



Global LEAP Off-Grid Fan Test Method

Beta Version (2015-08)

1 Scope

This document establishes methods to measure the performance, quality, and durability of fans for use in off-grid applications (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 62257-9-5:2013: Recommendations for small renewable energy and hybrid systems for rural electrification: Integrated system – Selection of stand-alone lighting kits for rural electrification*;
- A procedure for evaluating **durability** adapted from *GB/T 13380 – 2007: Alternating Current (AC) electric fans and regulators*;
- 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 Definitions¹

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.

¹ IEC 60879:1986: *Performance and Construction of Electric Circulating Fans and Regulators*.

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.

3 Test Conditions

3.1 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%

3.2 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.

3.3 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 humidity² 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), Fan speed (5.3), and Power input (5.4) in Nominal conditions.

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

- 3) Measure Air delivery (5.2), Fan speed (5.3), and Power input (5.4) in Over-voltage conditions.
- 4) Measure Air delivery (5.2), Fan speed (5.3) and Power input (5.4) in Under-voltage conditions.
- 5) Expose fan to Harsh Environment conditions (3.3).
- 6) Measure Air delivery (5.2), Fan speed (5.3) and Power input (5.4).
- 7) Conduct Physical Ingress Protection test (5.4).
- 8) Conduct Durability tests (5.5.1, 5.5.2, 5.5.3, 5.5.4).
- 9) Conduct Drop test (5.5.5).

5 Test Procedures

5.1 Overall quality inspection

- 1) Inspect product components (including but not limited to enclosure, blade, bearings, wiring, fittings, and connections) for quality and workmanship and note any visible defects.
- 2) Inspect the fan blade guard in accordance with Clause 20.101 of IEC 60335-2-80.
- 3) Inspect other safety measures for quality and workmanship and note any obvious hazards.
- 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) Review product instructions, user manual, and warranty information.
- 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.
- 7) Take photographs of the product, including packaging, front view, side view, and nameplate.
- 8) Document findings in test report.

5.2 Air delivery

- 1) Ensure the fan is in its as-shipped condition.
- 2) If the fan includes an oscillating mechanism, ensure that it is disabled for air delivery testing.
- 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.
- 4) Measure air delivery in accordance with Clause 9.4 (*Test for air performance*) of IEC 60879.
- 5) Document findings in test report.

5.3 Power input

- 1) Ensure the fan is in its as-shipped condition.
- 2) If the fan includes an oscillating mechanism, ensure that it is enabled for power input testing.

- 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.
- 4) Measure Power input in accordance with Clause 9.6 (*Measurement of power input*) of IEC 60879.
- 5) Document findings in test report.

5.4 Physical ingress protection

- 1) Ensure the fan is in its as-shipped condition.
- 2) Prepare and conduct the physical ingress protection test in accordance with Clause U.4.3 (*Simplified IP inspection for ingress of solid foreign objects*) of IEC 62257-9-5.
- 3) Document findings in test report.

5.5 Durability

5.5.1 Speed regulator switch (if relevant)

- 1) Ensure that the fan is connected to a power source.
- 2) Set the speed regulator switch to the “Off” position.
- 3) For each test cycle, sequentially switch the regulator to each regulated speed position and then back to the “Off” position.
- 4) Repeat for a total of 10,000 cycles.
- 5) Document any failure of the component in the lab report.

5.5.2 Angle adjustment device (if relevant)

- 1) Ensure that the fan is disconnected from its power source.
- 2) Set the angle adjustment device to its maximum elevation position.
- 3) For each test cycle, adjust the angle adjustment mechanism to its maximum depression position, and then return it to the maximum elevation position.
- 4) Repeat for a total of 500 cycles.
- 5) Document any failure of the component in the lab report.

5.5.3 Height adjustment device (if relevant)

- 1) Ensure that the fan is disconnected from its power source.
- 2) Set the height adjustment device to its highest position.
- 3) For each test cycle, adjust the height adjustment device to its lowest position, then return it to the highest position.
- 4) Repeat for a total of 500 cycles.
- 5) Document any failure of the component in the lab report.

5.5.4 Clamping device (if relevant)

- 1) Ensure that the fan is disconnected from its power source.

- 2) Fully open the clamping device.
- 3) For each test cycle, fully close/tighten the clamping device, then return it to its open position.
- 4) Repeat for a total of 500 cycles.
- 5) Document any failure of the component in the lab report.

5.5.5 Drop test

- 1) Ensure the fan is in its as-shipped condition.
- 2) Prepare and conduct the drop test in accordance with Clause W.4.1 (*Drop Test*) of IEC 62257-9-5.
- 3) Document findings in test report.