



## UNIRAC TECHNICAL BULLETIN

**Bulletin Number:** TB-130402-1455-1

**Theme:** Comparison of UL 467, UL 1703, and UL 2703

**Background:** There is some confusion regarding the differences in grounding and bonding requirements and testing between UL 467, UL 1703, and UL 2703. This bulletin attempts to clarify the similarities and differences between the 3 documents.

**Description:**

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1. UL 467 description and scope
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1. The scope of UL Standard for safety for Grounding and Bonding Equipment, UL 467 (1st edition 1943) is the following: *“These requirements cover grounding and bonding equipment for use in connection with interior wiring systems in accordance with the National Electrical Code, NFPA 70. These requirements also cover hospital grounding jacks and mating grounding assemblies.”* UL 467 as a stand-alone product certification has been interpreted to be insufficient by some AHJ’s due to the lack of atmospheric and corrosion testing required in the testing protocol. Also, the current protection typically associated with industry standard grounding lugs far exceeds the design loads of typical photovoltaic systems.
  2. The scope of UL Standard for safety for Flat-Plate Photovoltaic Modules and Panels, UL 1703 (1st edition 1986) is the following: *“These requirements cover flat-plate photovoltaic modules and panels intended for installation on or integral with buildings, or to be freestanding, in accordance with the National Electrical Code, NFPA 70 and Model Building Codes.”* UL 1703 defines electrical safety tests and includes atmospheric and corrosion tests. It is better matched to expected design loads of photovoltaic systems. However, the scope of UL 1703 limits product certification to photovoltaic modules only and does not include racking.
  3. The scope of UL Outline of Investigation for Rack Mounting Systems and Clamping Devices for Flat-Plate Photovoltaic Modules and Panels, UL 2703 (proposed in 2011) is the following: *“These requirements cover rack mounting systems and clamping devices for flat-plate photovoltaic modules and panels that comply with the Standard for Flat-Plate Photovoltaic Modules and Panels, UL 1703, intended for installation on or integral with buildings, or to be freestanding (i.e., not attached to buildings), in accordance with the National Electrical Code, ANSI/NFPA 70 and Model Building Codes.”* Racking can be used as part of the grounding system for photovoltaic systems. For those instances, UL 2703 was created using the electrical safety requirements from UL 1703, including the atmospheric and corrosion tests. As of May 4, 2012, UL 2703 is still an outline of investigation and has not been approved by the technical committee organized by Underwriters’ Laboratories. As such, some AHJ’s may be apprehensive to approve the use of products certified to that

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standard. The important point to stress in that situation is that the grounding and bonding requirements of UL 2703 are exactly the same as UL 1703, the standard for modules. From an electrical perspective, any racking product certified to UL 2703 could have been certified to UL 1703. UL 2703 is not an adequate structural standard. In order to be fully compliant to the International Building Code, a racking product should have an ICC Evaluation Service Report or ICC-ESR to ICC Acceptance Criteria 428. SOLARMOUNT-E is the only racking product to date that has both electrical and structural product certifications.

- 4. Authorities Having Jurisdiction (AHJ's) count on standards organizations like UL to produce standards that help them evaluate the inter-operability of products from different manufacturers. In the simplest example, an Inspector must trust that a UL Listed appliance can work safely with a UL listed electrical outlet or receptacle. This is a good analogy for the use of photovoltaic modules that use racking as part of the grounding path. It should be acceptable and safe to use photovoltaic modules and racking with product certifications for UL 1703 and UL 2703 without cause for concern.

However, there is a provision in the UL 1703 standard that can be interpreted to negate the statement above. UL 1703 requires module manufacturers to specify approved grounding method in their installation instructions. Some people within the solar industry read that requirement to mean that the module must be tested in conjunction with the racking to both UL 1703 and 2703 standards. This is contradictory to the intent of inter-operability mentioned above. Use of this very strict interpretation would require every module to be tested and listed with each individual racking system. This is not feasible for the solar industry due to the time and cost it would incur. Using the same logic, every electrical appliance would have to be tested with every electrical outlet.

In conclusion, it should be acceptable and safe to use products certified to UL 2703 or UL 467 with products certified to UL 1703. Module manufacturers may choose to add language to this effect to their respective installation manuals.

- 5. UL 467, UL 1703, and UL 2703 call for anywhere from 5 to 23 separate tests; however, with respect to bonding, all three define resistance tests as shown below.

UL 2703	UL 1703	UL 467
(sect 13) resistance < 0.1 Ohm at 2x the fuse Amp rating	(sect 25) resistance < 0.1 Ohm at 2x the fuse Amp rating	(sect 19) resistance < 0.03 Ohm at 30 Amps

Unirac's SOLARMOUNT-E system is classified to a 15 Amp fuse rating and therefore was tested at 30 Amps. The maximum resistance for mill finished parts was 0.005 Ohm; for dark finished parts, 0.022 Ohm.