

**Solar ABCs**  
**Product Safety Panel Meeting/Teleconference**  
July 9, 2008  
3:00 pm, Central Time  
Facilitated by Underwriters Laboratories

This teleconference was an update on on-going deliverables to gain feedback and determine and affect on the current direction of these projects.

### **1. PV Grounding**

A small task group that includes Brian Wiley, Bill Brooks, John Wiles and Tim Zgonena is revising the proposed revision to UL 1703 that was originally submitted by Brian Wiley. While that proposal is being re-developed separately, it may be possible to include it in the UL 61730 documents.

These proposed requirements include a separate test program for PV ground lugs that will address both UL 1703 and UL 467 requirements. It was noted that UL 467 does not address all of the PV requirements.

Major issues being addressed are the dissimilar metals, reliability, and field failures of PV ground connections. Goal is to provide a suitable test program and perhaps a generic solution that will not require long-term testing.

A PV Manufacturer raised a concern of the UL publication and implementation of UL 1703 Grounding CRD document. Tim Zgonena explained that the CRD was a clarification of existing published UL1703 requirements, not new requirements. It was issued and implemented to address reoccurring field failures of PV ground connections and many mfrs were making change an increasing number of field failures and AHJ complaints. After review of these complaints UL found that many manufacturers were revising their installation instruction grounding methods without the supporting testing required by UL 1703. PV manufacturers were required to either revise their instructions to match what was evaluated and testing or to evaluate and test their product to match their instructions.

Rob Wills noted that similar grounding issues are experienced in wind turbine generating systems and the issue is being worked on this under a NEC working group. Installers see huge pieces of aluminum bolted together with SS, so seems that those parts of arrays are solidly grounded as opposed to copper wire on aluminum.

### **2. UL61730-1 and UL61730-2 Drafts**

RTI Program:

During the IEC WG2 meeting in San Francisco there was a proposal by one of the European PV test labs to remove the RTI requirements from IEC 61730 because it was too time consuming

and that some IEC safety standards do not require long term thermal stability requirements for polymeric materials. This proposal was also based upon a supposition that the TC 200 and Damp heat test performed on the module during type testing would be sufficient to identify long term aging failures of critical polymeric materials. Tim will propose options in the upcoming revisions of IEC 61730 during the Korea Meeting of WG2 in October.

The existing IEC 61215 and 61646 test programs for performance documents do not evaluate long-term aging of materials. Tim is working with IEC technical Committee for polymerics to establish IEC requirements.

The following are the key differences between UL and IEC versions of 61730-1 and 61730-2.

Grounding – more important in US

Materials, components (evaluated to North American standards in US, EN for Europe)

NEC related references and requirements,

PV Connector requirements,

Markings and rating requirements,

Inconsistency in spacings table (IEC does not include creepage – proposed IEC creepage table).

Sharp: Will they be easy to harmonize? Answer: should be. If we can adopt IEC methods, that is what we will do. In some cases, will be able to apply both options.

UL 61730 was derived from IEC version with the addition of National Differences.

Sharp: Time table for UL 61730? Out to panel by the end of this month. There is a 45-day comment period. Send out for ballot, 45-day period. Address all comments, may result in another ballot. So, minimum is 90 days.

SunPower: Will 61730 completely replace UL 1703? Yes, at some time in the future.

At least 24 months, minimum of 18-month (not likely) effective date)

George Kelly: Parts already Listed to UL and certified to UL 61730, will there be any additional testing? Yes, likely to address US Deviations. Will have to evaluate on a case-by-case basis.

Many of the differences are related to correcting the incorrect references to outside component standards. Ex: polymeric standard references, omissions to environmental enclosure requirements. All of these issues will be proposed to the IEC as revisions to the IEC Working Group 2.

### **3. PV AFCIs**

UL R&D is developing trip times and trip signatures to avoid DC arcing as a failure mode and develop appropriate trip times. There is currently no solution available. AFCI for residential applications are available. These products look for AC arc signature and then disconnect upon identification. We are looking for the same type of function for PV DC circuits. A proposal for 2011 NEC revision will be prepared.

Rob Wills: If there is a fault, how to remove from array or string? Good question. Braking of circuit is difficult but possible. Currently just evaluating timing, not how to solve the issue. Rob

looked at a few years ago; proposal was on table for NEC, Solarex indicated that it would cause more problems than not due to PV design for continuous short-ckt operation.

SunPower: There is no product to address it now, so some product must be on market (available) to institute requirements, is this the case? Document will be written this year with requirements enabling commercial product development. Requirements must be able to be followed before using.

Howard B: NEC or IEC requirements (UL vs. IEC)? Both.

George Kelly: What process is being followed (similar to AC): Brushed motors have an arc continuously; PV water pumps have an arc, old charge controllers with pwm. Problem is not as severe in PV as AC. Verified that currently the requirements are being defined. AC had a task group, DC is working towards that. New and cutting edge at this time. Time based on cotton blankets surrounding broken cord. Our case, more like dried leaves. Ignition time is shorter for leaves than cotton blankets. Arcing is continuous in PV and will repeat on subsequent days.

#### **4. UL5703 PV Polymeric material evaluations**

UL Subject 5703: Originally for backskins, accelerated aging, peel test, electrical properties; and similar to requirements under development for encapsulants. Since new encapsulant materials are more common and there isn't any history of performance, we can't grandfather certifications. Program developed to be added to 5703, which will be republished to include non-EVA encapsulants.

#### **5. UL fire test project**

This project is intended to look at whether or not there is an effect on the fire resistance Class rating of roofing material if a PV module with a lower Class fire resistance rating is installed above it. There currently isn't any test data that shows what happens with a Class B or C over a Class A roofing material. This research project will also provide guidance on if different test set-up methods should be considered specifically for PV modules.

SunPower: Carl: Will industry be able to review test methods? The research project scope will be sent to out for comments through Solar ABCs prior to the next stakeholder meeting in October.

Joel Davidson: Fire testing, how will it differ from roofing tests? Now, it is basically the same as for roofing materials. Future, test modules above roofing materials not as if the modules were the roofing material. Tim: No data currently available, we have only been evaluating if the assembly passes. Speaker (unknown): So this will impact building code that specifies that class C materials may be mounted over roof without impacting roof rating? Tim: Not aware if those will be impacted. Need to wait until the research project is completed to draw any conclusions. We can address off-line.

SunPower: Timeline? Impact may be major, may not – is there going to be a period of time before effective date? Tim: local code issue, don't have to have a roof flame rating for UL Listing. Don't know how it will play out. SunPower: because it may have a major impact, most people on this call would like to be involved – should be done as publicly as possible. Tim: We don't have the data; need to determine what the issues are, if any, before considering any changes to requirements for modules.

SunPower – Carl Lennox: Key point, UL 790 tests may or may not be suitable test method which is why we need to get industry involved. Tim: Main point is how to determine if modules affect roof ratings and if the test method needs to be addressed.

## **6. UL 2579 Outline of Investigation for Low Voltage PV Fuses.**

600 V AFCI conference – The biggest failure rate is occurring with fuses based on thermal cycling (ambient) physical damage. Results in arcs due to burning open – results in fires in combiner boxes. UL is working with IEC and liaisons from fuse committees and PV committees, SC32B and C; UL document developer is chairman of IEC group.

Rob Wills: 2008 NEC requirements include inductance of PV wiring and time constants in justification for language, taken from battery language and how time constants in battery circuits. Related to battery discharge, called effective inductance. Beware of this, time constant used is wrong.

### **Other Issues**

Did not address deliverable on UL / IEC 62109-1 and -2. This draft will be sent back out for comment in August. It was on agenda, but not covered fully. Part -1 is good to go, Part -2 issues remain with VDE 10216 for large inverters. Technical Committee 82 working group 6 is responsible. Feedback was received on scaling, but will need a week or two to sort out. Working group feels they are close to completion.

Next meeting will be at Solar Power International in October.