Framework for Testing Product Component Families

This document presents a parallel quality assurance method to IEC TS 62257-9-5 for testing interchangeable product components that may be individually sold but are intended to be used together.

Version 2
December 2014

Introduction

Historically, the most widely-used business model that modern off-grid lighting manufacturers use is to sell their product as a complete kit (i.e., including one or more batteries, solar modules, and light sources). In some cases the product is a single unit with an integrated battery, solar module, and light source, and in other cases the solar module and/or light source(s) are external to the battery, intended to be connected via a cable. For both of these product configurations, manufacturers have traditionally sold the complete product as a single, defined unit. Verifying the quality of these preconfigured kits was the original goal for Lighting Global Quality Assurance (QA).

Recently, Lighting Global has observed an increasing trend in manufacturers selling "product families"—a set of interchangeable components sold on a component-level basis or as "mix-and-match" kits. A benefit of selling products at the component-level is that users are able to tailor a complete system to their budget and lighting needs. In principle it is also less costly to scale-up these systems by purchasing extra components, rather than another complete (larger) product kit that is incompatible with the original one.

This document provides details of the Lighting Global framework for component-level testing and associated programmatic support for "product families" that are considered to have met the Lighting Global Quality Standards. The intention of this framework is to provide a low-cost, timely product verification alternative for manufacturers that sell "product families."

Because of the potentially dozens of combinations that are possible from the same "family" of interchangeable components it would be prohibitively expensive to use a QA framework that required testing of each unique set. The market drive toward flexible families of products and this incompatibility with the original framework is what drives the development of the new policy that is presented here.

Product Family Testing Framework

The following is a set of testing rules for "product families":

Product Family Testing Rules:

1. **Interchangeability:** Product family testing is intended for products that are sold as individual components or as "mix-and-match" kits in which some or all of the components within the product family may be used interchangeably.
2. **Random Sampling:** All tested components must be randomly-selected according to the guidelines in IEC TS 62257-9-5, and all tests will use a sample size of 6.
3. **System-level Testing:** At least one fully-configured system "kit" must be tested according to the Quality Test Method. The organization seeking testing may recommend the arrangement of components to have tested as a complete kit, but if there is public advertising of any specific kits, one of those advertised kits must be selected for testing. It is allowed, of course, to select more than one complete kit to have tested, if desired. Though the organization may recommend a kit for testing, Lighting Global has the discretion to select which kit combination(s) will be tested and may require testing more than one kit.
4. **Coverage:** At least half (rounding down) of the models of each product component (PV module, battery/control unit, light point, etc.) must be tested. Lighting Global has the discretion to test more than half if deemed necessary.
    a. The smallest/dimmest and largest/brightest models the test lab is capable of testing must be tested, at a minimum.
    b. The other model(s) will be selected by Lighting Global.
5. **Test Plans:** Lighting Global will develop a custom test plan for each product family. The timeline and pricing of testing will be based on this custom test plan and be agreed upon in advance of testing.

Component-level testing may take place according to Rule 4. The Lighting Global Quality Test Method in IEC TS 62257-9-5 provides a framework for rigorously testing various product components:

- **Battery/energy storage characteristics**
    - Battery capacity
    - Appropriate charge control*
- **Photometric characteristics**
    - Light output*
    - Light distribution*
- **Lumen maintenance**
- **Photovoltaic module performance**
- **Durability, usability, and safety**
    - IP class estimate
    - Drop, switch/connector, gooseneck, and strain relief tests
- **Electrical quality inspection**

Of the tests listed above, only the three tests with an asterisk (*) currently require system-level information or other system components to carry out the test. Table 1 provides an explanation of

how this framework for testing "product families" will be implemented in the case of tests that normally require system-level information to carry out:

Table 1 List of tests that require system-level information to carry out according to the methods in IEC TS 62257-9-5 and how the testing will be conducted on a component-level basis.

Test	Information or Other Component(s) Required by IEC TS 62257-9-5	Test Plan for Component-Level Test
Appropriate charge control	Load and charging system information is required. For NiMH batteries in particular, charging system information is required to check for passive overvoltage protection.	1. Verify appropriate charge control protection in the tested kit(s) with n = 6. 2. Verify overvoltage protection for family using a) the smallest battery and largest charging source (with n = 3) and b) the largest battery and smallest charging source (with n = 3). 3. Verify deep discharge protection for family using a) the smallest battery and largest light load (with n = 3) and b) the largest battery and smallest light load (with n = 3).[1]
Light output	The light source is driven at the voltage corresponding to the average light output over the full-battery run time.	Drive the light load at the voltage corresponding to the average light output over the full-battery run time for the tested kit(s) with n = 6. If more than one kit is tested, the average of the voltages obtained during the full-battery run time test will be used.
Light distribution	The light source is driven at the average voltage through the full-battery run time.	Not required.

[1] The scenarios (a and b) outlined in steps 2 and 3 are subject to safety constraints that are required to be published by the manufacturer for the component family (e.g., "With battery X, only connect up to Y watts of PV module"). Lighting Global will determine if the published safety constraints are adequate.

The other testing in the bulleted list above will be conducted as normal (i.e., according to the IEC TS 62257-9-5 QTM methods) on each component tested, as applicable to the component itself. For all component-level and kit-level tests performed on the "product family", a measurement tolerance of 15% will be allowable for truth-in-advertising judgments (i.e., the average measured value across all samples can be up to 15% lower than the advertised value).

Product Family Program Support Framework

The Lighting Global Quality Assurance team will support quality-verified "product families" according to the following guidelines:

Lighting Global Program Support Guidelines:

1. **Standards:** All complete kits that are tested according to the Quality Test Method must meet the Lighting Global Quality Standards. Additionally, all individually-tested components must meet the applicable Lighting Global Quality Standards. If any kits or components fail to meet the Quality Standards, re-testing or other measures may be required for the product family to pass at the discretion of Lighting Global.

2. **Market Check Testing:** All components and complete kits, whether initially tested or not, are subject to market check testing. If any component or configuration fails a market check test, the status of all product configurations that utilize that component or which relied on results associated with the failed configuration may be revoked as described in the Market Check Test Policy.

3. **Communicating Quality:** Test results for product families with verified quality will be available on the Lighting Global Products web page in a "Spec Book" that includes test results that apply to the family of products (see below for details on the Spec Book contents). Additionally, each fully tested system configuration will be included in a separate, stand-alone Standardized Specification Sheet (SSS) along with the current ones.

Spec Books:

For "product families" that meet the Quality Standards—both kits and components—a "Spec Book" will be generated that provides information about all of the configurations within the family and the associated components. In addition, each fully tested kit will receive a separate Standardized Specification Sheet (SSS). Both the Spec Book and the individual product SSS will receive individual listings on the Lighting Global website (see http://www.lightingglobal.org/products/ for examples of standard SSS). **An example Spec Book is provided below**. The Spec Book will contain the following (in order):

1. A title page indicating the manufacturer name, name of the "product family," and the expiration date of the test results.
2. A component-level page indicating the component type, component name or model number, component rating, and measured performance. For components that did not undergo testing, they will be clearly labeled as not being quality-tested, but text on the page will state that based on the verified quality of the other tested components in the family, the components that did not undergo testing are considered to be quality-verified as well.
3. A table showing the systems that can be created using the quality-verified components, and the combination of components that are included in each system.
4. Information on component or system warranties and product certifications. The page will further reference the individual system-level SSS with a clear disclaimer indicating that other system configurations (i.e., kits) will perform differently.

Lighting Global
Standardized Specifications Book

Manufacturer: SunShine Co.

Component Family Name: SunShine Basic Kit

Date of Standardized Specifications Book Expiration: March 2017

Verify Online: http://www.lightingglobal.org/products/ss-basickit

Contact Information: sales@sunshine.com

Website: www.sunshine.com/sunshine-basic-kit

Optional Product Image

This Lighting Global Standardized Specifications Book presents a **component-level Standardized Specifications Sheet** listing the available components in the product family by component type, each individual component's performance rating, and performance results for each component tested according to the latest verison of the Quality Test Method (QTM) in IEC 62257-9-5. Following the component-level Standardized Specifications Sheet is a **list of the systems** covered by this Specifications Book that use combinations of these components.

NOTICE: Systems or kits developed using components from the component family will each perform differently and have not all been evaluated on a system-level basis. All systems listed in this Specifications Book are regarded to have passed the applicable Lighting Global Quality Standards.

Quality Standards Framework Version: 2015
Revision: 2015.03

Component-Level Standardized Specifications Sheet

SunShine Co.

SunShine Basic Kit Family

Battery / Control Box

Name / Model Number	Battery Capacity Rating (mAh)	Measured Battery Capacity (mAh)
Sun Battery 1	2000	3200
Sun Battery 2	4000	4500

PV Module

Name / Model Number	Peak Power at STC Rating (W)	Measured Peak Power at STC (W)
Sun PV module*	6	7.3
SunShine PV module	9	9.5

Light Sources

	Luminous Flux Rating (lm)				Measured Luminous Flux (lm)				Measured Lamp Efficacy (lm/W)			
Name / Model Number	High	Medium	Low	Bedtime	High	Medium	Low	Bedtime	High	Medium	Low	Bedtime
Sun Lamp 1	50	--	35	15	65	--	32	--	95	--	95	--
Sun Lamp 2**	75	50	35	15	80	--	33	--	95	--	95	--
SunShine Light 1	50	--	--	15	55	--	--	--	90	--	--	--
SunShine Light 2	85	--	--	15	Not Tested				Not Tested			
SunShine Light 3	120	--	--	15	130	--	--	17	85	--	--	80

*Notes

**More Notes

NOTICE: As indicated, not all components listed on this page were tested according to the Quality Test Method (QTM) in IEC 62257-9-5. However, based on the satisfactory performance of the tested components in the family, the components that were not tested are regarded to have passed the applicable Lighting Global Quality Standards. In addition, all tested components passed an internal inspection, the full array of *applicable* QTM durability tests, as well as ingress protection testing (where applicable).

List of Covered Systems

SunShine Co.

SunShine Basic Kit Family

System Name	Number of each component included in each system								
	Sun Lamp 1	Sun Lamp 2	SunShine Light 1	SunShine Light 2	SunShine Light 3	Sun Battery 1	Sun Battery 2	Sun PV module*	SunShine PV module
SunShine Kit 1	1					1			1
SunShine Kit 2	2					2			1
SunShine Kit 3		2					1		2
SunShine Kit 4		3	1				2		2
SunnyKit1**			1	1		2		1	
SunnyKit2**			1	2		3		2	
SunnyKit3**			1	3	1		2	3	
SunnyKit4			1	4	1		3	4	

******Tested as full systems. Individual SSS available on Lighting Global website.

NOTICE:

Only the SunnyKit1, SunnyKit2, and SunnyKit3 were fully tested as systems according to the Quality Test Method (QTM) in IEC 62257-9-5. Individual Standardized Specifications Sheets (SSS) that report system-level performance are available for the SunnyKit1, the SunnyKit2, and theSunnyKit3 at www.lightingglobal.org/products. Systems that were not tested, but that were developed using components from the component family will perform differently than the system(s) shown in the individual system-level SSS. All systems listed above are regarded to have passed the applicable Lighting Global Quality Standards.

Unless otherwise noted, the following information applies to all listed systems and components:

Warranty Information
Two year warranty on all kits and components

Marks and Certifications	
Factory certification	ISO 9001:2008
Safety certification	UL
Other certification	CE