

## Frequently Asked Inspection Questions

### What is a WEEB?

The WEEB (Washer, Electrical Equipment Bond) is the first production part specifically intended for use in grounding photovoltaic systems. There is a family of WEEB parts, one for each kind of photovoltaic mounting system. The WEEBs are used to bond photovoltaic modules to the mounting structure. A ground is connected to the resulting composite structure so that the photovoltaic modules are also grounded. This is more technically described in NEC sections 250.136 and 250.134 and discussed at the company website, [http://www.we-llc.com/WEEB\\_nec.html](http://www.we-llc.com/WEEB_nec.html).

### Are WEEBs listed?

Yes, all WEEBS meet ANSI/UL 467, standard for grounding and bonding equipment. Testing was performed by Intertek ETL. The WEEB are listed to US and Canadian standards. A copy of the certificate is available online at [http://www.we-llc.com/PDF/ETL mark.pdf](http://www.we-llc.com/PDF/ETL_mark.pdf)

### Why UL 467 and not UL 1703, standard for photovoltaic modules?

ANSI/UL 1703 only covers photovoltaic modules. Since the WEEB parts involve both module and mounting system, the more general standard, ANSI/UL 467 is required. Also, since ANSI/UL 467 was written with AC systems in mind it is a much more severe specification. All WEEBs are tested to carry a current of 1530 Amperes for 6 seconds. This is much more than any photovoltaic module can source and is why the WEEBs offer better lightning protection than previous grounding methods.

### Why not just use the commonly available grounding lugs?

The lugs are not listed for use in the manner they are commonly installed.

One popular method of grounding photovoltaic modules is to attach a lug to each module, then run a ground conductor between all the lugs. IlSCO and Burndy make a direct burial rated lug, listed to ANSI/UL 467 which is often used. In testing to ANSI/UL 467 for these lugs, the lugs are bolted to a steel plate. The majority of conduction is through the lug and not through the mounting bolt. Some installers instead use a #8 stainless steel screw to mount the lugs and rely on the screw to conduct current from the top of the lug, through the screw, into the module. The NEC does not permit a conductor to be other than copper or aluminum. One might consider the lug/screw combination to be one part; however, the screw is not provided by the lug manufacturer but by third party suppliers who have not had the lug/screw combination part listed.

Testing at Wiley Electronics LLC shows that if the third part suppliers were to have the lug/screw combination parts tested to ANSI/UL 467, they would only be rated for use with a 10 AWG wire maximum. This limitation is due to the high resistance of the stainless steel screw.

## How can an installation using WEEBs be verified?

We suggest measuring electrical resistance. This directly verifies the ground connection without the need for visual inspection. We recommend using an ohm-meter set to its lowest scale. Safety pins are a convenient extension to the ohm-meter leads. The sharp points can penetrate non-conductive aluminum oxide layers and be easily stored.

### 1. Verify module frames are connected

- a) Select two modules at random.
- b) Verify that the ohm-meter and probes are functioning.

Scratch through the anodized layer of the first module frame at two points and verify that continuity exists between the two points. Repeat for a second module frame.

- c) Verify continuity between the scratched points of the two module frames.
- d) Repeat steps (a) – (d) for a statistically significant number of other pairs of modules.

### 2. Verify modules are connected to mounting rails

- a) Select a module and mounting rail at random.
- b) Verify that the ohm-meter and probes are functioning.

Scratch through the anodized layer of the module at two points and verify that continuity exists between the two points. Repeat for the mounting rail.

- c) Verify continuity between the scratched points on the module and mounting rail.
- d) Repeat steps (a) – (c) for a statistically significant number of other modules and mounting rails.

### 3. Verify mounting rail is grounded

- a) Select a rail at random.
- b) Verify that the ohm-meter and probes are functioning.

Scratch through the anodized layer of the mounting rail at two points and verify that continuity exists between the two points.

- c) Verify continuity between one of the scratched points and the equipment ground conductor.
- d) Repeat steps (a) – (c) for a statistically significant number of other mounting rails.



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## **Servicing a grounded array**

Section 60.48 of the National Electric Code states that

“Where the removal of equipment disconnects the bonding connection between the grounding electrode conductor and exposed conducting surfaces in the photovoltaic source or output circuit equipment, a bonding jumper shall be installed while the equipment is removed.”

In rail mounted systems, each WEEB connects to two modules as is shown in figure 1. If the two WEEBs between the modules are removed in order to remove one of the modules, then the ground to the other module would be disturbed. To prevent this from happening, before a module is serviced, a new WEEB should be added at the far end of the module which is not being removed. This is shown as a circle in the figure. The additional WEEB connection will ensure that ground is present during the service operation.