Global LEAP Off-Grid Fan Test Method

Version 1 (2016-08)

1 Scope

This document establishes methods to measure the performance, quality, and durability of fans intended to be used with off-grid energy systems (e.g. standalone solar home systems, mini-grids).

The following test conditions are defined for the evaluation of product suitability for use in off-grid applications:

- **Nominal conditions**;
- **Voltage fluctuation conditions**, which simulate performance during over-voltage and under-voltage conditions; and
- **Harsh environment exposure conditions**, which simulate exposure to high temperature and humidity environments. Procedures are adapted from *IEC 60068-2-78: Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state* (2012).

The following test procedures are then defined for the evaluation of product performance under the above test conditions:

- A procedure for measuring **air delivery, power input, and energy efficiency value** adapted from *IEC 60879:1986: Performance and Construction of Electric Circulating Fans and Regulators*;
- A procedure for evaluating **drop resistance** and **physical ingress protection** adapted from *IEC TS 62257-9-5:2013: Recommendations for small renewable energy and hybrid systems for rural electrification – Part 9-6: Integrated system – Selection of stand-alone lighting kits for rural electrification*;
- A procedure for inspecting **fan blades and guards** adapted from IEC 60335-2-80: *Household and similar electrical appliances. Safety. Particular requirements for fans.*

2 Definitions

2.1 Ceiling type fan

A propeller-bladed fan having two or more blades, and provided with a device for suspension from the ceiling of a room so that the blades rotate in a horizontal plane.

2.2 Table type fan

A propeller-bladed fan having two or more blades, and intended for use with free inlet and outlet of air. It may be a table fan or bracket-mounted fan for wall, surface, or ceiling mounting.

2.3 Pedestal type fan

A propeller-bladed fan having two or more blades mounted on a pedestal of fixed or variable height and intended for use with free inlet and outlet of air.

2.4 Air delivery

Quantity of air delivered in a given time under specified conditions.

2.5 Energy efficiency value

The air delivery (in cubic metres per minute) divided by electrical power input to the fan (in watts) at the voltage and frequency specified for the test.

2.6 Fan Size

The diameter of the circle traced out by the extreme tips of the fan blades, measured in millimetres.

3 Test Conditions

3.1 Test Setup

The product shall be set up for testing using the power cable included in the product package.

- If a DC cable is provided with the product, use the DC cable and a DC power supply for testing.
- If only an AC/DC converter is provided with the product, use the AC/DC converter and an AC power supply for testing.

The type of power cable and power supply used during the tests shall be documented in the test report.

3.2 Nominal conditions

Nominal conditions are defined as follows:

Parameter	Value
Input voltage	Nameplate voltage (e.g. 12 VDC) +/- 2%
Temperature	25°C +/- 5°C
Relative humidity	20% to 80%

3.3 Voltage fluctuation conditions

Over-voltage conditions are equivalent to Nominal conditions, except that Input voltage is increased by 15% from Nameplate voltage.

Under-voltage conditions are equivalent to Nominal conditions, except that Input voltage is decreased by 15% from Nameplate voltage.

3.4 Harsh environment exposure conditions

Harsh environment exposure conditions are equivalent to Nominal conditions, except that products are exposed to 40°C temperature and 95% relative humidity[1] for a minimum of 24 hours prior to testing.

4 Test Sequence

The following sequence should be followed when carrying out the tests:

1) Conduct Overall Quality Inspection (5.1).
2) Measure Air delivery (5.2) and Power input (5.3) in Nominal conditions.
3) Measure Air delivery (5.2) and Power input (5.3) in Over-voltage conditions.
4) Measure Air delivery (5.2) and Power input (5.3) in Under-voltage conditions.
5) Expose fan to Harsh Environment conditions (3.4).
6) Measure Air delivery (5.2) and Power input (5.3).
7) Conduct Physical Ingress Protection test (5.4).
8) Conduct Drop test (5.5).

5 Test Procedures

5.1 Overall quality inspection

5.1.1 Inspect product components (including but not limited to enclosure, blades, bearings, wiring, fittings, switches, and connections) for quality and workmanship and note any visible defects.

5.1.2 Inspect the fan blade guard in accordance with Clause 20.101 of IEC 60335-2-80.

5.1.3 Inspect other safety measures for quality and workmanship and note any obvious hazards.

5.1.4 Review the product packaging and nameplate to verify that the following information is clearly visible: manufacturer name, product name, model number, input voltage, rated air delivery, energy efficiency value, fan size, fan speed, number of blades, number of regulator speeds, date of manufacture, and conformity with standards.

5.1.5 Review product instructions, user manual, and warranty information.

5.1.6 Examine the product and determine whether a low voltage disconnect / reconnect (LVD/LVR) circuit, or similar automatic shutdown mechanism, is available to protect batteries from unintended power drain.

5.1.7 Take photographs of the product, including packaging, front view, side view, and nameplate.

5.1.8 Document findings in test report.

[1] Per *IEC 60068-2-78: Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

5.2 Air delivery

5.2.1 Ensure the fan is in its as-shipped condition.

5.2.2 If the fan includes an oscillating mechanism, ensure that it is disabled for air delivery testing.

5.2.3 Prepare the product for testing in accordance with Clause 9.2 (*Limits of error of electrical measuring instruments*) and 9.3 (*Test voltage and frequency*) of IEC 60879, with the exception of any required Test conditions as specified in Section 3 of this test method.

5.2.4 Measure air delivery in accordance with Clause 9.4 (*Test for air performance*) of IEC 60879.

5.2.5 Document findings in test report.

5.3 Power input

5.3.1 Ensure the fan is in its as-shipped condition.

5.3.2 If the fan includes an oscillating mechanism, ensure that it is enabled for power input testing.

5.3.3 Prepare the product for testing in accordance with Clause 9.2 (*Limits of error of electrical measuring instruments*) and 9.3 (*Test voltage and frequency*) of IEC 60879, with the exception of any required Test conditions as specified in Section 3 of this test method.

5.3.4 Measure Power input in accordance with Clause 9.6 (*Measurement of power input*) of IEC 60879. The regulator, if provided, shall be set at the highest speed position.

5.3.5 Document findings in test report.

5.4 Physical ingress protection

5.4.1 Ensure the fan is in its as-shipped condition.

5.4.2 Visually inspect the product for protection against ingress of solid foreign objects to determine whether the product meets IP20, IP30, and IP40 requirements, in accordance with Clause 13 (*Tests for protection against solid foreign objects indicated by the first characteristic numeral*) of IEC 60529:1989+AMD1:1999+AMD2:2013 CSV.

5.4.3 Take photographs of IP testing and document findings in test report.

5.5 Drop test (only applicable to table and pedestal fans)

5.5.1 Ensure the fan is in its as-shipped condition.

5.5.2 Prepare and conduct the drop test in accordance with Clause W.4.1 (*Drop Test*) of IEC 62257-9-5.

5.5.3 Document findings in test report.