



# ENERGY STAR<sup>®</sup> Program Requirements Product Specification for Residential Pool Pumps

## Draft 2 Test Method Rev. Aug-2012

### 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 Residential Pool Pumps.

### 4 TEST SETUP

#### 4.1 Input power

- A) All products shall be connected to an ac mains as specified in Table 1 below depending on the voltage required by the pump. For any pump that can use a combination 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 %           |

#### 4.2 General

- A) Ambient Temperature: Ambient temperature shall be from 65° F to 82° F.  
B) Relative Humidity: Relative humidity shall be from 10% to 80%.

- 20 C) Power Meter: Power meters shall possess the following attributes:
- 21 1) Crest Factor: Possesses an available current crest factor of 3 or more at its rated range
- 22 value.
- 23 2) Minimum Frequency Response: 3.0 kHz
- 24 3) Minimum Resolution:
- 25 i) 0.01 W for measurement values less than 10 W;
- 26 ii) 0.1 W for measurement values from 10 W to 100 W; and
- 27 iii) 1.0 W for measurement values greater than 100 W.
- 28 D) Measurement Accuracy:
- 29 1) Power measurements with a value greater than or equal to 0.5 W shall be made with an
- 30 uncertainty of less than or equal to 2% at the 95% confidence level.
- 31 2) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less
- 32 than or equal to 0.01 W at the 95% confidence level.
- 33 3) Flow rate measurements shall be made with an uncertainty of less than or equal to 1.5% at
- 34 the 95% confidence level.
- 35 4) Pressure measurements shall be made with an uncertainty of less than or equal to 1.0% at
- 36 the 95% confidence level

## 37 5 TEST CONDUCT

### 38 5.1 Measurement Requirements

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

46 **Note:** The Measurement Requirements language above is identical to that published in the Draft 1 Test

47 Method. However, DOE and EPA did not receive comments on this proposal and encourage

48 stakeholders to provide feedback in their Draft 2 comments.

49 The standard used for pool pump testing by the California Energy Commission (CEC) does not include

50 any requirements for the duration of a reading and the number of readings to be taken for each reported

51 value. It also does not require steady state conditions to begin taking readings. The inclusion of Section

52 5.1 does not alter testing but ensures that values are more accurate and the test is more repeatable.

### 53 5.2 Test Requirements

- 54 A) Speeds for Testing:
- 55 1) Single speed pumps shall be tested at the only available speed.
- 56 2) Multi-speed pumps shall be tested at all possible motor speeds.
- 57 3) Variable-speed pumps shall be tested at the minimum, maximum, and most efficient speeds
- 58 available. Manufacturers shall report all speeds tested.

59 **Note:** DOE has altered the speeds required for testing variable-speed pumps to align with the Association  
60 of Pool & Spa Professionals (APSP)-15 Standard for Energy Efficiency for Residential Inground  
61 Swimming Pools and Spas. DOE believes testing at these speeds will provide the most accurate  
62 representation of a pump's full range of efficiencies. DOE is interested in stakeholder feedback regarding  
63 this change. DOE is also interested in feedback regarding the differences (if any are present) between the  
64 speeds proposed here and those proposed for the *CEE<sup>SM</sup> Efficient Residential Pool Pump Specification*.

65 B) For each speed tested, the following values shall be reported for the normal operating point  
66 corresponding to each of the three system curves (A, B, and C) listed below.

- 67 1) Motor nominal speed (RPM)
- 68 2) Rate of flow (GPM)
- 69 3) Power (watts and volt amps)
- 70 4) Energy Factor (gal/Wh)

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

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

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

74 Curve A:  $H = 0.0167 \times Q^2$

75 Curve B:  $H = 0.050 \times Q^2$

76 Curve C:  $H = 0.0082 \times Q^2$

77 *Where:*

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

## 80 6 TEST PROCEDURES

### 81 6.1 UUT Pre-Test Initialization

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

- 83 1) Set up the UUT per *American National Standards Institute/Hydraulics Institute (ANSI/HI) 1.6,*  
84 *Centrifugal Pump Tests; Section 1.6.5.5 Performance test setup;* with the additional guidance  
85 in Section 5.
- 86 2) Connect the UUT to its power source.
- 87 3) Turn the UUT ON and allow it to run for one hour before the first test is performed.
  - 88 a) After this initial warm-up period is completed, pumps need only be run for 30 minutes  
89 before subsequent tests.

### 90 6.2 Pump Flow Testing

91 A) Perform the following steps for each pump speed tested.

- 92 1) Measure and record the pump flow rate at maximum flow,  $Q_{Max}$ , in gallons per minute (GPM).
- 93 2) Increase the flow from dead head (zero flow) to  $Q_{Max}$  in increments of  $Q$ , where  $Q$  is defined  
94 in Table 2 and depends on  $Q_{Max}$ .

95

**Table 2: Flow Rates for Measurement**

| Maximum Flow Rate,<br>$Q_{Max}$<br>(GPM) | Flow Rate Increments,<br>$Q$<br>(GPM) |
|--|---------------------------------------|
| $Q_{Max} \leq 25$                        | 2.5                                   |
| $25 < Q_{Max} \leq 50$                   | 5                                     |
| $50 < Q_{Max} \leq 100$                  | 10                                    |
| $100 < Q_{Max}$                          | 15                                    |

- 96           3) At each designated flow rate measure and record the following values:
- 97           a) Suction Pressure (ft of water)
- 98           b) Discharge Pressure (ft of water)
- 99           c) Rate of Flow (GPM)
- 100          d) Power (W)

101   **6.3 Standby Mode Testing**

- 102          A) Perform the following steps for all pumps capable of entering Standby Mode.
- 103           1) Place the unit in Standby Mode.
- 104           2) Wait five minutes to allow the unit to stabilize.
- 105           3) Measure and report the true average power over the course of a five minute period.

106   **Note:** DOE has proposed to include Standby Mode testing. DOE is interested in stakeholder feedback  
 107   regarding this proposal. Standby Mode testing was not included as part of Draft 1 of the Residential Pool  
 108   Pumps Test Method; however, DOE did perform validation testing in Standby Mode. Standby Mode  
 109   power consumption was found to be significantly less than Active Mode power consumption; however,  
 110   pumps spend a considerable portion of time in Standby Mode during the swimming season, and even  
 111   more in the off season.

112   **7 REFERENCES**

- 113          1) ANSI/HI 1.6:2000. Centrifugal Pump Tests
- 114          2) AS 5102.1:2009. Performance of household electrical appliances – Swimming pool pump-units –  
 115          Energy consumption and performance
- 116          3) APSP-15. Standard for Energy Efficiency for Residential Inground Swimming Pools, and Spas.