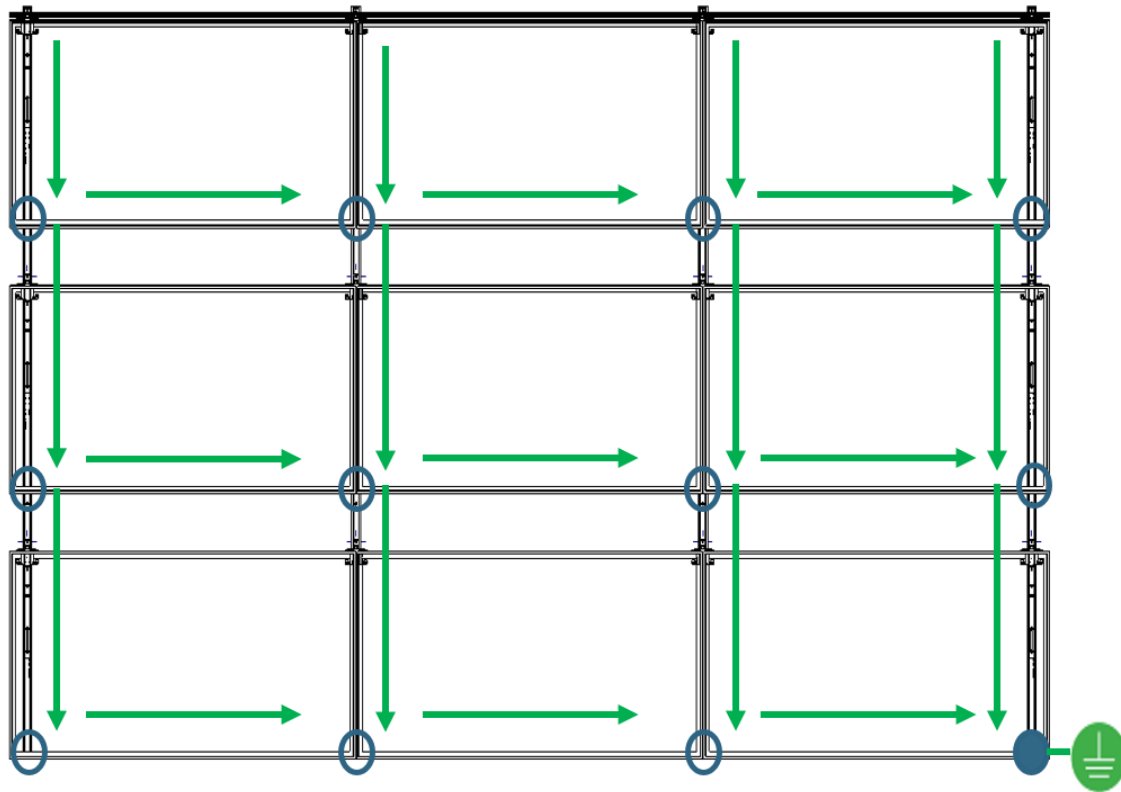
SYSTEM LEVEL FIRE CLASSIFICATION: The system fire class rating is only valid when the installation is conducted in accordance with the assembly instructions contained in this manual over a fire resistant roof covering rated for the application. GridFlex™ has been classified to the system level fire portion of UL2703. It has achieved Class A performance for low sloped roofs when used in conjunction with type 1, 2, 3 with a metal frame, 19, 22, and type 25 module constructions. Please see the specific conditions for mounting details described within this document required to maintain the Class A fire rating. Minimum and maximum roof slopes are restricted through the system design and layout rules. The fire classification rating is only valid on roof pitches less than 2:12 (slopes < 2 inches per foot, or 9.5 degrees).

Refer to page 9 for proper installation of wind deflectors for fire mitigation.

NOTE: Fire Type information can be found on back of modules or through manufacturers documentation. Some building codes and fire codes require minimum clearances around such installations, and the installer should check local building code requirements for compliance.

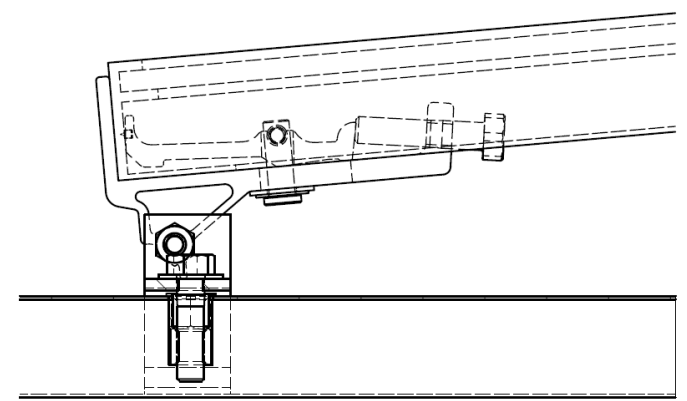
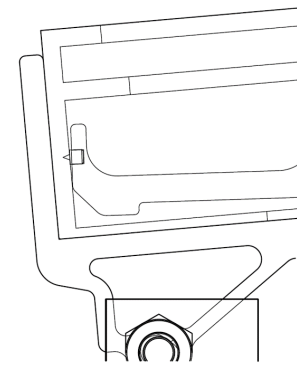
CLASS A FIRE RATING MOUNTING ORIENTATION

GridFlex™ has achieved Class A system level fire performance for type 1, 2, 3 with a metal frame, 19, 22, and type 25 module constructions. In order to maintain the fire rating, the module J-Box must be oriented away from the array east-west edges.



NOTE: Ground bond path can be established by installing the ground lug and copper wire connection to either the South Stanchion, North Stanchion, Rail, Wind Deflector, or Ballast Tray

- Ground Lug
- Grounding Clamp
- Min. 10 AWG Copper Wire



Module to South Stanchion to Rail Connection

GROUNDING LUG MOUNTING DETAILS AS REQUIRED BY CODE & ENGINEER OF RECORD: The IlSCO lug has a green colored set screw for grounding indication purposes. One lug is recommended per continuous array, not to exceed 150ft X 150ft. Unirac GridFlex™ is intended to be used with PV modules that have a system voltage less than or equal to that allowable by the National Electric Code (NEC). It is the installer’s responsibility to check adherence to local codes.

NOTE: The installation must be conducted in accordance with the National Electric Code ANSI / NFPA 70.

GROUND LUG	BOLT SIZE	TORQUE VALUE
IlSCO Lug SGB-4	1/4" - 20	6.5ft-lbs (75 in-lbs)
IlSCO Lug GBL-4	#10 - 32	2.9ft-lbs (35 in-lbs)
Wiley 6.7	1/4" - 20	10ft-lbs (120 in-lbs)

NOTE: In order to prevent corrosion induced by dissimilar metals, it is important to verify that the bare copper wire does not come into contact with aluminum or galvanized steel. These metals must be kept separate.

Although conformance with UL2703 was demonstrated without the use of oxide inhibitor material, it is recommended by IlSCO to provide an optimized bonding solution for their lay-in-lug.

IlSCO SGB-4 Solar Grounding & Bonding



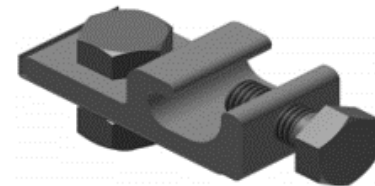
TERMINAL TORQUE:
Install conductor and torque to the following: **4-14 AWG: 35 in-lbs**

IlSCO GBL-4 Solar Grounding & Bonding



TERMINAL TORQUE:
Install conductor and torque to the following: **4-6 AWG: 35 in-lbs, 8 AWG: 25 in-lbs**

Wiley WEWB-Lug 6.7 Solar Grounding & Bonding



TERMINAL TORQUE:
Install conductor and torque to the following: **4-6 AWG: 10 ft-lbs, 6-14 AWG: 7 ft-lbs**

Electrical Bonding and Grounding Test Modules

The list below is not exhaustive of compliant modules but shows those that have been evaluated and found to be electrically compatible with the GridFlex™ system.

Manufacture	Module Model / Series
Aleo	P-Series & S-Series
Aptos Solar	DNA-120-(MF/BF)26 DNA-144-(MF/BF)26
Astronergy	CHSM6612 M, M/HV CHSM6612P Series CHSM6612P/HV Series CHSM72M-HC,
Auxin	AXN6M610T, AXN6P610T, AXN6M612T AXN6P612T
Axitec	AC-xxxMH/120(S/V/SB/VB) AC-xxxMH/144(S/V/SB/VB)
Boviet	BVM6610, BVM6612
BYD	P6K & MHK-36 Series
Canadian Solar	CS1(H/K/U/Y)-MS CS3K-(MB/MB-AG/MS/P/P HE/PB-AG) CS3L-(MS/P) CS3U-(MB/MB-AG/MS/P/P HE/PB/PB-AG) CS3W-(MS/P/P-PB-AG) CS5A-M CS6K-(M/MS/MS AllBlack/P/P HE)
Centrosolar America	C-Series & E-Series
CertainTeed	CT2xxMxx-01, CT2xxPxx-01, CTxxxMxx-01, CTxxxPxx-01, CTxxxMxx-02, CTxxxMxx-03 CTxxxMxx-04, CTxxxHC11-04
Eco Solargy	Orion 1000 & Apollo 1000
ET Solar	ET AC Module, ET Module

Manufacture	Module Model / Series
Flextronics	FXS-xxxBB
GCL	GCL-P6 & GCL-M6 Series
Hanwha SolarOne	HSL 60
Hansol	TD-AN3, TD-AN4, UB-AN1, UD-AN1
Heliene	36M, 36P 60M, 60P, 72M & 72P Series
HT Solar	HT72-156(M/P), HT72-156P-C, HT72-156P(V)-C HT72-156M(PDV)-BF, HT72-156M(PD)-BF HT60-156M-C, HT60-156M(V)-C
Hyundai	KG, MG, RW, TG, RI, RG, TI, KI, HI Series HiA-SxxxHG, HiD-SxxxRG(BK), HiS-S400PI
ITEK	iT-SE Series
Japan Solar	JPS-60 & JPS-72 Series
JA Solar	JAP6 60-xxx, JAM6(k)-60/xxx, JAP6(k)-72-xxx/4BB, JAP72SYY-xxx/ZZ, JAP6(k)-60-xxx/4BB, JAP60SYY-xxx/ZZ, JAM6(k)-72-xxx/ZZ, JAM72SYY-xxx/ZZ, JAM6(k)-60-xxx/ZZ, JAM60SYY-xxx/ZZ. i. YY: 01, 02, 03, 09, 10 ii. ZZ: SC, PR, BP, HiT, IB, MW YY = Backsheet, ZZ Cell technology
Jinko	JKM & JKMS Series JKMxxxM-72HL-V
Kyocera	KD-F & KU Series

Manufacture	Module Model / Series
LG Electronics	LGxxx(E1C/E1K/N1C/N1K/N2T/N2W/S1C/ S2W/Q1C/Q1K)-A5 LGxxx(A1C/M1C/M1K/N1C/N1K/Q1C/Q1K/ QAC/QAK)-A6 LGxxxN2W-B3 LGxxxN2T-B5 LGxxxN1K-B6 LGxxx(N1C/N1K/N2T/N2W)-E6 LGxxx(N1C/N1K/N2W/S1C/S2W)-G4 LGxxxN2T-J5 LGxxx(N1K/N1W/N2T/N2W)-L5 LGxxx(N1C/Q1C/Q1K)-N5 LGxxx(N1C/N1K/N2W/Q1C/Q1K)-V5
LONGi	LR4-60(HPB/HPH) LR4-72(HBD/HPH) LR6-60 LR6-60(BK/HPB/HPH/HV/PB/PE/PH) LR6-72 LR6-72(BK/HBD/HV/PB/PE/PH) RealBlack LR4-60HPB RealBlack LR6-60HPB
Mission Solar Energy	MSE Mono, MSE Perc
Mitsubishi	MJE & MLE Series
Neo Solar Power Co.	D6M Series
Panasonic	VBHNxxxSA06/SA06B/SA11/SA11B VBHNxxxSA15/SA15B/SA16/SA16B, VBHNxxxKA, VBHNxxxKA03/04, VBHNxxxSA17/SA17G/SA17E/SA18/SA18E, VBHNxxxZA01/ZA02/ZA03/VBHNxxxZA04
Peimar	SGxxxM (FB/BF) SMxxxM

- The frame profile must not have any feature that might interfere with the bonding devices that are integrated into the racking system
- Use with a maximum over current protection device OCPD of 30A
- Please see GridFlex™ information at Unirac.com to ensure the exact solar module selected is approved for use with GridFlex™
- Listed models can be used to achieve a Class A fire system rating, for low slope applications, only when modules fire typed 1, 2, 3 with a metal frame, 19, 22, or 25.

Electrical Bonding and Grounding Test Modules

The list below is not exhaustive of compliant modules but shows those that have been evaluated and found to be electrically compatible with the GridFlex™ system.

Manufacture	Module Model / Series
Phono Solar	PSxxxM1-20/U PSxxxM1H-20/U PSxxxM1-20UH PSxxxM1H-20UH PSxxxM1-20/UH PSxxxM1H-20/UH PSxxxM-24/T PSxxxMH-24/T PSxxxM-24/TH PSxxxMH-24/TH
Prism Solar	P72 Series
Q.Cells	Q.PEAK L G4(2)(.5) Q.PEAK DUO L - G4.2 Q.PLUS L G4.2 Q.PEAK DUO L - G5(1)(.2)(.3) Q.PLUS DUO L - G5(1)(.2)(.3) Q.PEAK DUO (BLK) - G5(SC) Q.PEAK DUO BLK-G6+/TS Q.PEAK DUO (BLK) - G6(+)(AC)(SC) Q.PEAK DUO L - G6(1)(.2)(.3) Q.PEAK DUO (BLK) - G7 Q.PEAK DUO L - G7(1)(.2)(.3)(.4)(.7) Q.PEAK DUO (BLK) - G8(+) Q.PEAK DUO L - G8(1)(.2)(.3)(.3/BFF) Q.PEAK DUO (BLK) - ML (BLK) G9(+) Q.PEAK DUO XL-(G9/G9.2/G9.3) Q.PEAK DUO (BLK) ML-G10(+)

Manufacture	Module Model / Series
REC	RECxxxAA (BLK/Pure) RECxxxNP (N-PEAK) RECxxxNP2 (Black) RECxxxPE, RECxxxPE72 RECxxxTP, RECxxxTP72 RECxxxTP2(M/BLK2) RECxxxTP2S(M)72 RECxxxTP3M (Black) RECxxxTP4 (Black)
Renesola	All 60-cell modules
Risen	RSM Series
S-Energy	SN72 & SN60 Series
Seraphim	SEG-6 & SRP-6 Series SEG-XXX-6MA-HV SRP-XXX-6MB-HV SRP-XXX-BMA-HV SRP-XXX-BMB-HV SRP-XXX-BMC-HV SRP-XXX-BMD-HV SRP-XXX-BMZ-HV
Sharp	NU-SA & NU-SC Series
Silfab	SLA-M, SLA-P, SLG-M, SLG-P & BC Series SILxxx(BL/NL/NT/HL/ML/BK/NX/NU/HC)
Solaria	PowerXT
Solartech	STU HJT, STU PERC & Quantum PERC
SolarWorld	Sunmodule Protect, Sunmodule Plus/Pro
Suntech	STP
Suniva	MV Series & Optimus Series (35mm)

Manufacture	Module Model / Series
Sun Edison	F-Series, R-Series
SunPower	AC, X-Series, E-Series & P-Series
Talesun	TP572, TP596, TP654, TP660, TP672, Hipor M, Smart, TD6172M
Tesla	SC, SC B, SC B1, SC B2 TxxxS
Trina	PA05, PD05, DD05, DD06, DE06 DE15H(II), DE15M(II) PD14, PE14, DD14, DE14
TSMC	TS-150C2 CIGSw
Upsolar	UP-MxxxP, UP-MxxxM(-B)
URECO	D7Kxxx(H7A/H8A), D7Mxxx(H7A/H8A) FAKxxx(C8G/E8G), FAMxxxE7G-BB FAMxxxE8G(-BB)
Vikram	Eldora, Somera, Ultima
Vina	VNS-72M1-5-xxxW-1.5, VNS-72M3-5-xxxW-1.5, VNS-144M1-5-xxxW-1.5, VNS-144M3-5-xxxW-1.5, VNS-120M3-5-xxxW-1.0
VSUN	VSUN315-60M-BB, VSUN390-72MH VSUN415-144BMH, VSUN450-144BMH
Winaico	WST & WSP Series
Yingli	YGE & YLM Series
ZNShine Solar	ZXM6-72 Series

- The frame profile must not have any feature that might interfere with the bonding devices that are integrated into the racking system
- Use with a maximum over current protection device OCPD of 30A
- Please see GridFlex™ information at Unirac.com to ensure the exact solar module selected is approved for use with GridFlex™
- Listed models can be used to achieve a Class A fire system rating, for low slope applications, only when modules fire typed 1, 2, 3 with a metal frame, 19, 22, or 25.