

COMMON MISCONCEPTIONS ABOUT GROUNDING

The WEEB (Washer, Electrical Equipment Bond) is listed to UL 467, standard for Grounding and Bonding Equipment and meets all applicable NEC codes. The following provides answers to some questions that have been asked.

1. The WEEB does not ground the module at any of the locations marked on the module. Does that meet code?

UL1703 requires markings for “a terminal ... intended to accommodate an equipment grounding conductor”. The WEEB does not use an equipment grounding conductor, but bonds the module frame to the mounting structure and therefore need not attach at the marked location. Remember the purpose of an equipment ground is to connect all exposed metal together. If there were something electrically different about the marked location, that would mean the module frame was not correctly constructed. The National Electrical Code in section 250.136 specifically allows bonding electrical equipment to a mounting structure which is then grounded instead of grounding the equipment directly.

2. Does the code require equipment ground connections to be of the make-first and break-last type?

The National Electrical Code Section 250.124(A) applies only to drawout equipment or attachment plugs and mating connectors and receptacles, not PV modules. Furthermore, even when using the old method of running a separate wire to each module, the module may not be able to be completely removed without detaching the equipment ground. In this instance it is better to be completely safe when handling modules: cover the modules first so they can not possibly source any power and, when in doubt, connect an external equipment ground before servicing.

3. Does the code require the WEEB to be listed with each PV module manufacturer?

The WEEB is a general purpose piece of equipment. It is not specific to any one PV module but only requires the same rigidity of the frame that mechanical clamping methods require. It therefore makes no sense to have it tested with each PV module.

Grounding and Bonding Equipment has a specific safety standard, UL 467 and the WEEB meets all requirements of that standard. In the event that specific PV requirements are identified, the standard should be updated to reflect those requirements. The WEEB products would certainly be re-tested to meet any such changes.

4. Does UL1703 require equipment ground connections to be capable of being assembled/disassembled 10 times?

No.

Internally, UL has a requirement of evaluating removable connectors in this manner. The WEEB is intended to be a permanent connection and therefore cannot and should not be evaluated by repeated removal. The other popular method of connection, an equipment ground lug with a thread forming screw, is also intended to be a permanent connection. The process of forming the threads results in a solid electrical connection, but only the first time and, after removal, cannot be counted on to make a reliable connection.

5. Southwest Technology Development Institute (SWTDI) recommends different equipment ground methods. Do they meet code?

SWTDI used to recommend the use of a thread forming screw with an outdoor-rated tin-plated copper lug. Note that although the lug itself may be listed to UL 467, it is not listed for use with a thread forming screw and therefore does not meet code when used in the recommended way. At some point SWTDI stopped recommending this method but hasn't publicized a retraction. Most Authorities Having Jurisdiction (AHJs) are still allowing systems to be installed with this method.

SWTDI is currently recommending the following method. Remove any anodization or oxidation from the aluminum module frame with a stainless steel brush. Apply a thin coat of anti-oxidant film, then use a stainless steel #10 screw, nut and lock washer to attach an outdoor-rated tin-plated copper lug. Attach an equipment ground conductor to the lug. This method is not included in the PV module manufacturer's instructions and therefore does not meet code. It is possible for the module manufacturers to have their product re-evaluated with this method, but no manufacturers have done so to date.

UL is supposed to be internally re-evaluating grounding for PV modules so we may see these non-code compliant methods be discontinued.