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CPV Solar Cell and Receiver Package Qualification Standard

Initial Proposal – CPV-5, Palm Desert, Fall 2008

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CPV Solar Cell and Receiver Package Qualification Standard

First Draft – PVSC, Philadelphia, Spring 2009

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**CPV Solar Cell *and Receiver Package?* Reliability
Qualification ~~Standard~~ Technical Specification**

Draft –PVSEC 24, Aix les Bains, Fall 2009

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**CPV Solar Cell *and Receiver Package?* ~~Reliability~~
~~Qualification Standard~~ Performance Technical
Specification**

Draft – CPV-6, Freiburg, Spring, 2010

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CPV Solar Cell and Receiver Package **Combined
Reliability Qualification ~~Standard~~ and Performance
Technical Specification**

Test Tables Only – PVSEC 25, Puertollano, Fall, 2010



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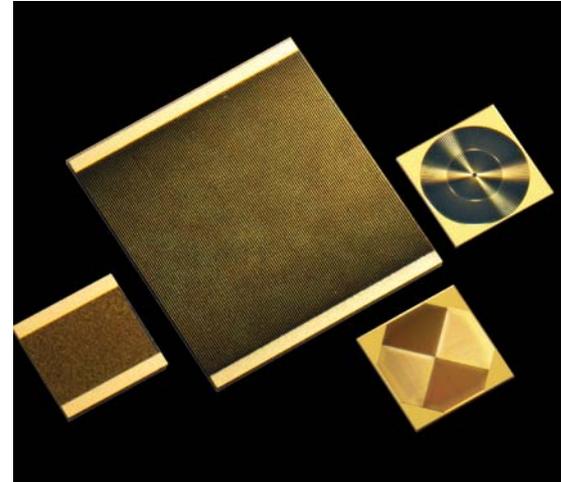
**CPV Solar Cell and Receiver Package ~~Combined~~
Reliability Qualification Standard and ~~Performance~~
~~Technical Specification~~**

Survey Results – CPV-7, Las Vegas, Spring, 2011

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Concentrator Photovoltaic (CPV) Solar Cells and **Cell-on-carrier (COC)** Assemblies - Reliability Qualification (Standard)

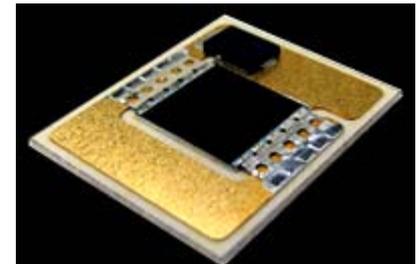
NWIP Approved – PVSEC 26, Köln, Fall, 2011



Bare Cell



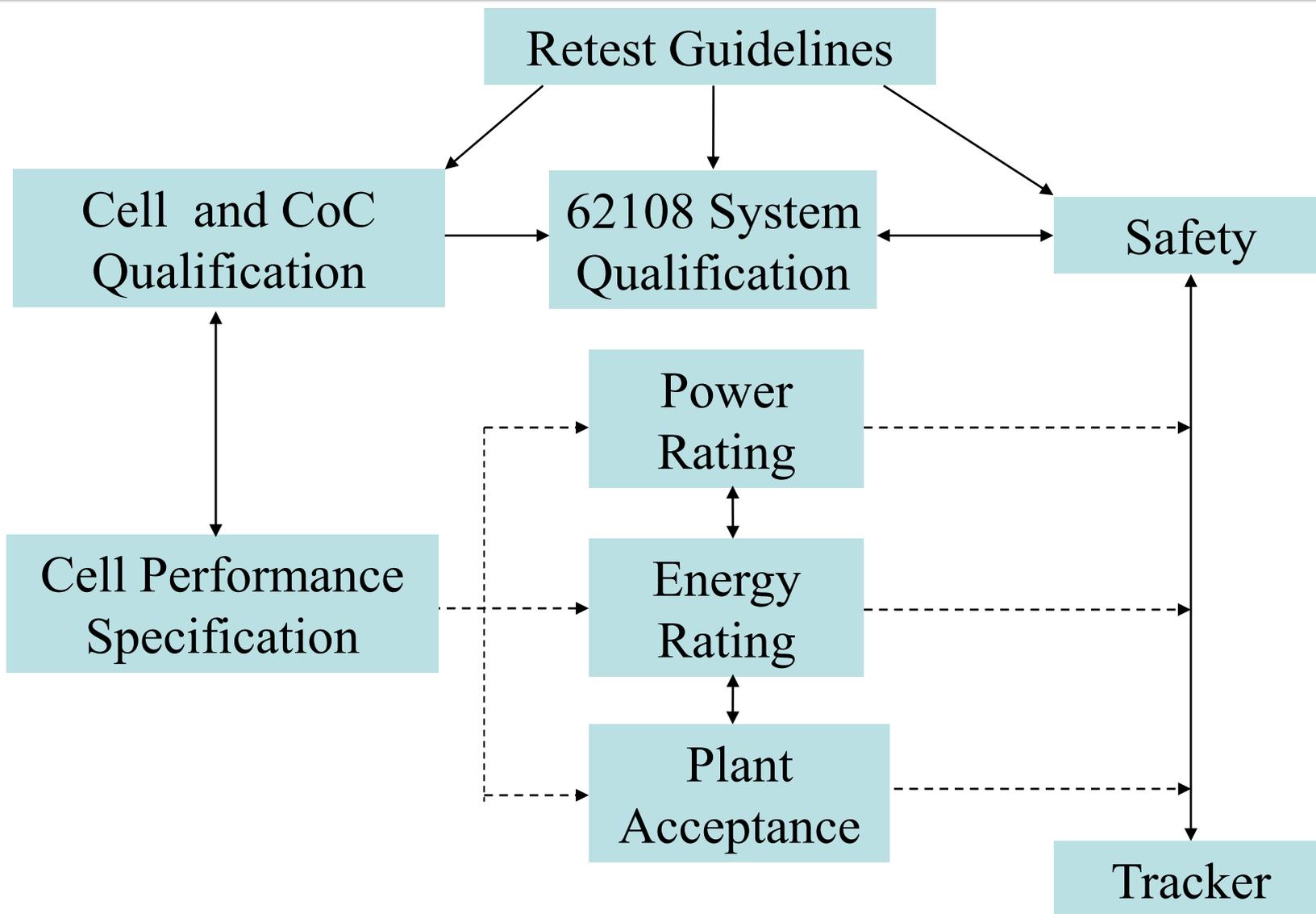
Interconnected Cell



Cell on Carrier

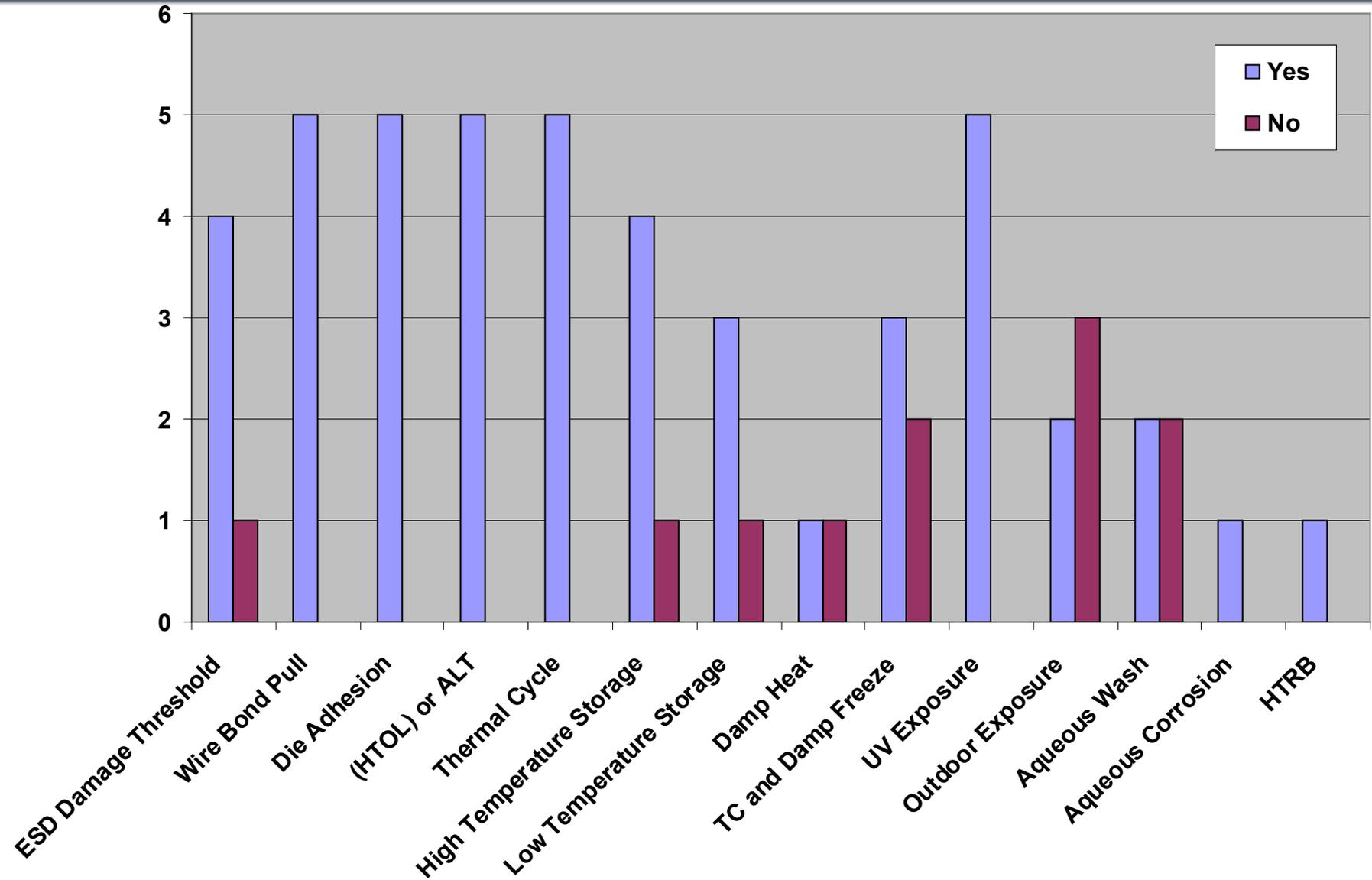
- **Electronic and Optoelectronics Component Qualification Standards**
 - **Telcordia e.g. GR-468-CORE Issue 2, September 2004,**
 - Reliability Assurance Requirements for Optoelectronic Devices Used in Telecommunications
 - **IEC e.g. 61751 ed1.0,**
 - Laser modules used for telecommunication - Reliability assessment.
- **PV for Space Power Applications**
 - **AIAA S-111-2005**
 - Qualification and Quality Requirements for Space Solar Cells
 - **ECSS-E-ST-20-08C**
 - Photovoltaic assemblies and components
- **PV Cells**
 - **Solar America Initiative (SAI) Procurement Specification Proposal**
- **PV and CPV Modules and System Level**
 - **IEC 61215 and IEC 62108**
 - PV and CPV modules and assemblies – Design qualification and type approval.

Relationship of Standards/Specifications

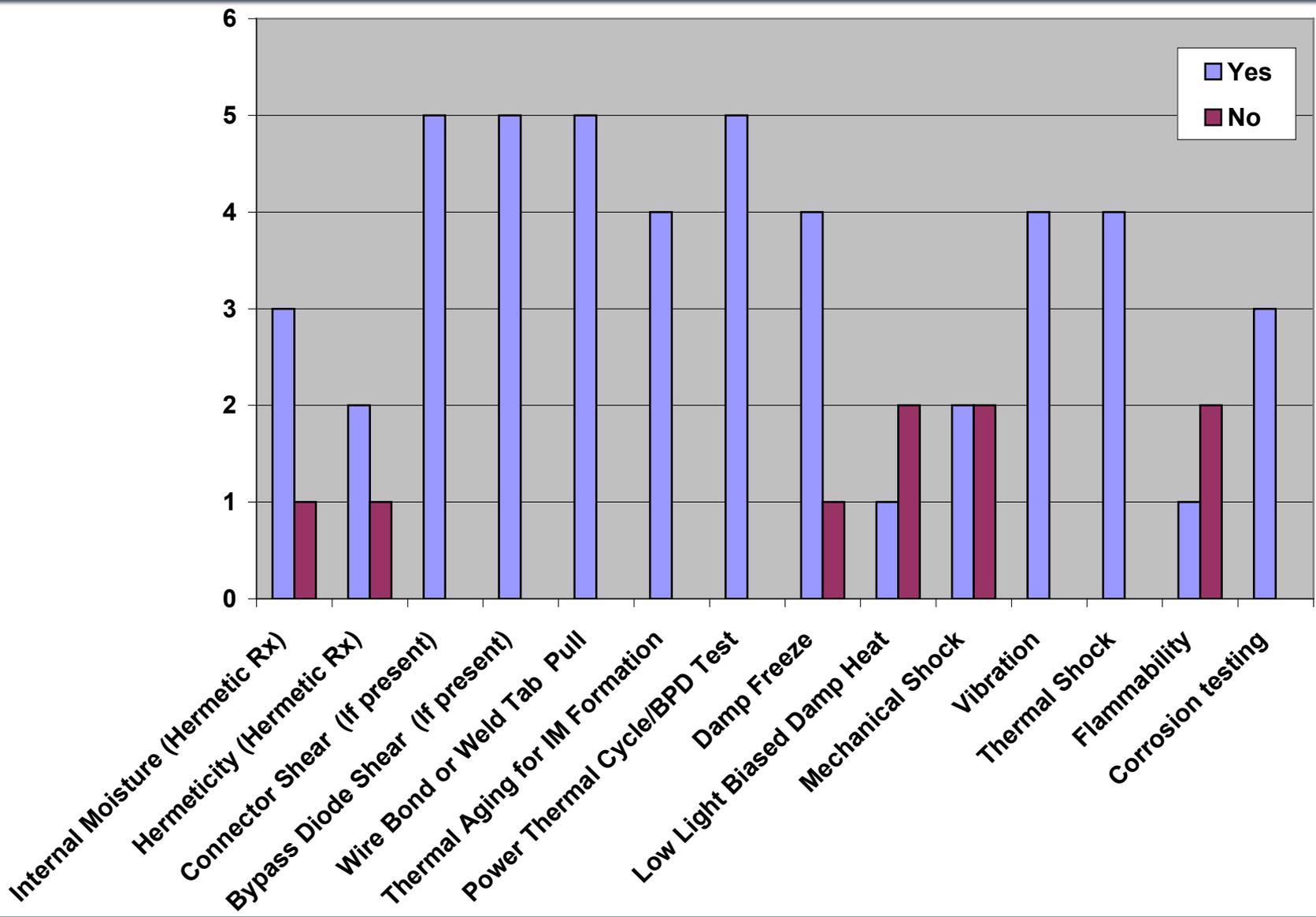


Cell Qualification Poll Results

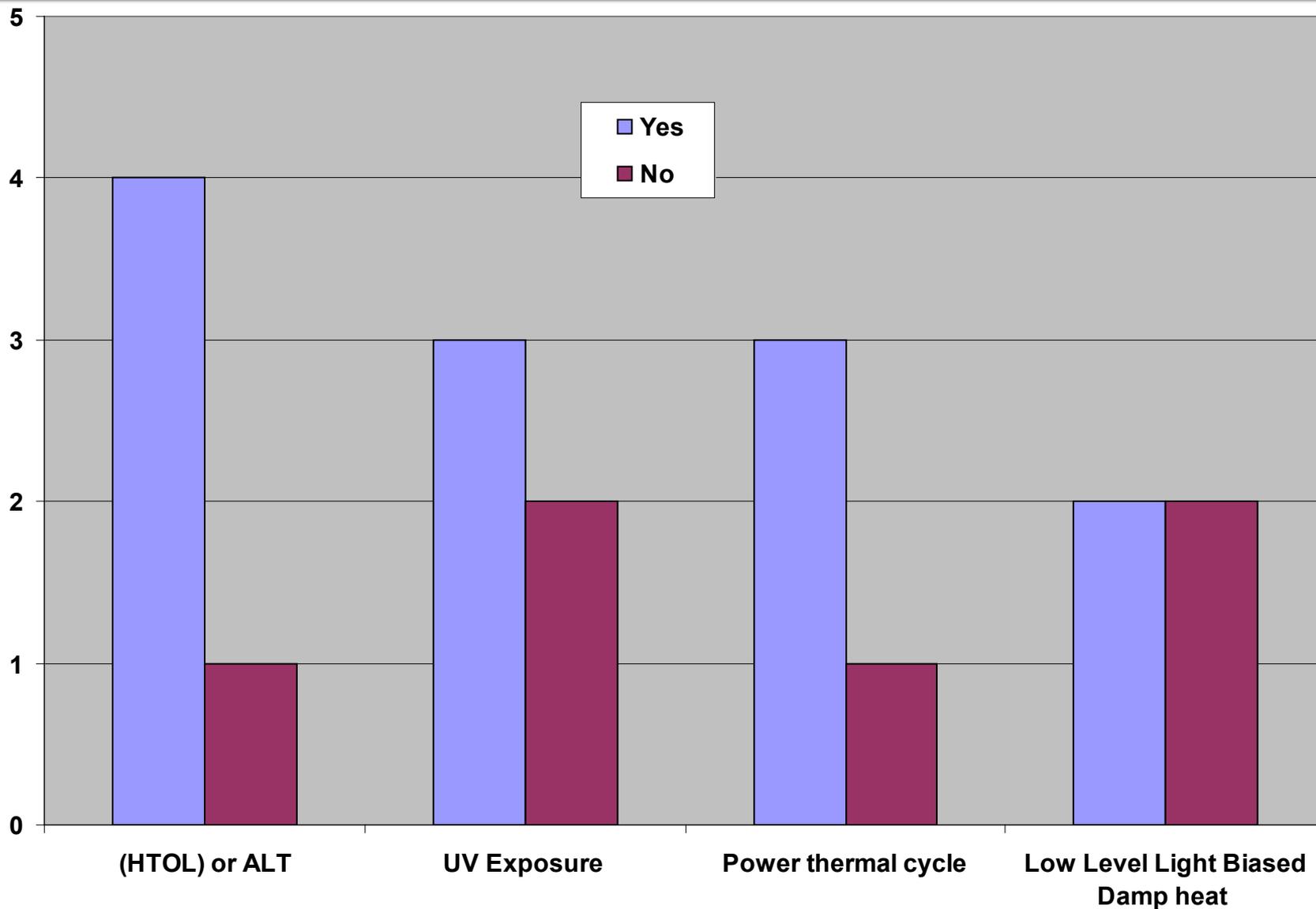
IEC TAG 82
WG7



Receiver Package Qualification Poll Results



Rx Package Qualification ALT Poll Results



Proposed Cell Qualification Plan

Stress Test Name	Reference Standard	Cell Test Conditions	Sample Size/ Failures	P/F Criteria
ESD Damage Threshold	HBM	Incremental Voltage tests for HBM and CDM to establish damage threshold. Dark IV.	6	Pass all operational parameters per product datasheet
Front Metal Adhesion	Wire bond pull	Wire or ribbon bond, pull until failure, record mode and yield force.	11/0	Per STD
Back Metal Adhesion	Die Adhesion	Solder or adhesive die attach, pull to failure, record mode and yield force.	11/0	Per STD
(HTOL) or ALT		T = T _{OP} (max), I = max tolerable, X hours. DIV (info only) and Flash test pre stress and at periodic pull points.	25	No MVD, < 5% reduction in power output.
Thermal Cycle	IEC 62108 Annex A. Seq. # 10.6	T = -40 C to Tmax. 1k cycles for T max = 85 C, 500 cycles for T max = 110 C, 2k cycles for Tmax = 65 C, periodic light bias or no bias, dwell >10 min within ±3°C of extremes. 10 to 18 cycles per day. DIV (info only) and Flash test pre stress and at end.	11/0	No MVD, <5% power degradation.
High Temperature Storage	EIA/TIA-455-4A ≤ 40% RH	Ts (max) or 85C for 2000 hours.	11/0	No MVD, <5% power degradation.
Low Temperature Storage	EIA/TIA-455-4A	Ts (min) or -40C 72 hours.	11/0	No MVD, <5% power degradation.
Damp Heat	IEC 62108 Annex A. Seq. # 10.7	1k hours at 85 C, 85% RH or 2k hours 65 C, 85% RH, DIV (info only) and Flash test pre stress and at periodic pull points.	11/0	No MVD, <5% power degradation.
TC and Damp Freeze	IEC 62108 Annex A. Seq. # 10.8	Precondition for 200 cycles, Tmax = 85 C, 100 Cycles Tmax = 110 C, 400 cycles Tmax = 65 C, Tmax and 85% RH for 20 hours, ramp down to -40 C for 4 hours, 20 cycles for Tmax = 85 C, 40 cycles for Tmax = 65 C. DIV (info only) and Flash test pre stress, after precondition, and at end.	11/0	No MVD, <5% power degradation.
UV exposure	IEC 62108 Annex A. Seq. # 10.15	Expose to a total dose of 2.5 kWhrs/cm ² , Lambda < 400 nm. DIV (info only) and Flash test pre stress and at periodic pull points. (Concurrent with HTOL.)	25	No MVD, <5% power degradation.
Optical Exposure	IEC 62108 Annex A. Seq. # 10.16	Expose to a total dose of 5 kWhrs/cm ² , DNI > 30 W/cm ² . DIV (info only) and Flash test pre stress and at periodic pull points. (Concurrent with HTOL.)	25	No MVD, <5% power degradation.

Proposed CoC Qualification Plan

Parameter	Standard	Conditions	Sample Size/ Failures	Pass/Fail Criteria
Internal Moisture (Hermetic Rx only)		Bake at 100°C for 16 to 24 hours, RGA	11/0 for Qual, AQL if in-line	< 5k ppm H ₂ O
Hermeticity (Hermetic Rx only)		He bomb, leak detector	11/0 for Qual, AQL if in-line	Per calculation
Connector shear (If present)		Shear tool	11/0 for Qual, AQL if in-line	Per calculation
Bypass Diode shear strength (If present)		Shear tool	11/0 for Qual, AQL if in-line	Per calculation
Wire bond or weld tab pull strength		Pull tool	11/0 for Qual, AQL if in-line	Per calculation
Thermal aging for intermetallic formation		300C for 1 hour aging	11/0	Per calculation
		300C for 1 hour aging	11/0	Per calculation
PTC	IEC 62108, Section 10.6, Option 2 for thermal cycling parameters	-40C to 110C for 500 cycles, IR or joule heating subcycles	11/0	No MVD, 3kV Hipot, on-sun (<13%) or flash(<8%)
Damp Freeze	IEC 62108, Section 10.8	Same sample as power temp cycle (for required TC preconditioning), 85C/85% RH for 20 hours, ramp down to -40 C for 4 hours, 20 cycles.	11/0	No MVD, 3kV Hipot, on-sun (<13%) or flash(<8%)
Low Level Light Biased Damp heat	Similar to IEC 62108, Section 10.7 but with light bias	Light Biased to ≥ 0.9 Voc, 85C/85% RH for 1000 hours	11/0	No MVD, 3kV Hipot, on-sun (<13%) or flash(<8%)
Mechanical Shock		Terminal peak sawtooth of amplitude 30gs and duration of 15 mSec (See figure 516.5-10 and Tables 516.5-III and IV.)	11/0	No MVD, Pass 3kV HiPot, < 10% relative change in DIV parameters
Vibration		Random vibration simulating U.S. Highway truck vibration exposure.	11/0	No MVD, Pass 3kV HiPot, < 10% relative change in DIV parameters
Thermal Shock		Storage temperature extremes, > 60°C/min rate, 1 min dwells	11/0	No MVD, Pass 3kV HiPot, < 10% relative change in DIV parameters
Flammability		For receivers with flammable components only.	3/0	Per flammability rating.

Other Considerations

- **Reliability Tests**
 - Accelerated Life Tests (ALTs)
- **Sample Sizes/distributions**
 - Samples from across distributions
- **Pass/Fail Criteria**
- **On-going sampling or periodic retest**
- **Report format**

New Work Item Proposal

	[Document reference]	
	NEW WORK ITEM PROPOSAL	
	Proposer TC 82 Secretariat	Date of proposal [REDACTED]
	TC/SC TC 82	Secretariat USA
Classification according to IEC Directives Supplement, Table 1	Date of circulation [REDACTED]	Closing date for voting [REDACTED]

A proposal for a new work item within the scope of an existing technical committee or subcommittee shall be submitted to the Central Office. The proposal will be distributed to the P-members of the technical committee or subcommittee for voting, and to the O-members for information. The proposer may be a National Committee of the IEC, the secretariat itself, another technical committee or subcommittee, an organization in liaison, the Standardization Management Board or one of the advisory committees, or the General Secretary. Guidelines for proposing and justifying a new work item are given in ISO/IEC Directives, Part 1, Annex C (see extract overleaf). **This form is not to be used for amendments or revisions to existing publications.**

The proposal (to be completed by the proposer)

Title of proposal		
CONCENTRATOR PHOTOVOLTAIC (CPV) SOLAR CELLS AND CELL-ON-CARRIER (COC) ASSEMBLIES - RELIABILITY QUALIFICATION.		
<input checked="" type="checkbox"/> Standard	<input type="checkbox"/> Technical Specification	<input type="checkbox"/> Publicly Available Specification
Scope (as defined in ISO/IEC Directives, Part 2, 6.2.1)		
This International Standard specifies the methodology for reliability qualification of photovoltaic cells and Cell-on-Carrier (or other interconnected cell) assemblies used in Concentrator Photovoltaic (CPV) power generation systems.		

We Now Have a Number!

IEC TAG 82
WG7

- Earlier this year TAG-82 voted to approve the New Work Proposal and 5 member countries assigned experts to work on the draft. This resulted in the IEC issuing a number for the standard:

62787

- So the clock is ticking and the real work begins.
- And if we are successful, sometime in 2014, this standard number will be rolling off our tongues as easily as 62108!