



# ENERGY STAR® Program Requirements Product Specification for Pool Pumps

Final Draft Test Method  
Rev. Nov-2012

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## 1 OVERVIEW

The following test method shall be used for determining product compliance with requirements in the ENERGY STAR Eligibility Criteria for Pool Pumps.

## 2 APPLICABILITY

ENERGY STAR test requirements are dependent upon the feature set of the product under evaluation. The following guidelines shall be used to determine the applicability of each section of this document:

- Section 6 shall be conducted on all eligible pool pump products.

## 3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the ENERGY STAR Eligibility Criteria for Pool Pumps.

## 4 TEST SETUP

### 4.1 Input power

- A) All products shall be connected to a voltage source appropriate for the intended market, as specified in Table 1.
- Pumps with a nameplate rated voltage not listed in Table 1 shall use the voltage and frequency combination, specified in Table 1, that is closest to the nameplate rated voltage.
  - A pump rated for more than one voltage shall be tested using the higher voltage source.
  - All nameplate rated voltages and the voltage used for testing shall be reported.

**Table 1: Input Power Requirements for All Products**

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
North America, Taiwan	115 V ac or 230 V ac	+/- 1.0 %	2.0 %	60 Hz	+/- 1.0 %
Europe, Australia, New Zealand	230 V ac	+/- 1.0 %	2.0 %	50 Hz	+/- 1.0 %
Japan	100 V ac	+/- 1.0 %	2.0 %	50 Hz or 60 Hz	+/- 1.0 %

**Note:** DOE has updated the input voltage requirements to reflect that pool pumps may be rated for use at 230 V ac and 60 Hz, not 230 V ac and 50 Hz, in the U.S. DOE has also updated the language in Section 4.1 to accommodate pumps with a nameplate rated voltage not listed in Table 1. Finally, DOE has updated the voltage input requirements to include the nominal voltages for other markets, so that this ENERGY STAR Test Method may be used for testing outside of the U.S. and to align with other ENERGY STAR Programs.

## 4.2 Test Setup

- A) Ambient Temperature: Ambient temperature shall be from 65° F to 82° F.
- B) Relative Humidity: Relative humidity shall be from 10% to 80%.
- C) Power Meter: Power meters shall possess the following attributes:
  - 1) Crest Factor: Possesses an available current crest factor of 3 or more at its rated range value.
  - 2) Minimum Frequency Response: 3.0 kHz
  - 3) Minimum Resolution:
    - a. 0.01 W for measurement values less than 10 W;
    - b. 0.1 W for measurement values from 10 W to 100 W; and
    - c. 1.0 W for measurement values greater than 100 W.
- D) Measurement Accuracy:
  - 1) Power measurements with a value greater than or equal to 0.5 W shall be made with an uncertainty of less than or equal to 2% at the 95% confidence level.
  - 2) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less than or equal to 0.01 W at the 95% confidence level.
  - 3) Flow rate measurements shall be made with an uncertainty of less than or equal to 1.5% at the 95% confidence level.
  - 4) Pressure measurements shall be made with an uncertainty of less than or equal to 1.0% at the 95% confidence level.

## 5 TEST CONDUCT

**Note:** DOE has removed the measurement requirements proposed in the Draft 2 Test Method as they increased test burden without providing an increase in accuracy.

### 5.1 Test Requirements

#### A) Test Speeds:

- 1) Single-speed pumps shall be tested at the rated speed.
- 2) Multi-speed pumps shall be tested at all rated speeds.
- 3) Variable-speed pumps shall be tested at the minimum, maximum, and Most Efficient speeds available. Manufacturers shall report all speeds tested.

**Note:** DOE has modified the test speed language to specify testing at “rated speeds” instead of “available speeds” for both Single- and Multi-speed pumps.

#### B) For each speed tested, the following values shall be reported for the Normal Operating Point corresponding to each of the three system curves (A, B, and C) listed below.

- 1) Motor nominal speed (RPM)
  - a. Motor nominal speed shall be the rated speed(s) for Single- and Multi-speed pumps and shall be the speed displayed on the speed controller for Variable-speed pumps.
- 2) Rate of flow (GPM)
- 3) Power (watts)
- 4) Energy Factor (gal/Wh), calculated using Equation 1

#### Equation 1: Calculation of Energy Factor

$$EF = \frac{Q \times 60}{P}$$

Where:

- $Q$  is the flow rate in GPM.
- $P$  is the power in watts.

#### C) A graph of the pump performance curve for each speed tested shall also be reported.

#### D) The three system curves to be used are:

#### Equations 2, 3, & 4: Calculation of Pool Curves A, B, & C

$$\text{Curve A: } H = 0.0167 \times Q^2$$

$$\text{Curve B: } H = 0.050 \times Q^2$$

$$\text{Curve C: } H = 0.0082 \times Q^2$$

Where:

- $H$  is the total system head in feet of water.
- $Q$  is the flow rate in GPM.

## 6 TEST PROCEDURES

### 6.1 UUT Pre-Test Initialization

A) Prior to the start of testing, the UUT shall be initialized as follows:

- 1) Set up the UUT per *American National Standards Institute/Hydraulics Institute (ANSI/HI) 1.6, Centrifugal Pump Tests; Section 1.6.5.5 Performance test setup*, using the “open or closed tank” setup described in *Figure 1.117*.

**Note:** DOE has clarified the reference to Section 1.6.5.5 of ANSI/HI 1.6 to specify using the “open or closed tank” setup to ensure consistent testing across all labs.

- 2) Connect the UUT to its power source.

- 3) Turn the UUT On and allow it to run for one hour before the first test is performed.

- a. After this initial warm-up period is completed, pumps need only be run for 30 minutes before subsequent tests.

**Note:** Stakeholders commented that testing should be allowed to continue without re-stabilization if a pump is stopped for no longer than five minutes during a given test. DOE is currently unaware of any situation in which a pump would need to be stopped during a test and has not updated the stabilization requirements in the Final Draft Test Method. DOE welcomes stakeholder feedback on specific situations that would require a pump to be stopped during testing.

### 6.2 Pump Flow Testing

A) Perform the following steps for each pump speed tested, with the additional guidance included in Section 5.1 of this test method.

- 1) Increase the flow rate to maximum flow,  $Q_{Max}$ , by fully opening the test setup’s control valve.
- 2) Increase the system head, by closing the control valve in the test setup, until the measured flow rate and system head lie on the Normal Operating Point for the pump at each of the Pool Curves (Curves A, B, and C), described in Section 5.1.D of this test method.
- 3) At each Normal Operating Point, set all measurement equipment to begin taking readings at a rate greater than or equal to one reading per second. Accumulate measurement values for at least one minute and record the average (arithmetic mean) value.

**Note:** DOE has updated the test method to specify testing only at the intersection of the Pump Performance Curve and each of the three System Curves to increase the accuracy of the final reported values, as well as to reduce overall test burden. DOE has also specified that all values shall be measured as an average over the course of at least one minute to ensure all pumps are tested in a similar manner and reported values provide an accurate representation of pump performance at each System Curve.

### 6.3 Standby Mode Testing

A) Perform the following steps for all pumps that are shipped with a pump controller or time clock that does not have a separate main power cord from the pump.

- 1) Place the unit in Standby Mode.
- 2) Wait five minutes to allow the unit to stabilize.
- 3) Measure and report the true average power over the course of a five minute period.

**Note:** Stakeholders commented that pumps other than those with a speed controller may consume power in Standby Mode. As such, DOE has updated the requirements for Standby Mode testing to include all pumps shipped with a controller or time clock to ensure all Standby Mode power consumption is measured. DOE is interested in stakeholder feedback regarding all pump control devices (e.g., pump controllers, timers) that continue to consume power while the pump is not in operation.

## 7 REFERENCES

- 1) ANSI/HI 1.6:2000. Centrifugal Pump Tests.
- 2) ANSI/APSP/ICC-15-2011. American National Standard for Residential Swimming Pool and Spa Energy.