



# Global LEAP Off-Grid Fan Test Method

Version 1.2 (2020-01)

## 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<sup>1</sup> for a minimum of 24 hours prior to testing.

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<sup>1</sup> Per IEC 60068-2-78: Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state

## 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 and Clause 20.2 of IEC 60335-1 to assess whether fan guards are secured and can prevent solid foreign object to touch dangerous moving parts.
- 5.1.3 Inspect other safety measures for quality and workmanship and note any obvious hazards.
- 5.1.4 Take photograph of product packaging and any documentation included with the product: product specification sheets, product installation instructions, user manuals, and warranty information.
- 5.1.5 Take photographs of the product, including front view, side view, and nameplate.
- 5.1.6 Review the product packaging, documentation, and nameplate to verify that the following information is clearly visible: manufacturer name, product name, model number, fan size, input voltage, rated power consumption, rated air delivery, fan speed, number of blades, number of regulator speeds, country of manufacture.
- 5.1.7 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.
- 5.1.8 Document findings in test report.

## 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 IP10, 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, e.g. IP numbers, whether each is a pass or fail, and if fail, describe points of failure.

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

- 5.5.1 Ensure the fan is in its as-shipped condition. Test samples shall be minimally altered (ideally unaltered), fully functional, and have sufficient charge to check for functionality throughout the test
- 5.5.2 For table fans, prepare and conduct the drop test from a height of 1 m in accordance with Clause W.4.1 (*Drop Test*) of IEC 62257-9-5. For pedestal fans, prepare and conduct the drop test from a level surface without elevation.
- 5.5.3 Document findings and damages in test report.