

UNDERWRITERS LABORATORIES INC. CERTIFICATION REQUIREMENT DECISION

This Certification Requirement Decision is prepared by UL LLC. It is normative for the applicable UL Product Certification Program(s); however, it is currently not part of the UL Standard(s) referenced below.

Product Category (CCN): QIKA

Standard Number: UL 3703

Standard Title: Standard for Solar Trackers

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Section / Paragraph Reference: 6 Mechanical Assembly (reference only), 16 Bonding for Grounding and PERFORMANCE

Subject: Add additional requirements for spring clip module securement and pinned joints in the bonding path.

DECISION:

6 Mechanical Assembly

6.2 A tracker shall be assembled so that it is not adversely affected by the vibration of normal operation.

16 Bonding for Grounding

16.6 A connection in the bonding path shall be by a positive means, such as by a clamp, a rivet, a bolted or screwed connection, or by welding, soldering, or brazing with materials having a softening or melting point greater than 455°C (850°F). The bonding connection shall penetrate nonconductive coatings, such as paint or vitreous enamel. Ferrous metal parts shall comply with Protection Against Corrosion, Section 6. Revolute or pinned joints in the bonding path shall be assessed for positive means according to the Section 62A, Cyclic Load Test.

PERFORMANCE

62A Cyclic Loading Test

62A.1 The provisions of this section establish a minimum level of fatigue resistance for the structure (see 6.2) and bonding path (see 16.6), for units that include revolute or pinned joints.

62A.2 The tracking system, composed of the module, module mounting means and supporting structural members shall resist low-cycle fatigue without a loss in mechanical integrity or loss of bonding path circuit continuity, when subjected to a minimum of 15,000 cycles of the alternating load defined in this section.

62A.2.1 Mechanical Integrity: The Tracker shall not exhibit evidence of structural or mechanical failure, visual permanent deformation that may adversely affect system safety or compliance, and for any PV module securement means including top-down clamps, there shall not be any shifting/movement.

62A.2.1.1 The load applied shall be based upon the summed tributary area of the modules defining a repeatable unit, including all functional interfaces of the racking system.

62A.2.1.2 If the modules are stowed within $\pm 10^\circ$ of flat/horizontal during high wind speeds (greater than 50 mph), the applied loading shall be 10 psf minimum in the negative (downward) direction and 5 psf in the positive (upward) direction.

62A.2.1.3 If the modules are not stowed within $\pm 10^\circ$ of flat/horizontal during high wind speeds, the applied loading shall be 20 psf in the negative (downward) direction and 10 psf in the positive (upward) direction.

Exception: Other applied loads (e.g., originating from wind tunnel testing or computational fluid dynamics modeling) are allowed if they are clearly stated on the manufacturer's technical datasheet and installation instructions.

62A.2.1.4 The load(s) shall be applied as point loads at the center of the module(s), or as distributed load(s) across the modules and the load shall vary cyclically from positive to negative at a frequency not greater than 2 HZ.

62A.2.2 Bonding Path Continuity. Bonding paths shall pass the Bonding Path Resistance Test (below) at the start and completion and not exhibit loss of circuit continuity between readings.

62A.2.2.1 The Section 42 Bonding Path Resistance Test shall be measured within the first 100 cycles and within the last 100 cycles of the applied cyclic load.

62A.2.2.3 Between resistance measurements, the bonding path is to be monitored for loss of circuit continuity using an instrument with a sampling rate at least 20x faster than the maximum mechanical cyclic rate. If the bonding resistance measurement includes an averaging function, the averaging window shall be minimum 20 times smaller than the fastest mechanical cycling rate.

RATIONALE FOR DECISION:

Regarding mechanical integrity, UL 3703 refers to UL 2703 for module mounting clamps. UL 2703, Section 6 does not preclude the use of spring-style clamping means for modules and 6.3 makes clear the need for adequate structural integrity of the clamping means to retain the modules under cyclic load. UL 2703 specifically addresses compliance for mechanical integrity through construction means with conventional threaded fasteners, rivets, and fusion welding. For other designs, a performance-based assessment is needed to establish suitability. The approach applied in this CRD is a low-cycle fatigue test. It is similar in its 10,000 cycle baseline to the Cyclic Load test described in IEEE 1262-1995 but is modified for actual load value to drive consistency with the minimum design loads specified in UL 2703 Sec 21.4 and incorporates a minimum safety factor of 1.5 to the cycle count. The value of applied load is different for trackers that stow during high speed wind events and aligns to UL 2703 in its minimum static load requirements for trackers that do not perform a stow function. It is recognized that the predominance of Computational Fluid Dynamics modeling and boundary-layer wind tunnel testing means that the manufacturer may wish to apply different loads during this test and that is allowed provided that the loads used are clearly stated in their technical documentation.

To assess the suitability of a pinned or revolute joint present in the bonding path, the key issue is the validation of "positive means" as referred to in UL 3703 Section 16.6 and present in UL 2703 Section 9.5. The daily motion of a tracker and its exposure to wind leads to potential fatigue-induced degradation of the bonding path, with a potential failure mode leading to a shock hazard. The cyclic load test described above is considered a suitable means to assess low cycle fatigue degradation of the bonding path when a resistance measurement at the start and end of the test is below 0.1 ohm and there is no loss of bonding circuit continuity evident through the course of the test.

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