

RAIL-BASED TILT BALLASTED FLAT ROOF

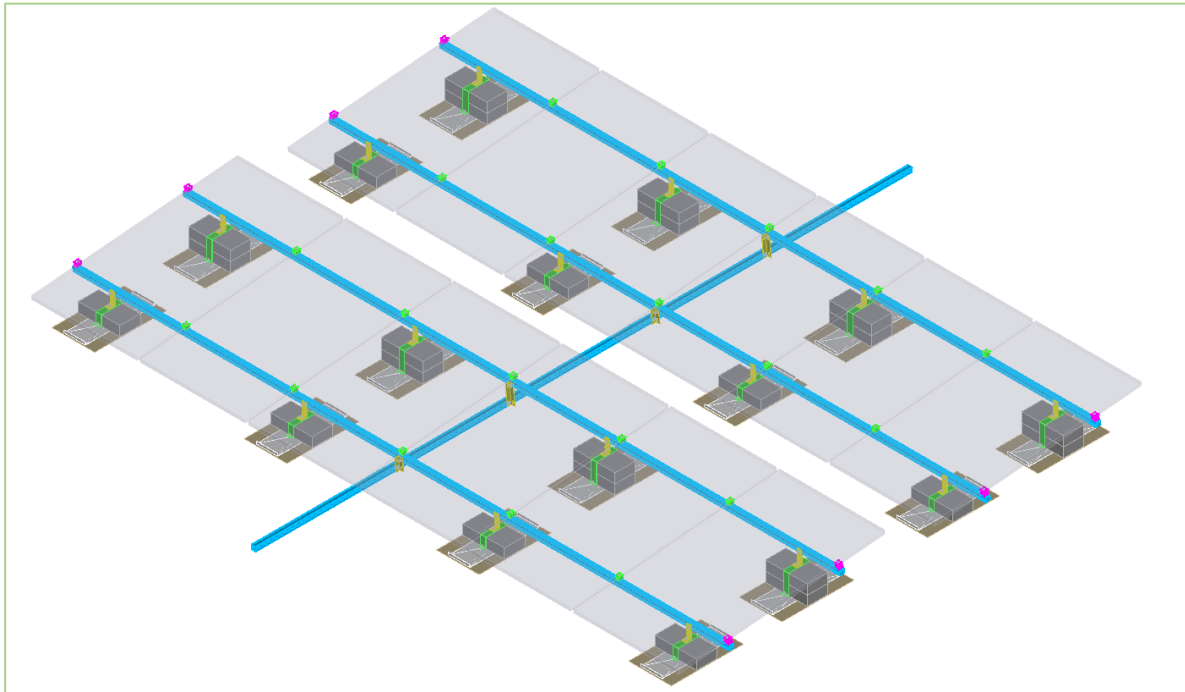


Table of Contents/Index:

Item	Page(s)
Notes	3
1. Components	4
2. Layout-Drawing	6
3. Layout-General Notes.....	7
4. Block Layout and Row Spacing	8
5. Racking Installation	9
6. Module Clamping	11
7. Rail Splice Installation	11
8. Expansion Joints Installation	12
9. Grounding/Bonding	12
10. General Arrangement Drawing	13

Notes:

UL2703 verified compatible modules

Modules chosen for UL2703 grounding/bonding testing were chosen to represent a range of available solar modules. Modules tested were from the following manufacturers:

- LG NeON– Model LGxxxN2W-A5
- Jinko Solar – Model JKMxxxM-72L-V, JKM-xxx-M-72-H
- Seraphim SRP-xxx-BMA
- Mission MSE-xxx-SQ8T
- Axitec AC-xxx-MH
- Canadian CS6X-xxx-P.

Grounding/Bonding

- Only grounding/bonding devices listed in this manual have been approved for use with this racking and qualified per UL2703 installation details provided in this document
- This racking system may be used to ground and/or mount a PV module complying with UL 1703 only when the specific modules has been evaluated for grounding and/or mounting in compliance with the included instructions.
- Routine maintenance of a module or panel shall not involve breaking or disturbing the bonding path of the system.
- The racking system has a 25 Amp fuse series rating.
- Installer is responsible for and shall 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.
- Installation shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1.

Periodic Inspection

Periodic re-inspection of installed racking components must take place to identify any loose components, loose fasteners or corrosion. Loose or corroded components or fasteners must be replaced immediately.

Fire Rating

UL1703 FIRE CLASSIFICATION

This system has achieved a Class A fire rating when installed using UL1703 Fire Classification Type 1 modules under the following conditions:

- Installation must be done in strict accordance to this instruction manual
- The maximum roof slope may be up to 2"/12" or 9.46°

Mechanical Load Design Rating

System Level Allowable Design Load Rating: 35 psf downward, 20 psf upward, 15 psf down-slope.

Each set of site-specific plans must have system loads evaluated and approved by an appropriate structural engineer. This system is designed to be expandable and is not limited by a maximum number of PV modules. Maximum size of PV modules evaluated was 79.7" x 40.3" (i.e. typical 72-cell) and modules are mounted in portrait. A typical modular rail length is approximately 20' (6m) and could hold up to 6 modules.

Label

After the racking system is fully assembled, a single Marking Label should be applied to the rail at the edge of the array. Note: The sticker label should be placed such that it is visible, but not outward facing.



Sharp Edges and Piercing Module Clamps

Ensure wiring is kept away from any sharp edges that may have resulted from cutting rails etc. Module clamps contain pre-installed bonding nodes which are designed to pierce the module frame when tightened to proper torque.

Site-Specific Engineering Drawings

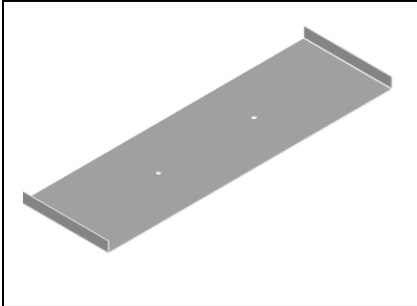
This manual is to be used in conjunction with any site-specific engineering drawings that have been developed for your specific project.

TOOL LIST:

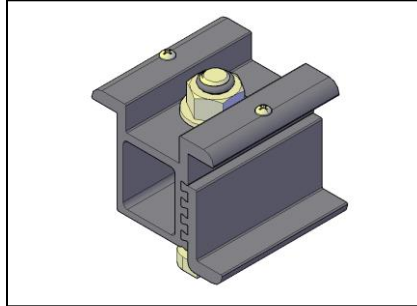
- 7/16 Wrench for SGB-4
- 13 mm (1/2") Socket
- Nut Driver Set
- Impact Driver
- Measuring Tape
- Saw For Cutting Rails

1. Components

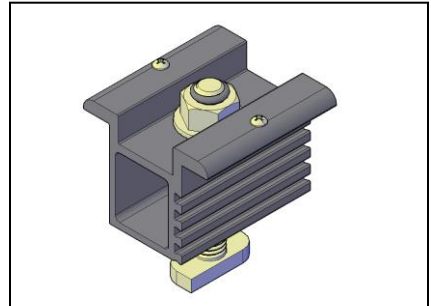
14 Ga Aluminum Ballast Tray



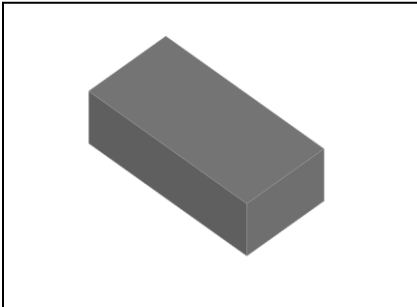
Advanced End Clamp



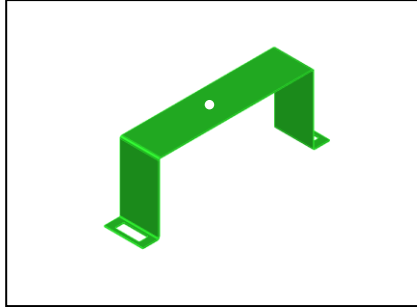
Advanced Mid Clamp



Ballast Block



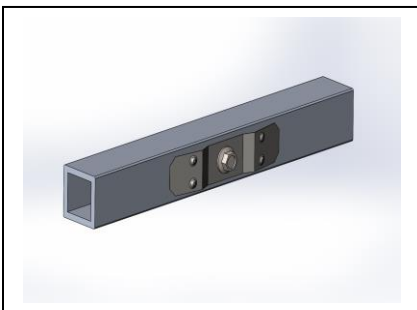
Front Ballast Strap



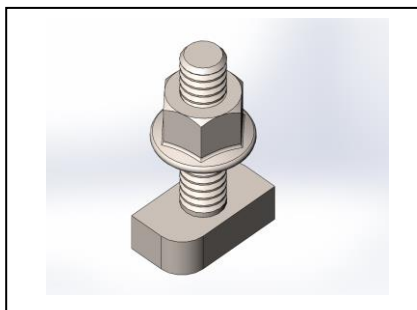
Rear Ballast Strap



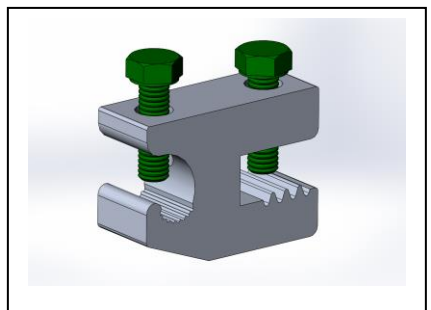
Advanced Rail Splice



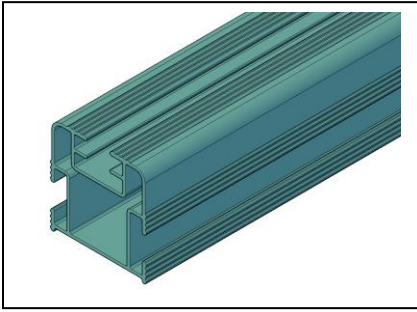
M8x30 T-Bolt & M8 Nut



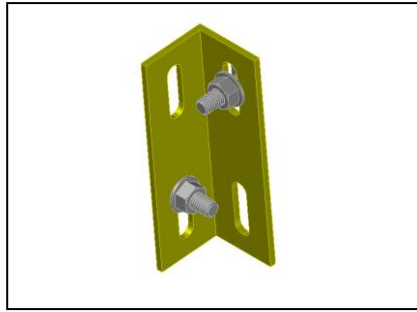
SGB-4 Grounding Lug



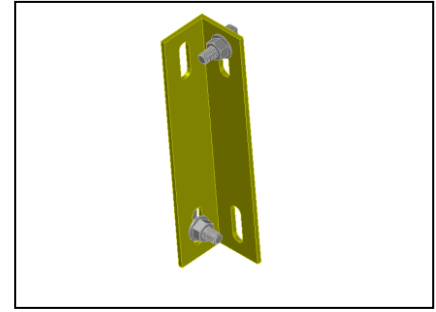
Advanced Rail



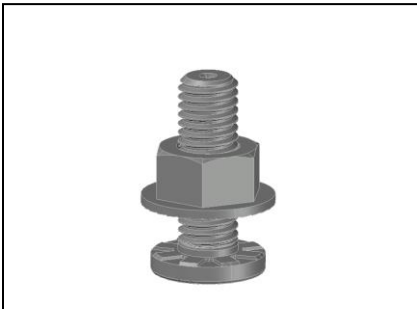
Rear Row Connector Bracket



Front Row Connector Bracket



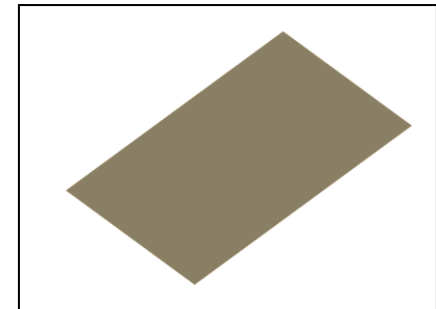
M8x25 Stud Bolt & M8 Nut



L-Foot (3°-25° Tilt)



Roof Protection Mat (Slip Sheet)



2. Layout-Drawing

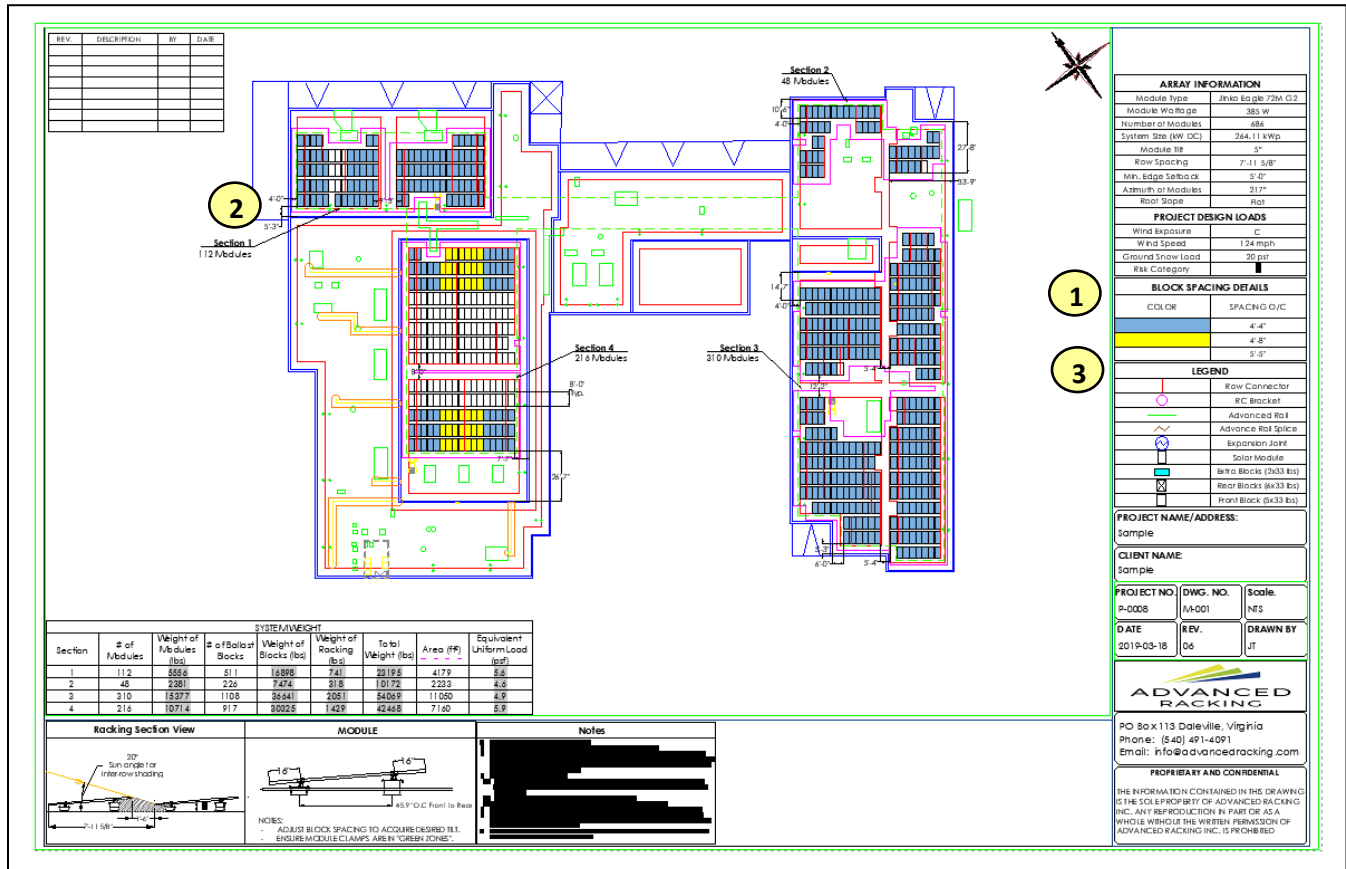


Fig. 1 LAYOUT M-001 FOR EXAMPLE ONLY

Use the stamped, color-coded layout drawing(s) to determine:

1 Block Spacing – in Fig 1. (example):

- Blue shading = 4'-4" o.c.
- Yellow shading = 4'-8" o.c.
- No shading = 5'-5" o.c.

2 Starting Dimensions (Fig 1. example)

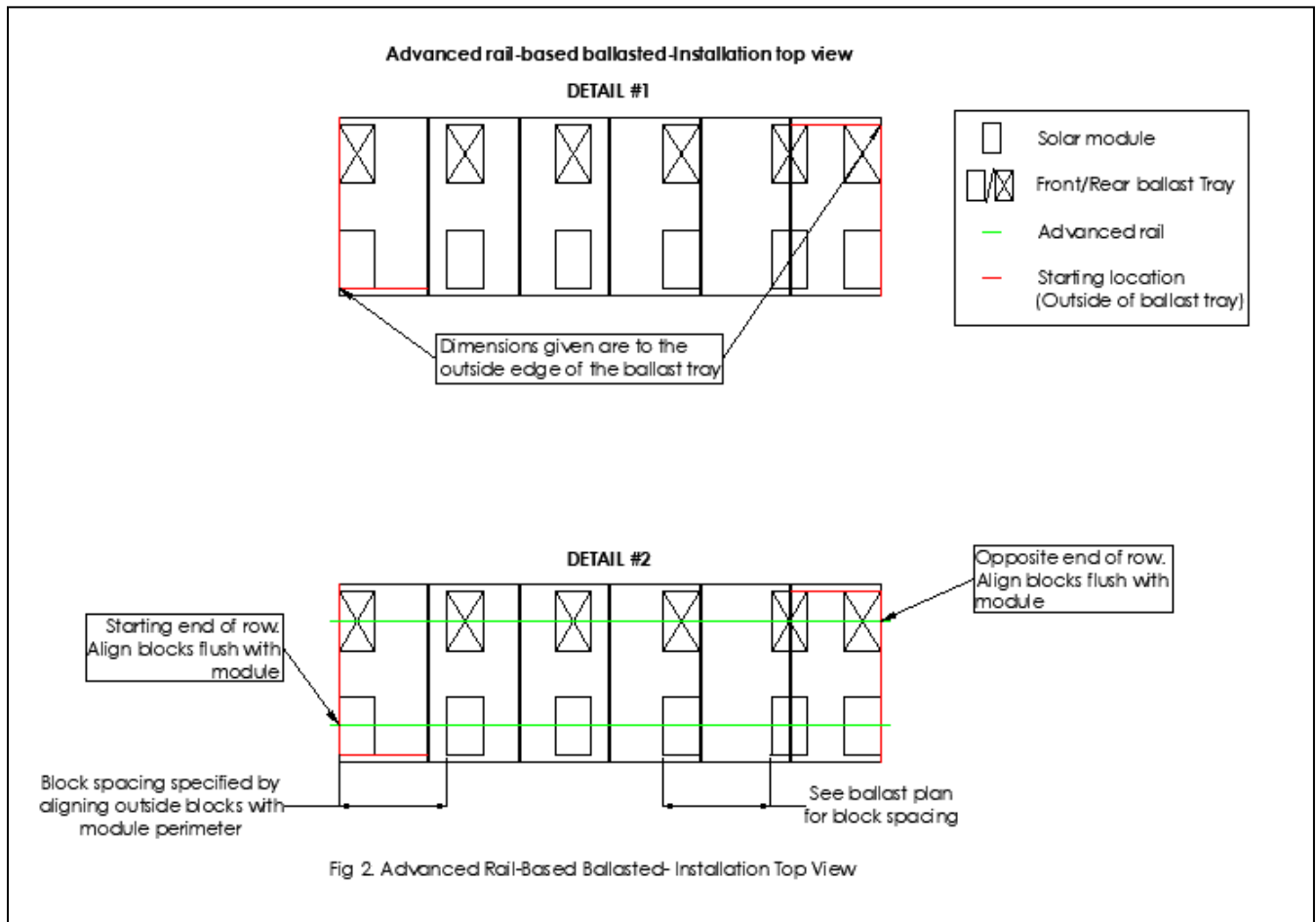
Note:

Starting dimensions are to outside edges of ballast Trays, NOT to edges of modules.

Starting dimensions are from the inside of the parapet. If there is no parapet they are from the edge of the building.

3 Module and Racking Component locations – see Legend in Fig 1.

3. Layout-General Notes



Note:

- **All dimensions are to the outside of the ballast block – See Fig 2., Detail #1**
- Ensure you are using the current Layout drawing(s) before starting installation – these will normally be provided by Advanced Racking.
- Use the dimensions given to map out the starting points

4. Block Layout and Row Spacing

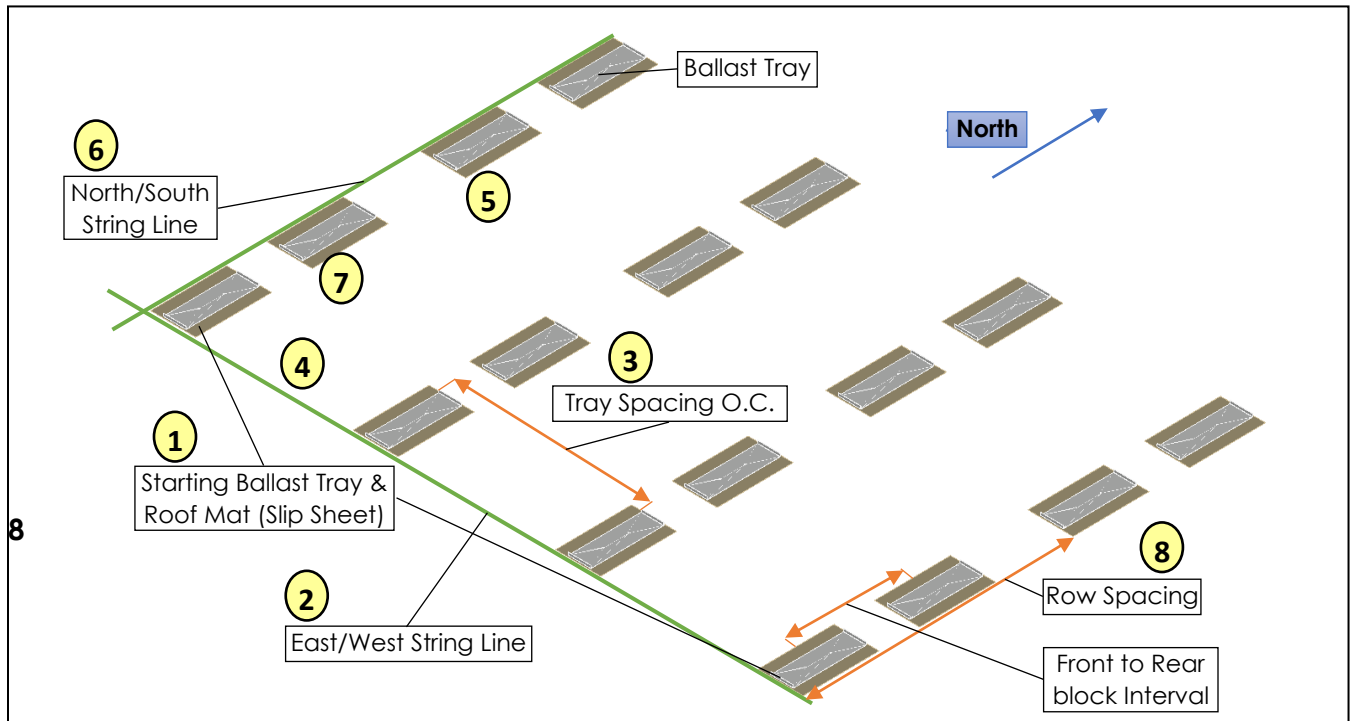


Fig 3. Block Layout and Row Spacing Details

- 1 Use starting dimensions on layout to locate starting roof mat/ballast trays (typically south corners of array). Roof protection mats are placed underneath each ballast tray.
- 2 Run a String Line in the East/West direction between starting trays/blocks
- 3 Use layout to determine the roof mat/blocks spacing
- 4 Place ballast trays and roof protection mat along East/West string line using tray/blocks spacing info from layout

Row Spacing (North/South)

- 5 Place next tray/block in North/South direction using row spacing from layout
This will be the front tray/block for the following row
- 6 Run a string line in the North/South direction
- 7 Use module clamping zone guidelines to properly place rear tray/block for the first module row: Center of ballast tray must line up with desired module clamping zone (refer to module manufacturer's installation documentation for correct module clamping zone)
- 8 Place ballast trays along the North/South string line at row spacing and front/rear intervals

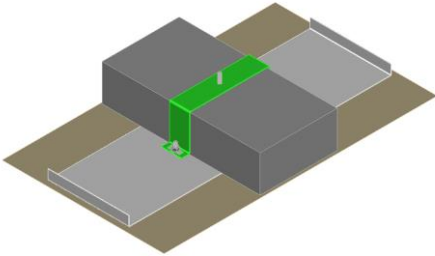
Important Notes:

- If an obstruction interferes with a block: move the block East/West just enough to avoid the obstruction

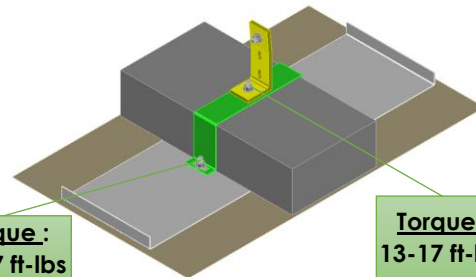
- Ensure the North/South blocks are square to the East/West blocks before proceeding.
- When placing roof *protection mats* and *blocks* on a ballasted EPDM roof, make sure there are no stones caught between the roof *protection mat* and roof membrane.

5. Racking Installation

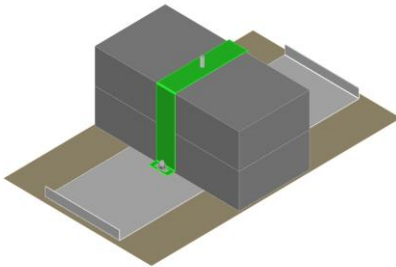
STEP 1: Front Foot - Start by following "Block Layout and Row Spacing" guide on page 8. Place one ballast block centered on the tray. Use strap bolt and nut to attach the ballast strap to the ballast tray.



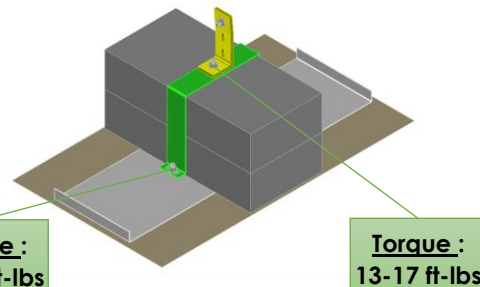
STEP 2: Attach the L-Foot to the ballast strap using a strap bolt and nut. The head of the strap bolt is to be located between the strap and the block.



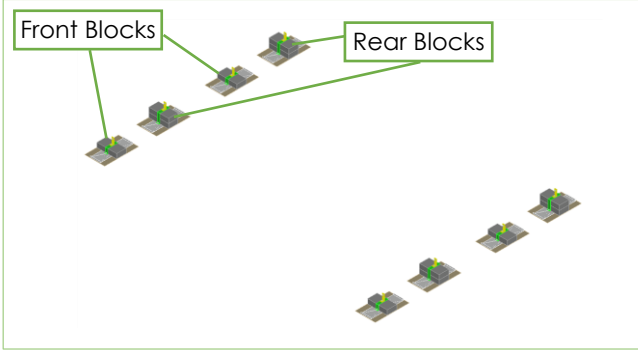
STEP 3: Rear Foot - Start by following "Block Layout and Row Spacing" guide on page 8. Place two ballast block centered on the tray. Use strap bolt and nut to attach the ballast strap to the ballast tray.



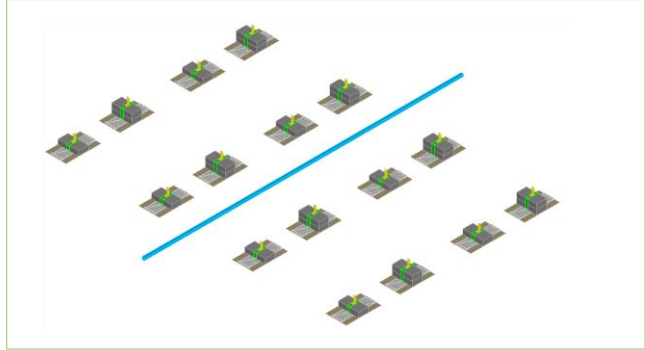
STEP 4: Attach the L-Foot to the ballast strap using a strap bolt and nut. The head of the strap bolt is to be located between the strap and the block.



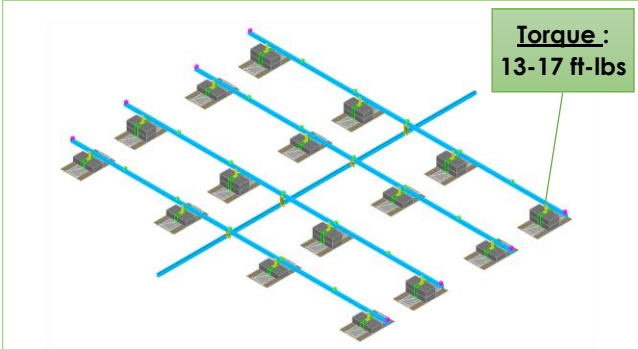
STEP 5: Place first and last block for each row. Fill in remaining blocks and hardware. As long as first and last blocks below are placed accurately, the remaining blocks can be placed roughly in place by eye. They will be shifted into final position once rails are attached.



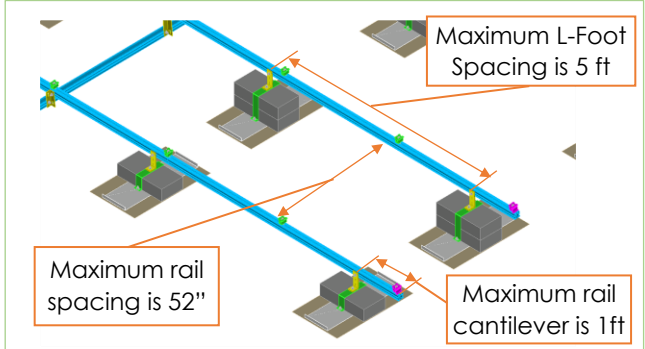
STEP 6: Place row connectors roughly in position on roof following locations from layout. Placing now avoids having to slide row connectors under the module rails later. Precision is not necessary – row connectors are simply placed under indicated module column.



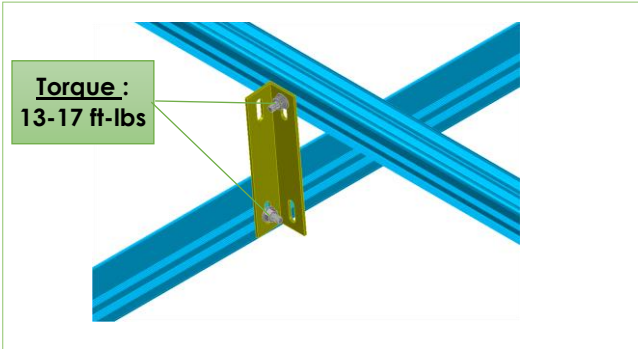
STEP 7: Connect advanced rails to L-foot using supplied T-bolt and nut (Torque 13-17 ft-lbs). Refer to page 11 for rail splicing details. Check and correct module tilt regularly using angle finder. Adjust rail heights as needed.



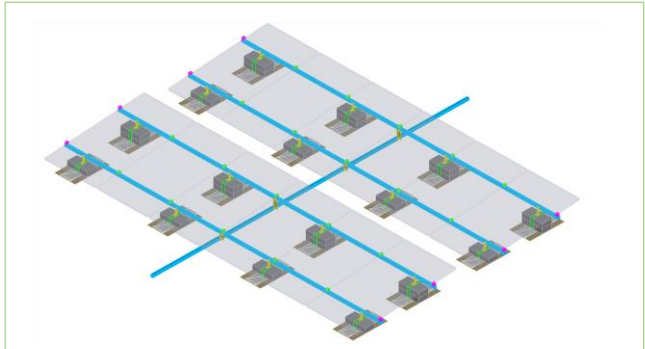
STEP 8: The system must be installed such as to meet the Max. rail cantilever, Max. L-foot spacing and Max. rail spacing requirements.



STEP 9: Attach row connectors (Advanced rail) to module rails using Row Connector Brackets, T bolts and nuts. Tall bracket for rear, short for front. Row connectors are rail installed upside down.



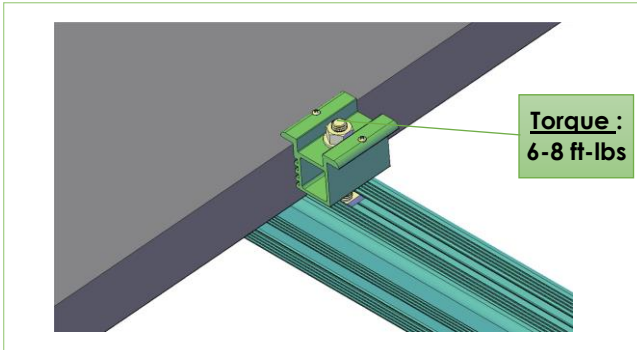
STEP 10: Install modules - place module on the rails and ensure the rails are in the desired module clamping zone. Ensure the Module is set to correct tilt.



6. Module Clamping

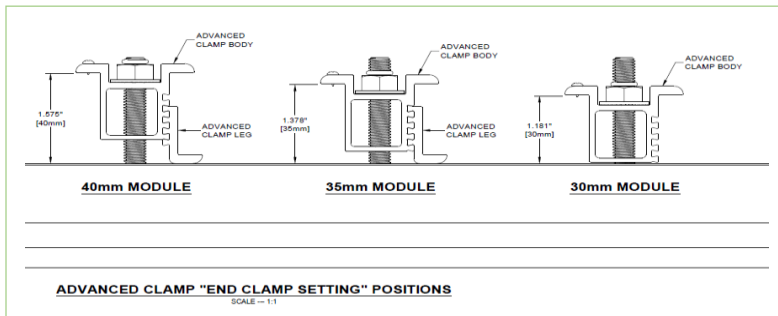
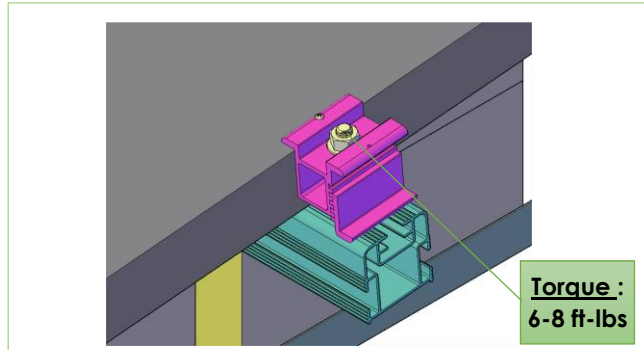
Mid Clamp

1. Place clamp on rail near first module.
Insert T-bolt inside the **top slot of the rail**.
2. Slide next module. Torque bolt to 6-8 ft-lbs



End Clamp

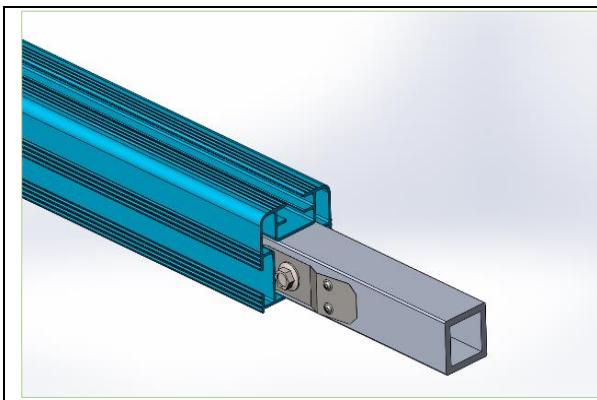
1. Place clamp on rail near end module.
2. For 30 mm thick module only, Mid clamp must be used to replace End Clamp (See figure below).
Torque bolt to 6-8 ft-lbs



For 40mm, 35mm and 30mm thick modules, use corresponding end clamp configuration as shown on the figure beside.

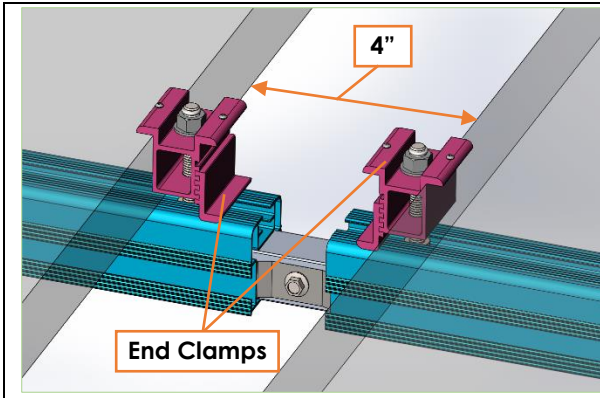
Note: T Bolts are inserted into the top slot of the rail.

7. Rail Splice Installation



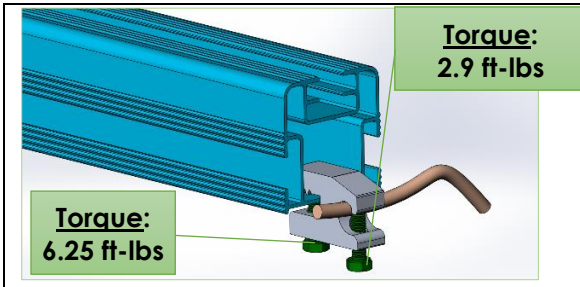
- Join rails by inserting splice bar into first rail, then sliding second rail over splice. The integrated bonding washer bonds the two pieces of rail. No braided jumper is necessary.
- Splice bars must be inserted into the cavity of the Advanced rail before you can complete the installation to the L-Foot
- Make sure splice bar locations do not land directly over an L-Foot. Splice bars should be roughly 1/3 distance between L-Foot locations

8. Expansion Joints

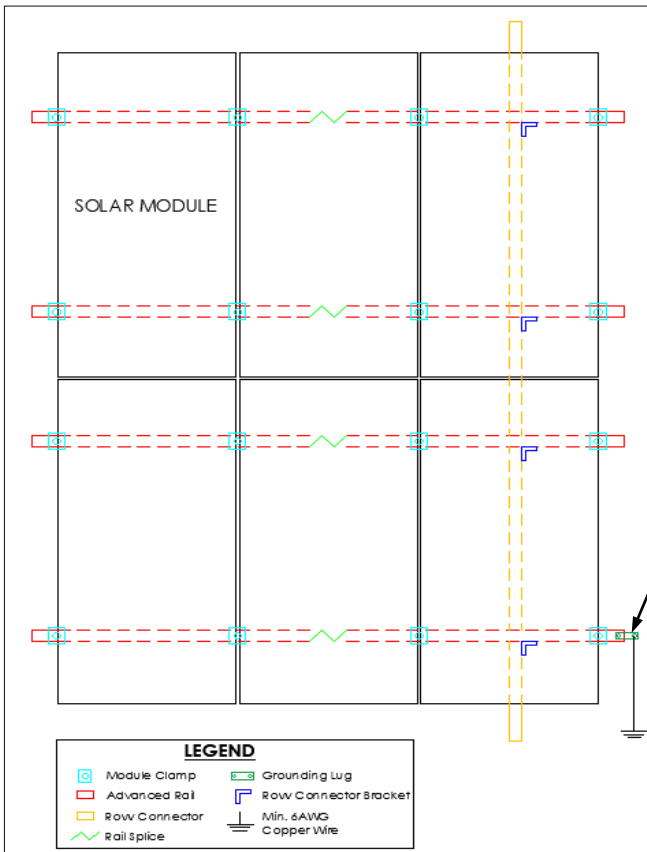


- Expansion joints are required to minimize stresses to the racking, modules and the roof due to thermal expansion.
- Adding an expansion joint consists of ending a row of modules using end clamps, adding rail splices, then beginning the row again using end clamps on the adjacent rail.
- Expansion joints are typically added every 27 modules, though it is recommended to follow the rail layout drawings provided.

9. Grounding / Bonding



- As per the diagram beside, use SGB-4 to bond the last rail of each sub-array using Min.#6 copper wire. North-South bonding of each array is achieved through the row connector and RC bracket. System grounding must be in accordance with the National Electrical Code, ANSI/NFPA 70.



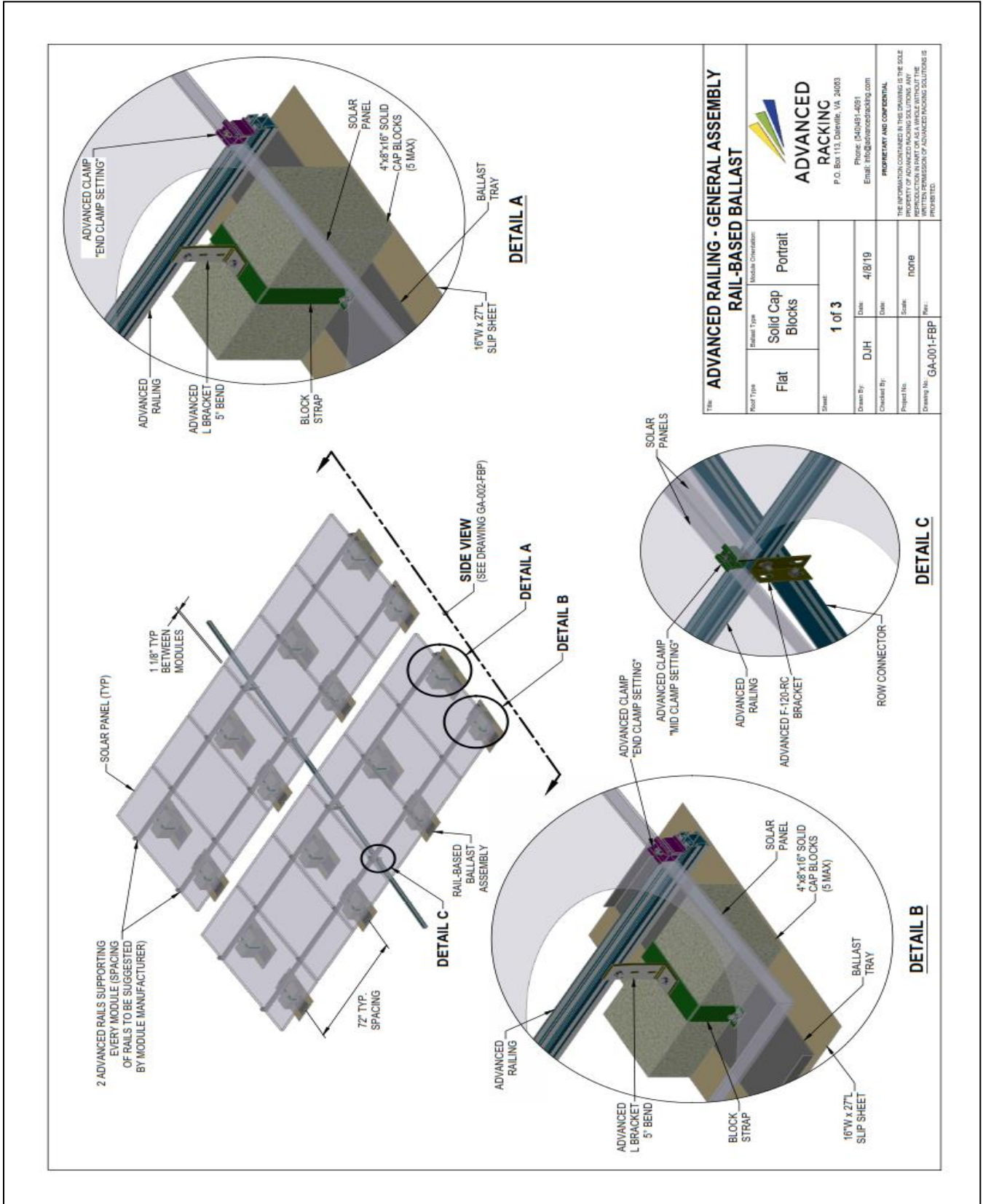
Affix UL2703 label to racking near final grounding lug (i.e. last ground lug before ground wire leaves array for combiner or inverter).

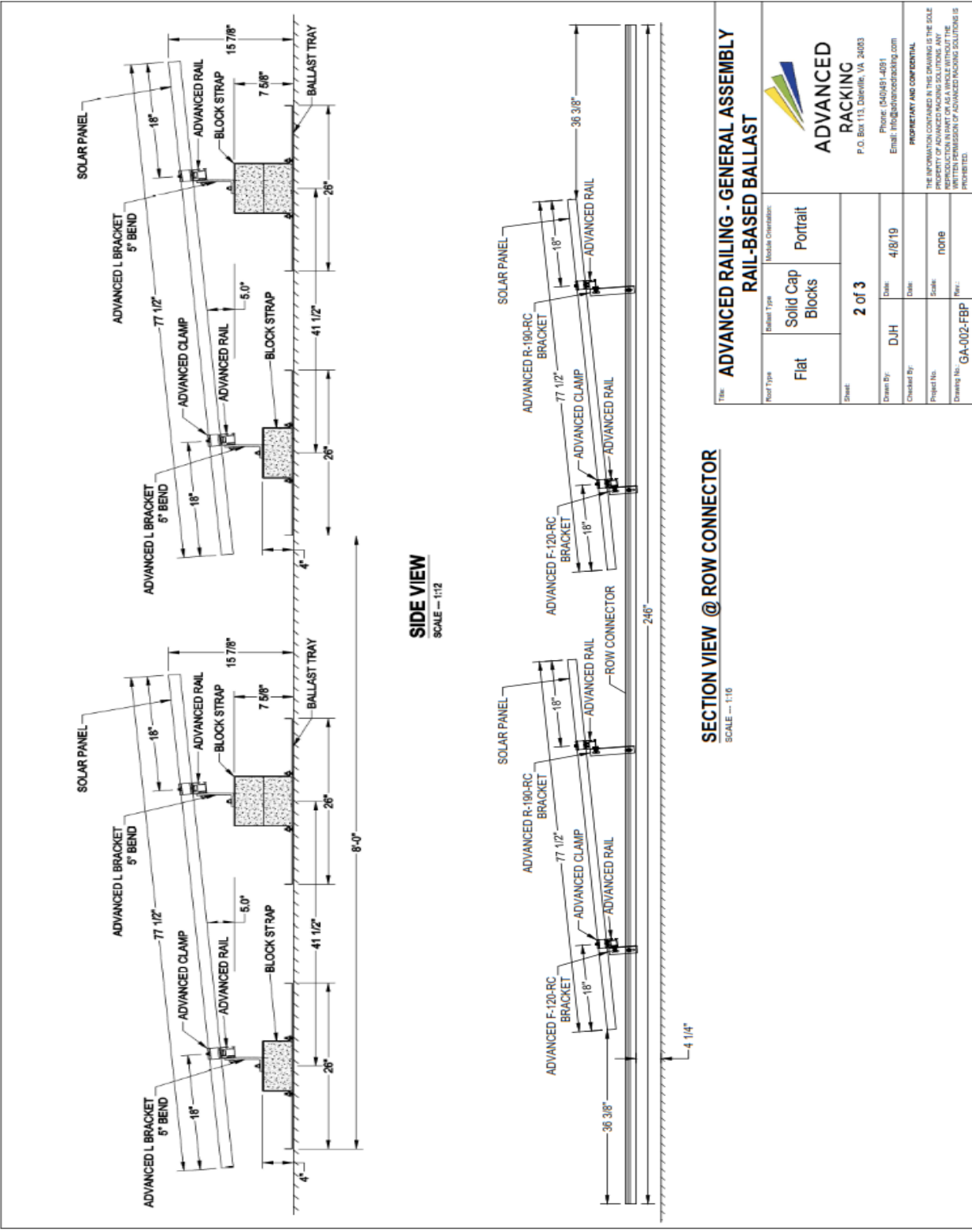
NOTE: Module clamps have piercing pins achieving an electrical bonding between the module and the advanced rail.

NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION.

NOTE: AFFIX UL2703 LABEL TO THE RACKING IN A VISIBLE LOCATION NEAR THE GROUNDING LUG AT FINAL BONDING LOCATION.

10. General Arrangement Drawing





ADVANCED RAILING - GENERAL ASSEMBLY
RAIL-BASED BALLAST

Roof Type	Flat	Module Orientation	Portrait
Panel Type	Solid Cap Blocks		
Sheet	2 of 3		
Drawn By	D.J.H.	Date	4/8/19
Checked By		Date	
Project No.		Scale	NOTED
Drawing No.	GA-002-FBP	Rev.	

Phone: (540)491-4091
Email: info@advancedracking.com
PROPRIETARY AND CONFIDENTIAL

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF ADVANCED RACKING SOLUTIONS. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF ADVANCED RACKING SOLUTIONS IS PROHIBITED.