

Bonding Approval:

Grounding and Bonding is a challenge with any solar installation. This paper outlines the grounding and bonding certification and approval of the EcoX rail-less racking system, and outlines specific bond connections between components.

What is EcoX?

EcoX is a rail-less racking system designed to support flush-to-roof Solar PV installations. The EcoX system attaches to the roof, and the EcoX components connect individual modules together into an array. EcoX system provides a reliable mechanical support system to mount modules to the roof for the life of a PV installation. In addition, EcoX racking and approved modules create a continuously bonded system. This paper outlines the bonding certification, and shows how bond points are established with the EcoX system.

How EcoX Grounding and Bonding Certified?

EcoX is certified to UL2703. UL2703 is a system certification, designed to rate the racking system with specific approved modules. This testing ensures the EcoX components combined with approved modules create a reliable bond path. The testing consists of multiple test cycles to simulate weathering and corrosion, and validates that the system will remain bonded over time. A copy of the test certificate is included on the following page.

What modules are approved for use with EcoX?

The UL2703 certification includes specific modules that have been tested and validated for use with EcoX. Additional modules may be added over time.

What agency certifies EcoX?

EcoX has been tested and certified to UL2703 by TUV Rheinland PTL, a Nationally Recognized Test Laboratory.

How is the EcoX system labeled?

The EcoX label applied to the back of the skirt component documents the system certification. The bond connections within the EcoX system are documented in this paper. The EcoX UL Certificate documents that the system and all provided EcoX components, along with the listed modules, have passed the UL2703 bonding testing.

Solar / Fuel Cell Technologies Photovoltaic Modules

Attn: Mr. Chris Bamat
Lead Validation Engineer
Ecolibrium Solar
340 West State Street
Unit 22
Athens, OH 45701

July 06, 2015

Letter of Conformance – Bonding Tests

Type of Equipment: PV Mounting System
Model Designation: EcoX2
Serial Number: N/A
Test Requirement: UL 2703

TÜV Rheinland Reference File: L1-ELS150128a (RevB)
TÜV Rheinland Project Number: ELS150128a

Dear Mr. Bamat,

Ecolibrium Solar's **EcoX2 PV mounting system** has been successfully evaluated for electrical Bonding according to the requirements of UL 2703.

Congratulations on this achievement.

The following modules have been evaluated and qualified for use on the EcoX2 racking system with respect to Bonding.

Manufacturer	Module Type/Series	Manufacturer	Module Type/Series
Yingli Solar	YGE 60 (YL2XXP-298)	Q-Cells	Q.PRO-G3
Yingli Solar	Panda 60 (YL2XXC-30b)	Q-Cells	Q.PRO BFR-G3
Trina Solar	TSM-PX05.XX	LG Solar	LGXXXN1C-A3 (Mono Neon)
SunEdison	F-Series: F2XXXXXX-XX	LG Solar	LGXXXS1K-A3
SolarWorld	Pro - SW XXX POLY	LG Solar	LGXXXS1C-A3
SolarWorld	Plus - SW XXX MONO BLACK	LG Solar	LGXXXN1C-G3
SolarWorld	Plus - SW XXX MONO	LG Solar	LGXXXA1C-B3
Canadian Solar	C56P Monocrystalline (C56P-XXXM)	Jinko Solar	JKMxxxP-60
Canadian Solar	C56P Polycrystalline (C56P-XXXP)	Jinko Solar	JKMxxxM-60
Hyundai	HIS-XXXXRW (60-cell)	Jinko Solar	JKMxxxMM-60
Hyundai	HIS-XXXXRG (60-cell)	Jinko Solar	JKMxxxP-60
Hyundai	HIS-XXXXMG (60-cell)	Suniva	OPT XXX-60-4-1B0

This letter may be used as a letter of conformance (LOC) indicating these PV modules are suitable for use on the EcoX2 PV mounting system with respect to electrical Bonding. The EcoX2 racking system installation manual may be updated to include these modules.

Sincerely,



Jack Castagna, PE
Solar Components Program Manager
TÜV Rheinland PTL

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EcoX Bonding Description:

The outline below provides a general guide to explain how the EcoX system functions.

Integrated Bonding:

EcoX components feature integrated bonding. In general, these features “bite” or embed into the aluminum of the module frame and racking components during clamping, creating a bonded connection. The continuity of these connections, and of the EcoX components, is verified and documented by the UL2703 Certification.

Torque requirements:

All EcoX components should be torqued to 14 ft-lbs.

Bonding Continuous Rows:

The clamps and couplings in the EcoX system create a continuous bonded row. Clamps, couplings, and other components bond on the south (or downhill) side of the component. Once a given row of clamps and couplings is installed, all EcoX components in that row are bonded to the skirt or row of modules on the *downhill* side.

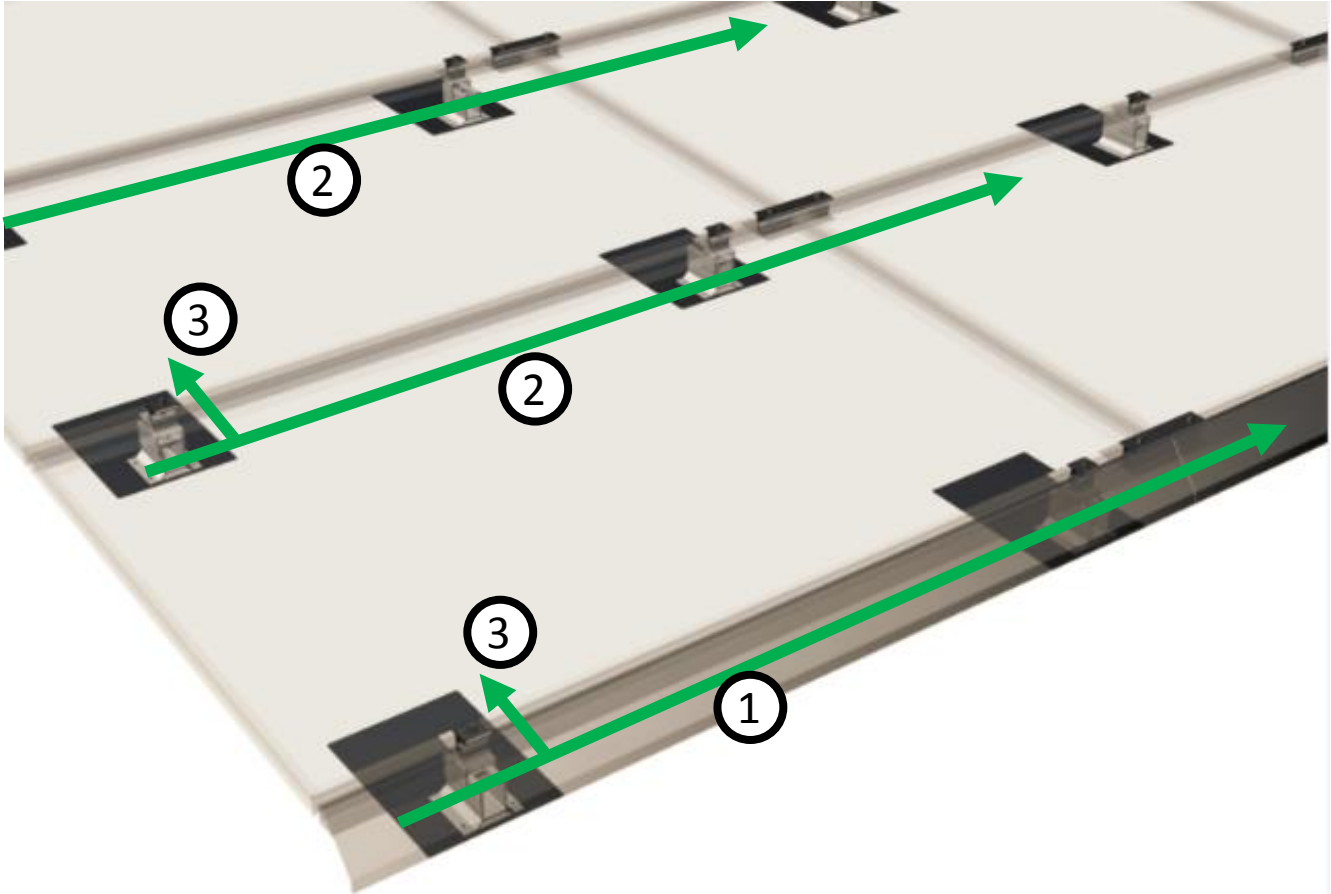
Row to Row Bonding:

Once continuous rows are installed, a bonding clip is used on a single clamp in each row. This bonds the row of skirts to the first row of modules, and each row of modules to the adjacent row. The result is a continuously bonded array, with all racking components and module frames bonded together.

Final Ground Connection:

It is the installer’s responsibility to connect the array to a final ground point.

System Bonding Overview:



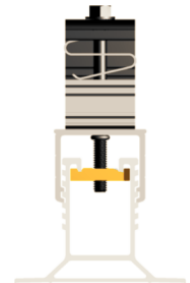
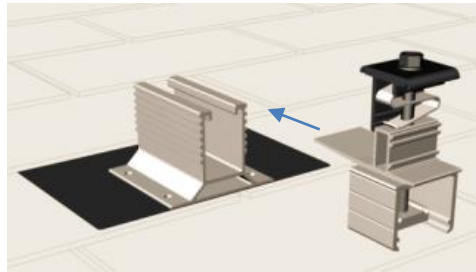
- ① Skirt row continuous bond:**
Continuous bond from base and clamp to skirt. Couplings bond skirt to skirt. Complete row of skirts and EcoX components clamped to skirt are bonded.
- ② Module row continuous bond:**
Continuous bond from flashing through clamp to module. Couplings bond module to module. Complete row of modules and EcoX components clamped to modules are bonded.
- ③ Row to row bonding:**
Bond clip added to uphill side of one clamp per row. This bonds skirt row to modules on downhill row, and module row to next module row on each subsequent row.

Component Connections:

The following outlines bond connection mechanisms between Components:

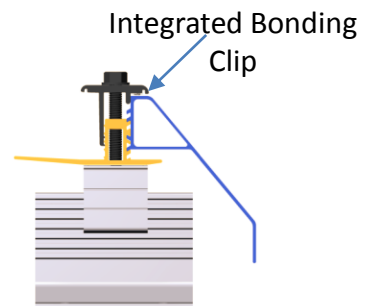
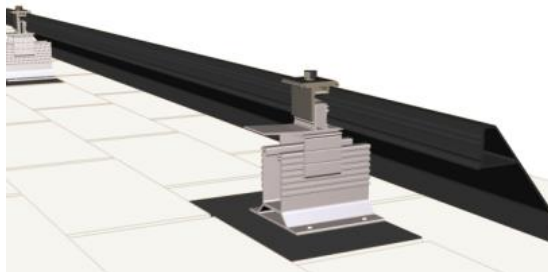
Clamp Assembly to Base:

The clamp slides onto the base. The strut nut (highlighted in yellow) has teeth that embed in the base.



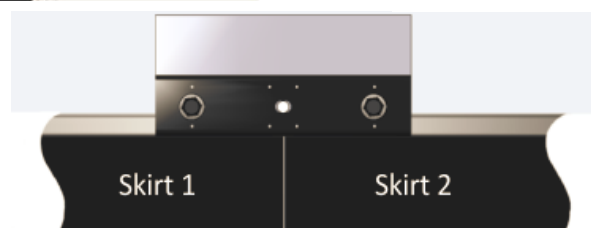
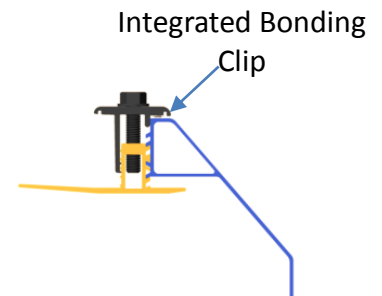
Clamp to Skirt:

The clamp features an integrated bonding clip. This clip bites onto the skirt on the downhill row.



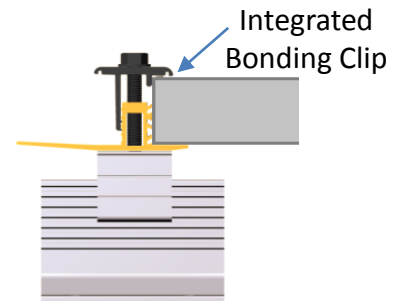
Coupling Bonds Skirt to Skirt:

The coupling features two integrated bond clips. These clip bond each skirt to the neighboring skirt.



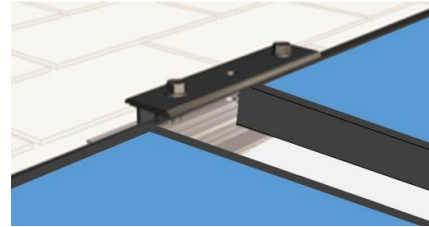
Clamp to Module:

The clamp features an integrated bonding clip. The clamp bonds to the module downhill from the clamp.



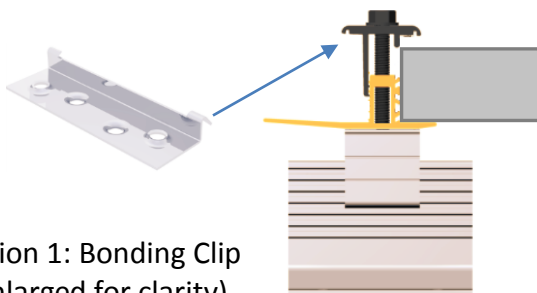
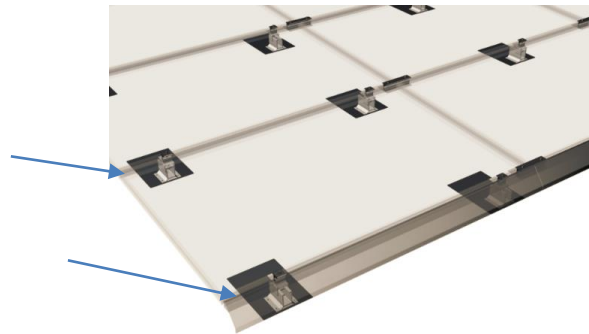
Coupling Bonds Module to Module:

The coupling features two integrated bond clips. On module rows, the coupling bonds each module to the neighboring module.

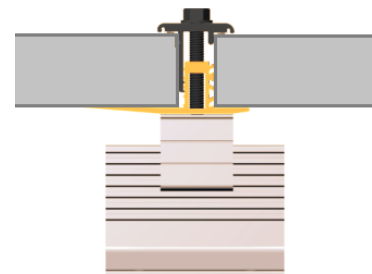


Bond Row to Row:

Additional bonding must be added to bond the skirt row to the first row of modules, and to bond each row of modules together. This can be accomplished by adding a bond clip to the uphill side of each clamp. Alternately, and approved bonding jumper may be used. This is required between the skirt and the first row of modules, and between every row of modules. Either side of the array is acceptable.



Option 1: Bonding Clip
(Enlarged for clarity)



Option 2: Bonding Jumper

