



ENERGY STAR® Program Requirements Product Specification for Pool Pumps

DRAFT Test Method for Determining Pool Pump Energy Use

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

The following test method is applicable to all products eligible for qualification under the ENERGY STAR Eligibility Criteria for Pool Pumps.

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.

Note: Definitions are proposed in the ENERGY STAR Framework document for pool pumps and will be maintained in the Eligibility Criteria, once released.

4 TEST SETUP

A) Input power for all products shall be as specified in Table 1 below depending on the voltage required by the pump. For any pump that can use either of the listed voltage sources, test the pump using the higher rated voltage source.

Table 1: Input Power Requirements for All Products

Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
115 V ac	+/- 1.0 %	2.0 %	60 Hz	+/- 1.0 %
230 V ac	+/- 1.0 %	2.0 %	50 Hz	+/- 1.0 %
100 V ac	+/- 1.0 %	2.0 %	50 Hz/60 Hz	+/- 1.0 %

B) Ambient Temperature shall be from 65° F to 82° F.

C) Relative Humidity shall be from 10% to 80%.

D) 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

22 3) Minimum Resolution:

- 23 a) 0.01 W for measurement values less than 10 W;
24 b) 0.1 W for measurement values from 10 W to 100 W; and
25 c) 1.0 W for measurement values greater than 100 W.

26 E) Measurement Accuracy:

- 27 1) Power measurements with a value greater than or equal to 0.5 W shall be made with an
28 uncertainty of less than or equal to 2% at the 95% confidence level.
29 2) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less than
30 or equal to 0.01 W at the 95% confidence level.
31 3) Flow rate measurements shall be made with an uncertainty of less than or equal to 1.5% at the
32 95% confidence level.
33 4) Pressure measurements shall be made with an uncertainty of less than or equal to 1.0% at the
34 95% confidence level

35 **5 TEST CONDUCT**

36 **5.1 Measurement Requirements**

- 37 A) Reported Values: Values reported for each test performed in Section 6 shall follow the guidelines
38 presented in *Australian Standards (AS) 5102.1-2009, Performance of household electrical appliances*
39 *– Swimming pool pump-units, Part 1: Energy consumption and performance; Sections 4.3.2: Number*
40 *of readings and Section 4.3.3: Duration of readings.*
41 B) Steady Conditions: For conditions to be considered stable, conditions must meet the criteria set forth
42 in *AS 5102.1-2009, Performance of household electrical appliances – Swimming pool pump-units,*
43 *Part 1: Energy consumption and performance; Section 4.5 Stability of Operation.*

Note: The standard used for pool pump testing by the California Energy Commission (CEC) does not include any requirements for the duration of reading and number of readings to be taken for each reported value. It also does not require conditions to be steady in order to begin taking readings. The inclusion of Section 5.1 does not alter the test method but ensures that values are more accurate and the test is more repeatable. DOE and EPA welcome stakeholder input on the proposed measurement requirements.

44 **5.2 ENERGY STAR Guidance for Implementation of AS 5102.1**

- 45 A) Multi-speed pumps shall be tested at all possible motor speeds.
46 B) Variable-speed pumps shall be tested at the lowest possible speed, 1725 RPM, and 3450 RPM. If a
47 pump is incapable of operating at either of the two higher speeds, test the pump at the closest
48 available speed and record the speed at which the test was performed.

Note: The CEC only requires that variable-speed and multi-speed pumps be tested at the highest and lowest speeds available. DOE and EPA have required that both be tested at a third speed in between the highest and lowest speeds in order to acquire a more complete data set. DOE and EPA welcome stakeholder input on the proposed approach.

- C) Each pump shall be turned ON and allowed to run for one hour before the first test is performed. After this initial warm-up period is completed, pumps need only be run for 30 minutes before subsequent tests.
- D) For all pump types, the following values shall be calculated:
- 1) Total head (H)
 - 2) Energy Factor (EF)
- E) 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)
 - 2) Rate of flow (GPM)
 - 3) Power (watts and volt amps)
 - 4) Energy Factor (gal/Wh)
- F) A graph of the pump performance curve for each speed tested should also be provided.
- G) The three system curves to be used are:

Equations 1, 2, & 3: Calculation of Pool Curves A, B, & C

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

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

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

Where:

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

6 TEST PROCEDURES FOR ALL PRODUCTS

6.1 Unit Under Test (UUT) Preparation

Unit Under Test (UUT) preparation shall be performed according to *American National Standards Institute/Hydraulics Institute (ANSI/HI) 1.6, Centrifugal Pump Tests; Section 1.6.5.5 Performance test setup*; with the additional guidance in Section 5.

6.2 Single-speed Pump Testing

Single-speed pumps shall be tested according to *AS 5102.1-2009, Performance of household electrical appliances – Swimming pool pump-units, Part 1: Energy consumption and performance; Section 6.4: Test Procedure – Single-speed Pump-units*; with the additional guidance in Section 5.

6.3 Multi-speed Pump Testing

Multi-speed pumps shall be tested according to *AS 5102.1-2009, Performance of household electrical appliances – Swimming pool pump-units, Part 1: Energy consumption and performance; Section 6.5: Test Procedure – Two-speed and Multi-speed Pump-units*; with the additional guidance in Section 5.

6.4 Variable-speed Pump Testing

Variable-speed pumps shall be tested according to *AS 5102.1-2009, Performance of household electrical appliances – Swimming pool pump-units, Part 1: Energy consumption and performance; Section 6.5: Test Procedure – Two-speed and Multi-speed Pump-units*; with the additional guidance in Section 5.

87 **7 TEST RECORDS**

88 **7.1 Test Report**

89 The test report shall include the following information

- 90 A) Location and date of test.
- 91 B) Manufacturer's name, pump-unit model number, serial number of motor, and year of manufacture.
- 92 C) Type of pump: Single-, Multi-, or Variable-speed.
- 93 D) Nominal pump-unit ratings: motor speed(s) (RPM), input power (W), and horsepower (HP). For
- 94 variable-speed pumps report the highest and lowest possible speeds.
- 95 E) Diameter of piping at measuring sections.
- 96 F) Ambient conditions: Temperature (°F) and barometric pressure (in Hg)

97 **7.2 Calculations**

98 Calculations for Energy Factor shall be performed according to *AS 5102.1-2009, Performance of*
99 *household electrical appliances – Swimming pool pump-units, Part 1: Energy consumption and*
100 *performance; Sections 7.2: Determination of Q and H, and 7.4: Determination of EF*; with the additional
101 guidance in Section 5.