

Webinar Agenda

Introduction	5 min	Nigel Preston, GOGLA Technical Working Group Chair
Presentation	25 min	Arne Jacobson, Lighting Global Quality Assurance
Expert Insights on Lithium Battery Safety	10 min	Stephan Lux, Fraunhofer Institute for Solar Energy Systems
		Jit Bhattacharya, Fenix International
Q&A	35 min	Moderated by Nigel Preston
Next Steps	5 min	Arne Jacobson
Wrap Up	5 min	Nigel Preston

Proposed Changes to Draft IEC Quality Standards and Lithium Battery Safety

Dr. Arne Jacobson

Lighting Global Quality Assurance

13 May 2019



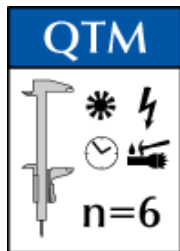
Outline

- Status of IEC adoption of Lighting Global quality standards (IEC 62257-13-1)
- Key revisions introduced during IEC process:
 - Lithium battery safety requirements
 - PV module safety
 - New performance reporting requirements
 - Other proposed changes (date of manufacture, ports, wiring)
- Lithium battery safety discussion

Lighting Global Quality Assurance Primary Program Elements

Lighting Global QA Framework

Test methods and standards



Technical Specification
62257-9-5, Ed 4.0



Quality Standard TS 62257-13-1

Testing, Verification, & Surveillance

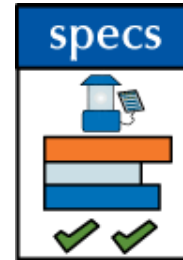


ISO 17025 accredited
labs for QTM testing



market check test labs

Communicating Quality to Market



www.lightingglobal.org/products

> 150 products listed

Stakeholder Engagement



Off-Grid Solar Sector




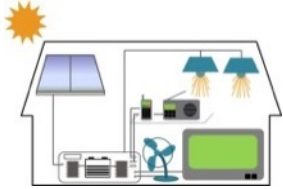
Development Agencies




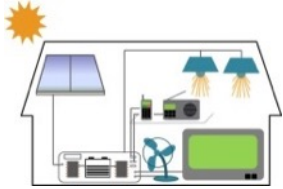
Governments



Lighting Global QA Framework Includes Both Pico- Solar Products and Solar Home Systems

	Pico-Solar Product	Solar Home System Kit
Product Type		
Product's PV Power	≤ 10 Wp	> 10 Wp & ≤ 350 Wp
Test Methods	IEC TS 62257-9-5	IEC TS 62257-9-5
Quality Standards	Lighting Global Quality Standards for Pico-Solar	Lighting Global SHS Kit Quality Standards
Products Tested Through Lighting Global Framework	>200	>40
Products That Have Met the Quality Standards & Are Listed on the Lighting Global Website	116	34

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Country Adoption of Harmonized Test Methods and Standards



Kenya



Ethiopia



Tanzania



Rwanda

Countries with standards harmonized with IEC TS 62257-9-5 and LGQA



Pakistan



Afghanistan



Madagascar



PNG

Pakistan, Afghanistan, Madagascar, and Papua New Guinea have initiated adoption of QA.



ECOWAS Countries:

Benin, Burkina Faso, Liberia, Gambia, Ghana, Guinea, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo, and Cape Verde.

ECOWAS is initiating a process to adopt quality standards for SHS kits based on IEC TS 62257-9-5 and the Lighting Global SHS kit standards / IEC 62257-13-1

IEC Adoption of Standards for Pico-Solar Products and SHS Kits (IEC 62257-13-1)

- IEC 62257-13-1 is under review
 - Based on Lighting Global Quality Standards for pico-solar products and SHS kits (both combined in one document)
- IEC review process status
 - IEC representative comments received on committee draft in November; we are working to address comments; revised draft to be resubmitted for CDV stage in May
 - Next JWG1 meeting on May 27 in Zhuhai, China
 - Using this stakeholder process to incorporate comments from a broad range of stakeholders
- Key revisions introduced during IEC process
 - PV module safety: balancing cost with safety issues
 - Lithium battery safety: addressing thermal runaway concerns (will talk about last)



PV Module Requirements

- Current status for PV module testing
 - Maximum power measurement (IV curve)
 - Tests for strain relief and junction box IP
- Comment received in IEC process
 - Some IEC stakeholders proposed requiring existing safety and durability tests for PV modules in SHS kits (IEC 61730 and IEC 61215)
- Proposed approach
 - Require IEC 61730 and IEC 61215 for modules > 240W
 - Apply targeted safety tests for modules < 240 W: hot spot (abbreviated), impact, sharp edge, enhanced visual inspection, label marking durability, and a few others

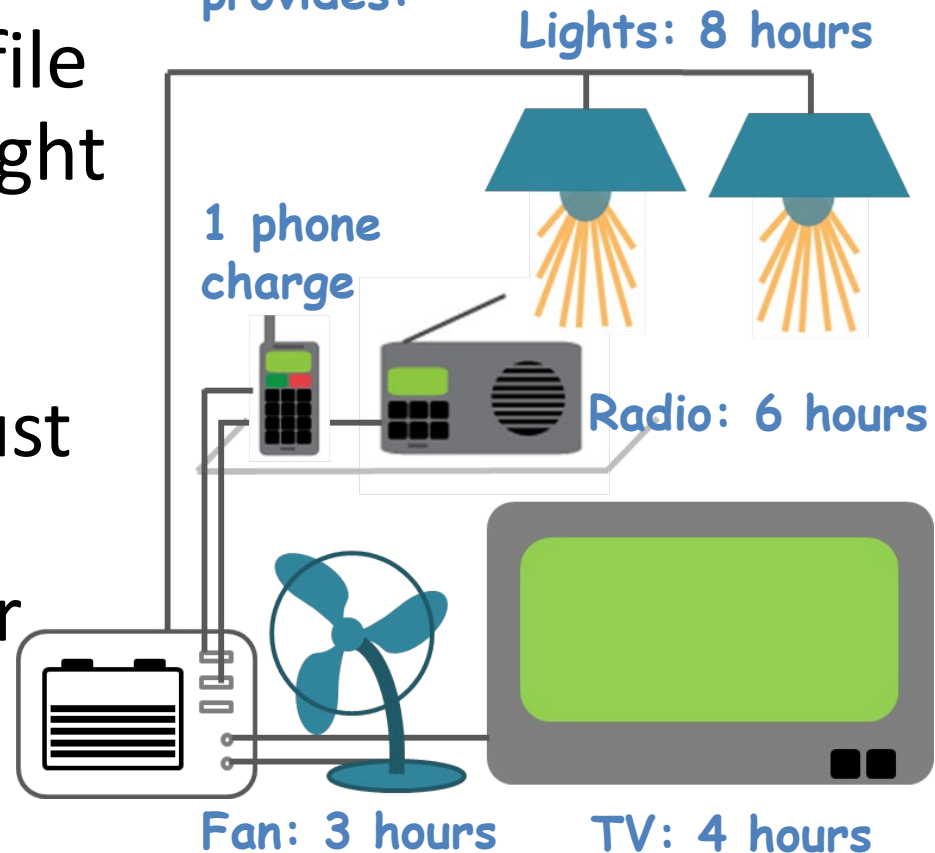


Proposed Performance Reporting Requirements

For SHS Kits (>10 W):

- One solar run time profile for all of the included light points (high brightness setting) and any other included appliances must be provided on the packaging or in the user manual.
- PV module power

One day of solar charging provides:



Proposed Performance Reporting Requirements

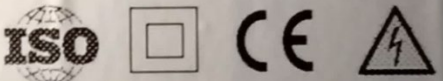
For components (either packaged with kit or separately):

- **Batteries:** battery capacity in mAh or Ah and nominal voltage (must also be provided on the battery)
- **Auxiliary lighting appliance with battery:** light output (or brightness) in lumens and the full battery run time for the brightest setting
- **Lighting appliance without battery:** lumen output (or brightness) in lumens
- **Appliances without batteries:** power in watts
- **Appliances with batteries:** power in watts and battery capacity in mAh or Ah and nominal voltage

Proposed Performance Reporting Requirements

PV modules (aligned with IEC 61215):

- name or registered trade mark of manufacturer;
- type or model number designation;
- serial number (unless marked on other part of product);
- date and place of manufacture; alternatively, serial number allowing to trace the date and place of manufacture;
- maximum system voltage;
- voltage at open-circuit or Voc;
- current at short-circuit or Isc;
- module maximum power or Pmax.

Solar Module	
Rated Maximum Power(Pmax)	40W
Open Circuit Voltage(Voc)	22.6V
Short Circuit Current(Isc)	2.34A
Max Power Voltage(Vmp)	17.8V
Max Power Current(Imp)	2.25A
Weight	3.25KG
Dimension	420*670*25mm
Maximum System Voltage	1000V
Maximum Series Fuse Rating	10A
All technical data at STC: 1000W/m2, AM1.5, 25° C	
	

Other proposed changes



- **Date of manufacture:** All products must be labeled with the date of manufacture or traceable serial number.
 - helps in diagnosing reasons for product failure.
 - ensures that products selected for market check testing are appropriate for evaluating currently available stock.
- **Appliance ports:** All ports on appliances must be tested unless they are explicitly advertised as “not for charging.”
- **Extend the “Wiring and connector safety” requirement to pico-products:** “All wires, cables and connectors must be appropriately sized for the expected current and voltage.”
 - Assessed primarily using a manufacturer declaration
 - Confirmed during testing by observing the product during normal use

Lithium Battery Safety

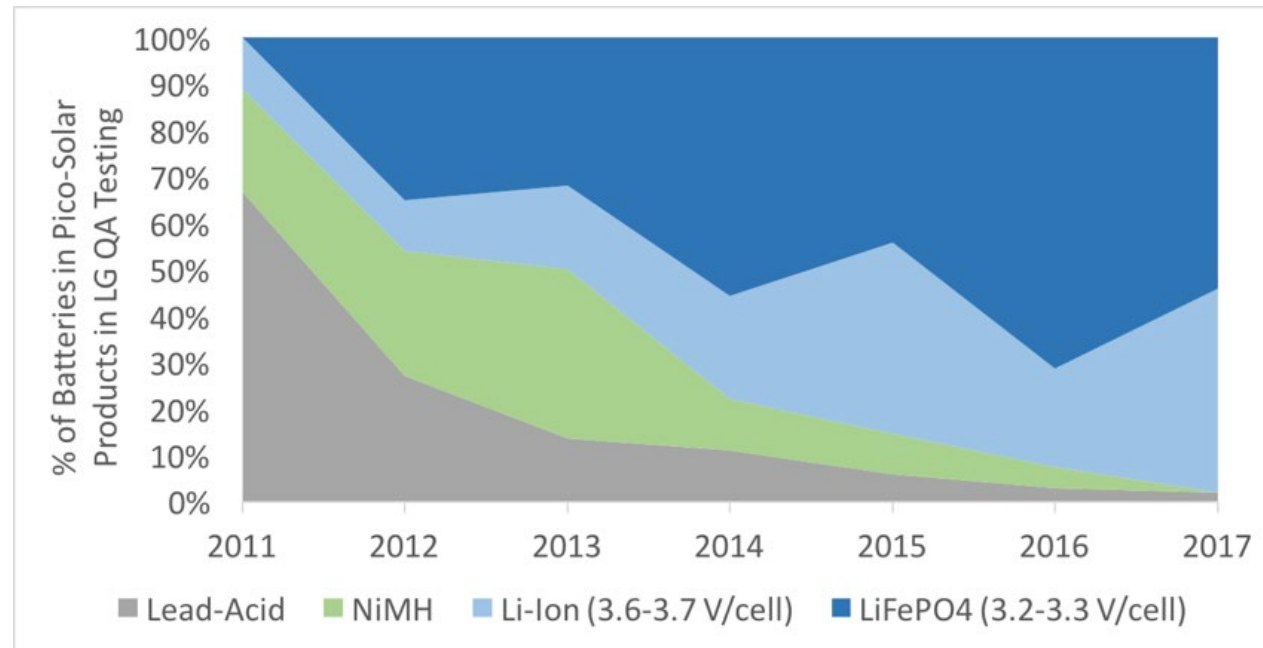
- Lithium-based batteries can offer substantial advantages relative to many types of lead-acid batteries
 - Improved durability / cycle life, reduced sensitivity to deep discharge, higher charge-discharge efficiency
- However, lithium batteries come with safety hazards related to thermal runaway
 - Hazards vary by chemistry, battery design, and use case
 - Can be mitigated through safety testing and product design / control circuits



Off-Grid Solar Products Are Shifting Toward Lithium Batteries

- The shift toward lithium batteries is nearly complete for quality assured pico-solar products
- An increasing number of SHS products are also using lithium batteries as these batteries become more affordable

Battery type for pico-solar products tested by LG QA



Nova Lumos Solar Power Station
w/83 W solar module and 363 Wh
lithium-ion battery

Lithium Battery Fires Can Cause Real Damage



House that burned following a fire associated with an off-grid solar system that had a lithium NMC battery

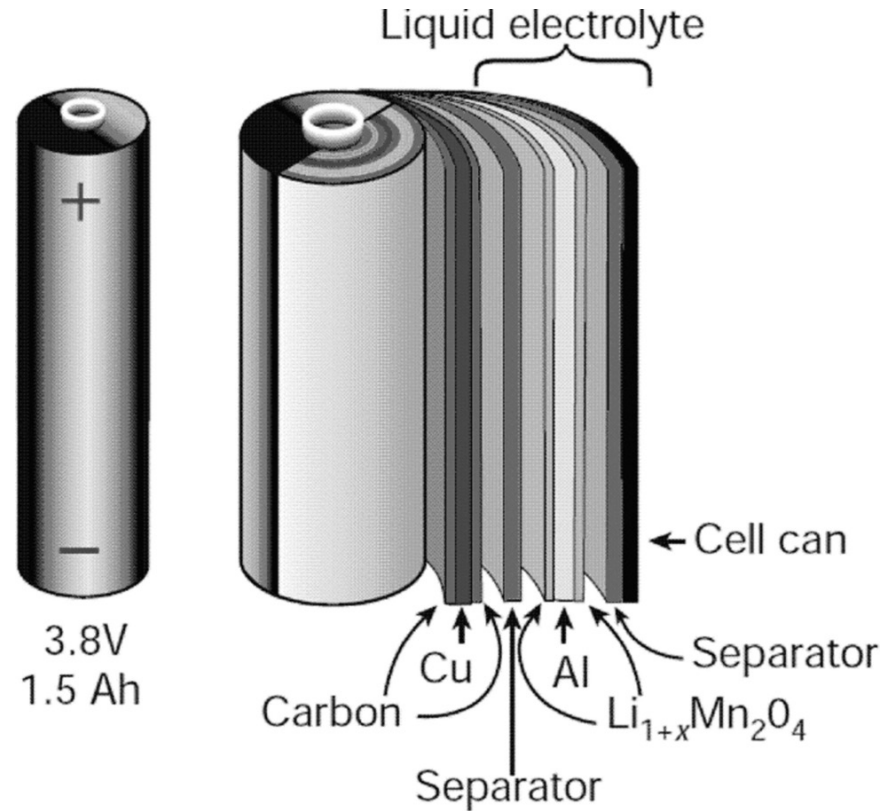
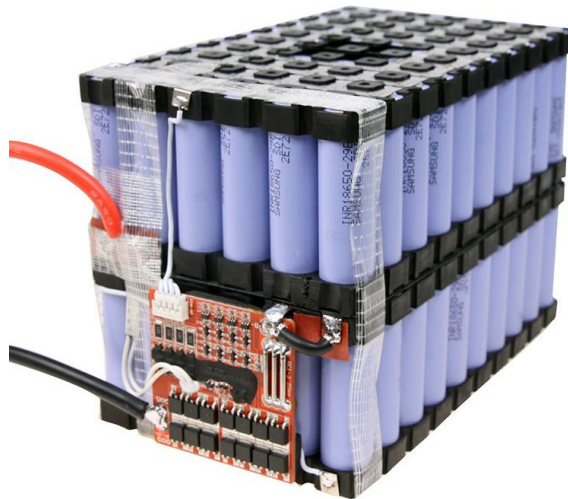
We have also received reports regarding fires associated with lithium iron phosphate batteries



Lithium NMC battery from an off-grid solar system following a fire

Causes of Lithium Battery Fires

- Short circuits (internal & external)
- Overcharging
- Overdischarge / rapid discharge
- Puncture



Source: <http://jes.ecsdl.org/content/159/12/A2060/F1.expansion.html>

Addressing Lithium Battery Safety

- Common safety standards
 - Safety during transport: UN 38.3
 - Includes cell and pack-level tests
 - Testing cost at accredited lab \$2000 - \$3000
 - Testing time: 4-6 weeks is typical
 - Safety during use: IEC 62133-2
 - Includes cell and pack-level tests
 - Testing cost at accredited lab \$2000 - \$7000
 - Testing time: 4-6 weeks is typical



Image sources: Intertek

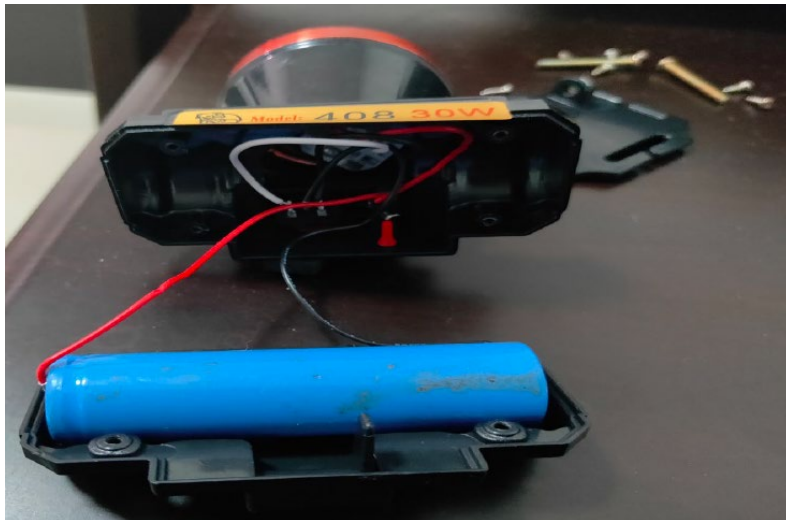
Lithium Battery Requirements

- Current Lighting Global requirements for lithium batteries
 - *“Lithium batteries must carry IEC 62281, IEC 62133-2, UL 1642 or UN 38.3 certification and have overcharge protection for individual cells or sets of parallel-connected cells. Batteries of included appliances must also meet this standard.”*
 - Charge control circuits must use appropriate set points
- Proposed approach for IEC 62257-13-1
 - Any lithium-based battery must be tested to and meet the requirements of a standard for safety during use: either IEC 62133-2, UL 62133, or UL 1642/UL 2054
 - Testing must be carried out at cell and pack level
 - Other requirements related to charge control and cell/pack overcharge protection continue to apply

Additional note on lithium battery safety: Fires can be caused by batteries in appliances charged by SHS



House fire mentioned earlier may have been caused by head lamp with unprotected lithium-ion battery. Fire may have started in head lamp while charging, then spread to SHS's lithium battery



Thank You!

Please review the proposed changes and submit your comments by May 17:

<https://www.lightingglobal.org/resource/call-for-comments-on-proposed-changes-to-the-draft-quality-standards-under-review-by-the-iec/>



Arne Jacobson, Ph.D.

Director, Schatz Energy Research Center

Technical Lead, Lighting Global QA

Humboldt State University

arne.jacobson@humboldt.edu

+ 1-707-826-4302

<http://users.humboldt.edu/arne>

Preliminary feedback from GOGLA members regarding proposed lithium battery safety certification requirements

1. *“We don’t suggest to request more certification on batteries. IEC 62133 is not very hard to pass technically. But it will increase cost and lead time before product launch which will slow innovation. For IEC 62133, the test cost is quite high, especially if we have to provide it for both cell and each one of different pack”*
2. *“IEC 62133-2 we also have for one of the batteries we are using and I don’t think it should be a problem to obtain this for the others – except of course that there is a cost and time associated with this”*
3. *“We can provide safety certificates for our fully assembled battery packs as well as individual cells.”*
4. *“For IEC 62133-2, each type of battery costs about 3500 USD and 3-4 weeks of test time. This will definitely affect our projects timelines and costs in a negative way but could be done if necessary”*
5. *“Not only the safety certificate of assembled battery is not easily to be obtained, but also the safety certificate is designed for cells, and there is no significant safety difference between cell and pack”*
6. *“If a requirement is to be introduced for a pack, this should be done at a threshold (size, number? According to chemistry). Again, how to define this level may be the tricky part.”*

Each item listed above represents a comment from a different organization.

Expert Insights on Lithium Battery Safety



Stephan Lux
Head of Group, Battery Engineering
Fraunhofer Institute for Solar Energy Systems



Jit Bhattacharya
Chief Technology Officer
Fenix International

Questions