Report on Activities in QA Task 10: Durability of Junction Box Connectors and Wiring

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Topics of Presentation

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- Field experience drivers for durability issues in junction box wiring and connectors
- Survey results from PV community on junction box wiring and connector issues and durability study priorities (about half of approximately 15 participants in Task 10 responded)
- Task 10 future activities

Field Failure Observations at Junction Boxes and Connectors*

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Additional connector failures observed after 2-4 years include broken latches and separated connectors

***Reported at NREL PV Module Reliability Workshop February 26-27, 2013, Golden CO**

Results of Survey on Priorities for Junction Box Durability Studies

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Task 10. Durability of Junction Box (JB) Connectors and Wiring

Summary of top objectives voted in survey for topic A- manufacturing

Task	Objective	Description	Proposed Action Items
10.1	Junction Box wiring – electrical and mechanical stress testing	Review standards for electrical and mechanical assembly procedures and strategies for junction box manufacturing and propose stress tests to extend them to expose potential failure mechanisms.	1. Review IEC 6252 ed.1.CVD, 60364-7-712, 62548(CD) 2. Review work of Tasks 1-9 for duplication, overlap 3. Define stress parameters for testing 4. Propose experiments to expose critical stress factors causing failures
10.2	Durability parameters for Junction Boxes	Review standards and testing for durability issues for junction boxes and propose durability tests to extend them and expose potential failure mechanisms.	1. Review IEC 62790 ed.1.CVD (JB's), 62852 ed.1.CVD (connectors), IEC 60998, 60999 (terminals). 2. Review work of Tasks 1-9 for duplication, overlap 3. Define durability parameters for testing 4. Propose experiments to expose durability issues
10.3	Junction Box materials	Review durability testing methods for component materials to examine insulation and corrosion properties and propose tests for various JB material constituents.	1. Compile information on available characterization methods or polymer degradation rates, molded material in-process produced stresses, flux corrosiveness, and wiring 2. Define durability parameters for testing 3. Propose experiments to test for durability failures including melt flow rate analysis, chemical stress crack analysis and residual stress.
10.4	Junction Box Wiring terminations	Review manufacturing practices and designs for soldered, resistance welded and pressure contacts and propose tests to uncover end-of-life JB metal corrosion failure modes	1. Develop best practices and designs for soldered, resistance welded and pressure contact formation. 2. Propose tests to uncover JB metal corrosion failure modes induced by pottants, fluxes and humidity. 3. Propose durability tests to reveal end of life failure modes for JB metal joints.
10.5	Junction Box manufacturing	Establish testing protocols and verification methods for manufactured JB component and assembly durability.	Develop testing protocols and verification methods for manufactured JB component and assembly durability.

Example of Task 10 Review Activity for Standards

Standards Reference Area (standard development in progress)	Test Area	Current IEC Reliability and UL Scope	Durability Concerns to be Established and Tests to be Developed
Tasks 10.1-10.3 review IEC TC 6252 ed.1.CVD et al - Junction box wiring- electrical and mechanical stress testing	Design, manufacturing strategies	Connector terminations (solder vs pressure vs welding) and wiring	Propose testing to accelerate and extend stressing factors to reveal failures
	Materials	Polymer degradation, molding stresses, flux, corrosion resistance, flammability, dielectric resistance, etc.	Characterization methods, durability factors in material failures in ageing

I would like to acknowledge contributions of Task 10 members from Industry, Universities and National Laboratories

Task 10 Future Activities

- Review of existing standards and application to durability of Junction Box connectors in progress
- Development of tests to extend IEC and UL standards on Junction Boxes to establish durability of wiring and connectors
- Writing of durability testing protocols

I would like to acknowledge contributions of Task 10 members from Industry, Universities and National Laboratories