

Subject 1741

October 31, 2018

SUMMARY OF TOPICS

The following changes in requirements to the Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741, are being proposed:

1. Rapid Shutdown Revisions to Better Align with the Standard for Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction, UL 61730-1.

STP BALLOTS AND ALL COMMENTS DUE: November 30, 2018

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~.

1. Rapid Shutdown Revisions to Better Align with the Standard for Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction, UL 61730-1.

RATIONALE

Proposal submitted by: Tim Zgonena, UL LLC

In the environmental Table 88.1, Outdoor and Roof top columns are the same since rooftop installations are typically outdoor. Therefore, it is proposed that the roof top column be deleted with no change in requirements.

For Table 94.4, the existing UL 1703 standard requires parallel TC200 and HF10 tests on separate samples of PV modules. The more recent UL 61730 based standard requires a TC50 followed by a HF10 on the same sample. The published UL 1741 PVRSE requirements appears to be an incorrect hybrid of both standards and requires a single sample to be subjected to 200 Temperature Cycles (TC200) followed by 10 Humidity Freeze Cycles (HF10). This combined (TC200 and HF10) sequential testing on the same sample is not aligned with either published PV module UL standard. This hybrid test sequence is a much more severe evaluation protocol that may introduce unforeseen and unrepresentative failure modes. This proposal is to replace the TC200 tests with TC50 tests so the resulting (TC50 +HF10) sequential testing will better align with the UL 61730 standard that is replacing UL 1703.

PROPOSAL

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Table 88.1
PVRSS rated location based environmental requirements

Rating	Environmental conditions per the manufacturer's specifications, subject to the following requirements				
	Outdoor/<u>rooftop</u>	Indoor, unconditioned ^c	Indoor, conditioned	Roof top (part of the PV module assembly or mounted less than 1/2 inch from the module substrate) ^e	Roof-top
Pollution degree ^a	Min. PD3	Min. PD3	Min. PD2	Min. PD3	Min. PD3
Wet location	Yes	No	No	Yes	Yes
Rated Ambient Temperature Range ^b	-40 °C to +50 °C or manufacturer specified	-40 °C to +50 °C or manufacturer specified	0 °C to +40 °C or manufacturer specified	-40 °C to +50 °C or manufacturer specified	-40 °C to +50 °C or manufacturer specified
Equipment test temperature range	Same as Rated Ambient Temperature Range	Same as Rated Ambient Temperature Range	Same as Rated Ambient Temperature Range	Air -40°C to +65 °C or manufacturer specified Substrate -40°C to +85 °C or based on manufacturer specified using formula ^d	Same as Rated Ambient Temperature Range
Relative humidity range	4 % to 100 % (Condensing)	5 % to 95 % (Non (Non condensing)	5 % to 85 % (Non (Non condensing)	4 % to 100 % (Condensing)	4 % to 100 % (Condensing)
UV exposure	Required	Not Required	Not Required	Required	Required
Ingress protection	Min. Type 3R or IP34	Min.Type 1 or IP20	Min Type 1 or IP20	Min. Type 4X or IP65	Min. Type 3R or IP34.

^a Describes the environment around the equipment with respect to moisture (such as rain or condensation) and contaminants. Equipment enclosure designs may allow for a reduction in pollution degree level applied to the internal circuit being evaluated. Pollution degree levels are defined in UL 840.

^b Manufacturer's specified rated ambient range shall be clearly identified in the installation instructions with the intention that the AHJ will determine suitability. The temperature range for a geographic region shall be the Extreme Annual Mean Minimum Design Dry Bulb Temperature for the minimum design temperature and the 2% high design temperature for the maximum design temperature. These values are found in the ASHRAE Handbook – Fundamentals, 2017 available online at <https://www.ashrae.org/resources--publications/handbook/2017-ashrae-handbook-fundamentals>.

^c These spaces provide environmental protection and may not provide protection from cold ambient and may also result in an increased high ambient.

^d Conditions stated are based on the PVRSE mounted behind the PV module and subjected to heat from the substrate and air temperature between the module and mounting surface. The specified air temperature assumes the module is mounted off the roof with no obstruction, which results in a 15 °C difference between the rated ambient air (per note b) and air behind the module. The module substrate temperature can be determined by the formula:

$$T_{cell} = T_{amb} + 1200/800 \cdot (NOCT - 20)$$

where T_{amb} is the rated ambient air temperature per note b.

Note: NOCT is determined at 800W/m² at an ambient temperature of 20 °C. The above adjusts this for more realistic worst-case irradiance to ensure maximum temperatures.

Air temperatures behind the module and substrate temperatures will be higher for other systems that are enclosed, built in or have other obstructions that restrict natural air movement under the array. Additional testing and evaluation of the design will be necessary to determine substrate and behind the module air temperatures for these systems.

^e The ½ inch distance is solely used to determine the environmental requirements for PVRSE testing and does not address the requirements for the combination of PVRSS component/ equipment and PV module which may have separate requirements and conditions of use to address concerns including but not limited to electrical, mechanical and environmental impact on the PV module. For PVRSE mounted behind the PV module or array (> ½ inch), the ambient rating may need to be higher than the geographic location ratings.