

Developing a Roadmap for the Establishment of PV Weathering Standard

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IEC Weathering Roadmap Workshop

February 27, 8AM – 2PM, at NREL. *Must be registered in advance.*

Organizers:
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John Wohlgemuth, NREL
Crystal Vanderpan, UL
Mike Kempe, NREL

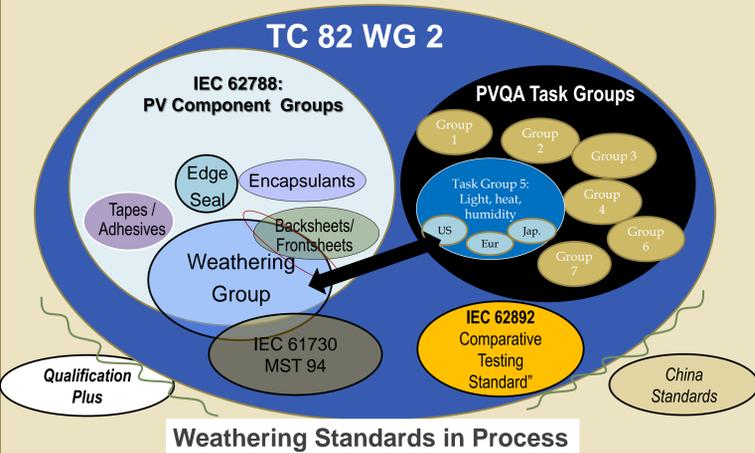
Workshop Goals

- For weathering sequences in IEC Standards:
- Review the variety of approaches
 - Develop a consistent underlying philosophy
 - Provide guidance on how to incorporate weathering testing into Standards
 - Draft a road map/timeline showing:
 - Est. completion dates for PVQA expts
 - Target standard draft dates

Agenda

- John's vision for TC 82 WG 2 Weathering
- Weathering approaches to TC 82 WG2
- Ongoing weathering studies (PVQA, others)
- Discussion: Guiding Principles
- Lunch**
- Roadmap Exercise
- Moving Forward...
- Wrap-up

Some TC82 WG 2 groups related to long term wear out



Weathering Standards in Process

Standard	Title	Weathering Portion	Status
IEC 62788-1	Encapsulant Component Standard	Not started yet	Pending
IEC 62788-2	Backsheet Component Standard	Under discussion.	Draft in progress
IEC 62788-?	Tapes/Adhesives Component Standard	Not started yet	Pending
IEC 62788-?	Edge Seal Component Standard	Under discussion.	Draft in progress
	Component Weathering Guidelines	Guidelines for sample preparation, exposures, testing: considerations and approach	Under consideration
IEC 62892	Comparative Testing Standard	Differentiation of module testing for different applications in different climates	Draft in progress
Qualification Plus	Extension of 61730 and 61215, with focus on improved Reliability	See "Qualification Plus" Table	Open comment period
IEC 61730 ed 2	Photovoltaic Module Safety Qualification	Method A, cycle 3 of ISO 4892-2.	CD submitted for comment
IEC 61215 ed 3	Weighted junction box test [36]	Tests robustness of junction box mounting	Draft in progress
Chinese National Standards			Draft circulating in China

• **Abstract:** Long term wear-out is not addressed well in existing PV standards. Numerous groups are working to address this gap, writing standards using the best available knowledge, and performing experiments to gather data around the issues. A number of different approaches are being considered.

• The Weathering Group is hosting the Weathering Roadmap Workshop on Thursday. Take a moment to review a weathering perspective of standards in progress and some of the issues prompting discussion.

• This is a **Working Poster!** Please review the questions and add your comments.

4. What philosophy should be used for weathering Pass/Fail Criteria?

- Low Bar: Pass for any sample that survives somewhere
- High Bar: Pass only for samples that survive everywhere
- Variable Bar: Segment by climate and application
- Other

Standardized Weathering Tests

Standard	Material	Test Coupon	Exposure Side (Sun or J-Box)	Evaluation Tests	Xe (340 setpoint)	ChT	RH	BPT	cycling	hours	
Qualification Plus	Encapsulants	*same configuration in which they will be deployed*, e.g. Glass Encapsulant Film*	Sun	% Transmission	0.55	70°C	50%	90°C	-	4000	
	Backsheet Set 1	Glass Encapsulant Backsheet	Sun	Visual	0.8	50°C	50%	70°C	-	4000	
	Backsheet Set 2	Glass Encapsulant Backsheet	J-Box	Visual	0.8	50°C	50%	70°C	-	4000	
	Backsheet Set 3	Glass Encapsulant Transp. Release Mat1 Backsheet	Sun	Remove backsheet and test alone: a) Visual b) Elongation at break	0.8	50°C	50%	70°C	-	4000	
	Backsheet Set 4	Glass Encapsulant Transp. Release Mat1 Backsheet	J-Box	Remove backsheet and test alone: a) Visual b) Elongation at break	0.8	50°C	50%	70°C	-	4000	
	Alternative exposure for front/backsheets and encapsulants:					0.8	70°C	50%	90°C	-	4000
	Cables and Connectors	Cables w/ connectors	J-Box	Visual Temperature rise, Mechanical operation Bending (flexing) test, Dielectric strength	0.55	70°C	50%	90°C	-	4000	
	Junction Boxes	Junction box w/ cables and diodes, fixed to the substrate	J-Box	Fixing of lid at rewirable junction box Terminations and connection TMs Test of cord anchorage Retention of the mounting surface Wet leakage current test Knock-out inlets (outlets)	0.59	50°C	65%	65°C	18 min spraying, 102 min dry	500	
	61730 ed 1, Materials (current)	Front/Back Sheet	film	none, if no direct exposure							
	61730 ed 2, Materials (draft)	Front/Back Sheet	as used, e.g. glass encapsulant backsheet	film toward light source	impulse voltage ignitability 90° Peel	UVA, 60 W/m ² ref ISO 4892-2	50°C	nc	50°C	Cont. illum. 5 h UV, 1h water spray	1000
62788-2, film and coupon	Front/Back Sheet	film only, options: A) expose with no filter B) expose with manl. specified filter	tbd	Tensile strength Breakdown voltage Colour Surface gloss Outer appearance				tbd			
		coupon, as used, e.g. glass encapsulant backsheet	tbd	harmonize with 61730 ed 2?				tbd			

1. What should be used as a basis for Accelerated Weathering Setpoints (irradiation, temperature)?

- Material Specific: based on activation energies
- Material Agnostic: based on microclimate
- Other

5. How should weathering standards address the very different microclimates found with different applications?

- Same test for roof and rack mounted materials
- Different tests for rack mounted and roof mounted
 - roof → higher T, no backside UV
- Other

8. Different standards address PV safety, PV performance, and characterization of components. Comment on how the weathering testing should be coordinated between the various groups.

- Define a generic weathering cycle to be used for all three
- Leave it to each group to decide their approach
- Start by considering each group separately, then coordinate and improve.
- Other

2. Comment on which light source should be used for small (non-module) samples.

- Xe with filter only
- Target Xe, provide guidelines for other light sources
- Combination (Xe for new materials, other for requalification)
- Other

6. How should weathering standards address the very different microclimates found with different applications?

- Same test for roof and rack mounted materials
- Different tests for rack mounted and roof mounted
 - roof → higher T, no backside UV
- Other

9. How much real time is reasonable to allow for a weathering test?

- One month
- Six months
- As long as it takes to establish confidence in the targeted service life
- Other

3. Goal of a PV weathering test

- Demonstrate 25 year service life in "average" locations
- Demonstrate 25 year service life in "extreme" locations
- Demonstrate the material doesn't change after a limited accelerated weathering exposure
- Other

7. Given the need for component materials to work together (e.g. backsheet and encapsulant), how should the weatherability of components be determined?

- Weather each component by itself
- Weather each component in an environment similar
- Different tests for rack mounted and roof mounted
 - roof → higher T, no backside UV
- Other

10. Comments on Qualification Plus Weathering Cycles?

- Individual cycles
- The set of cycles