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## PG GENERAL NOTES:

Refer to construction drawings for project specific details. Construction drawings have precedence over these installation guidelines.

### TECHNICAL SPECIFICATIONS:

Material Types: 16G ASTM A653 GR50 Steel  
G235 Galvanization

Hardware: Stainless Steel

Bonding and Grounding: UL2703 Listed Continuous Bonding Path.

### TOOLS REQUIRED OR RECOMMENDED FOR LAYOUT, ATTACHMENTS & INSTALLATION:

- Drill (**Do Not Use An Impact Driver**)
- 7/16" Socket
- Torque Wrench
- Tape Measure
- Chalk Reel
- Optional Spacers (See Diagram - Page Right)

### GENERAL HARDWARE:

- ¼-20 X 2 ½" Hex Head Bolt - Module Clamps
- ¼-20 X 1" Hex Head Bolt - Wind Deflectors
- ¼-20 Stainless Steel U-Nuts
- ¼" Flat Washer 1 ½" O.D.

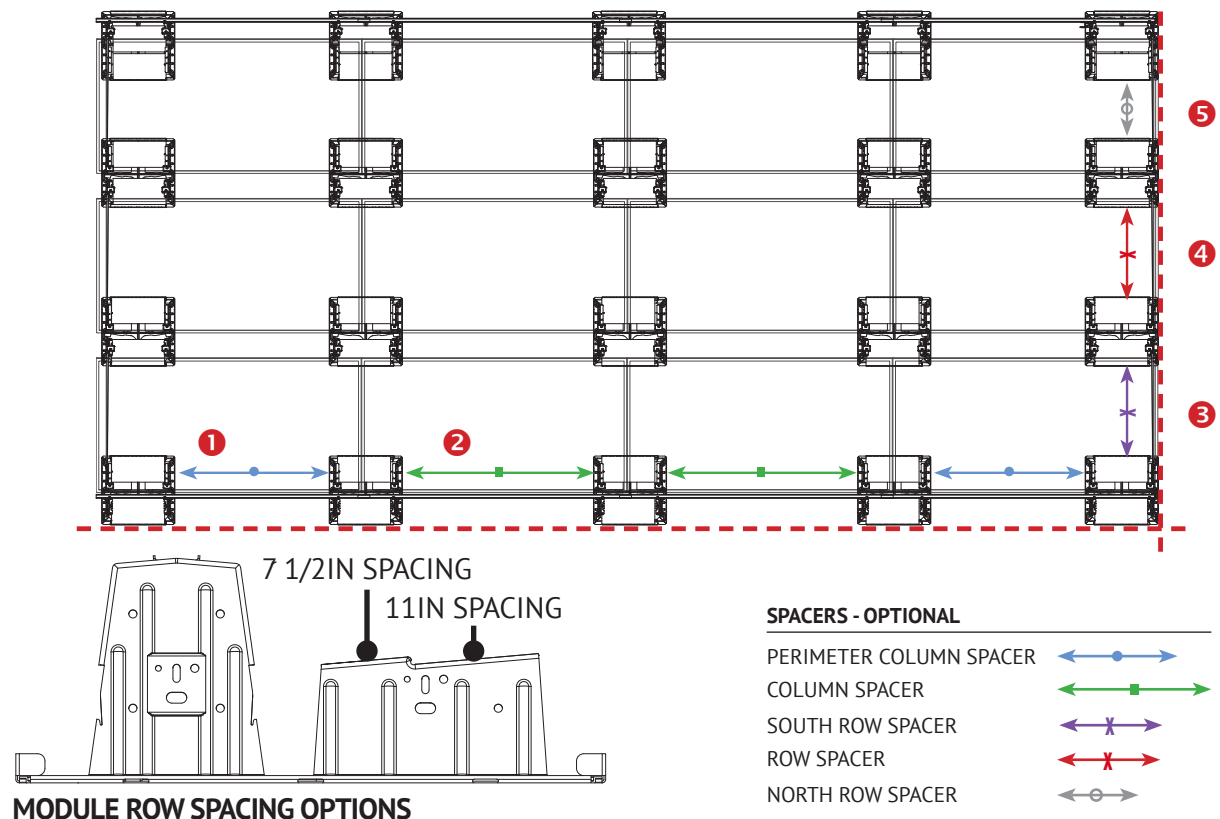
### SAFETY:

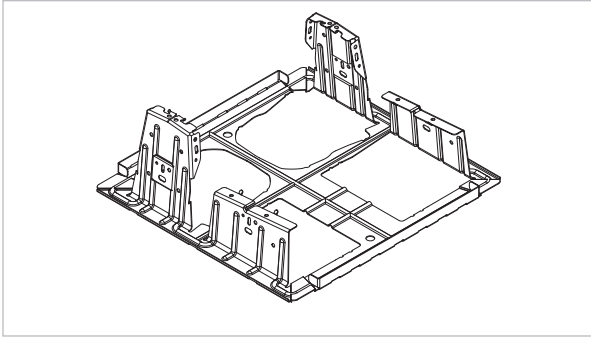
All applicable OSHA safety guidelines should be observed when working on a PV installation job site. The installation and handling of PV solar modules, electrical installation and PV racking systems involves handling components with potentially sharp metal edges. Rules regarding the use of gloves and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

### LAYOUT ASSISTANCE TOOL:

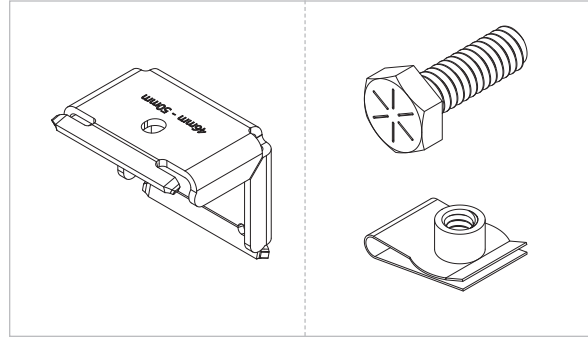
RM5		Equations (Inches)		Project Specs (Spacing Inches)	
				Module Length (IN)	Module Width (IN)
1	Perimeter Column Spacing	$(\text{Module Length}) + (\text{Gap Spacing}) - 21.36$			
2	Column Spacing	$(\text{Module Length}) + (\text{Gap Spacing}/2) - 31.95$			
3	South Row Spacing	$7.5" \text{ Module Width} - 12.75"$	$11" \text{ Module Width} - 12.75"$		
4	Row Spacing	$7.5" \text{ Module Width} - 12.75"$	$11" \text{ Module Width} - 9.25"$		
5	North Row Spacing	$7.5" \text{ Module Width} - 22"$	$11" \text{ Module Width} - 18.5"$		

**RM5 Spacing arrangement, S = 7 1/2IN OR 11IN**

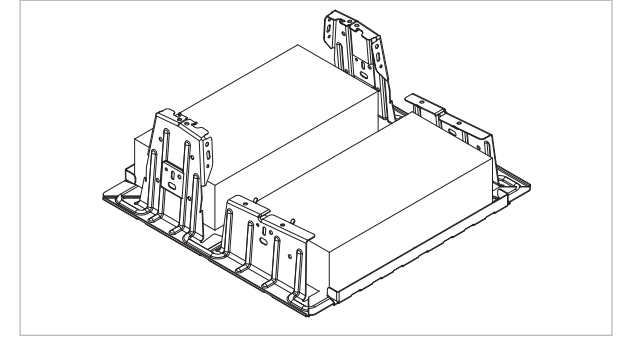




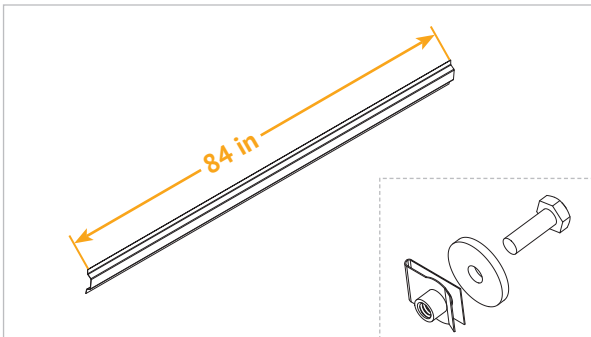
**BALLAST BAY:** The Ballast Bay is constructed of a high strength low alloy G235 Galvanized Steel. This system has a modular design that allows for easy installation around roof obstructions and accommodates roof undulations. The Ballast Bays are designed to nest within each other to optimize shipping logistics.  
**NOTE: Systems installed on PVC roofs require ballast bays with pre-installed Santoprene pads.**



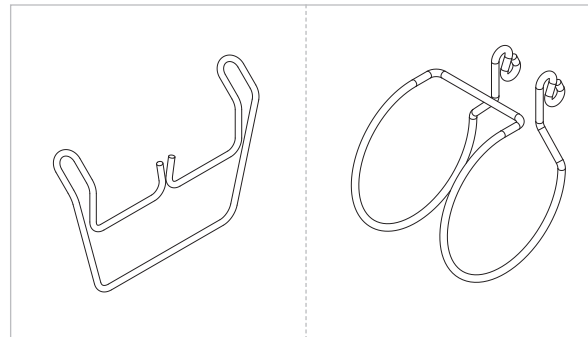
**CLAMP & HARDWARE:** The Module Clamp is made of Stainless Steel and can be used with module frame heights indicated on the clamp. The clamps are a portion of the UL2703 Listed system when installed according to this installation guide. A 1/4"-20 stainless steel bolt and u-nut are the associated hardware for installing clamps. **NOTE: U-Nuts come in packages separate from Clamp Kit.**



**BALLAST BLOCK:** The RM ballast bay can fit up to 2 standard 4"x8"x16" solid concrete cap blocks. Block weight can range from 26 - 38 lbs. and shall meet ASTM C1491 requirements for freeze thaw durability. Verify your block weights before using the Unirac U-Builder online design tool.

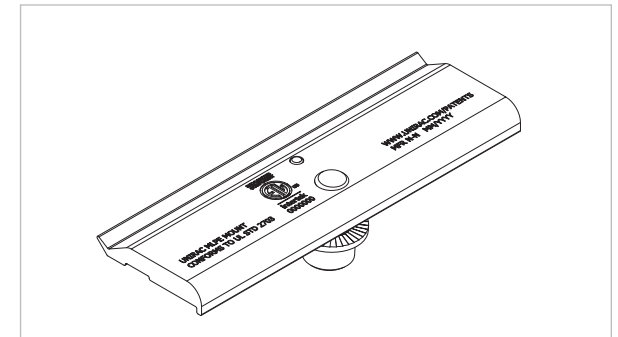


**WIND DEFLECTOR:** 18G G180 steel wind deflector aids in ballast reduction and provides fire mitigation. A 1/4" - 20 stainless steel bolt and fender washer (1.5" O.D) are associated hardware for wind deflectors.  
**NOTE: U-Nuts come in packages separate from deflector hardware.**



**OPTIONAL WIRE MANAGEMENT:** Custom Unirac wire clip along with mounting options for various off the shelf wire management clips.

**NOTE: All conduit and wire ways should be grounded & bonded per the (NEC) National Electric Code.**



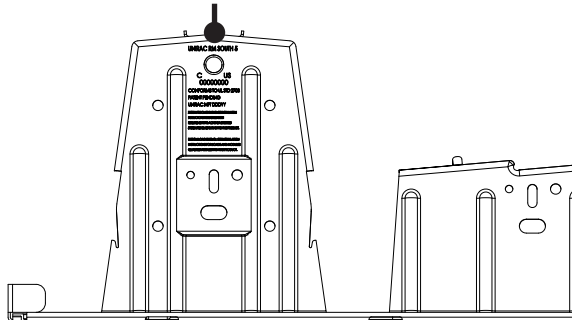
**OPTIONAL MICROINVERTER MOUNTING:** Microinverter / Power optimizer bracket, see page B for additional instructions.

**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. RM ROOFMOUNT has been classified to the system level fire portion of UL1703. It has achieved Class A performance for low sloped roofs when used in conjunction with type 1 and type 2 module constructions. Please see the specific conditions below for mounting details 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 right for proper installation of wind deflectors for required fire mitigation.

**NOTE:** Type I or Type II information is generally located 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.

Unirac RM  
CONFORMS TO UL STD2703

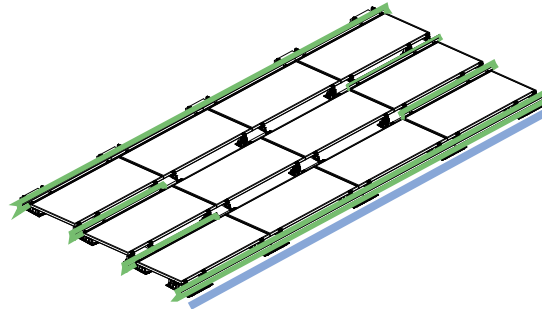


Module Type	System level Fire Rating	Mitigation
Type 1	Class A	Prescriptive. See notes & Illustration Below
Type 2	Class A	Prescriptive. See notes & Illustration Below

### TYPE 1 / TYPE 2 CLASS A FIRE RATING MOUNTING ORIENTATION

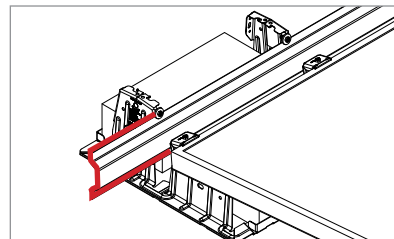
Unirac RM has achieved Class A system level fire performance for type 1 and type 2 module constructions. In order to maintain the fire rating for type 1 modules wind deflectors must be installed on the north edge of the array. Type 2 modules require wind deflectors to be installed on the north and south edges of the array and at all perimeter modules.

**NOTE:** See page 7 for installation of wind deflectors.



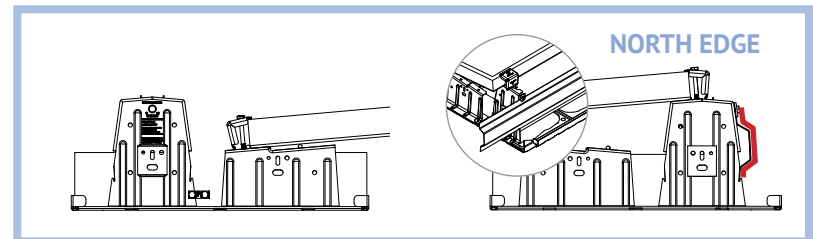
Please use the U-builder tool to optimize the usage of wind deflectors for fire mitigation.

- Type I Requires fire mitigation on North Edge when there are no additional wind deflectors throughout the array
- Type II Requires fire mitigation on all perimeter modules within array.

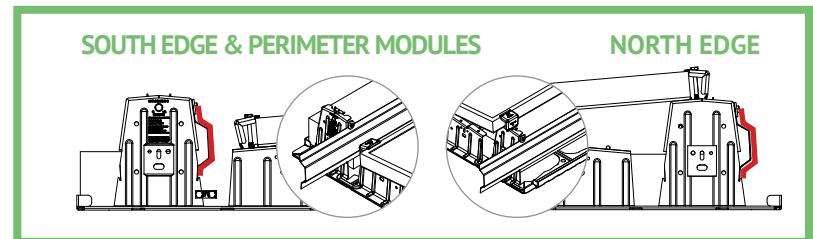


**EAST/WEST EDGES:** Install wind deflectors in each row with 6" overhang on east and west edges. This applies for any deflector installed on east and west edges throughout the array.

**TORQUE VALUE: 10FT-LBS**  
All Wind Deflector Hardware  
(1/4-20 x 1inch bolt, 1/4-20 u-nut & 1/4inch flat washer 1 1/2in O.D.)

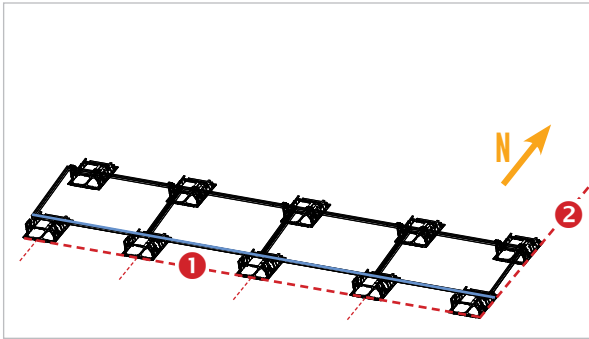


**TYPE I:** Install wind deflectors on North edge of array.

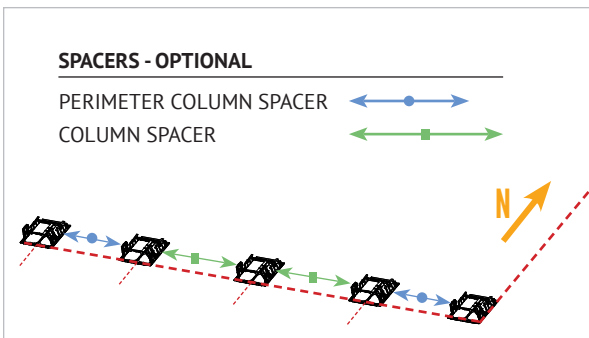


**TYPE II:** Install wind deflectors on all perimeter modules within array



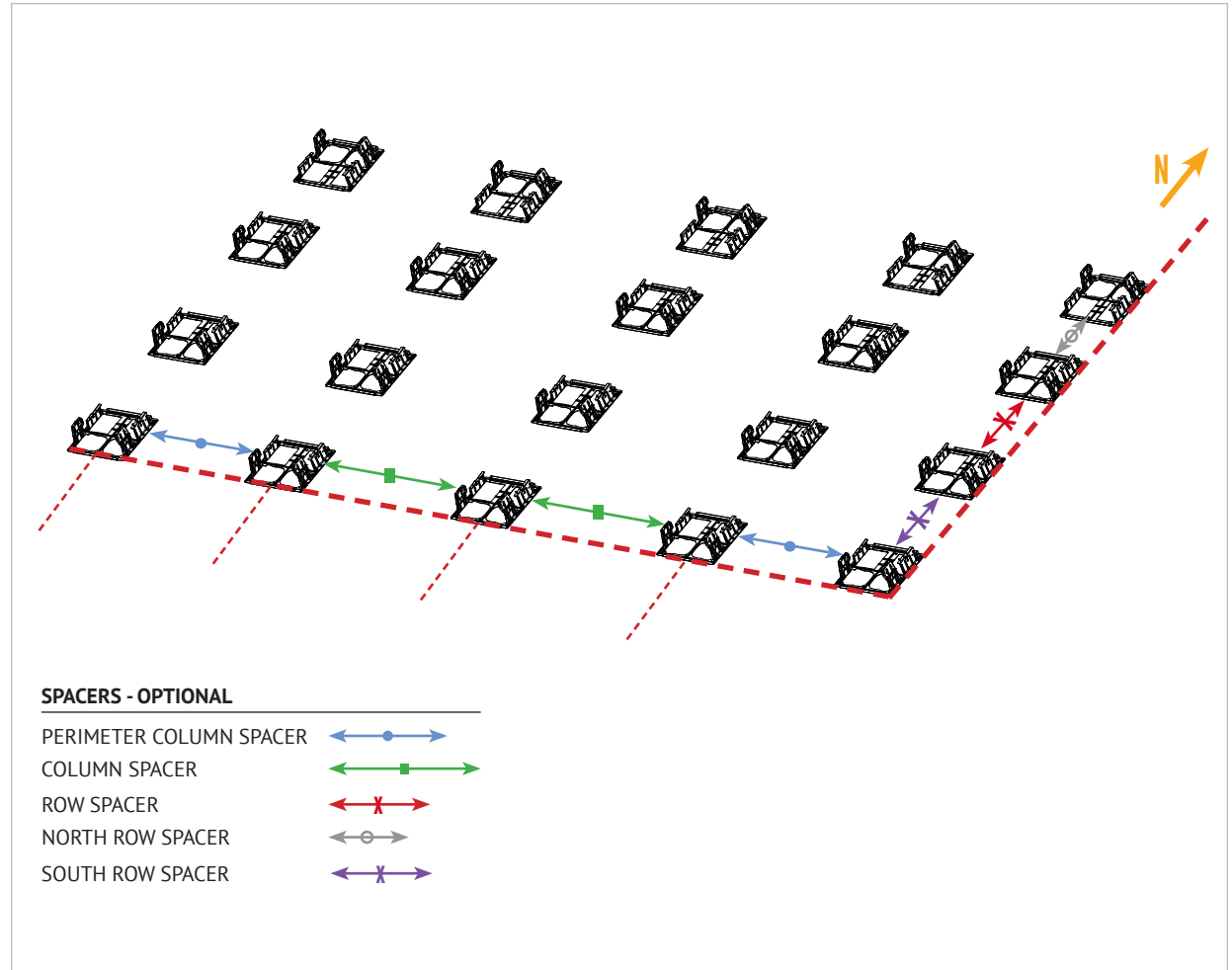


**SNAP SOUTH PERIMETER CHALK LINE, THEN EAST OR WEST PERIMETER CHALK LINE.** As best practice, on south edge of array mark lines to locate the center of each bay.



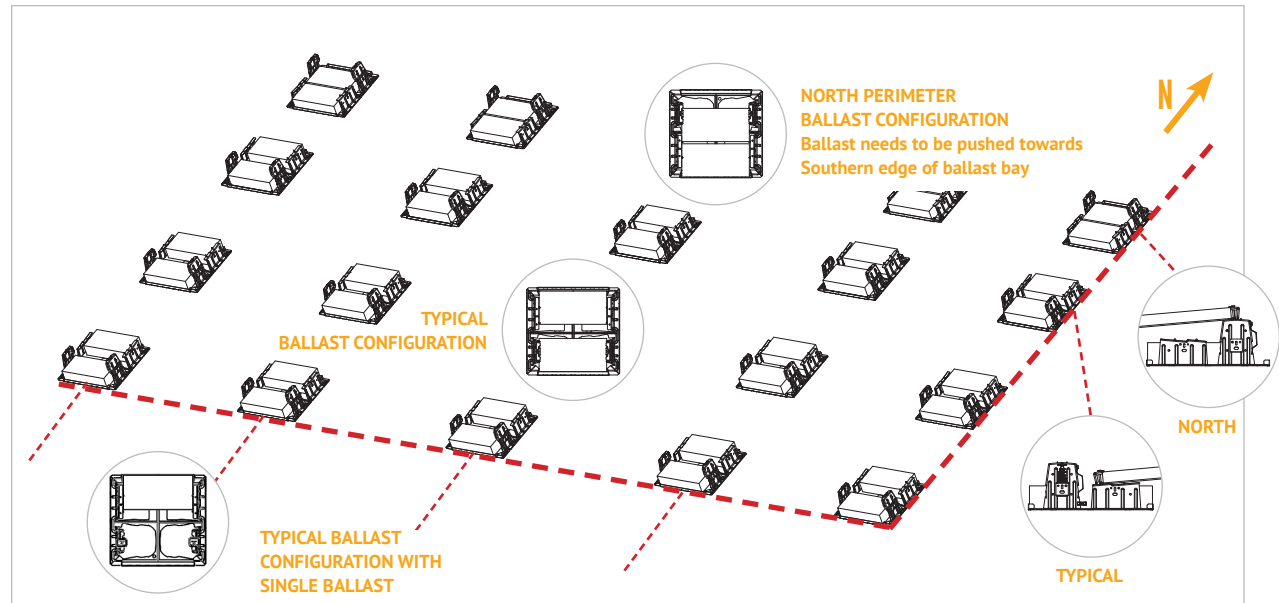
**PLACE SOUTH PERIMETER BAYS FIRST.** If slip sheets are required, place per manufacturers recommendations.

**NOTE: Custom spacers can be made to aid in the placement of bays on the roof. See page 1.**



**PLACE ALL BAYS.**

**PLACE ALL BALLAST:** A maximum of two (2) ballast blocks can be placed in each ballast bay, typically pushed into the retention feature on the north or south edge. The North perimeter requires ballast blocks to be pushed towards the southern edge of the ballast bay to accommodate wind deflectors. Site specific ballast calculations should be created for each individual project in accordance with the U-Builder design software. This system has been rated for the mechanical load provisions of UL2703. In addition, it has been designed and tested to comply with the more rigorous requirements of SEAOC PV1, PV2 and ASCE 7.



**SOUTHERN EDGE MODULE PLACEMENT:** Each bay has two spacing options, select the appropriate tab according to layout requirements.

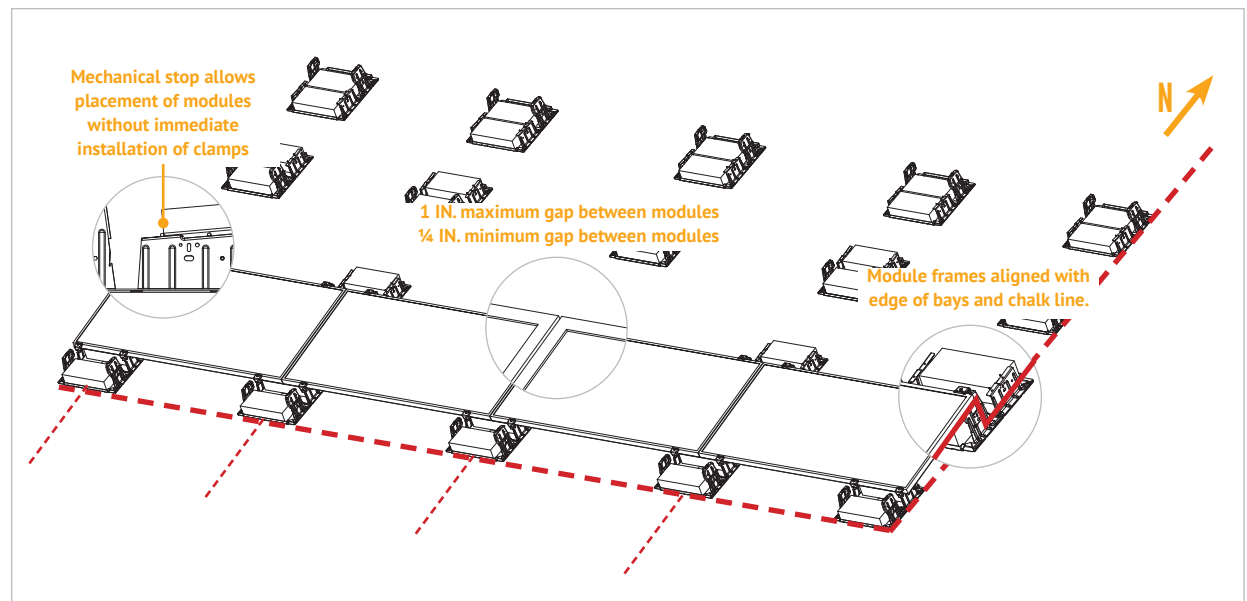
Place southern row of modules on bays. You may adjust second row of bays. Do not adjust southern most row of bays

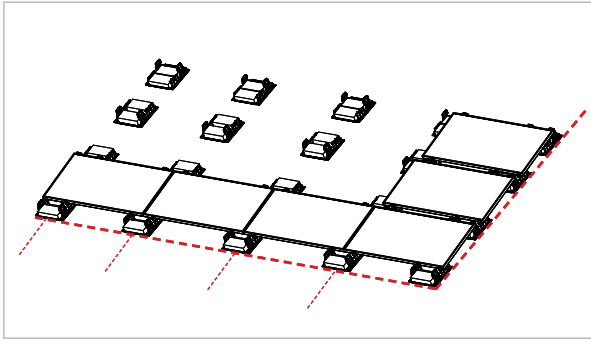
1 IN. Maximum gap between modules

¼ IN. Minimum gap between modules

**NOTE:** Modules may be placed on bays without immediate installation of clamps.

**NOTE:** Modules shall be mounted in landscape orientation only.

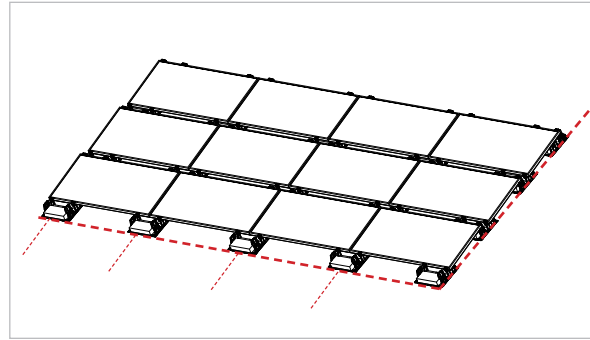




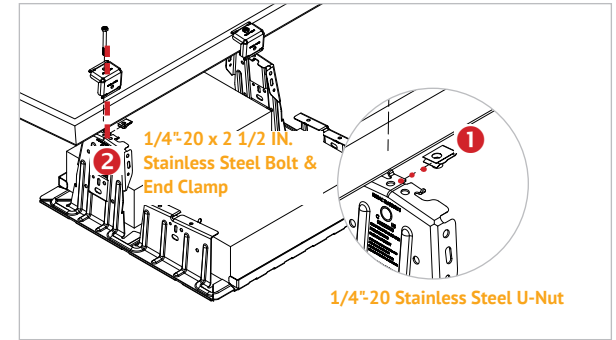
### EAST OR WEST EDGE MODULE PLACEMENT

**NOTE:** Modules may be placed on bays without immediate installation of clamps.

**NOTE:** Modules shall be mounted in landscape orientation only.



### COMPLETE MODULE PLACEMENT

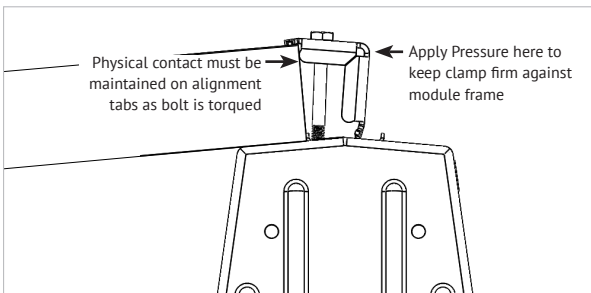


### INSTALL U-NUT & INSTALL CLAMPS

**NOTE:** U-NUT - Single Use Only - Do not re-torque once fully seated

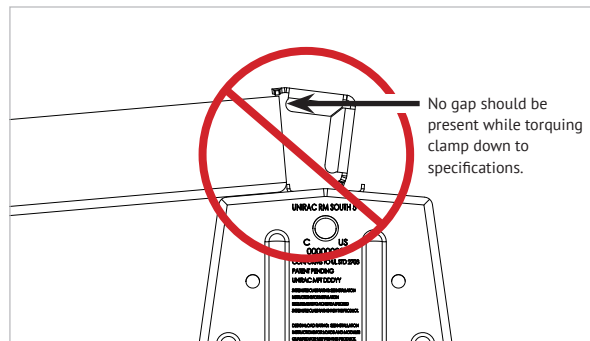
**NOTE:** CLAMP AND BOLT - Single Use Only - Do not re-torque once fully seated

**TORQUE VALUE:** 7FT-LBS MINIMUM to achieve UL2703 required clamp load



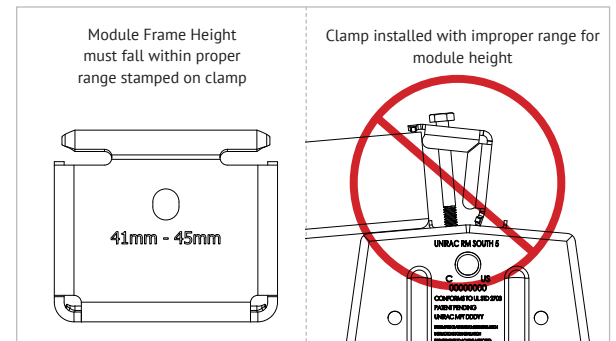
### PROPER CLAMP INSTALLATION:

- Clamp is stamped for module frame height on each leg
- Clamp should be firmly held against module frame while being torqued



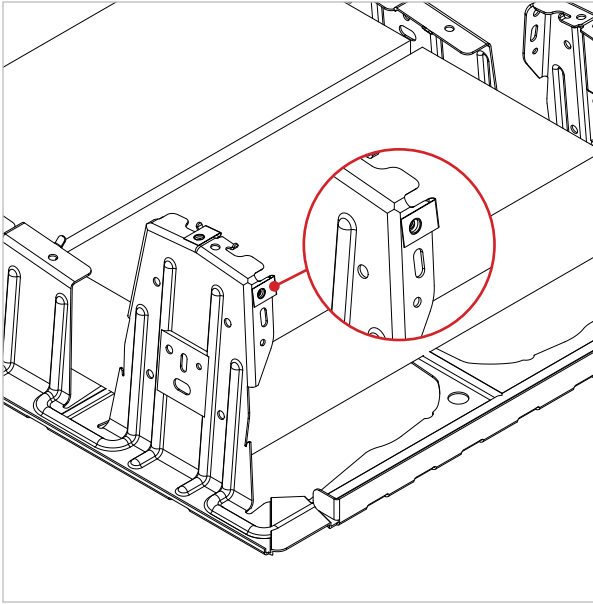
### PROBLEM – CLAMP NOT SEATED AGAINST MODULE DURING TORQUING

- Clamp needs to be held securely against the module frame during torquing for proper installation

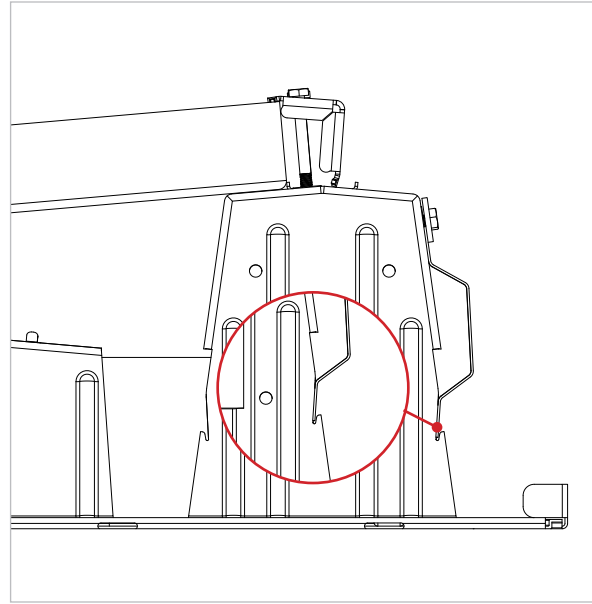


### PROBLEM – NOT USING PROPER SIZE OF CLAMP FOR MODULE FRAME HEIGHT

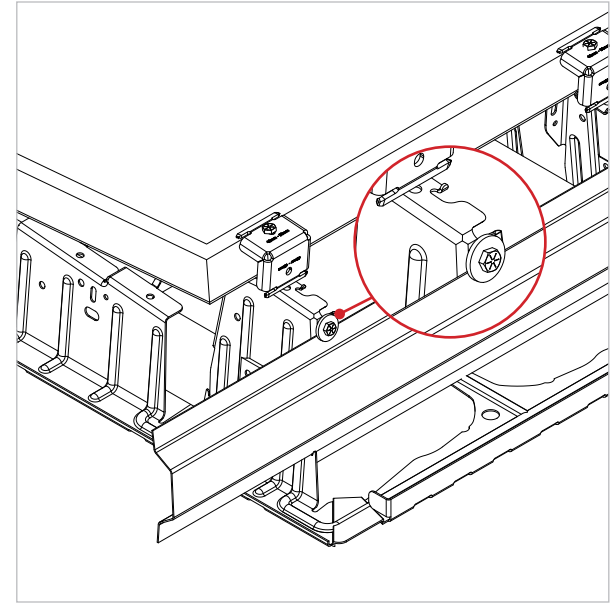
- Double check the stamping on clamp to use the correct leg of clamp for module frame height
- The module height shall fall within the range shown on the top of the clamp
- Excessive angle on clamp will inhibit required clamp load on module



**STEP 1 - U-NUTS:** Install u-nuts on side flange

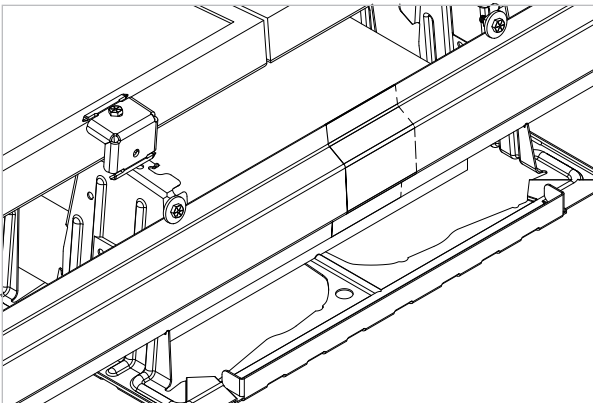


**STEP - 2 WIND DEFLECTOR:** Position wind deflector in the slots provided in the bay



**STEP 3 - HARDWARE:** Secure wind deflector with 1 1/2" O.D. flat washer and 1/4-20 x 1" Bolt, as shown above

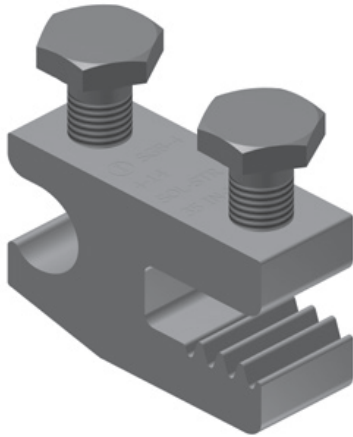
**TORQUE VALUE: 10FT-LBS**



**INSTALL BALLAST BAY WIND DEFLECTORS**

**NOTE:** Wind deflectors overlap at splice

Ilsc0 SGB-4 Solar Grounding & Bonding



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

**GROUNDING LUG MOUNTING DETAILS AS REQUIRED BY CODE & ENGINEER OF RECORD:** The Ilsc0 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 ROOFMOUNT 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.

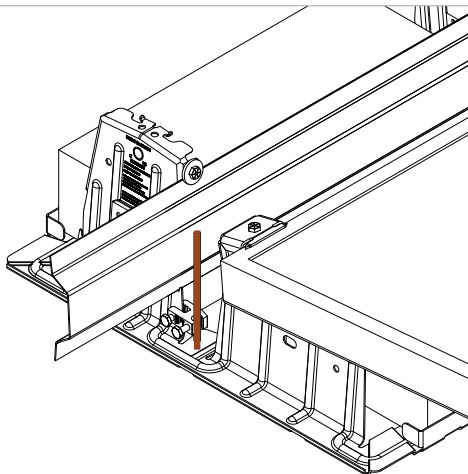
**NOTE:** The installation must be conducted in accordance with the National Electric Code ANSI / NFPA 70.

Ground Lug	Bolt Size	Torque Value
Ilsc0 Lug SGB-4	1/4"-20	6.5 ft-lbs (75 in-lbs)
Ilsc0 Lug GBL-4	#10-32	2.9 ft-lbs (35 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 materials must be kept separate.

Although conformance with UL2703 was demonstrated without the use of oxide inhibitor material, it is recommended by Ilsc0 to provide an optimized bonding solution for their lay-in lug.

Ilsc0 SGB-4 Solar Grounding & Bonding



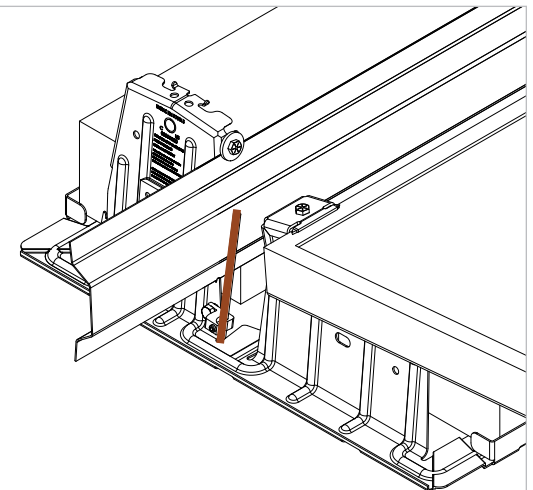
**GROUNDING NOTE:**  
Can be installed on any location with a flat surface on the bay in order to ground the system.

Ilsc0 GBL-4 Solar Grounding & Bonding



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

Ilsc0 GBL-4 Solar Grounding & Bonding



**GROUNDING NOTE:**  
Can be installed on any location with a flat surface on the bay in order to ground the system.



## MECHANICAL LOAD TEST QUALIFICATION

The Unirac RM system has been tested to the mechanical load provisions of UL2703 and covers the following basic parameter(s):

- Tested loads: 25 psf up, 54 psf down
- Certification Loads: 16.7 psf up, 36 psf down, 5 psf down-slope

## TESTED MODULE

Module Manufacturer	Model / Series
Hyundai	HIS-S325TI



**ELECTRICAL BONDING & GROUNDING TEST MODULES:** This racking system may be used to ground and/or mount a PV module complying with UL 1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

**VERIFIED COMPATIBLE MODULES:**

Manufacture	Module Model / Series	Frame Height (MM)
Aleo	P18 & P19	35
Aleo	S18, S19, S59, & S79	50
AU Optronics	PM Series	40
Auxin	AXN6M610T, AXN6P610T, AXN6M612T & AXN6P612T	40
BYD	P6K Series	35
Canadian Solar	CS5A-M, CS6P-M, CS6X-P, CS6U-P, CS6U-M, CS6K-MS, CS6K-M, CS6V-M, CS6K-P, CS6P-P, CS3U-P, CS3U-MS, CS3K-P, CS3K-MS & CS1K-MS	40
Centrosolar America	C-Series & E-Series	40
CertainTeed	CT2xxMxx-01 & CT2xxPxx-01	35
CertainTeed	CTxxxMxx-01, CTxxxPxx-01 & CTxxxMxx-02	40
ET Solar	ETAC & ET Modules	40
Eco Solargy	Orion 1000 & Apollo 1000	40
GCL	GCL-P6 & GCL-M6 Series	35/40
Hansol	TD-AN3	40
Hanwha SolarOne	HSL 60 & HSL 72	40
Heliene	36M, 60M, 60P, 72M & 72P Series	40
Hyundai Heavy Industries	MG, TG, RG, & KG Series	35
Hyundai Heavy Industries	TI & RI Series	50
Hyundai Heavy Industries	MI, RI, KI, & TI Series	40
ITEK	iT, iT-HE & iT-SE Series	40
Japan Solar	JPS-60 & JPS-72 Series	35/40
JA Solar	JAP6-60, JAM6-60	40
JA Solar	JAP6-72, JAM6-72	45

Manufacture	Module Model / Series	Frame Height (MM)
JA Solar	JAP6(k)-60-xxx/4BB, JAP60SYY-xxx/ZZ, JAM6(k)-60-xxx/ZZ, JAM60SYY-xxx/ZZ	35/40
JA Solar	JAP6(k)-72-xxx/4BB, JAP72SYY-xxx/ZZ, JAM6(k)-72-xxx/ZZ, JAM72SYY-xxx/ZZ	35/40
Jinko	JKMxxxM, JKMxxxP, JKMxxxPP, JKMSxxxPP & JKMSxxxP	40
Kyocera	KD-F Series	46
LG Electronics	MONO X	35/46
LG Electronics	MONO X 2, MONO X Plus, NeON, NeON2 Black, NeON 2 AC, NeON2 Bifacial	40
LG Electronics	NeON2	40/46
LG Electronics	NeON R & NeON R Black	40
LONGi	LR6-60 & LR6-72 Series	40/45
Mission Solar Energy	MSE MONO & MSE PERC	40
Mitsubishi	MJE & MLE Series	46
Neo Solar Power Co.	D6M Series	35
Phono Solar Tech.	Standard Modules	40/45
Panasonic	VBHNxxxSA15 & SA16, VBHNxxxKA01 & KA02	35
Panasonic	VBHNxxxSA17 & SA18, VBHNxxxKA03 & KA04	40
Q.Cells	Q.PLUS/PEAK/PRO - L G4.x	35
Q.Cells	B.LINE PLUS/PRO - L G4.x	35

Manufacture	Module Model / Series	Frame Height (MM)
Q.Cells	Q.PLUS L-G4.2/TAA	35
Q.Cells	Q.PRO L-G2	40/42
Q.Cells	Q.PRO BFR G4x Q.PEAK G4.1/MAX, Q.PRO/Q.PLUS G4, Q.PEAK-G4.1/TAA, Q.PEAK BLK G4.1/TAA, Q.PLUS BFR G4.1 Q.PLUS BFR G4.1/TAA, Q.PLUS BFR G4.1/MAX, B.LINE PLUS BFR G4.1, B.LINE PRO BFR G4.1, Q.PRO EC-G4.4 Q.PEAK BLK G4.1 & Q.PEAK G4.1 Q.PEAK DUO-G5, DUO BLK-G5	32
Q.Cells	Q.PEAK-G3 & G3.1, Q.PEAK BLK G3 & G3.1, Q.PLUS BFR G3.1, Q.PLUS/PRO G3	35
REC	PEAK & ECO	38
REC	PeakEnergy 72, TwinPeak	45
REC	TwinPeak (2)(BLK)(2), N-Peak	38
REC	TwinPeak2S(B)(XV)	30
Reosola	60 Cell Modules & Vitrus2	40
Seraphim	SEG-6 & SRP-6 Series	40
Sharp	ND-24CQJ & ND-25CQCS	46
Sharp	ND-Q235F4 & ND-F4Q300	46
Sharp	NU-SA	35
Sharp	NU-SC	40

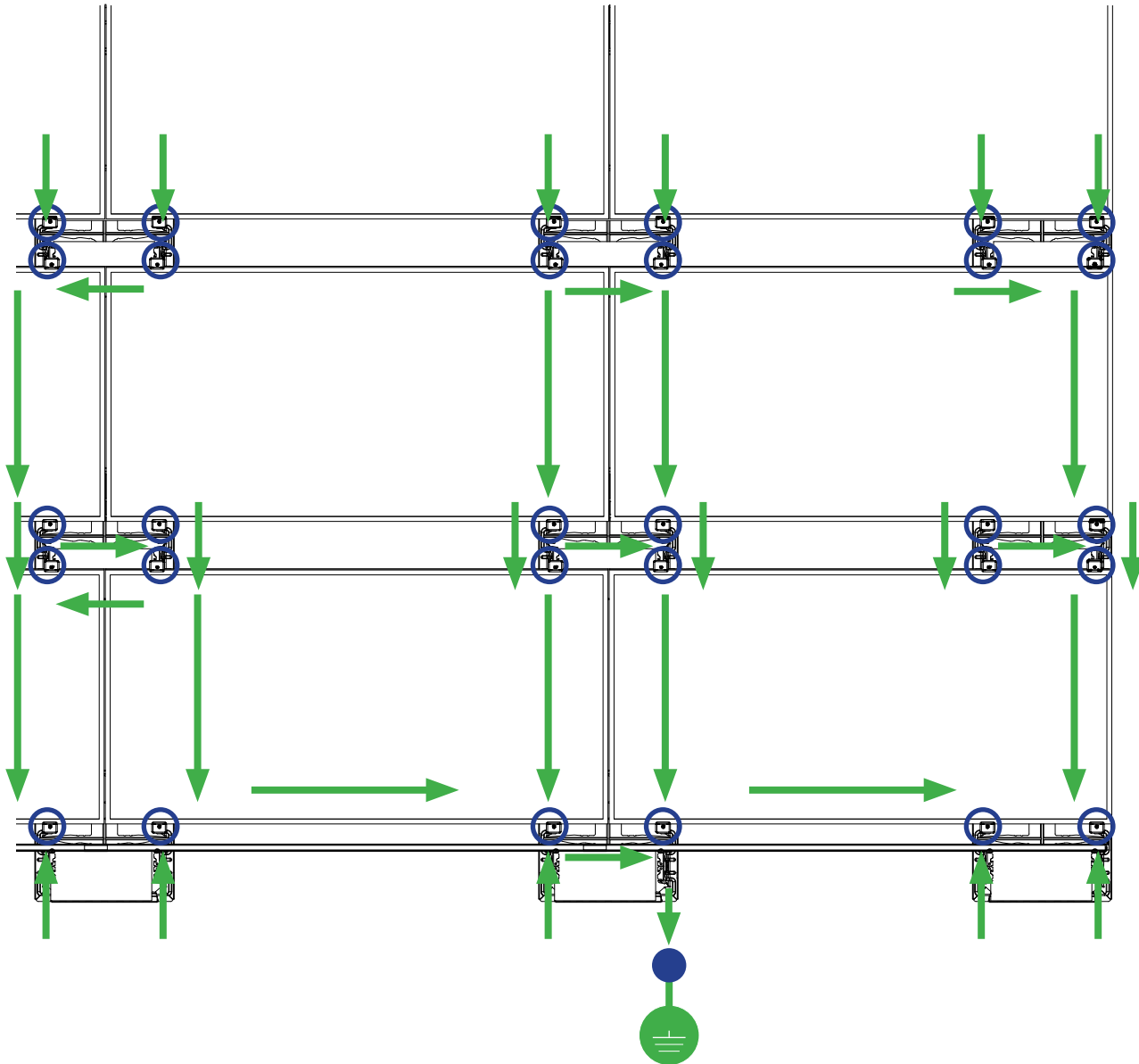






**ELECTRICAL BONDING & GROUNDING TEST MODULES:** This racking system may be used to ground and/or mount a PV module complying with UL 1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

**VERIFIED COMPATIBLE MODULES (CONTINUED):**

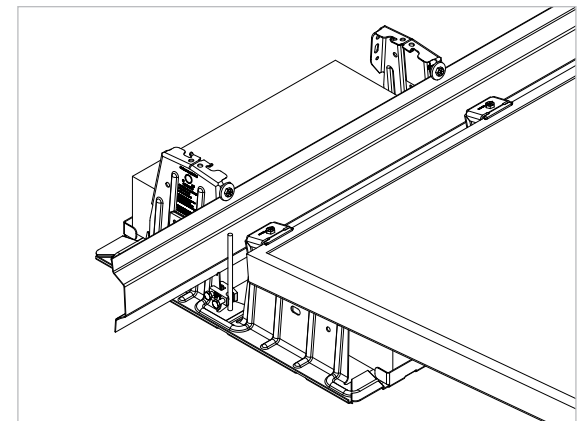
Manufacture	Module Model / Series	Frame Height (MM)
Silfab	SLA-M/P & SLG-M/P	38
SolarTech	STU HJT & STU PERC	42
SolarWorld	Sunmodule Protect/Plus	33
Suniva	Optimus Series	35/38
Suniva	MV Series	40/46
Suntech	STP "XXX"	35/40
Sun Edison/Flextronics	F-Series / FLEX FXS	35/50
Sun Edison/Flextronics	R-Series / FLEX FXS	35/50
S-Energy	SN72 & SN60 Series	40
SunPower	X-Series 72 & E-Series 72	46
SunPower	X-Series 96 & E-Series 96	46
SunPower	P-Series	46
SunPower	Sig Black	46
Talesun	TP572, TP596, TP654, TP660, TP672, Hipor M, Smart	35/40
Trina	PA05, PD05, DD05	35
Trina	PD14, PE14, DD14, DE14	40
Winaico	WST & WSP Series	35/40
Yingli	Panda 60	40
Yingli	YGE U72	40
Yingli	YGE 60 Cell	40
Yingli	YGE 60 Cell Series 2	35
Yingli	YGE 60 Series 2	40
Yingli	YLM 60	40
Yingli	YLM 72	40

Please see the RM5 UL2703 Test Report at [Unirac.com](http://Unirac.com) to ensure the exact solar module selected is approved for use with RM5



-  Fault Current Ground Path
-  Ground Lug
-  Grounding Clip & Bolt
-  Min. 10 AWG Copper Wire

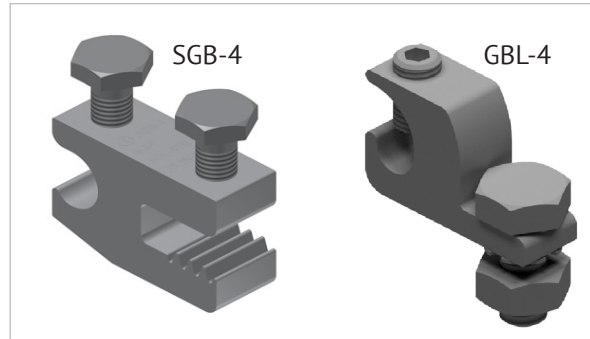
Module Frame  
 Module Bay w/ Grounding Clips



**TEMPORARY GROUNDING & BONDING PROCEDURE:** Periodic inspections should be conducted on the PV array to ensure there are not loose components, loose fasteners or corrosion. If any of the above items are found, the affected components are to be immediately replaced. **If a module must be removed or replaced, a temporary bonding jumper must be used to ensure safety of the personnel and PV system.**

**NOTE:** Removing a PV module from a system is not considered to be routine maintenance. This type of activity should only be performed by trained and qualified installers.

**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 materials must be kept separate.

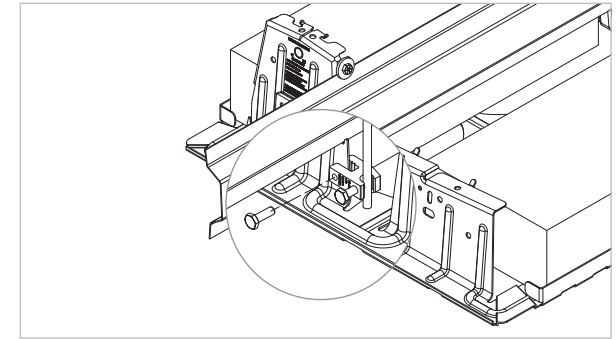


**APPROVED LUGS:**  
IlSCO lay-in Lug IlSCO - SGB-4, GBL-4

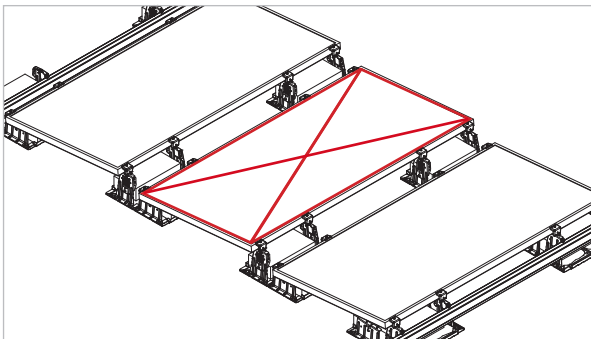
**TERMINAL TORQUE:** Install conductor and torque to the following:

SGB-4: 4-14 AWG: 35 in-lbs

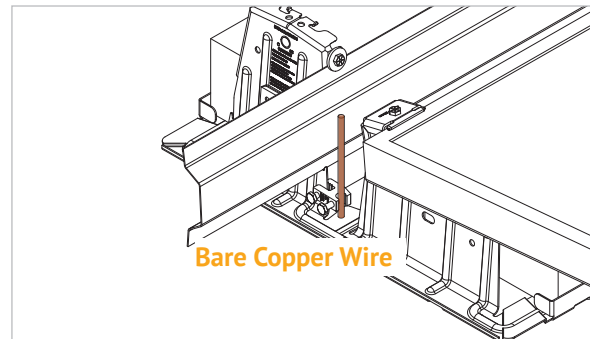
GBL-4: 4-6 AWG: 35 in-lbs, 8 AWG: 25 in-lbs



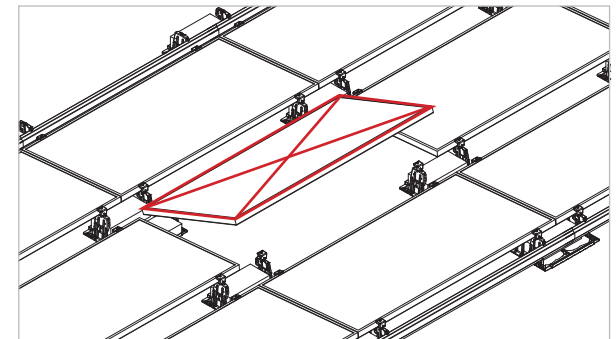
**ATTACH LUGS:** Use approved lug(s) to install on adjacent bays where the module is being removed.



**HERE IS ONE EXAMPLE OF A MODULE REMOVAL THAT WILL REQUIRE THE USE OF A BONDING JUMPER**



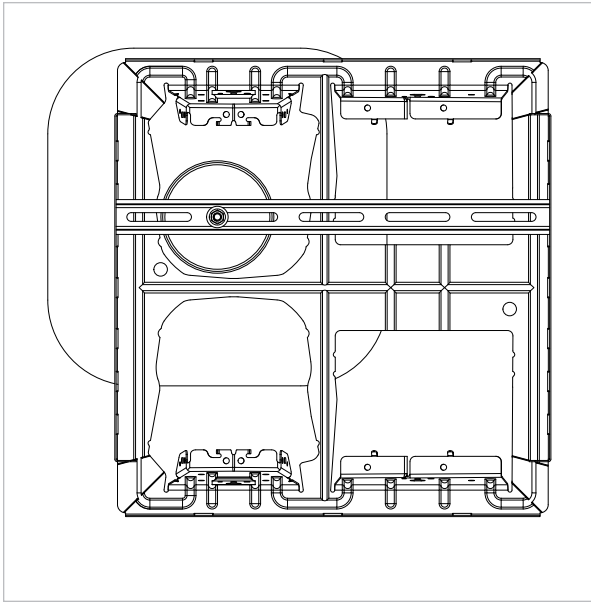
**INSERT COPPER WIRE:** Insert bare copper wire into each lug, providing a bonding jumper across the missing module location.



**REMOVE MODULE & REVERSE THE OPERATION AFTER MAINTENANCE IS COMPLETE**

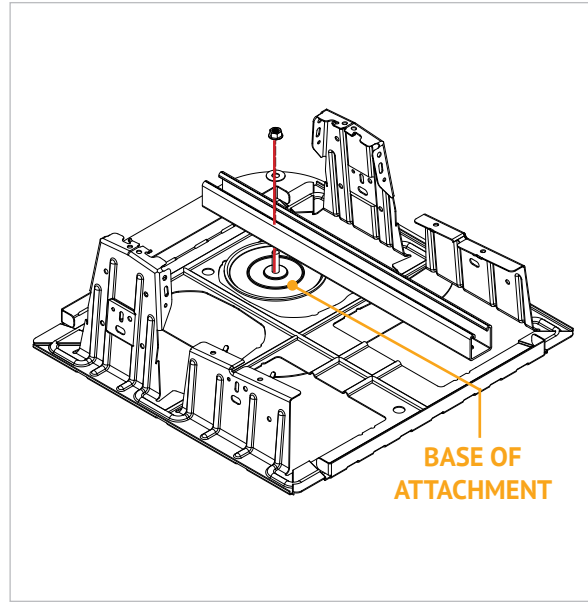
Bonding jumper not required here, due to integrated bonding/grounding path throughout module frames/ bays around this location.

**NOTE: CLAMP AND BOLT - Single Use Only - Use new clamps after any module replacements or system maintenance.**



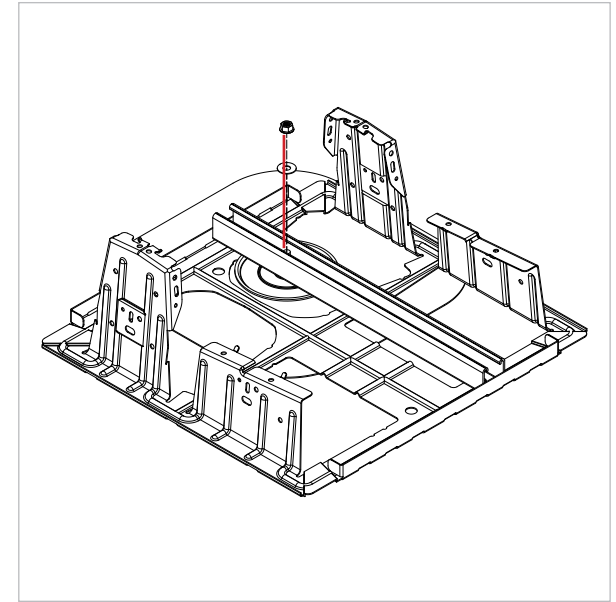
**STEP 1 - POSITION ROOF ATTACHMENT:** Position Roof Attachment under bay requiring attachment and install according to manufacturer installation instructions.

**NOTE:** Center roof attachment under ballast bay as close as possible.



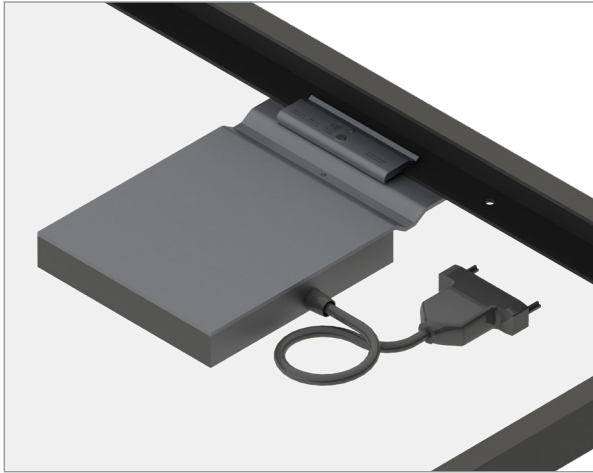
**STEP 2 - PLACE UNISTRUT:** Place Unistrut across bay with the anchor stud through a slot.

**NOTE:** Metal base of attachment where stud is located cannot exceed a height of 1/4".



**STEP 3 - SECURE UNISTRUT TO ROOF ATTACHMENT:** Place 3/8" washer and 3/8-16 serrated flange nut on anchor stud, serrations facing down and tighten to 30 ft-lb.

**TORQUE VALUE: 30FT-LBS**



**PRE-INSTALL MICROINVERTERS:** Install MLPE in a location on the module that will not interfere with ballast bays or grounding lugs. To use trunk cable most efficiently, install MLPE components in the same locations on all modules in the same row.

**TORQUE VALUE: 20FT-LBS**

