Solar America Board for Codes and Standards

Solar ABCs Interim Report

Grounding Photovoltaic Modules: The Lay of the Land

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Grounding Photovoltaic Modules: The Lay of the Land

Study Report Overview

This report summarizes the current state of codes and standards that apply to equipment grounding of photovoltaic (PV) modules and systems. The Solar America Board for Codes and Standards (Solar ABCs), commissioned this work with the intent of providing the PV industry with practical guidelines and procedures for module grounding. This initial "lay-of-the-land" report sets the stage for a final report that will draw on feedback from industry experts as well as ongoing research at Underwriters Laboratories, Inc. (UL) to develop guidelines and recommendations for changes to existing standards.

Why the Report is Important

PV modules are typically installed on aluminum or galvanized, painted, or stainless steel frame structures. These structures and any other electrically conductive components that may become energized by the PV array (or other sources) and that may be accessible during routine servicing, must be bonded to ensure safe touch voltages. Module manufacturers currently provide detailed directions for grounding the modules in their installation manuals. Manufacturers of grounding equipment for PV modules have developed components designed for general use, and have pursued different approaches for certifying or listing these devices. There is little industry consensus on the appropriateness or completeness of the available standards for these general use components. The result has been a large number of fielded systems that demonstrate:

- unsatisfactory module grounding measures,
- violations of the module's UL 1703 listing because the installation does not comply with the installation manual's prescribed method of module frame grounding,
- incorporation of components listed to more general grounding equipment standards that may or may not be suitable for the application, and/or
- well-engineered grounding means that have, at present, no clear path for demonstrating their adequacy to customers and inspectors.

Issues

While there are many issues facing the industry today with regard to PV module and system grounding, this report focuses on two principal industry concerns. The first is the lack of confidence in existing, approved grounding methods, which results from the many grounding failures observed in fielded systems. Although statistical studies of failure rates are not available, there is enough a necdotal evidence to support recommendations for additional testing and revision of standards.

The second major issue is the limited number of approved grounding methods and devices available for PV modules and systems that are certified or listed by nationally recognized testing laboratories. Industry stakeholders who would prefer to market or use new grounding methods and devices point out that the absence of certification for these products is not necessarily based on issues pertaining to safety or reliability but rather results from a lack of consensus in the assignment and development of applicable standards.

Solar America Board for Codes and Standards Recommendation

This interim report documents many of the problems facing the PV industry today with respect to module grounding standards and performance. Given the fluid nature of PV module and system grounding requirements at present, the following are near-term recommendations:

- Perform research testing to qualify the impact of different current levels in the continuity and component performance tests.
- Monitor and review developments during the revision of UL 467 to incorporate PV system-specific applications.
- Monitor and review results and developments from UL's enhanced environmental and corrosion resistance testing.
- Engage additional corrosion experts outside of the PV industry to help interpret the new test results and provide guidance on how they can be applied effectively in new or revised standards.
- Explore the possibility of developing special tests for coastal environments, again using guidance from other industries (such as the maritime industry) with relevant experience.
- Seek additional expertise on whether and how strain relief and force tests may be incorporated to evaluate grounding means based on the forces experienced during installation.
- Conduct additional research to identify and classify installation environments and to determine how they might impact grounding design, installation, and maintenance decisions.

Download the full report:

www.solarabcs.org/grounding

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About Solar America Board for Codes and Standards

The Solar America Board for Codes and Standards (Solar ABCs) is a collaborative effort among experts to formally gather and prioritize input from the broad spectrum of solar photovoltaic stakeholders including policy makers, manufacturers, installers, and consumers resulting in coordinated recommendations to codes and standards making bodies for existing and new solar technologies. The U.S. Department of Energy funds Solar ABCs as part of its commitment to facilitate widespread adoption of safe, reliable, and cost-effective solar technologies. For more information, visit the Solar ABCs website: www.solarabcs.org

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