

Solar ABCs Product Safety Panel

Evelyn Butler
Regional Business Manager
Renewable Energy, Automotive

Tim Zgonena
Principal Engineer
Distributed Energy Resources Equipment and Systems
Underwriters Laboratories Inc.



Underwriters Laboratories Inc. (UL)

- An independent, not-for-profit product safety organization testing and certifying products
- Writing and publishing Standards for Safety
- Accredited by OSHA as a Nationally Recognized Test Laboratory (NRTL) and the Standards Council of Canada
- The only IECCE North American National Certification Body (NCB) for photovoltaic (PV) product certification
- North American market leader in certification



Solar ABCs Product Safety Panels and UL Standards

- Provides an open forum to industry and other interested parties
 - Comment on work being done
 - Suggest areas to Solar ABCs to be addressed
 - Could then be presented to UL STPs
 - Make inquiries and ask questions about existing standards and requirements
- Identify and address gaps in standards requirements
- Provide additional opportunities to collaborate with research studies on related projects



Product Safety Panel - General

- The majority of activities and deliverables of the *Product Safety Panel* center on planning, coordination, and outreach tasks related to UL standards covering PV modules and systems components including:
 - UL 1703 and UL61730 (modules)
 - UL1741 and IEC 62109 (inverters)



Panel Working Process

- Use of website to post research, reports as well as gather input and opinions from stakeholders.
- Quarterly meetings or teleconferences to discuss SAI work, findings and to provide input and feedback.



PV Grounding

- Grounding Task Group started in May of 2008 has developed a new Grounding section that has been proposed to the UL1703 STP for inclusion in UL61730.
- The STP is revising this new section and it will be included in the upcoming UL61730 ballot documents.
- UL 61730 status will be discussed later this morning.



New Grounding Proposal

- The new proposal was written to address the major issues including; dissimilar metals, reliability and field failures of PV ground connections.
- The new proposal allows for the specific evaluation of PV module grounding, module grounding lugs and devices.



Product Safety Panel – Polymeric Materials

- Update – Based upon industry information and existing polymeric material test practices, UL plastic materials experts developed a test program to evaluate the long-term temperature rating of multi material laminated PV module backsheet materials being used today.
- This test program is being expanded for evaluation of PV encapsulants.

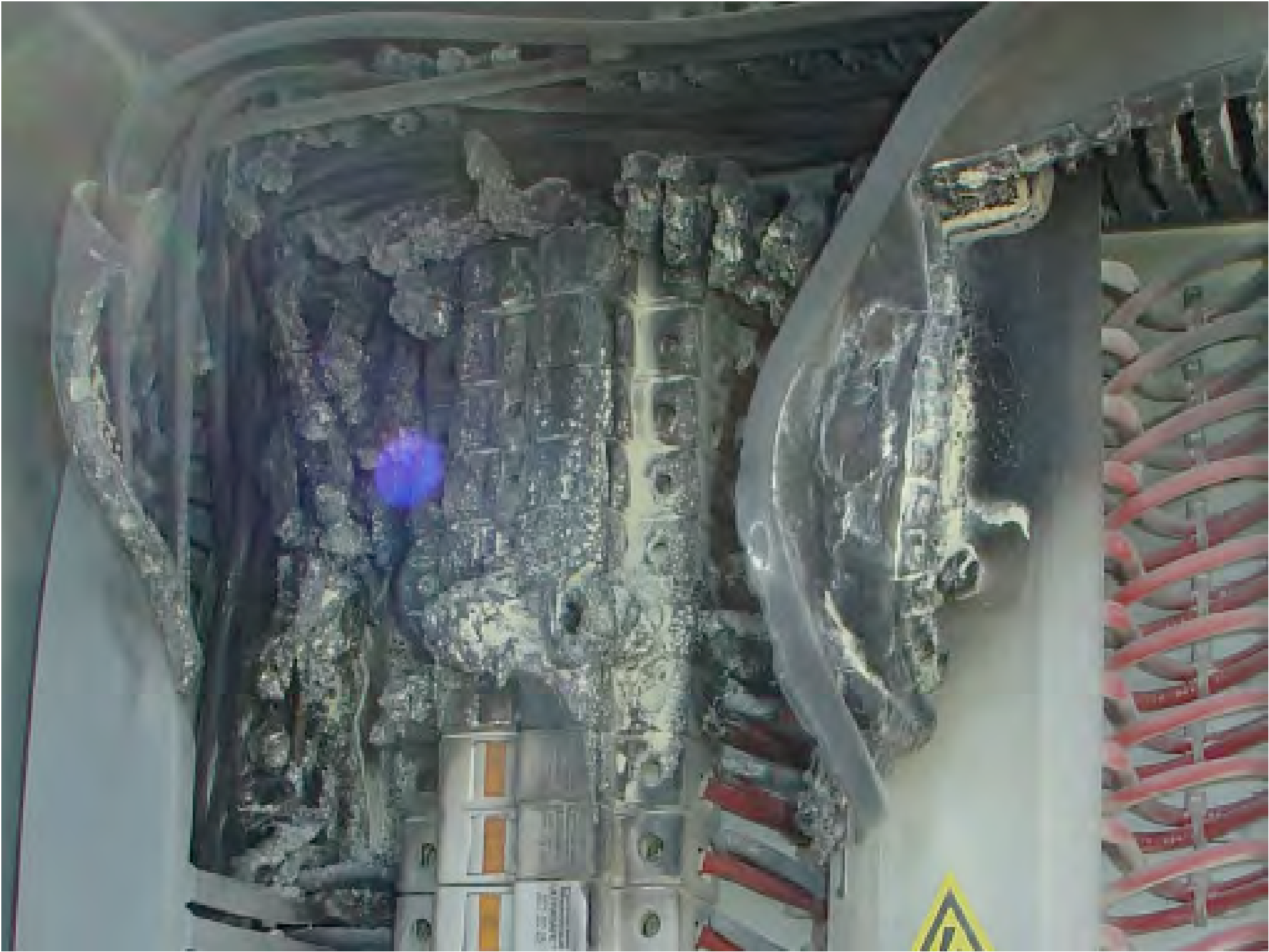


PV Arc Faults



Failures and fires due to PV arc faults have occurred





Product Safety Panel – PV AFCI

- In response to recent increases in PV module field failures due to arcing faults within high voltage PV systems, the Solar ABCs *Product Safety Panel* has identified development of an arc fault circuit interrupter as technology research area that may lead to improved safety and reliability as well as overall reduced costs of PV systems.



Series Arcing Faults

- **When one of the current-carrying paths in series with the load is unintentionally broken or opened.**
- **Series arc faults could be mitigated by an inverter, charge controller or other load component with DC arc fault protection.**



This could happen to any PV connection or connector that is unmated under load.
This test was run at 150Vdc and 6A.

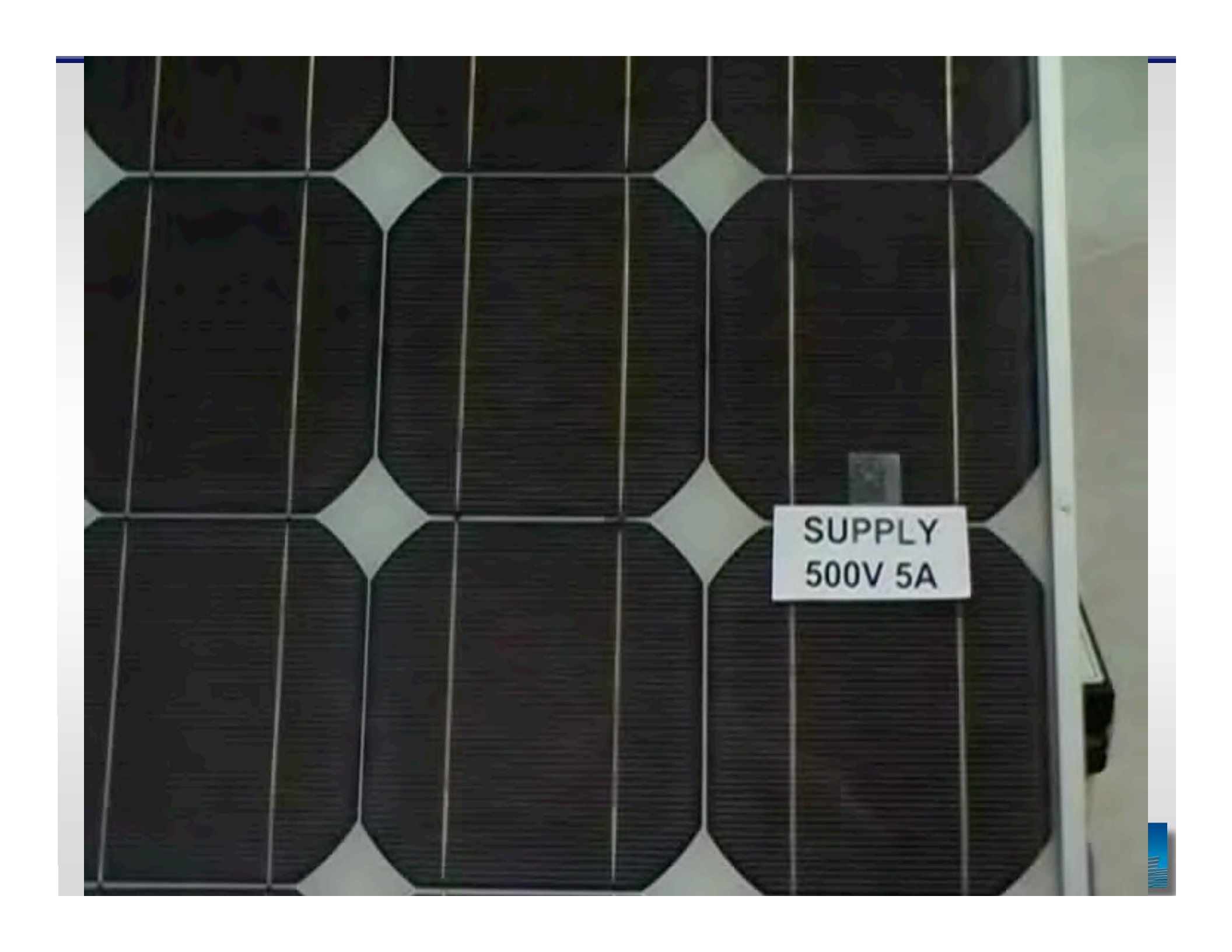




In the following series arc test video the module's bypass diodes were removed

- Localized burning of backsheet
- Glass superstrate shattered
- Localized glass melting
- Carbon coat surrounding area and allows easy restrike of arc
- Arc travels as “electrode” materials are consumed



A photograph of a power supply unit. The unit is dark-colored with a grid of ventilation holes. A white label is attached to the front panel, displaying the text "SUPPLY 500V 5A". The label is positioned on the right side of the unit. The background is a plain, light-colored wall.

SUPPLY
500V 5A

Potential Issues That Could Lead to Arcing Faults

- normal aging and long field life
- physical stress
- environment stress
- corrosion
- degradation of connections
- degradation of components
- degradation of materials



UL has established a UL1699 PV AFCI Ad Hoc Working Group.

- This group will be assisting UL in the research and standards development activities related to requirements for arc-fault circuit-interrupter protection for photovoltaic system applications.

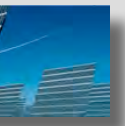


This Technology Exists

This is an Eaton Commercially Available Aerospace Component



This is the Same Test Without DC AFCI Protection



Moving Forward

- PV AFCI protection requirements need to be developed.
- Following this research project and with the help of the PV AFCI Ad Hoc Working Group, UL will publish an evaluation program for PV AFCI protection.

Solar ABCs contacts

Tim Zgonena

Principal Engineer

Distributed Energy Resources
Equipment and Systems

Underwriters Laboratories Inc.

Phone:

+1-847-664-3051

E-mail:

Timothy.P.Zgonena@us.ul.com

Evelyn Butler

Regional Business Manager

Industrial Sector, North America

Renewable Energy & Automotive

Underwriters Laboratories

Phone:

+1-916-941-3871 or +1-408-591-9447

E-mail:

Evelyn.M.Butler@us.ul.com

