Requirements for DC Solar Home System Kit

ICS:67.160.10
Published by Ethiopian Standards Agency
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Commissioned by:

MoEFCC
gef
UNDP

ES6087:2017
First edition
09/05/2017

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Draft of the standard has been presented by IFC.

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Foreword

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This Ethiopian Standard specifies requirements for performance, safety and durability for plug – and – play type DC Solar Home Systems Kit that have the peak power rating above 10 and up to 350W. This standard’s requirements do not include component-based systems and kits with screw terminals.

2. Normative References
The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.


3. Terms and Definitions
For the purpose of this standard, the following definitions shall apply.

3.1. plug-and – play
All electrical connections can be made without the use of tools. No design expertise is required to choose appropriate system components and no technicians or electricians are necessary to safely and successfully install and operate the system.

3.2. PAYG
In a “pay-as-you-go” (PAYG) business model, a company essentially rents consumers a solar home system that comes with a battery, a charge controller, a solar panel, LED bulbs and a mobile charger. Basic systems have enough power to charge phones and lights, and TVs. Consumers use basic mobile phones to pay on a monthly, or similar, basis. PAYG allows customers to buy the lantern for a small down installment. If the customer does not pay, the system is automatically switched off by the manufacturer or supplier.
Requirements for DC Solar Home System Kit

1. Scope

This Ethiopian Standard specifies requirements for performance, safety and durability for plug – and – play type DC Solar Home Systems Kit that have the peak power rating above 10 and up to 350W.

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4. General Requirements

4.1. All components required to provide basic energy services shall be installed as a kit and the following components shall be included.
   a. PV module(s),
   b. Charge control unit(s),
   c. Battery/batteries,
   d. Cables, switches, connectors, and protective devices sufficient to connect the PV module(s), charge control unit(s) and battery/batteries,
   e. Loads (optional): Lighting and requisite cables, load adapter cables (e.g., for mobile phones), and other appliances (TV, fan, radio, etc.) and their requisite cables.

4.2. The PV module maximum power point voltage and the working voltage of any other components in the kit shall not exceed 35 V DC. AC inputs may exceed this limit.

4.3. Only DC systems, outputs, and loads shall be covered. No inverters, systems with AC outputs/outlets, or AC appliances shall be accepted and AC inputs shall be used if the AC charger meets the AC/DC charger safety standard.

4.4. Kits shall be plug-and-play.

4.5. All testing shall be conducted using the test methods provided in IEC TS 62257-9-5 or the Lighting Global Solar Home System Kit Quality Assurance Protocols.

4.6. The system and any included appliances shall pass a soldering, electronics and assembly inspection.

4.7. The system and any included appliances shall be rated “Good” or “Fair” for workmanship quality as defined in Annex F of the Lighting Global Solar Home System Quality Assurance Protocols or IEC 62257-9-5. At most, one sample may fail to function when initially evaluated. At most, one sample may fail to function when initially evaluated.

4.8. For PAYG Systems,
   4.8.1. Appropriate battery protection shall remain active regardless of whether the system is in an enabled or disabled state.
   4.8.2. The solar module shall be able to charge the battery even if the product is in a disabled state.
     (To avoid damage to a battery during long-term periods of non-payment disabled system status)

4.9. Document and Information Requirement
   4.9.1. All advertised ratings and features shall be truthful and functional, respectively.
   4.9.2. User manual shall be presented with instructions for installation, use and troubleshooting of the system.
   4.9.3. Installation instructions shall include appropriate placement and installation of the PV module.
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4.9.4. Installation & operation instructions shall be presented in English language and in graphics.

4.9.5. Warranty shall be presented in English language.

4.9.6. Basic electrical safety and system maintenance shall be included in the manual.

4.9.7. At a minimum, the operation manual shall contain graphical and/or written guidance on the following:

   a. How to connect the PV module to the unit for charging,
   b. Instructing the user not to shade the PV module,
   c. Facing the PV module surface toward sun,
   d. Any required pre-use steps necessary for the product (e.g. fully charge battery, insert supplied fuse),
   e. How to make all required permanent connections,
   f. How to connect all advertised appliances,
   g. How to interpret the battery state-of-charge indicator or other instructions related to determining and understanding the battery state-of-charge.

4.9.8. Any included AC-DC charger carries approval from a recognized consumer electronics safety certification organization. (See ANNEX A part A5 for details).

4.9.9. Consumer information shall provide either:

   a. Specifications for components that may require replacement (fuses, lights, PV, batteries) and instructions for replacement, refer Annex A part A16
   b. Directions as to how the consumer can get components, including the battery, replaced at service centers, both during and post warranty, OR
   c. A clear consumer-facing statement that the batteries and other components are not replaceable.

4.9.9.3. Detailed instructions or descriptions regarding replacing components may be included in the user manual, but a clear statement regarding the battery replacement shall be included on the consumer-facing packaging.

4.9.9.5. Accepted phrases are:

   a. Battery is field replaceable,
   b. Battery may be serviced by manufacturer,
   c. Battery is not replaceable.

NOTE: similar phrases should be accepted.

4.10. Warranty Requirements

4.10.1. The minimum warranty period from the time of purchase by the end-user shall be at least:

   a. 2 years for the main system, including the PV module, control box, cables, lights and the system battery,
   b. 1 year for batteries included within appliances,
4.10.1.3. 1 year for all lighting appliances that include their own batteries (including pico-power lights), all non-lighting appliances, USB charging adaptors and similar accessories.

4.10.2. The battery warranty

4.10.2.1. Shall include a capacity retention figure, benchmarked to the advertised battery capacity and/or the battery capacity presented in the test report.

4.10.2.2. The capacity retention figure shall be equivalent to or better than at least 80% capacity at the end of warranty period.

4.10.3. The warranty shall cover, at a minimum, manufacturing defects that impede operation under normal use and protection from early component failure.

4.10.4. The consumer-facing warranty shall explain

4.10.4.1. How the consumer can access the warranty (return to point of purchase/distributor/service center, call or SMS a number, etc.) and

4.10.4.2. How the warranty will be executed (repair, replacement.), and should advise the customer to inquire about the warranty terms prior to purchase.

4.10.5. The consumer-facing warranty shall 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.

4.10.6. Consumer-facing warranties shall be included on the product box, or on a user agreement or warranty card that is easily accessed prior to purchase.

5. Specific Requirements

5.1. Battery

5.1.1. The battery deep discharge protection voltage shall comply with Table 1 in Annex A part A7 unless specified by the battery manufacturer.

5.1.2. The battery overcharge protection voltage and temperature shall comply with Table 2 unless specified by the battery manufacturer.

5.1.3. Lithium batteries shall additionally carry UN 38.3 certification and have overcharge protection for individual cells or sets of parallel-connected cells.

5.1.4. If the battery is disconnected, the system shall not be damaged and PV open-circuit voltage shall not be present on load terminals.

5.2. Cable

5.2.1. The minimum length of Cables shall be 3m long when connecting a “fixed indoor” or “portable separate” component to the PV module or any other fixed outdoor component.

5.2.2. Any outdoor cables shall be outdoor-rated and UV (Ultra Violet) resistant as specified in ANNEX A part A14.

5.2.3. All cables included appliances shall pass a strain relief test according to the IEC TS 62257-9-5 or Lighting Global Solar Home System test Protocols.

5.2.4. Wires cables and connectors shall be appropriately sized for the expected current and voltage. (See ANNEX A part A6 for details).
5.3. Ports

5.3.1. Port voltage and current specifications, if provided, shall be accurate.

5.3.2. Included appliances shall function when connected to SHS ports.

5.3.3. Power output of ports shall be sufficient to power appliances that are advertised but not included.

5.3.4. Specific guidelines for USB and 12 V ports fulfill requirements specified in ANNEX A part A3 and ports of included appliances are not required to meet this standard.

5.3.5. All ports advertised or reasonably expected to provide 12 V shall maintain a voltage between 10.5 – 15 V over the advertised current range.

5.3.5.1. If no current range is advertised, over the entire tested range of currents, though port voltages may fall below 10.5 V at low battery state-of-charge.

5.3.5.2. If a voltage range is advertised for a 12 V port, the measured values shall not fall more than 0.1 V outside of the advertised values, but may fall below the lower limit at low battery state-of-charge. (See ANNEX A part A3)

5.3.6. All ports with a USB form factor and all 5 V ports advertised or reasonably expected to be used for mobile phone charging (including barrel plugs) shall meet the requirements below.

5.3.6.1. If a voltage range is advertised for a 5 V port, the measured values shall not fall more than 0.05 V outside of the advertised values and meet:-

5.3.6.1.1. Voltage requirements for sustained current less than or equal to 0.5 A (or less than or equal to the advertised current if the advertised current is higher than 0.5 A):

a. Minimum steady-state voltage: 4.5 V at all simulated battery voltages except the deep discharge protection voltage; 4.25 V at the deep discharge protection voltage.

b. Maximum steady-state voltage: 5.5 V

5.3.6.1.2. Voltage requirements for sustained current greater than 0.5 A (or greater than the advertised current if the advertised current is higher than 0.5 A):

a. No minimum steady-state voltage requirement

b. Maximum steady-state voltage: 5.5 V

5.4. Lumen Maintenance at 2000 Hours

The Lumen Maintenance at 2000 hours of the system shall meet the requirement specified in Annex A part A4.

5.5. Switch, goosenecks, moving parts and connectors

5.5.1. The Switch, goosenecks, moving parts and connectors of the system shall meet the requirement specified in 6.4.8
NOTE: Most switches and connectors are considered to be intended for regular use. Mechanisms expected to be used primarily during installation are limited to only a few cases, such as:
  o A safety disconnect switch or circuit breaker that is turned on during installation and only turned off for maintenance,
  o Connectors dedicated to light points that are unlikely to be relocated after installation,
  o Connections between a light point and an extension cable.

5.6. Durability

5.6.1. The durability of the system shall meet the requirement specified in Table 3.
5.6.2. for Portable lighting components and non lighting portable appliances shall be functional after the drop test and modified drop test respectively as specified in 6.4.9.

Table 3 Quality and durability

<table>
<thead>
<tr>
<th>S.No</th>
<th>Metric</th>
<th>Quality standard</th>
</tr>
</thead>
</table>
| 1    | Physical Ingress Protection (for components containing electronics or electrical connections) | Fixed Outdoor Components: IP5x  
All PV Modules: IP3x OR IP2x with circuit protection  
All Other Components: IP2x |
| 2    | Water Protection (for components containing electronics or electrical connections). see Annex A part A11 | Fixed Outdoor Components: Permanent outdoor exposure: IPx5 OR IPx3 with circuit protection  
All PV Modules: Outdoor rooftop installation: Modified IPx4 OR circuit protection  
Portable Integrated Components: Frequent rain, which requires meeting one of: 1) IPx3 2) IPx1 + technical protection 3) IPx1 + warning label 4) Technical protection + warning label  
Portable Separate Components: Occasional rain: IPx1 OR technical protection OR warning label  
Fixed Indoor Components: No requirement |

5.7. Safety Requirement

5.7.1. Circuit and Overload Protection

The system shall pass an over current and an overload protection test.

5.7.2. Products shall include a current limiting mechanism to prevent irreversible damage to the system. The mechanism shall be easily resettable or replaceable by the user, or shall automatically reset.

5.7.3. If replaceable fuses are used for circuit protection, sizes shall be labeled on the device and listed in the user manual, and, if fuses are replaceable by the user, at least one spare fuse shall be included with the product.
5.7.4. The user interface should be designed to minimize the likelihood of making improper connections. If improper or reversed connections can easily be made, they should cause no damage to the system or harm to the user.

5.7.5. Hazardous Substances Ban

5.7.5.1. Battery shall not contain cadmium or mercury at levels greater than trace amounts (<0.0005% Hg and <0.002% Cd by weight).

6. Sampling and testing

6.1. Sampling and testing shall be carried out in accordance with IEC TS 62257-9-5 or Lighting Global Solar Home System Kit test Protocol. Initial qualification under the quality, warranty, and performance reporting requirements outlined in this document requires one of the following:

6.1.1. Required Quality Test Method (QTM) results according to Clause 6 of the Lighting Global Solar Home System Kit Quality Assurance Protocols or IEC/TS 62257-9-5 with a sample size of four. A product family (set of interchangeable components sold on a component-level basis or as a mix-and-match kit) can receive initial qualification as follows:

i. At least one fully configured system (“kit”) shall be tested according to the QTM.

ii. At least half (rounding down) of the models of each product component (PV module, battery / control unit, light point, etc.) shall be tested. The smallest/dimmest and largest/brightest models of each component shall be tested, at a minimum.

6.1.2. Targeted testing of fee-for-service or pay-as-you-go (PAYG) enabled versions of products that were previously qualified according to this standard using one of the processes described in a) above. Targeted testing is comprised of:

i. Visual inspection, including internal assessment

ii. Durability testing on any aspects that may have been impacted by the addition of the PAYG option (e.g. new ports or changes to the existing casing).

iii. An estimate of the parasitic consumption or additional standby loss due to the addition of the PAYG option.

iv. Submission of manufacturer declaration indicating that the performance of the PAYG-enabled version is equivalent to that of the previously tested non-PAYG product.

6.1.3. Re-testing shall be required two years after the date of completion for the QTM testing. If the product has remained unchanged since QTM testing, testing according to the Market Check Method (MCM) Primary Check Test with a sample size of two according to Clause 7 of the Lighting Global Solar Home System Kit Quality Assurance Protocols or IEC/TS 62257-9-5. If the product has changed since QTM testing, testing according to the QTM with a sample size of four shall be conducted. Furthermore, market check testing according to the Clause 7 of the Lighting Global Solar Home System Kit Quality
Assurance Protocols or IEC/TS 62257-9-5 with a sample size of two for all applicable tests can be used to verify that a product, after passing the quality and warranty requirements through QTM testing, continues to do so.

6.2. If a sample fails on any aspect at any point during testing, even if not during the specific test used to evaluate that aspect, the sample will still fail on the basis of that aspect. (See ANNEX A part A1 for details).

6.3. If products already have certifications that are equivalent to certain tests in the Lighting Global SHS Kit Quality Assurance Protocols, the examination should be in accordance with ANNEX A part A10.

6.4. Sample shall be taken for testing in accordance with lighting global solar home system test protocol.

6.4.1. All four samples shall pass soldering test.

6.4.2. The average capacity loss of 4 samples shall not exceed 25% and only one sample may have a capacity loss greater than 35% following the battery durability storage test. Requirements for flooded lead-acid batteries are mentioned in ANNEX A part A8.

6.4.3. If an included lighting appliance provides ≥15 lumens, it is subject to the battery durability standard. All other included appliances are not required to meet this standard.

6.4.4. The lumen maintenance standard shall be assessed using a 2000-hour test or an expedited method that requires LM80 data for the LEDs.

6.4.5. For the LM80 method as stated in Annex A part J of the Lighting Global Solar Home System Kit Quality Assurance Protocols or IEC 62257-9-5, the average lumen maintenance at 500 hours and the average estimated lumen maintenance at 2000 hours shall be ≥ 90% of initial light output, with no more than one sample below 85%. The LM80 test is intended as a way to expedite products entering the market and shall not be used for Associate Renewal or Market Check Method tests.

6.4.6. Average relative light output of 4 samples ≥ 90% of initial light output at 2,000 hours with only one sample allowed to fall below 85% OR All samples maintain ≥ 95% of light output at 1,000 hours. If an included lighting appliance provides ≥15 lumens, it is subject to the lumen maintenance standard.

6.4.7. For products that undergo 500-hour tests with a sample size of two (n=2) to qualify for or maintain program support (Associate Renewal, Market Check Method or Accelerated Verification Method tests), both samples shall maintain ≥ 95% of initial light output at 500 hours. If a product fails the 500-hour test, re-testing with 6 samples for the full 2000 hours will be required.

6.4.8. Switches, Gooseneck, Moving parts and connectors

6.4.8.1. Mechanisms expected to be used regularly for all 4 samples and any included appliances are functional after 1000 cycles.
6.4.8.2. Mechanisms expected to be used primarily during installation for all 4 samples and any included appliances are functional after 100 cycles.

6.4.9. Drop test

6.4.9.1. For portable lighting components: all 4 samples are functional after drop test (1 m on to concrete on six faces); none result in dangerous failures as specified in ANNEX A part A13.

6.4.9.2. For Non-lighting portable appliances (such as battery-powered radios, fans, razors and lights with light output below 15 lumens): 3 out of 4 samples are functional following a modified drop test requiring only 2 drops per sample rather than the standard 6 drops. The sides on which the product is dropped will be alternated between samples to ensure that all six sides are dropped at least once.

7. Labeling

7.1. The label of kit shall include

7.1.1. Peak PV wattage on side of packaging box.

7.1.2. On the side of packaging box or on component

a) Manufacturer,

b) Model Number,

c) Serial Number,

g) PV module maximum power voltage (V MPP),

h) PV module maximum power current (I MPP),

i) Lamp Type,

j) Battery Capacity,

k) Battery Nominal voltage,

l) Battery chemistry,

m) Light output in Lumen,

n) Warranty,

o) AC-DC charger carries approval certificate / if the charger is included.
ANNEX A
(Normative Reference)

A1. If a sample fails on any aspect at any point during testing, even if not during the specific test used to evaluate that aspect, the sample will still fail on the basis of that aspect. For example, if a switch stops functioning on a sample while its luminous flux is being measured, this failure would be included in the count of failures for the switch test.

In certain cases, where products are designed for special applications (e.g., productive uses), certain requirements may be waived, altered, or strengthened at the discretion of Lighting Global. Any deviations from the requirements listed in this document will be noted on test report and verification materials for the product.

A2. 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). If a range is provided, the best rating must be within the 15% tolerance. If a run time is advertised, it is assumed to be for solar run time and for the highest setting, e.g., brightest, unless otherwise stated. All advertised features shall be functional. 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.

Light distribution must only be measured for two samples to determine the full-width-half-max (FWHM) angle.

Included appliances are subject to truth-in-advertising requirements for performance claims. Relevant tests include: light output, battery capacity, power consumption, and the full-battery and solar run time. Certain existing performance test results for non-lighting appliances (such as TV power consumption from Global LEAP testing) may be referenced in place of additional testing. Only lights brighter than 15 lumens are required to be assessed for light output and light distribution.

Advertising regarding physical and water ingress protection may be evaluated. If a product advertises an IP rating of IP54 or higher, the manufacturer must provide documentation of meeting that IP rating based on test results from an accredited laboratory. The following common advertising terms are expected to meet the following IP levels:

- **IPX7**: Water proof, or similar
- **IPX4**: Splash proof, or similar
- **IPX3**: Rainproof, protected from heavy rain, or similar
- **IPX1**: Water resistant, splash resistant, rated for outdoor use, or similar
- **IP5X**: Dust proof, protected from dust, or similar

Note, advertisements cannot supersede the basic IP requirements by component form factor described in the Quality Standards.
A3. If a current or power range is advertised in association with a port, the port must be able to provide within 5% of the advertised rating at the typical battery discharge voltage. Advertised voltage ranges are subject to truth-in-advertising requirements. Specific requirements for 12 V and 5 V ports are below.

All ports advertised or reasonably expected to provide 12 V must maintain a voltage between 10.5 – 15 V over the advertised current range, or if no current range is advertised, over the entire tested range of currents, though port voltages may fall below 10.5 V at low battery state-of-charge. If a voltage range is advertised for a 12 V port, the measured values must not fall more than 0.1 V outside of the advertised values, but may fall below the lower limit at low battery state-of-charge. In cases where the measured voltage values fall below 10.5 V or the lower limit of the advertised voltage values during periods of low battery state-of-charge, the port and any advertisements must be marked to indicate that the voltage may drop below these limits at low battery state-of-charge and the feature or behavior must be described in the user manual.

All ports with a USB form factor and all 5 V ports advertised or reasonably expected to be used for mobile phone charging (including barrel plugs) must meet the requirements below. These standards are based on the USB Battery Charging Specification Revision 1.2 (USB Implementers Forum, 2012), with some modifications to address common charging requirements in the SHS kit market. Ports must comply with these default limits unless an acceptable reason and clear justification is presented for the port managing current and voltage in a different manner. Acceptance of alternate management schemes is not granted. If a voltage range is advertised for a 5 V port, the measured values must not fall more than 0.05 V outside of the advertised values and meet the requirements below.

- Voltage requirements for sustained current less than or equal to 0.5 A (or less than or equal to the advertised current if the advertised current is higher than 0.5 A):
  - Minimum steady-state voltage: 4.5 V at all simulated battery voltages except the deep discharge protection voltage; 4.25 V at the deep discharge protection voltage.
  - Maximum steady-state voltage: 5.5 V

- Voltage requirements for sustained current greater than 0.5 A (or greater than the advertised current if the advertised current is higher than 0.5 A):
  - No minimum steady-state voltage requirement
  - Maximum steady-state voltage: 5.5 V

A4. Approved marks: UL, CE, TÜV, CCC, or similar, with accompanying valid documentation of testing by an accredited test laboratory. Detailed guidelines are described in the AC Charger Safety Approval Policy.

A6. An external cables provided with the product must be capable of carrying the electric currents present during normal operation without exceeding 50 °C ± 3 °C (measured at 25 °C ± 3 °C ambient temperature). This Standard is primarily assessed using a declaration from the manufacturer.
A7. Table 1 contains default battery deep discharge protection voltages during testing and Table 2 contains default battery overcharge protection voltages and maximum 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 minimum voltage specification for nickel-based batteries only applies in cases where more than one cell is wired in series.

### Table 1. Default battery deep discharge protection voltage specifications

<table>
<thead>
<tr>
<th>S.No</th>
<th>Battery type</th>
<th>Deep discharge protection voltage (V/cell)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Recommended</td>
</tr>
<tr>
<td>1</td>
<td>Flooded lead</td>
<td>≥ 1.87</td>
</tr>
<tr>
<td>2</td>
<td>Valve-regulated / Sealed lead-</td>
<td>≥ 1.87</td>
</tr>
<tr>
<td>3</td>
<td>Lithium-ion</td>
<td>≥ 3.00</td>
</tr>
<tr>
<td>4</td>
<td>Lithium iron phosphate</td>
<td>≥ 2.50</td>
</tr>
<tr>
<td>5</td>
<td>Nickel-metal hydride</td>
<td>= 1.00</td>
</tr>
</tbody>
</table>

### Table 2 Recommended battery overcharge protection voltage and temperature specifications

<table>
<thead>
<tr>
<th>S.No</th>
<th>Battery type</th>
<th>Overcharge protection voltage (V/cell)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Recommended</td>
</tr>
<tr>
<td>1</td>
<td>Flooded lead</td>
<td>=2.4011</td>
</tr>
<tr>
<td>2</td>
<td>Valve-regulated / Sealed lead-</td>
<td>=2.40</td>
</tr>
<tr>
<td>3</td>
<td>Lithium-ion</td>
<td>≤ 4.20</td>
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<td>4</td>
<td>Lithium iron phosphate</td>
<td>≤ 3.65</td>
</tr>
<tr>
<td>5</td>
<td>Nickel-metal hydride</td>
<td>≤ 1.45</td>
</tr>
</tbody>
</table>

A8. The battery durability storage test requirement may be waived for flooded lead acid batteries which are shipped dry. In cases where batteries are shipped dry, manufacturers must provide the test labs with an adequate amount of the appropriate electrolyte solution or accurately specify the density and composition of the solution to be used.

A9. All applicable quality and durability standards are extended to PAYG components, such as remote-entry keypads, integrated circuits, and any other hardware systems that are included with the product.
A10. At the discretion of Lighting Global, some quality and durability requirements may be waived for non-lighting appliances that can be proven to meet other relevant standards. For instance, the following tests may be waived if the manufacturer provides evidence (test report, certification and/or other relevant documentation) showing that the appliance meets an internationally recognized standard for appliance safety, such as IEC 60065 (for TVs and radios) and IEC 60335 (for fans).

- Physical ingress protection,
- Strain relief,
- Switch, gooseneck, moving part, and connector durability,
- Drop test,
- Battery protection (charge controller)

A11. 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.” Additional guidance on testing IP requirements for PV modules is in a document titled “Lighting Global Test Methods for Ingress Protection for PV Modules.”

A12. Most switches and connectors are considered to be intended for regular use. Mechanisms expected to be used primarily during installation are limited to only a few cases, such as:

- A safety-disconnect switch or circuit breaker that is turned on after installation and only turned off for maintenance
- Connectors dedicated to light points that are specifically designed and explicitly stated to be for permanent installation and are not intended to be relocated after installation
- Connections between a light point and an extension cable.

A13. 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).


A15. At a minimum, the operation manual must contain graphical and/or written guidance on the following:

- How to connect the PV module to the unit for charging.
- Instructing the user not to shade the PV module.
A16. If the consumer information requirement is met by providing Option 1: “specifications for components that may require replacement (fuses, lights, PV, batteries) and instructions for replacement,” relevant specifications include the following:

- **PV module(s):** power, voltage (nominal, open-circuit and maximum power point), current (short circuit and maximum power point). All ratings should specify the conditions of the measurement (e.g., STC or NOCT) and should be included in a user manual or packaging. Ratings may be included on the module, but they must also be included in the user manual or packaging.

- **Battery (ies):** battery chemistry, nominal voltage, and capacity. Specifications must be provided for the main product battery (ies); specifications for appliance batteries are not required, but recommended.

- **Main lights:** drive voltage, power, and luminous flux (in lumens)

- **Fuses:** as noted in the “Circuit and Overload Protection” standard, if replaceable fuses are used for circuit protection, sizes must be labeled on the device and listed in the user manual, and, if fuses are replaceable by the user, at least one spare fuse must be included with the product. Included appliances are not required to meet this standard.

- **Other appliances:** specifications are not required, but are recommended.

Any other specifications necessary for a PV module, battery, light, or fuse to function with the system shall be included in the user manual. The purpose of this option is to enable a user or technician to be able to reasonably find a replacement if a key component of the system fails.

If the consumer information requirement is met by providing Option 2: “directions as to how the consumer can get components, including the battery, replaced at service centers, both during and post warranty,” the information must clearly state that the consumer can still have access to parts, repairs and replacements after the warranty period (these may be made available at a cost).
Organization and Objectives

The Ethiopian Standards Agency (ESA) is the national standards body of Ethiopia established in 2010 based on regulation No. 193/2010. ESA is established due to the restructuring of Quality and Standards Authority of Ethiopia (QSAE) which was established in 1998.

ESA’s objectives are:-

- Develop Ethiopian standards and establish a system that enable to check whether goods and services are in compliance with the required standards,
- Facilitate the country’s technology transfer through the use of standards,
- Develop national standards for local products and services so as to make them competitive in the international market.

Ethiopian Standards

The Ethiopian Standards are developed by national technical committees which are composed of different stakeholders consisting of educational Institutions, research institutes, government or ganizations, certification, inspection, and testing organizations, regulatory bodies, consumer association etc. The requirements and/or recommendations contained in Ethiopian Standards are consensus based that reflects the interest of the TC representatives and also of comments received from the public and other sources. Ethiopian Standards are approved by the National Standardization Council and are kept under continuous review after publication and updated regularly to take account of latest scientific and technological changes.

Orders for all Ethiopian Standards, International Standard and ASTM standards, including electronic versions, should be addressed to the Documentation and Publication Team at the Head office and Branch ( Liaisons) offices. A catalogue of Ethiopian Standards is also available freely and can be accessed from our website.

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ESA, representing Ethiopia, is a member of the International Organization for Standardization (ISO), and Codex Alimentarius Commission (CODEX). It also maintains close working relations with the International Electro-technical Commission (IEC) and American Society for Testing and Materials (ASTM). It is a founding member of the African Regional Organization for standardization (ARSO).

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