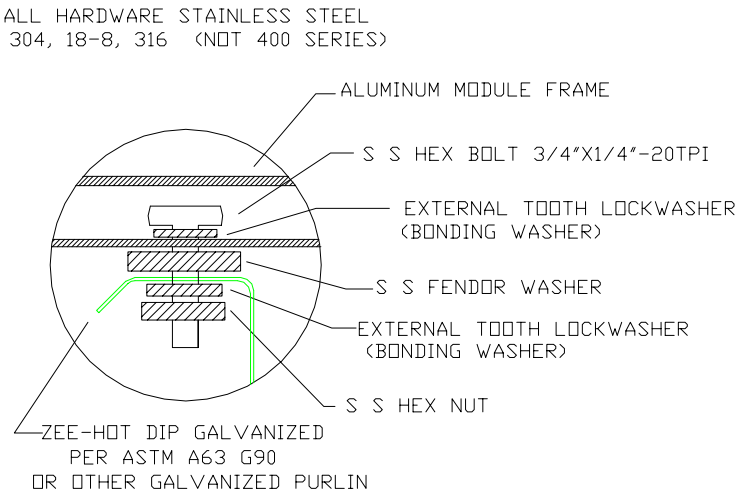
July 28, 2004

Subject: UL and NEC Compliance on bonding PV modules

Shell Solar PV modules can be grounded through means of mechanical fasteners and subsequent grounding of the array support structure through a single equipment grounding conductor. This method of grounding all non-current carrying conductive parts (equipment grounding) reduces the number of grounding conductors yet meets UL and NEC requirements for grid tied PV systems. The methods and standards described below.

- ¼" stainless steel hardware shall be used to fasten the modules to a steel or aluminum strut or other support member. An external tooth SS lock washer shall be used between the module frame and fastener head as shown. If aluminum is used for the support member an external tooth washer shall also be used. At least four fastening points shall be used be module.

- The module frame cannot be used as a path for the grounding circuit. In other words, if you remove a module from it's support frame, all other modules in the array must remain grounded.



MODULE BONDING DETAIL

UL1703, Section 11, Bonding and Grounding states the following:

11.2 Routine maintenance of a module or panel shall not involve breaking or disturbing the grounding path. A bolt, screw, or other part used for bonding purposes within a module or panel shall not be intended for securing the complete device to the supporting surface or frame.

11.3 Bonding shall be by a positive means, such as clamping, riveting, bolted or screwed connections, or welding, soldering (see 11.5) or brazing. The bonding connection shall penetrate nonconductive coatings, such as paint or vitreous enamel.

11.4 A bolted or screwed connection that incorporates a star washer under the screwhead or a serrated screwhead may be acceptable for penetrating nonconductive coatings. If the bonding means depends upon screw threads, two or more screws or two full threads of a single screw shall engage the metal.

Equipment grounding conductors must be sized appropriately and depends on the installation. When the above methods are used, UL and NEC standards are met.

If you require further clarification or have other questions, please call at 805-388-6234.

Sincerely,

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