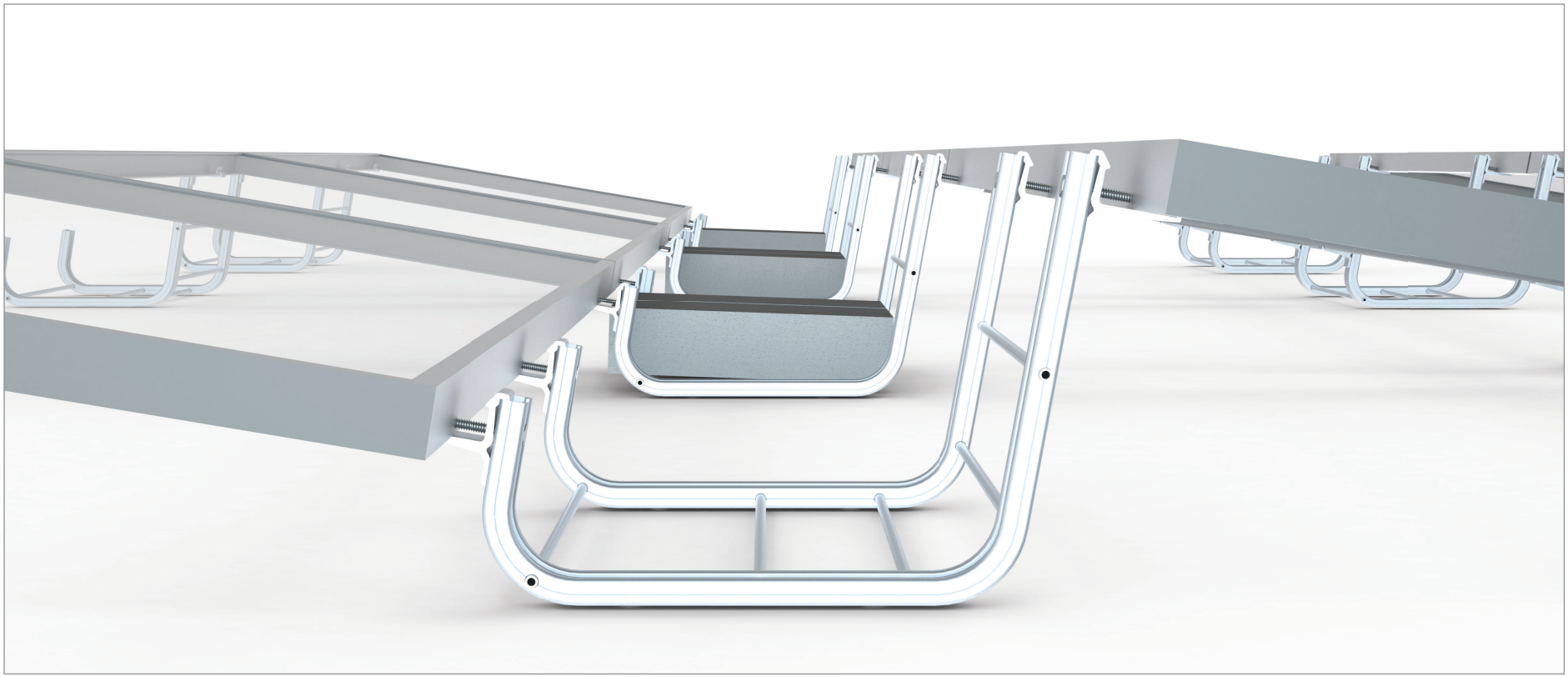
RM10 INSTALLATION GUIDE



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GENERAL NOTES:

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

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RM10

TOOLS & SPECIFICATIONS

TECHNICAL DATA SHEET | PAGE 1

TECHNICAL SPECIFICATIONS:

Material Types: Mill finish aluminum for clamps and ballast bays (6063-T5, 6105-T52, 6063-T5, 6105-T5 or6005A-T61)

Hardware: Stainless Steel with Threadlock compound

Bonding and Grounding: UL2703 Listed Continuous Bonding Path.

TOOLS REQUIRED OR RECOMMENDED FOR LAYOUT, ATTACHMENTS & INSTALLATION:

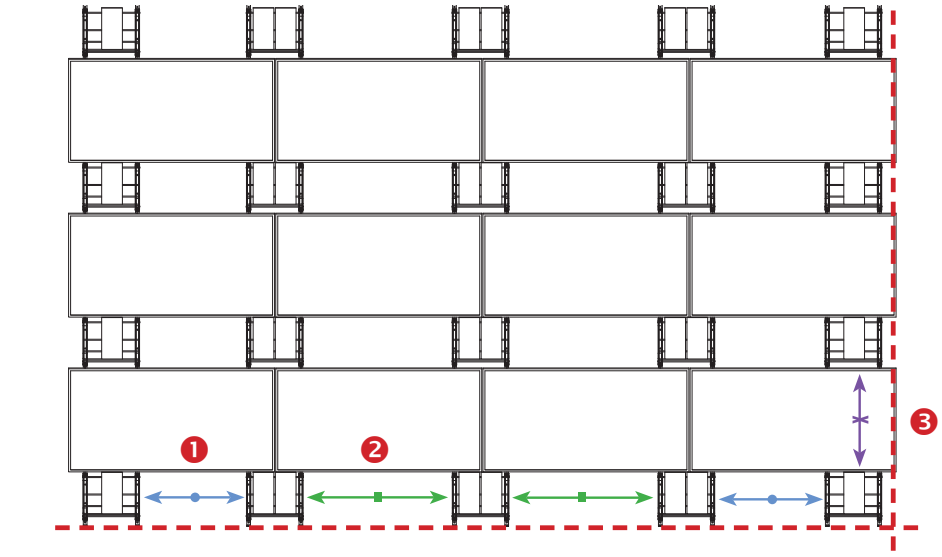
- Drill **(Do Not Use An Impact Driver)**
- 9/16" Socket
- Torque Wrench
- Optional torque limiter (8FT-LBS)
- Tape Measure
- Chalk Reel
- Optional Spacers (See Diagram - Page Right)

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:

Module Dimensions:		RM10	Module location:	Spacing Equations (in Inches):
Module Length **(ML) =**		1	Perimeter Column Spacing =	ML+(G/2)-33.25"
Module Width **(MW) =**		2	Interior Column Spacing =	ML+G-21.17"
Prefered module gap? (1/4" - 1" is permissible)		3	Row Spacing =	Fully install one panel, cut spacer to N/S distance
East/West Module Gap **(G) =**				

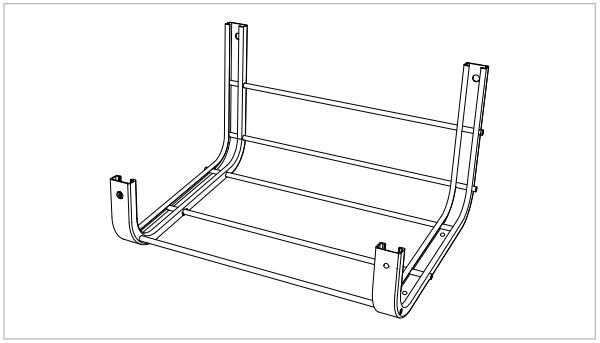


SPACERS - OPTIONAL

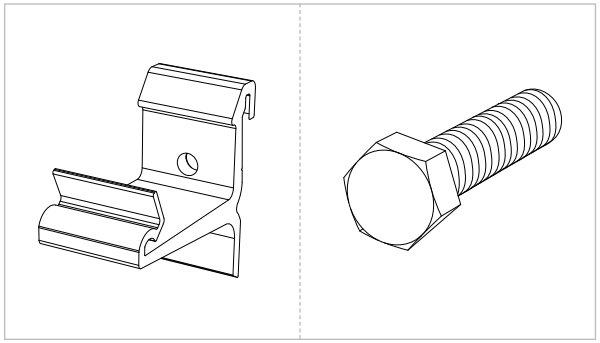
PERIMETER COLUMN SPACER

COLUMN SPACER

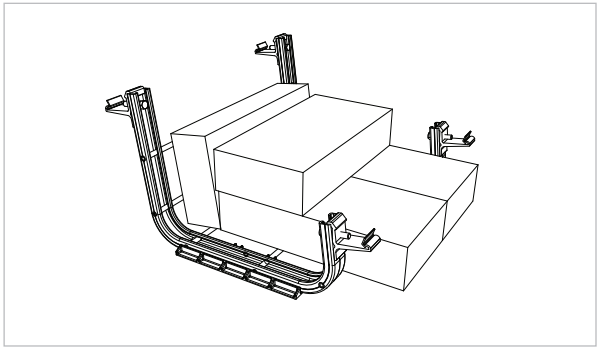
SOUTH ROW SPACER



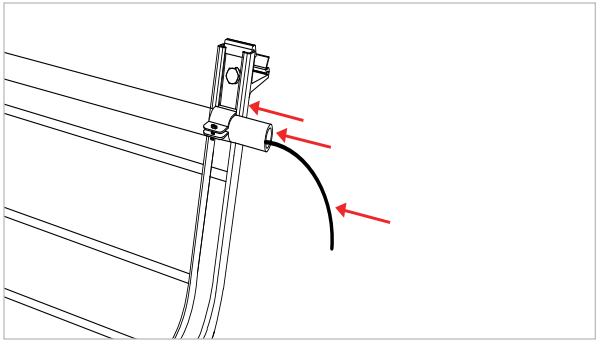
BALLAST BAY: The Ballast Bay frame is made of a mill finish Aluminum. This roof mount is a modular design that allows for easily getting around roof obstructions and accommodating roof undulations. The Ballast Bays are created such that they nest within each other to optimize shipping logistics.



CLIP & BOLT: The Module Clip 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.

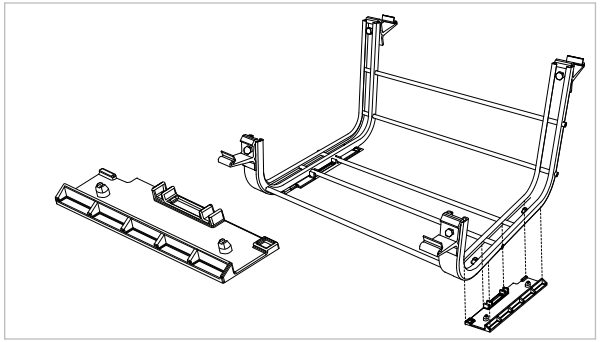


BALLAST BLOCK: The RM ballast bay can fit up to 4 standard 4”x8”x16” solid concrete cap blocks (6 blocks on north row modules). See "Complete Ballast Placement" page of this document for more information. Block weight can range from 26 – 38 lbs. The weight of the block will have a major impact on how many will be required for the project so be sure to verify your block weights before using the U-builder online tool.



OPTIONAL WIRE MANAGEMENT: The Ballast Bay frame runners will accept standard strut-strap wire management solutions, or standard strut nuts, available for purchase through your local electrical supply store.

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



OPTIONAL ROOF PAD: The Roof Pad provides a protective interface between the Ballast Bay and roofing material to protect the roof membrane. The Roof Pad snaps into the holes on the bottom side of the Ballast Bay, two Roof Pads per bay. Please consult the roofing manufacturer to see whether it is required and to verify compatibility.

ROOF PAD NOTE:

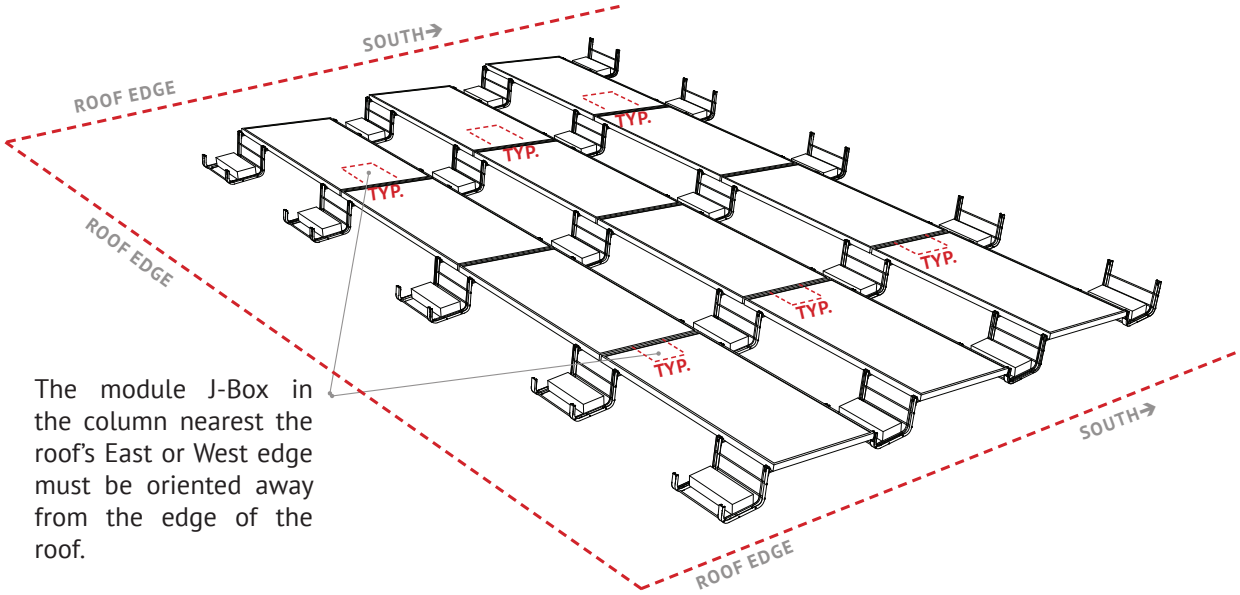
Roof pads are required for unattached system installation in certain seismic areas, or are included upon request. For more information about roof pad application, contact us at info@unirac.com or call 505.242.6411

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. RM Roof Mount 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, type 2 and type 3 module constructions. System fire class rating requires a prescriptive method of mounting the module. 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.

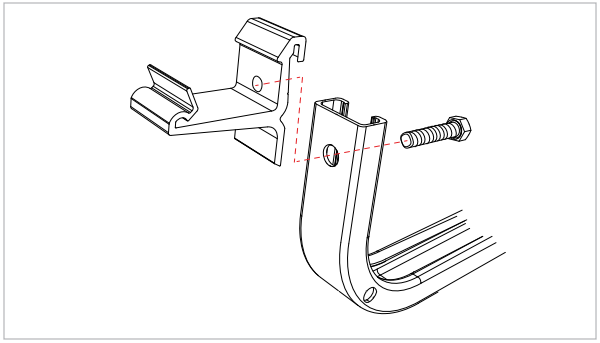
Module Type	System level Fire Rating	Mitigation
Type 1	Class A	Prescriptive. See notes & Illustration Below
Type 2	Class A	Prescriptive. See notes & Illustration Below
Type 3	Class A	None Required / No Limitations

TYPE 1 / TYPE 2 CLASS A FIRE RATING MOUNTING ORIENTATION

Unirac RM has achieved Class A system level fire performance for type 1, type 2 and type 3 module constructions. In order to maintain the fire rating for type 1 and type 2 modules, the J-Box must be oriented away from the roof edge as in the illustration below. Type 3 module constructions do not require specific mounting orientations in order to meet Class A requirements.

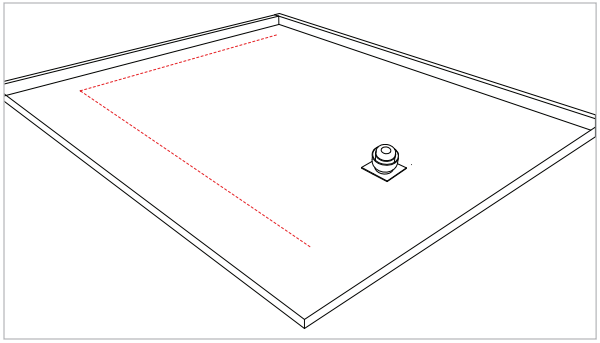


The module J-Box in the column nearest the roof's East or West edge must be oriented away from the edge of the roof.

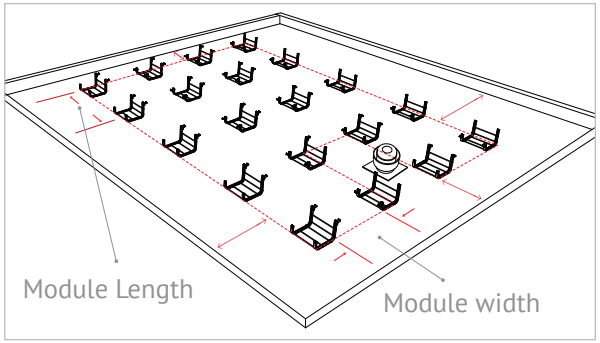


ATTACH CLIPS LOOSELY TO BAY POSTS INTENDED TO HOLD MODULES. For this initial setup, bolts should only be hand threaded a few turns.

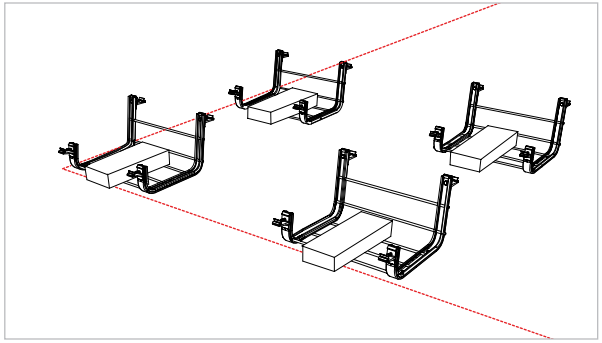
NOTE: CLIP - Single Use Only - For complete electrical bonding path, clips must be tapped in place with hammer.



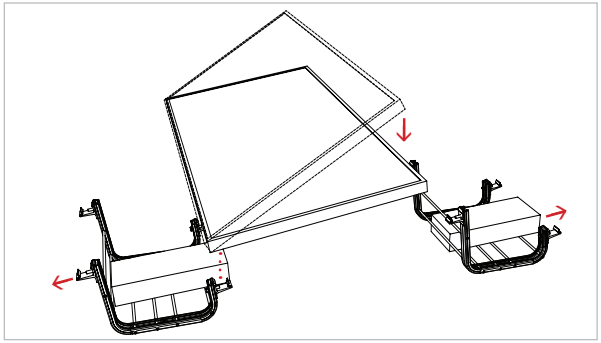
MARK ROOF WHERE ARRAY WILL START: Use chalk line to mark distances from roof edge as called out in construction documents.



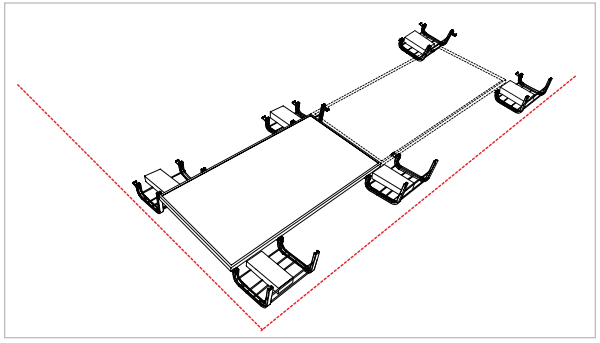
LOCATE ARRAY ON ROOF: Align Ballast Bays with previous chalk lines, using bay spacers as shown on Page 1 if desired.



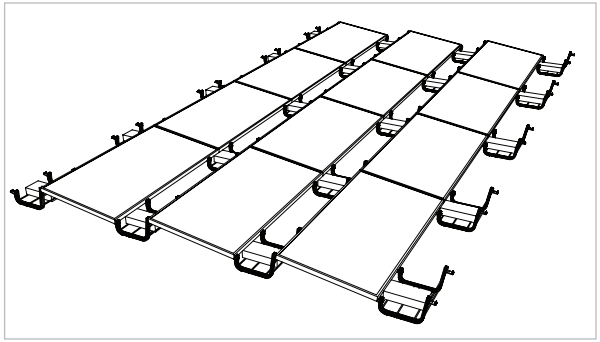
PLACE SOME BALLAST IN 1ST FOUR BAYS FOR FIRST MODULE



PLACE MODULE IN CLIPS

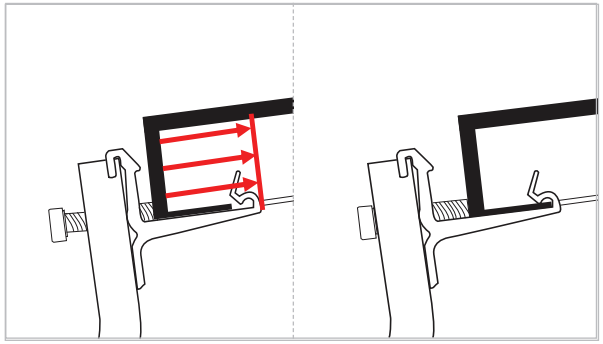


PLACE ANOTHER MODULE IN NEXT BAY CLIP

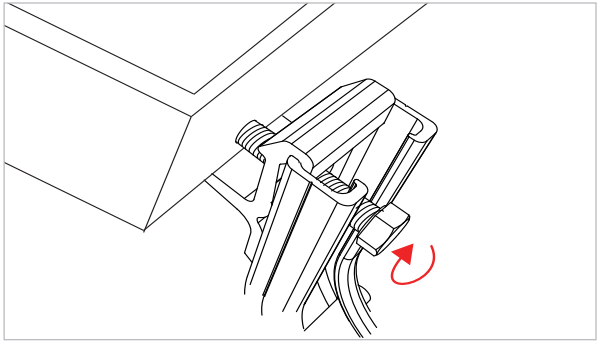


SEAT REMAINING MODULES IN CLAMPS: It is recommended to finish one row before beginning the next.

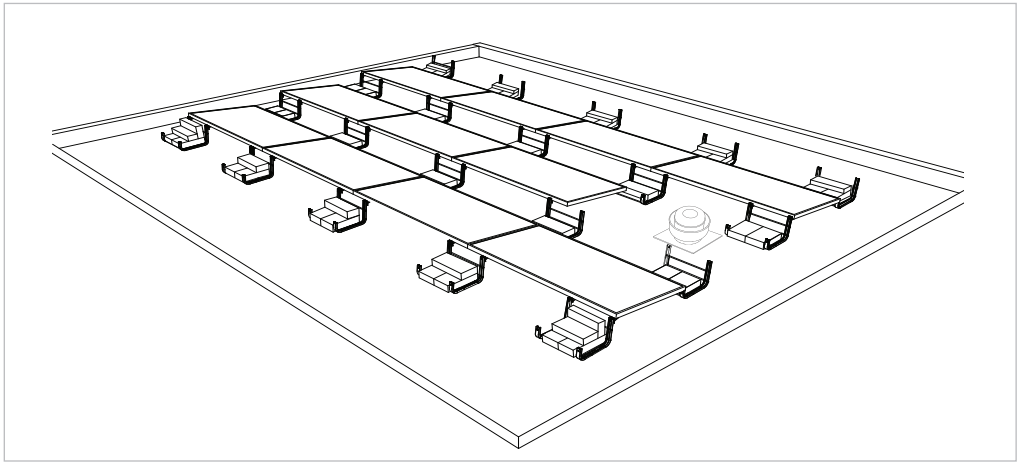
NOTE: 1/4" - 1" gap is required between modules for thermal expansion.



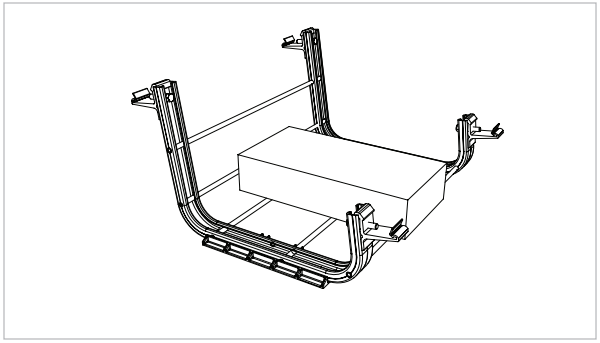
FULLY SEAT MODULE IN CLIPS AND TIGHTEN BOLTS: A gentle tug on the bays will seat the module into the module clip. It is NOT recommended to use the bolt to seat the module. Tighten bolts to **7-9FT-LBS**. It is recommended to tighten bolts one row at a time, working outward from the north or south edge of the array.



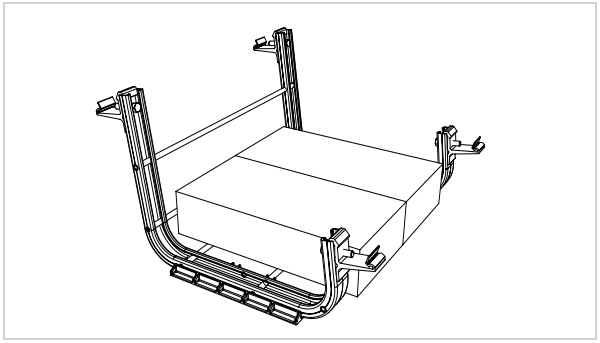
CHECK CLIP BOLT TORQUE IN SEQUENCE:
NOTE: Due to the thread-lock applied to the bolts, torque must be checked within 4 hours of initial tightening. Thread-lock will be fully cured after 72 hours.
TORQUE VALUE:
7FT-LBS - Minimum - 9FT-LBS - Maximum
NOTE: BOLT - Single Use Only



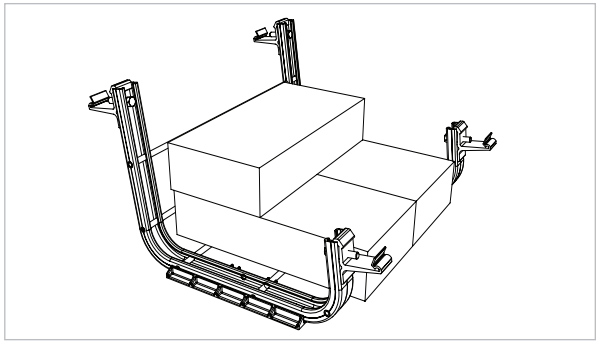
COMPLETE BALLASTED PLACEMENT: Place ballast as required. Deviations from block arrangements shown in this guide may cause shading. Site specific module loading and ballast calculations should be determined for each individual project in accordance with the U-Builder software and the Unirac Design and Engineering guide for ROOFMOUNT. This system has been rated for the mechancial 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.



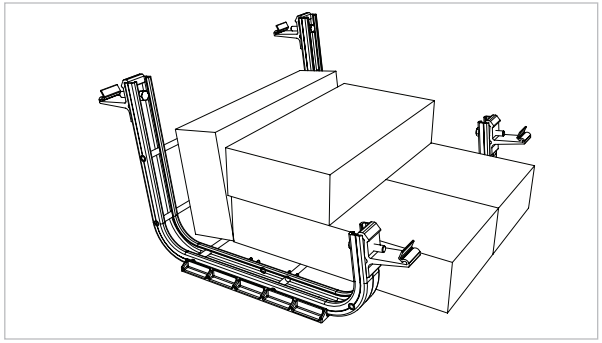
1-Block Configuration



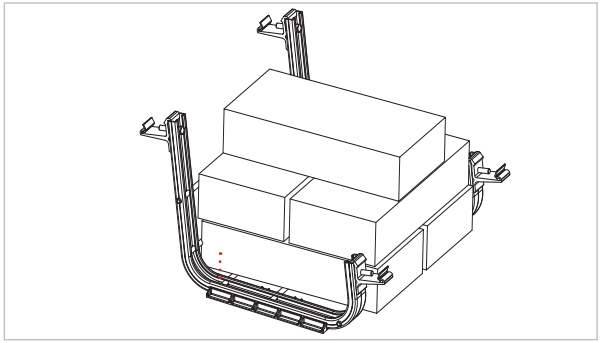
2-Block Configuration



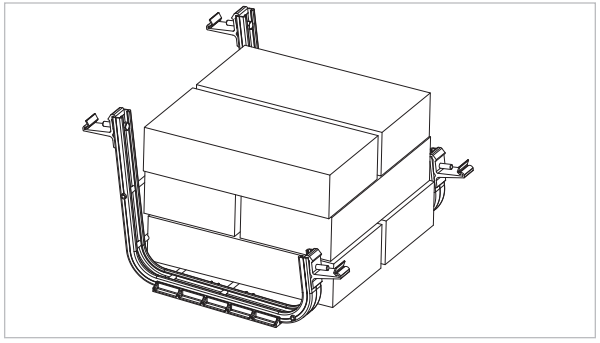
3-Block Configuration



4-Block Configuration

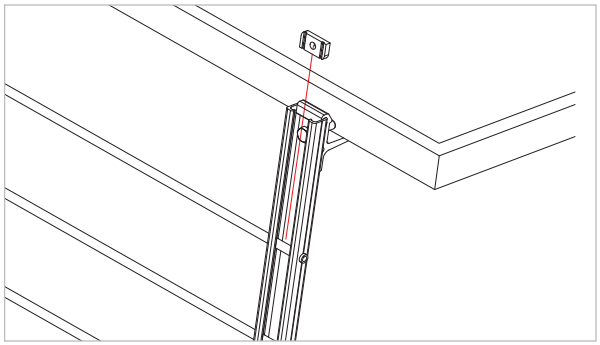


5-Block Configuration



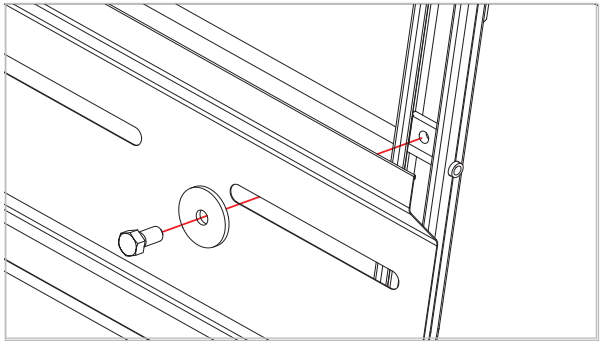
6-Block Configuration

NOTE: Use 5 and 6 block configurations only in unobstructed North Bays

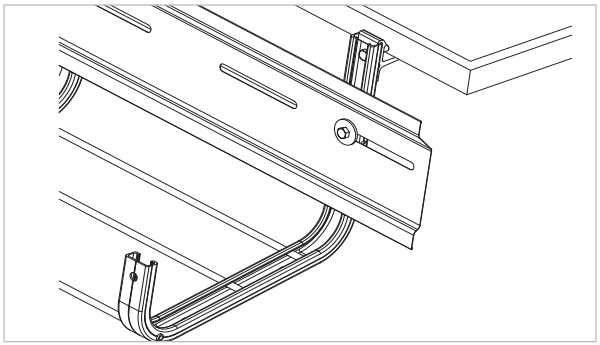


INSERT STRUT NUT INTO RM10 SKI: The strut nut may be dropped in from the top, or twist-inserted into the RM10 ski channel. It should rest on the top-most support dowel as pictured.

NOTE: One strut nut and bolt will be required at each RM10 ski covered by a wind deflector.



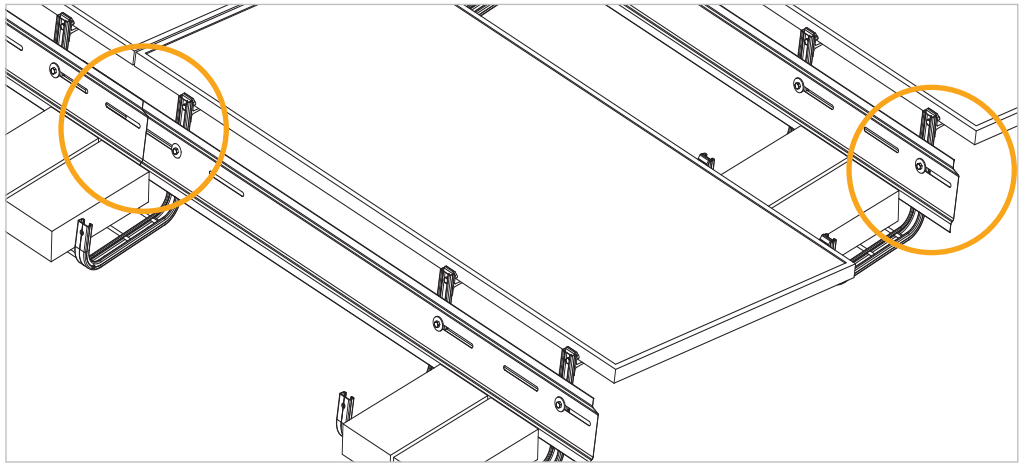
INSTALL WIND DEFLECTOR: Thread the bolts through the included washer, then wind deflector, and into the installed strut nut. The wind deflector will install between ballast and the RM10 ski.



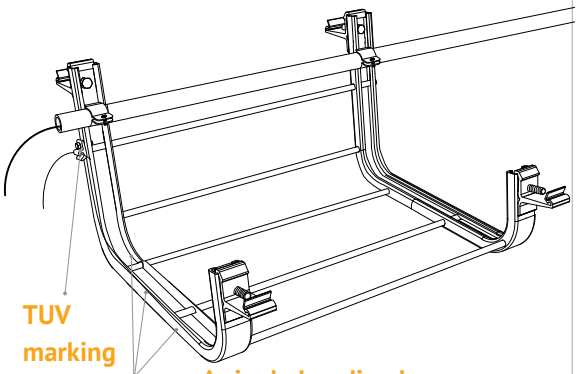
TIGHTEN BOLTS TO TORQUE:
Narrow side of the deflector will be on the bottom.

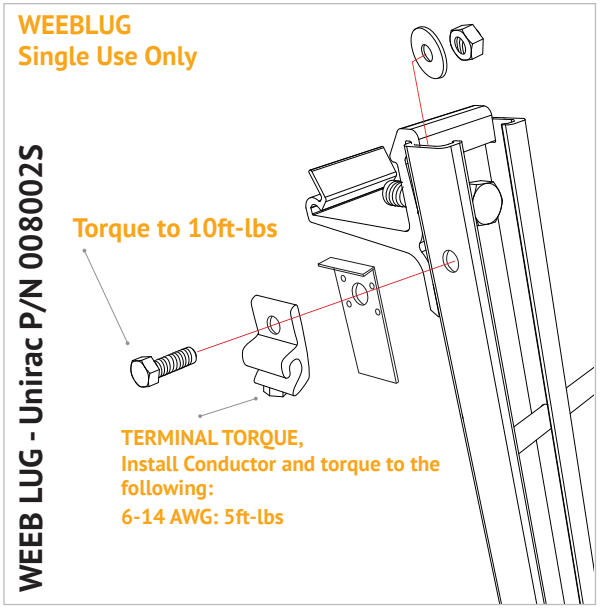
TORQUE VALUE:
7FT-LBS - Minimum - 9FT-LBS - Maximum
NOTE: BOLT - Due to thread lock compound, bolts are single use.

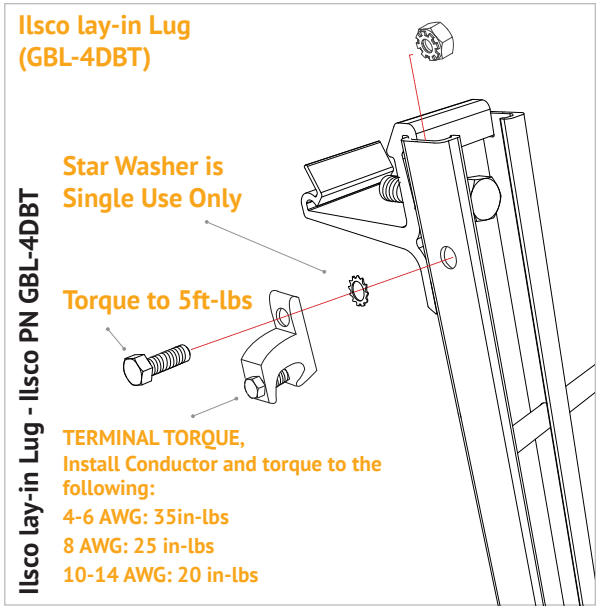
NOTE: Wind deflectors will overlap where modules meet.



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







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.

GROUNDING LUG MOUNTING DETAILS AS REQUIRED BY CODE & ENGINEER OF RECORD: Details are provided for both the WEEB and Ilsco products. The WEEBLug has a grounding symbol located on the lug assembly. 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 Roof Mount is intended to be used with PV arrays that have a system voltage less than or equal to 1000VDC. A min. 10 AWG, 105 degrees Celsius copper grounding conductor should be used to ground a 1000 VDC system, according to the (NEC) National Electric Code and the authority having jurisdicition. It is the installers responsibility to check codes, which may vary.

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

Ground Lug	Bolt Size	Drill Size	Torque Value
WEEB Lug	1/4"-20	17/64"	10 ft-lbs
Ilsco Lug	#10-32	7/32"	5 ft-lbs

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. The modules selected for UL 2703 bonding & grounding testing were selected to represent the broadest range possible of modules on the market. The tests performed cover the following basic module parameters:

- 60, 72 & 96 cell modules
- Frame thickness greater than or equal to 1.0mm
- Basic single and double wall frame profile (some complex frame profiles could require further analysis to determine applicability)
- Clear and dark anodized aluminum frames
- The frame profile must not have any feature that might interfere with bonding devices that are integrated into the racking system

VERIFIED COMPATIBLE MODULES:

Manufacturer	Module Model / Series
Astronergy / Chint	CHSM6610M (BF)+HV , AstroSemi CHSM72M-HC
AU Optronics (BenQ Solar)	PM Series
Auxin	AXN6M610T, AXN6P610T, AXN-6M612T & AXN6P612T
Axitec	AC-XXXP/156-60, AC-XXXP/72S, AC-XXXM/72S
Boviet	BVM6610(P/M) & BVM6612(P/M)
Canadian Solar	CS5A-M, CS6P-M, CS6P-P, CS6X-P
	CS3W-P, CS3U-P (HE), CS3U-MS, CS3K-P (HE), CS3K-MS (Black),
	CS6K-MS (AllBlack) , CS6K-M, CS6K-P (HE), CS6K,
	CS3U-PB-AG, CS3U-MB-AG, CS3K-PB-AG, CS3K-MB-AG,
	CS6U-M, CS6U-P (HE),
	CS1K-MS, CS1H-MS, CS1U-MS, CS3W-P-PB-AG, CS3L-P
	ELPS CS6P-MM, ELPS CS6A-MM
Centrosolar America	C-Series & E-Series
CertainTeed	CT M/P-01, CT M-02 & CT M-03
ET Solar	ET Module & ET AC Module
Flex	FXS 60
GCL	GCL-P6 & GCL-M6

Manufacturer	Module Model / Series
Hansol	UB-AN1, UD-AN1, TD-AN4, TD-AN3
Hanwha SolarOne	SolarOne HSL 60 SolarOne HSL 72
Heliene	72M, 72P, 60M & 60P
HT-SAAE	HT72-156M-C, HT72-156M(V)-C, HT72-156M HT72-156M(V), HT72-156P-C HT72-156P(V)-C
Hyundai Heavy Industries	TI, RI, KI, HI, MI & MG Series
JA Solar	JAP6 60, JAM6-60 /SI, JAM6(K)-60, JAP6(k)-72 /4BB, JAP72SYY /ZZ, JAP6(k)-60 /4BB, JAP60SYY /ZZ, JAM6(k)-72 /ZZ, JAM72SYY /ZZ, Note: YY: 01, 02, 03, 09, 10 ZZ: SC, PR, BP, HiT, IB, MW
Jinko Solar	Standard, JKM P-60B, JKM M-60(B/BL/V/HB/H/L/HL), JKM PP-72(Plus), JKM M-72(V/Plus), JKM PP-72-(L-V/V/HL-V)

Manufacturer	Module Model / Series
Kyocera	KD-F Series
LG Electronics	MONO X, MONO NEON, N1K-A5, N1C-A5, Q1C(Q1K)-A5, N2T-A5, N2W-A5, S2W-A5, S1C-A5, E1C-A5, E1K-A5, N1K-V5, N1C-V5, Q1K-V5, Q1C-V5, N2W-V5, N2T-J5
LONGi	LR6-60 & LR6-72 Series
Mission Solar	MSE Series
Panasonic	VBHN SA15/16/17(G/E)/18(E)
	VBHN KA01/03/04
Phono Solar Technology	Standard Modules
Q-Cells	Q.PEAK DUO L-G4.2/L-G5/ L-G5.1/L-G5.2/L-G5.3,
	Q.PEAK DUO L- G6/L-G6.2/L-G6.3
	Q.PLUS L-G4.2/TAA
	B.LINE PRO L-G4.1
	Q.PLUS/PEAK/PRO L-G4.2
	Q.PLUS/PEAK/PRO L-G4/L-G4.1
	B.LINE PLUS/PRO L-G4.2
	Q.PEAK DUO G5/G6/G7.x/G8
	B.LINE PEAK DUO G7/G7.2/ L-G7/L-G7.1/L-G7.2/:-G7.3
Renesola	All 60-cell modules

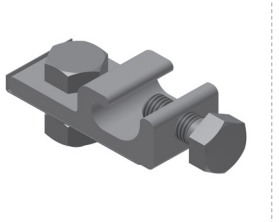
Manufacturer	Module Model / Series
REC	Peak, Eco, PE (BLK), TP2M, TP2, TP2 BLK2, NP (BLK), TP2SM72, TP2S72,TP2S72 XV
Risen	RSM72-6 (P/M), RSM144-6
S-Energy	SN P-10, M-10 & SN P-15
Seraphime	SEG-6, SEG-E & SRP-6 Series
Sharp	ND-24CQCJ, ND-25CQCS, ND-Q235F4, ND-F4Q300
Silfab	SLA & SLG Series, SLA-X
SolarWorld	Sunmodule Protect Sunmodule Plus
Suniva	OPTIMUS & MV Series
Suntech	STP Series
Sun Edison	F-Series & R-Series
SolarWorld	SunModule Plus & Protect
SunPower	X-Series, E-Series, AC & Sig Black
Talesun Solar	TP572, TP596, TP654, TP660, TP672, HIPRO TP660, SMART TP660P
Trina	PA05, PD05, DD5, PD14, DD14A(II), DE14A(II), PE14, PD14
URE	D7 (M/K) H7A, D7 (M/K) H8A
Vikram	Eldora, Solivo, Somera
Yingli	YGE60/72, YLM60/72, YLM-VG

Please see the RM10 UL2703 TUV/PTL Certification Document at Unirac.com to ensure the exact solar module selected is approved for use with RM10

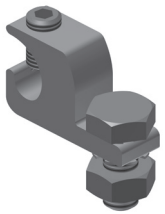
TEMPORARY GROUNDING & BONDING PROCEDURE: Periodic inspections should be conducted on the PV array to ensure there are not loose components, loose fasteners or corrosion. If any of the above items are found, the affected components are to be immediately replaced. **If a module must be removed or replaced, 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. These materials must be kept separate.



WEEBLug

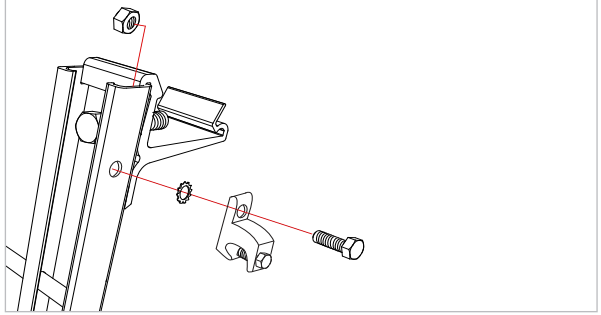


Ilsco lay-in Lug

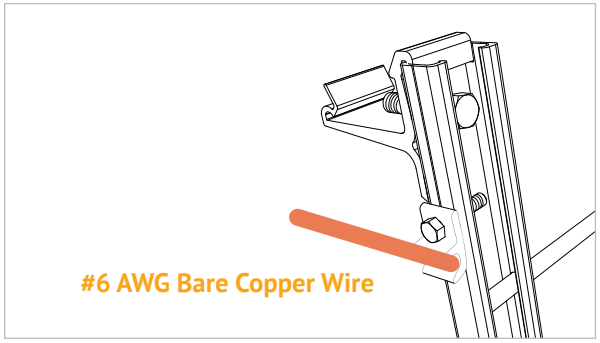
APPROVED LUGS

WEEBLug UNIRAC PN 008002S
See product data sheet

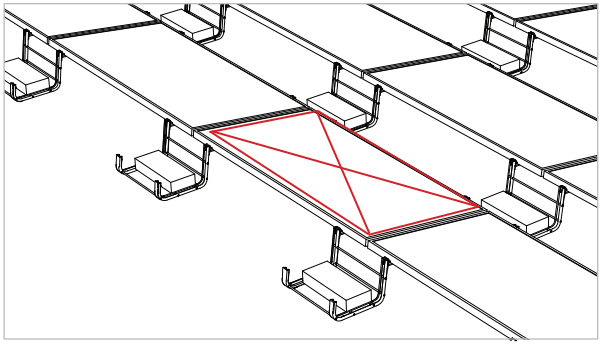
Ilsco lay-in Lug Ilsco PN GBL-4DBT
See product data sheet



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

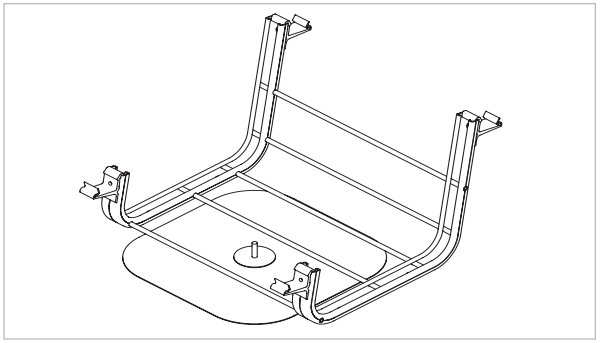


INSERT COPPER WIRE: Insert bare copper (#6 AWG) wire into each lug, providing a bonding jumper across the missing module location.



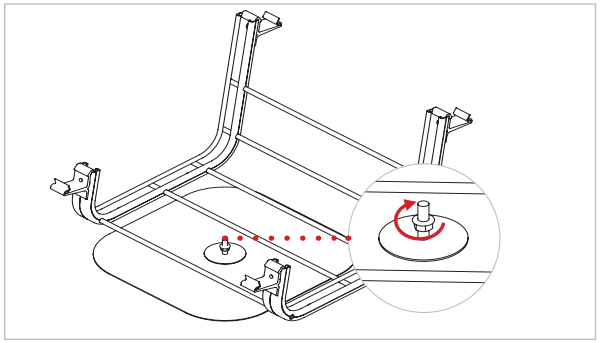
REMOVE MODULE & REVERSE THE OPERATION AFTER MAINTENANCE IS COMPLETE

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.

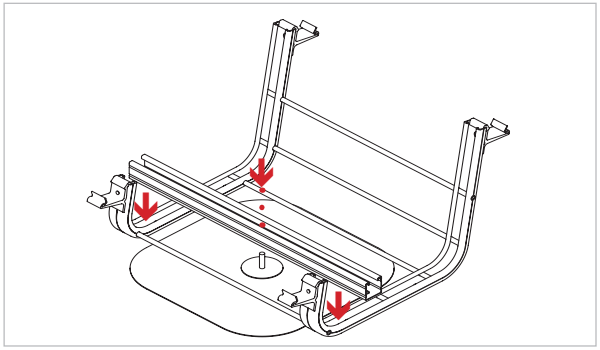


STEP 1 - POSITION U-ANCHOR: Position Roof attachment under bay requiring attachment and install according to manufacturer installation instructions.

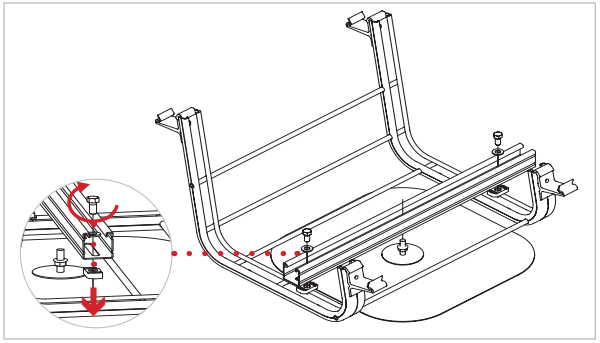
NOTE: Center roof attachment under ballast bay as close as possible.



STEP 2 - ENGAGE FLANGE NUT: Place 3/8-16 serrated flange nut and 1" OD washer on the anchor stud approximately halfway down, nut serrations facing up.

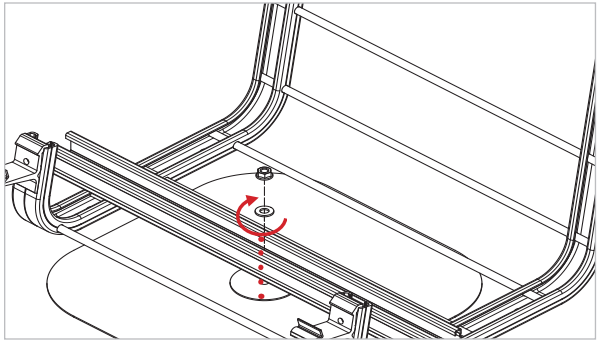


STEP - 3 PLACE UNISTRUT: Place 24" Unistrut across RM bay with the anchor stud though a slot.



STEP 4 - SECURE UNISTRUT TO BAY: Place strut nuts inside RM channels under Unistrut, and secure Unistrut with 3/8-16 x 3/4" bolt and 1" OD washer to 30 ft-lb.

TORQUE VALUE: 30FT-LBS



STEP 5 - SECURE UNISTRUT TO U-ANCHOR: Tighten nut that was placed on roof attachment stud in step 2 until making contact with the underside of the Unistrut. Then place another 3/8-16 serrated flange nut and 1" OD washer on the stud, serrations facing down and tighten to 30 ft-lb.

TORQUE VALUE: 30FT-LBS

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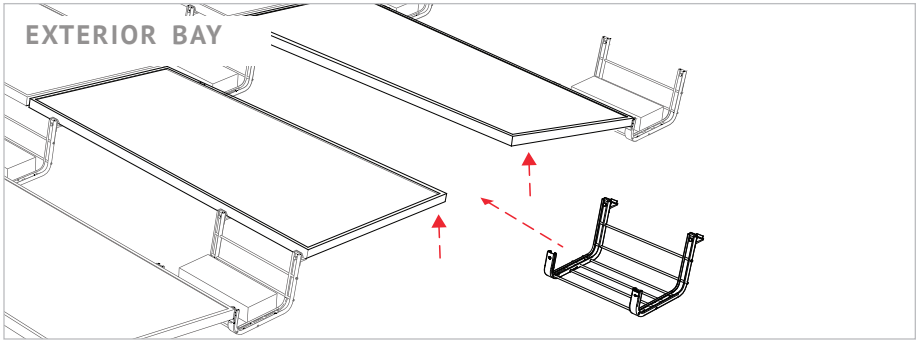
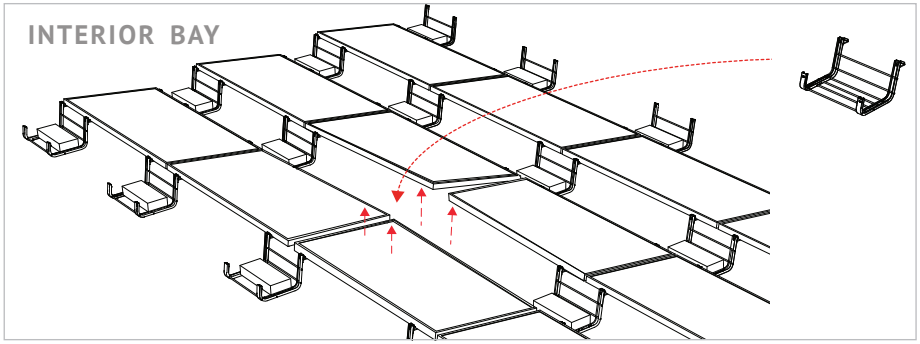
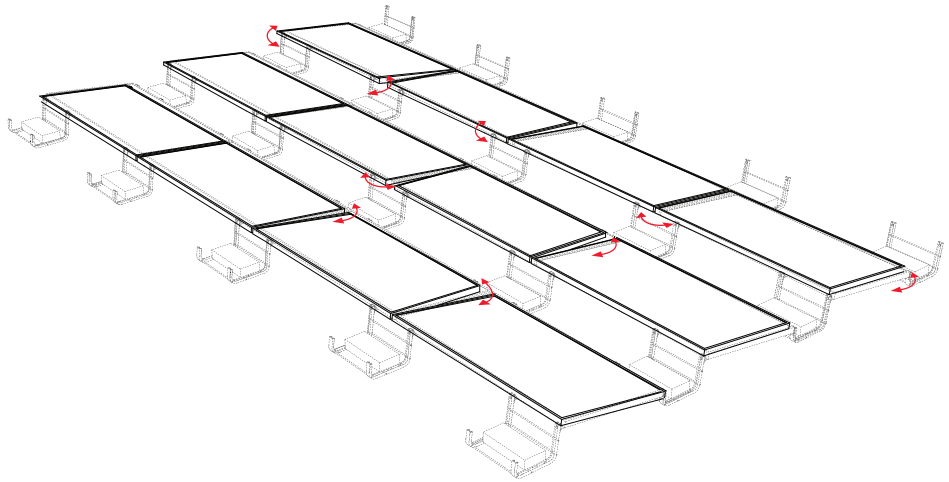
ADDING BAYS
ADJUSTMENTS GUIDE

A PAGE



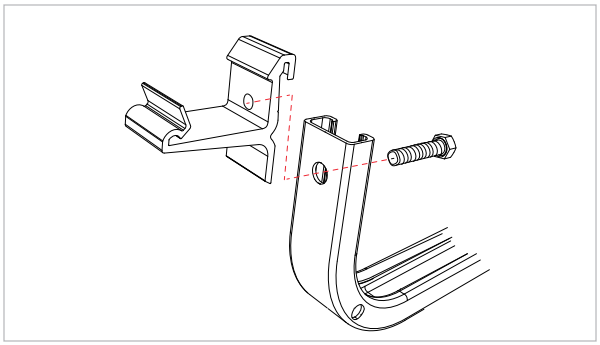


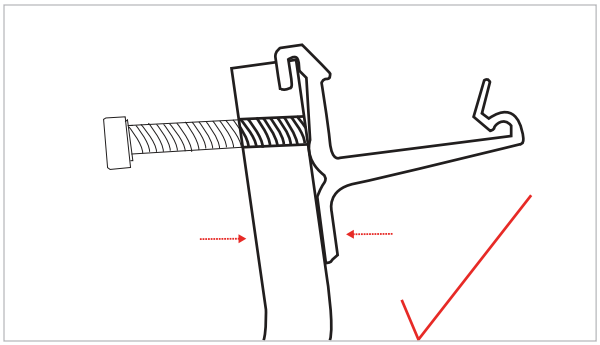
PROBLEM - ADDING BAYS AFTER INSTALLATION COMPLETED: Apply gentle, even uplift on the adjoining module frames, and maneuver bay into place

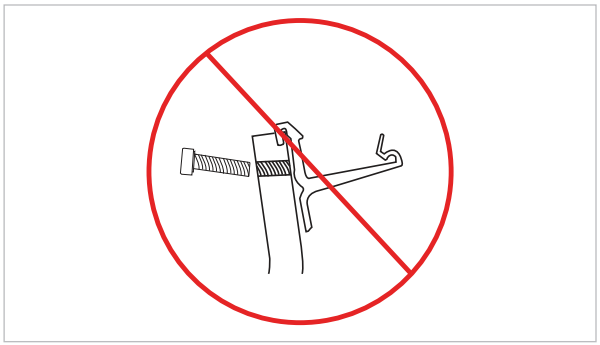


PROBLEM - ARRAY BUCKLES, OR HAS INCONSISTENT OR UN-PARALLEL GAPS BETWEEN MODULES: Loosen neighboring clips and re-adjust

- Sequentially tightening from installation outset can prevent this.

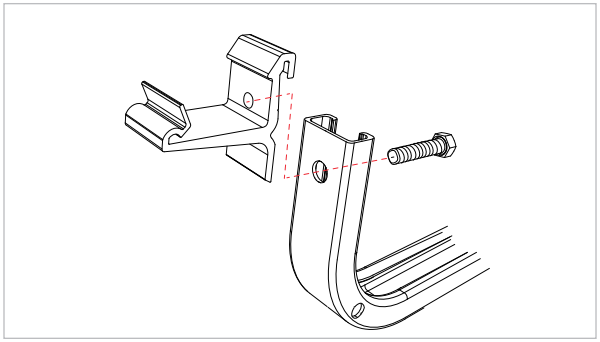


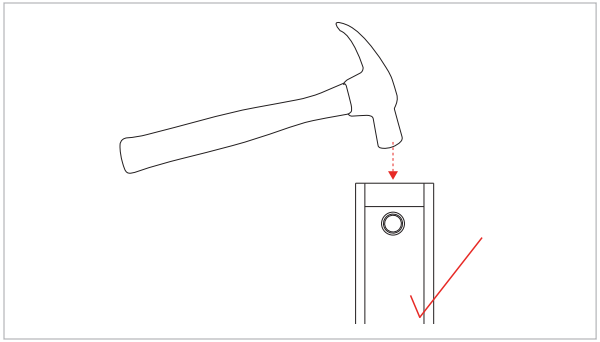


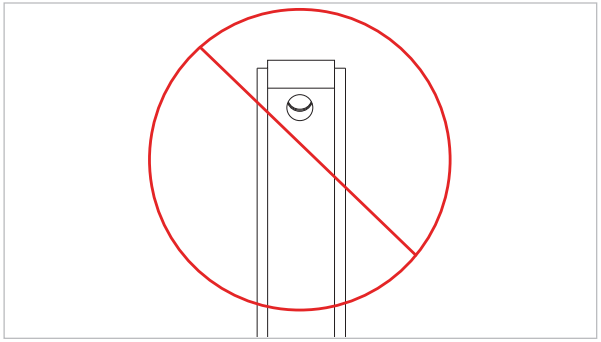


PROBLEM - CLIP BOLT CROSS-THREADS: Back bolt out and replace clip, or use thread cleaning too.

- Starting bolts with fingers instead of a power driver can minimize or eliminate cross-threading.
- When using power driver, hold it perpendicular to clip, and squeeze bottom of clip flat against bay post.







PROBLEM - MODULE CLIP THREADED HOLE AND BAY POST HOLE NOT LINED UP: Tight fit between these parts is critical for electrical bonding.

- Lining up holes may require assistance of a hammer or similar device.

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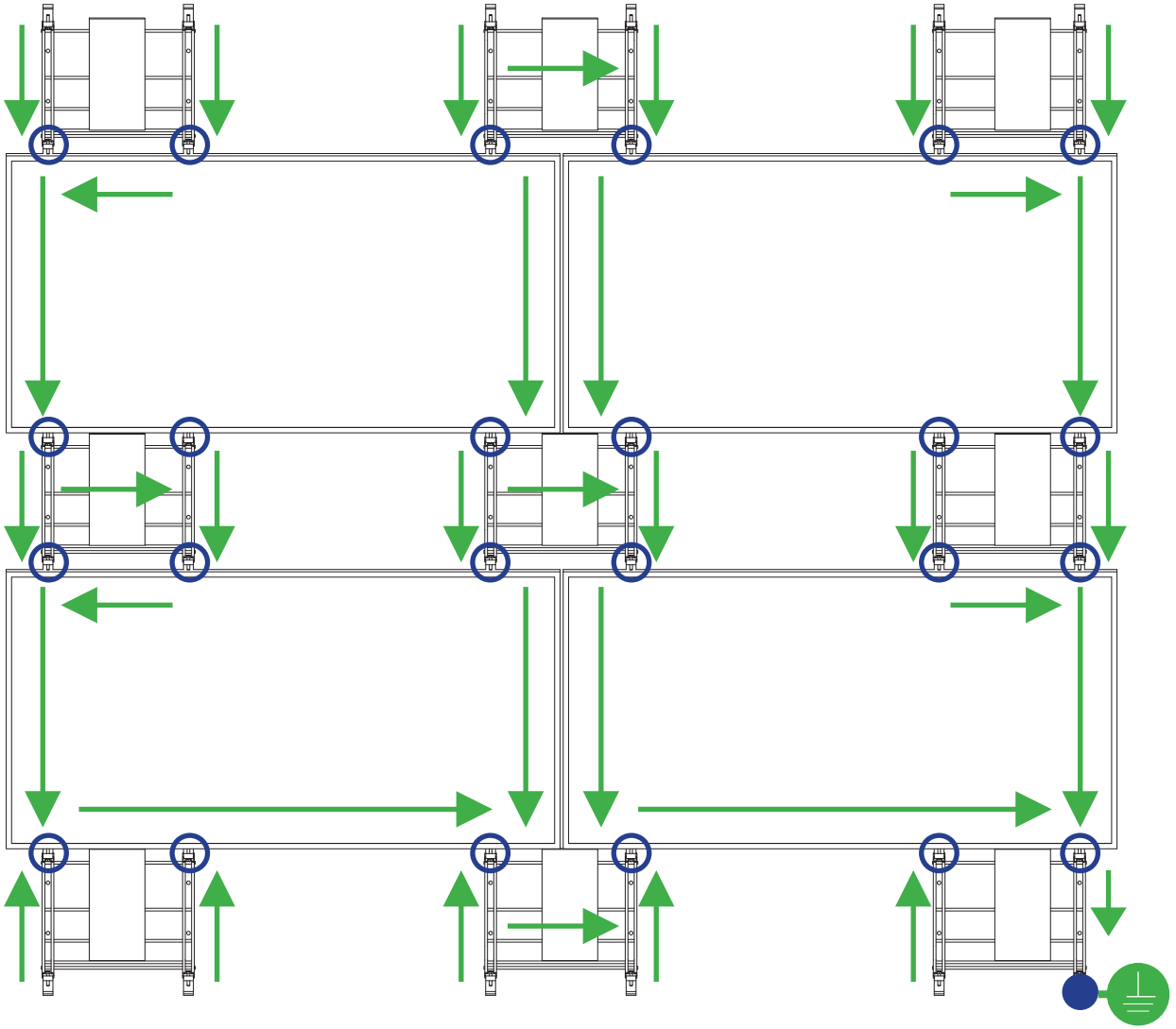
BONDING & GROUNDING ELECTRICAL DIAGRAM

INSTALLATION GUIDE | PAGE C



Fault Current Ground Path

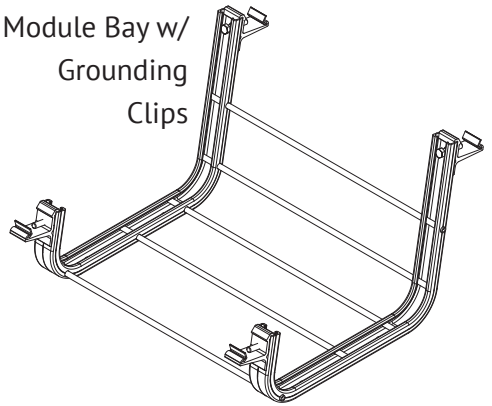
Ground Lug

Grounding Clip & Bolt

Min. 10 AWG Cooper Wire

Module Frame

Module Bay w/ Grounding Clips



MECHANICAL LOAD TEST QUALIFICATION

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

- Up to 96 cell framed modules
- Frame thickness greater than or equal to 1.0mm
- Basic single and double wall frame profiles
- Certification loads : 15 psf up, 50 psf down

TESTED MODULE

Module Manufacturer	Model / Series
SunPower	SPR-E20-327 / E-Series