

## Lighting Global Quality Standards

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Lighting Global maintains the Quality Standards, a set of off-grid lighting benchmarks that set a baseline level of quality, durability, and truth-in-advertising to protect consumers. The Quality Standards are summarized below and listed in more detail on the following page.

Conformance with the Quality Standards is evaluated based on results from laboratory testing according to the Quality Test Method (QTM) in the latest edition of the International Electrotechnical Commission (IEC) Technical Specification 62257-9-5. The tests are conducted at a third-party, approved test center using randomly-procured samples. Information contained in Lighting Global Standardized Specification Sheets (SSS) or Spec Books is acceptable for determining conformity with the Quality Standards; any product with an up-to-date SSS is required to have passed the Quality Standards.

### Summary of Quality Standards



**Truth-in-Advertising:** Accurate consumer-facing labeling (e.g., rated run time, light output battery capacity, PV power).

**Lumen Maintenance:** L85 time is greater than 2,000 hours.

**Battery:** Must be durable and adequately protected.

**Health and Safety:** Batteries may not contain mercury or cadmium, products are safe.

**Durability and Quality:** Appropriate protection to prevent early failure.

**Warranty:** At least one year of coverage.

*Effective March 1, 2015 or by program announcement:*

**Performance Information:** Run time and brightness reported.

**Table 1. Lighting Global Quality Standards**

Category <sup>a</sup>	Metric	Quality Standard	
<i>Truth In Advertising<sup>b</sup></i>	Manufacturer	Accurately specified	
	Product Name & Model #	Accurately specified	
	Light Output	If reported, accurately specified <sup>c</sup>	
	Lamp Type	If reported, accurately specified	
	Run Time	If reported, accurately specified <sup>c</sup>	
	Charger Rating	If reported, charger power rating accurately specified (e.g. PV power or mechanical charge time)	
	Other Aspects	If reported, accurately specified	
<i>Lumen Maintenance</i>	Lumen Maintenance at 2,000 hours	Average relative light output $\geq 85\%$ of initial light output at 2,000 hours, with only one sample allowed to fall below 75% OR All 6 samples maintain $\geq 95\%$ of initial light output at 1,000 hours	
<i>Health and Safety</i>	AC-DC Charger Safety	Any <i>included</i> AC-DC charger carries approval from a recognized consumer electronics safety regulator <sup>d</sup>	
	Hazardous Substances Ban	No battery may contain cadmium or mercury at levels greater than trace amounts	
<i>Battery</i>	Battery Protection	Protected by an appropriate charge controller that prolongs battery life and protects the safety of the user. 5 out of 6 samples must meet the requirements outlined below. <sup>e</sup>	
	Battery Durability	The average capacity loss of 6 samples must not exceed 25% and only one sample may have a capacity loss greater than 35% following the battery durability storage test as defined in IEC 62257-9-5 Annex BB	
<i>Quality and Durability</i>	Physical Ingress Protection	<i>Fixed Outdoor</i>	IP5x
		<i>Others</i>	IP2x
		<i>All PV Modules</i>	IP3x
	Water Protection <sup>f</sup>	<i>Fixed Indoor<sup>g</sup></i>	No requirement
		<i>Portable Separate<sup>g</sup></i>	Occasional rain: IPx1 OR <i>technical equivalent</i> OR <i>with warning label</i>
		<i>Portable Integrated</i>	Frequent rain: IPx3 OR <i>technical equivalent</i> OR IPx1 / <i>equivalent</i> + <i>warning label</i>
		<i>Fixed Outdoor</i>	Permanent outdoor exposure: IPx5 OR IPx3 AND <i>circuit protection</i>
		<i>All PV Modules</i>	Outdoor rooftop installation: <i>Modified IPx4</i> OR <i>circuit protection</i>
	Drop Test	<i>Fixed Indoor<sup>g</sup></i>	No requirement
		<i>Others</i>	5 out of 6 samples are functional after drop test (1 m onto concrete); none result in dangerous failures <sup>h</sup>
	Soldering and Electronics Quality	Pass soldering and electronics inspection; the maximum prevalence of bad solder joints, poor wiring or overall workmanship failure is 1 out of 6 samples in each category	
	Switch, Gooseneck, Connector, and Strain Relief Durability	5 out of 6 samples are functional after 1000 cycles (switch, connector, gooseneck tests); 5 out of 6 samples are functional (strain relief test); None result in dangerous failures (all tests)	
<i>Warranty</i>	Minimum Warranty Terms	Accurately specified and consumer-facing; minimum coverage of at least one year on manufacturing defects under normal use, including the battery. Details are noted below.	

## Warranty Requirements Details

To meet the Standard, Lighting Global requires that the following guidelines be followed when presenting and offering a warranty:

- The minimum warranty period is one year from the time of purchase by the end-user.
- The warranty must cover the entire product, including the battery.
- The warranty must cover, at a minimum, manufacturing defects that impede operation under normal use and protection from early component failure.
- The consumer-facing warranty must explain how the consumer can access the warranty (return to point of purchase/distributor/service center, call or SMS a number, etc.), how the warranty will be executed (repair, replacement, etc.) and should advise the customer to inquire about the warranty terms prior to purchase.
- Full terms of the warranty must be available to the consumer in writing in a way that enables the end user to verify and understand the terms of the warranty prior to purchase. The written information should be in a regionally appropriate language. Consumer-facing warranties could be included on the product box or on a warranty card that is easily accessed prior to purchase.

Note that this is a *Minimum* Standard and it is up to the discretion of manufacturers and distribution partners to exceed the basic protection offered in these terms to differentiate the best quality products in the market.

## Other Notes

<sup>a</sup> If a product fails on any aspect at any point during testing, even if not during the specific test used to evaluate that aspect, the product will still fail on the basis of that aspect. For example, if a switch stops functioning on a product while its luminous flux is being measured, this failure would be included in the count of failures for the switch test.

<sup>b</sup> Numeric aspects, such as light output and run time, must deviate no more than 15% from advertised ratings (though it is always acceptable if actual performance is better than advertised). Any description of the product that appears on the packaging, inside the package and in any other medium (internet, etc.) should be truthful and accurate. No statements should mislead buyers or end users about the features or utility of the product.

<sup>c</sup> Effective March 1, 2015 (or by program announcement), all manufacturers will be required to present performance metrics (brightness/light output and runtime) on product packaging and other relevant consumer-facing materials to enable consumers and distributors to compare products and make educated choices.

<sup>d</sup> Approved marks: UL or similar

<sup>e</sup> Table 2 contains recommended battery deep discharge protection voltages and minimum battery voltages during testing and Table 3 contains recommended battery overcharge protection voltages and maximum battery voltages and cell temperatures specific to the five common types (i.e., chemistries) of batteries. These default values are used when determining appropriate charge controller behavior, unless alternate appropriate design values are provided by the battery manufacturer for the deep discharge protection voltage cutoff, overcharge protection voltage cutoff or maximum cell temperature. Note that the voltage specifications for nickel-metal hydride batteries only apply in cases where more than one cell is wired in series.

**Table 2. Recommended battery deep discharge protection voltage specifications**

Battery type	Recommended deep discharge protection voltage (V/cell)	Minimum allowable discharge protection voltage (V/cell)	Maximum allowable discharge protection voltage (V/cell)
Sealed lead-acid	$\geq 1.87$	1.82	--
Lithium-ion	$\geq 3.00$	2.95	--
Lithium iron phosphate	$\geq 2.50$	2.45	--
Nickel-metal hydride	$= 1.00$	0.95	1.10

**Table 3. Recommended battery overcharge protection voltage and temperature specifications**

Battery type	Recommended overcharge protection voltage (V/cell)	Minimum allowable overcharge protection voltage (V/cell)	Maximum allowable overcharge protection voltage (V/cell)	Maximum charging temperature (°C)
Sealed lead-acid	= 2.40	2.35	2.45	45
Lithium-ion	≤ 4.20	--	4.25	45
Lithium iron phosphate	≤ 3.65	--	3.70	45
Nickel-metal hydride	≤ 1.45	--	1.50	60

<sup>f</sup> There are two alternative water protection compliance pathways allowed by Lighting Global (i.e., these are alternatives to meeting the IP class requirements). In one alternative (“technical equivalent”), the whole system of protection (ingress protection + electronic circuit protection + manufacturing QC) is evaluated to determine if the protection level is equivalent to that of a product with the required level of ingress protection. In another alternative (“warning label”) there are clear messages to the consumer about the degree of protection from water. The warning level messages must meet Lighting Global program guidelines. The pathways and associated guidelines are described in greater detail in a document titled “Integrated Water Protection Assessment.”

<sup>g</sup> The cable between the solar module and the battery (or the product housing that contains the battery) must be at least 3 m long to qualify as a “separate” or “fixed indoor” product.

<sup>h</sup> Dangerous failures are defined as those which may expose the user to physical harm, such as harmful chemicals, heat (e.g., from an electrical short or fire), or sharp materials (e.g. broken glass).