



# ENERGY STAR® Program Requirements Product Specification for Pool Pumps

## Eligibility Criteria Final Draft Version 1.0

1 Following is the **FINAL DRAFT Version 1.0** product specification for ENERGY STAR qualified Pool  
2 Pumps. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

### 3 **1 DEFINITIONS**

4 Provided below are definitions of the relevant terms in this document.

#### 5 **1.1 General**

6 A) Pool Pump: A mechanical assembly consisting of a “wet-end,” which houses the impeller, and a  
7 motor. The pump increases the “head” and “flow” of the water.

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9 B) Pump Controls: A switch or variable frequency drive either external to or onboard the pump that  
10 is capable of controlling two or more motor operating speeds.

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12 **Note:** In response to stakeholder feedback, EPA changed the Pump Controls definition in this Final Draft  
13 to further clarify that the device must be capable of switching between multiple operating speeds. The  
14 concern was that the definition as presented in Draft 2 could be interpreted to include devices that are  
15 only able to control ON and OFF, which was not the intended meaning.

#### 16 **1.2 Pump Types**

17 A) Residential Inground Pool Pump: A primary filter pump intended for installation with a  
18 permanently installed Residential Inground Swimming Pool with dimensions as defined in  
19 ANSI/NSPI-5 Standard for Residential Inground Swimming Pools.

20 B) Residential Aboveground Pool Pump: A primary filter pump intended for installation with a  
21 permanently installed Residential Aboveground/Onground Swimming Pool as defined in  
22 ANSI/APSP- 4 2007.

23 C) Residential Portable Spa Pump: A pump intended for installation with a non-permanently  
24 installed residential spa as defined in ANSI/NSPI-6 Standard for Portable Spas. Sometimes  
25 referred to as hot tub, but not a jetted bathtub.

26 D) Residential Auxiliary Pool Pump: A pump intended for purposes other than a primary pool filter  
27 pump, i.e. pool cleaner booster, water feature pumps, etc.

#### 28 **1.3 Product Sub-Types**

29 A) Single-speed Pump: A pump which has an electric motor that operates at only one speed.

30 B) Multi-speed Pump: A pump which has an electric motor that can operate at multiple, discrete  
31 speeds.

32 C) Variable-speed Pump: A pump which has an electric motor that can operate at continuously  
33 variable speeds.

34 D) Variable-flow Pump: A pump which has an electric motor that can operate at continuously  
35 variable speeds, with added controls that automatically adjust speed to control flow.

## 1.4 Product Ratings

- A) Rated Horsepower (HP): The motor power output designed by the manufacturer for rated revolutions per minute (RPM), voltage and frequency. May be less than Total Horsepower where the Service Factor is > 1.0, or equal to Total Horsepower where the Service Factor = 1.0. Also known as Nameplate Horsepower.
- B) Service Factor: A multiplier applied to Rated Horsepower of a motor to indicate the percent above Nameplate Horsepower at which a pump motor may operate continuously without exceeding its allowable insulation class temperature limit, provided the other design parameters such as rated voltage, frequency and ambient temperature are within limits. A 1.5 HP pump with a 1.65 service factor produces 2.475 HP (Total Horsepower) at the maximum Service Factor point.
- C) Total Horsepower: The product of the Rated Horsepower and the Service Factor of a motor used on a Pool Pump (also known as Service Factor horsepower, SFHP) based on the maximum continuous duty motor power output rating allowable for nameplate ambient rating and motor insulation class. Total Horsepower = Rated Horsepower x Service Factor.

## 1.5 Testing and Qualification

- A) Pump Performance Curve: A curve comparing the Total Head in feet of water to the Rate of Flow in gallons per minute (GPM) for a given pump at a given Motor Speed.
- B) System Curves: Equation that compares the actual head gained by the fluid from the pump to the system parameters, which include elevation head and friction losses. The curves are used to help size a pump based on the pool size, pipe system, and pool features present in a given pool system. They are plotted on the same graph as Pump Performance Curves, which compare Rate of Flow to Total Head.
- C) Normal Operating Point: Point that corresponds to the rate of flow, total head, and energy consumption at which a pump will operate given a specific system curve. It corresponds to the point of intersection of the pump performance and system curves.
- D) Rate of Flow (Q): The total volume throughput per unit of time. For this test method, Rate of Flow is expressed as GPM.
- E) Motor Speed (n): The number of revolutions of the motor shaft in a given unit of time. For this test method, Motor Speed is expressed as revolutions per minute (RPM.).
- F) Most Efficient Speed: The speed with the highest Energy Factor for a given pump.
- G) Head (H): Energy content of the liquid at any given point in the system, expressed in units of energy per unit weight of liquid. For residential pool pumps, the measuring unit for head is feet of water.
- H) Total Suction Head ( $H_S$ ): The head in the inlet section of the pump, calculated as follows:

$$H_S = z_S + \frac{(p_S \times a)}{\gamma} + \frac{U_S^2}{2g}$$

Where:

- $z_S$  is the height from the water level of the suction pressure measuring device, in feet (ft),
- $p_S$  is the suction pressure measured by the pressure measuring device, in pounds per square inch (psi),
- $U_S$  is the mean velocity at the suction pressure measuring device, in ft/s,
- $a$  is a conversion constant equal to  $144 \text{ in}^2/\text{ft}^2$ , and
- $\gamma$  is the specific weight of water, in  $\text{lb}/\text{ft}^3$ .

- I) Total Discharge Head ( $H_D$ ): The head in the outlet section of the pump, calculated as follows:

$$H_D = z_D + \frac{(p_D \times a)}{\gamma} + \frac{U_D^2}{2g}$$

Where:

- $z_D$  is the height from the water level of the discharge pressure measuring device, in ft,

- $p_D$  is the discharge pressure measured by the pressure measuring device, in psi,
  - $U_D$  is the mean velocity at the discharge pressure measuring device, in ft/s,
  - $a$  is a conversion constant equal to  $144 \text{ in}^2/\text{ft}^2$ , and
  - $\gamma$  is the specific weight of water, in  $\text{lb}/\text{ft}^3$ .
- J) **Standby Mode:** A reduced power state in which the unit is connected to an ac main power source and pump controls/timers remain On, but the motor remains idle, and no water is being pumped through the system.
- K) **Energy Factor (EF):** The volume of water pumped in gallons per watt hour of electrical energy consumed by the pump motor (gal/Wh).
- L) **Product Family:** A group of product models that are (1) made by the same manufacturer, (2) subject to the same ENERGY STAR qualification criteria, and (3) of a common basic design (identical motor and wet-end design); Product models within a family differ from each other according to one or more characteristics or features that either (1) have no impact on product performance with regard to ENERGY STAR qualification criteria, or (2) are specified herein as acceptable variations within a product family; For pool pumps, acceptable variations within a product family include:
- i. Product color
  - ii. Rated Horse Power (Total Horse Power is not an acceptable variation)
  - iii. The type or presence of union fittings

**Note:** EPA agrees with stakeholder comments requesting that the list of acceptable variations within a product family be expanded to include rated horse power and unions. There were additional requests to include brand name as an acceptable variation; however, EPA believes that the following statement initially proposed in the Draft 2 specification adequately addresses the case where identical products are offered under different brand names: "Product Family: A group of product models are...of a common basic design (identical motor and wet-end design)." Manufacturers may be asked by the Certification Body to provide further information on a product design sold under more than one brand but based on this definition should not be required to perform additional testing.

In addition, EPA removed the Representative Model definition from Section 1.5, as it is defined under Section 6.

## 1.6 Acronyms

- A) ac: Alternating Current
- B) ANSI: American National Standards Institute
- C) APSP: Association of Pool and Spa Professionals
- D) EF: Energy Factor
- E) °F: Degrees Fahrenheit
- F) gal: gallons
- G) GPM: Gallons per minute
- H) H: Head
- I) HI: Hydraulics Institute
- J) hp: Horsepower
- K) Hz: hertz
- L) n: Motor Speed
- M) NSPI: National Spa and Pool Institute

- 123 N) Q: Rate of Flow  
124 O) RPM: Revolutions per minute  
125 P) UUT: Unit under test  
126 Q) V: volts  
127 R) W: watts  
128 S) Wh: watt-hours

## 129 2 SCOPE

### 130 2.1 Included Products

131 Products that meet the definition of a Residential Inground Pool Pump, that are Single-speed, Multi-  
132 speed, Variable-speed, or Variable-flow as specified herein are eligible for ENERGY STAR  
133 qualification, with the exception of products listed in Section 2.2. Only those pool pumps that are  
134 single phase and with a Total Horsepower rating of >0.5 HP and ≤ 4 HP can qualify as ENERGY  
135 STAR under this specification.

### 136 2.2 Excluded Products

137 Residential Aboveground Pool Pumps, Residential Auxiliary Pool Pumps, and Spa Pumps as defined  
138 in Section 1 are not eligible for ENERGY STAR under this specification. Multi-speed Pumps with  
139 manual pump controls that are not sold ready to connect to external pump controls, are also not  
140 eligible.

141 **Note:** Stakeholders have expressed interest in expanding the scope in future specification revisions to  
142 include **aboveground pool pumps, commercial inground pool pumps, and replacement motors**.  
143 EPA recognizes that each of these product groupings may represent significant energy savings  
144 opportunities; however, EPA has identified unique issues that call for the tailoring of the current test  
145 method before these product types can be considered more fully for inclusion in this specification. For  
146 example, the following issues have been identified:

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- 148 • Three-phase inground commercial pool pumps cannot be tested under ANSI/HI 1.6 Centrifugal Pump  
149 Test and a more appropriate test method must be identified.
  - 150 • Replacement motors can be installed and paired with an unknown variety of wet ends in the field, and  
151 stakeholders confirmed that Energy Factor is not an appropriate performance metric.
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153 Stakeholders have indicated that aboveground pool pumps can be tested using the current test method  
154 and therefore offer the most direct path towards being considered for incorporation into the next  
155 specification revision. Other stakeholders have expressed interest in exploring testing and evaluating the  
156 performance of aboveground pool pumps while connected to the pre-designed piping and filtering  
157 package, which would require significant test method alteration.

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159 Any information that stakeholders may be able to provide to help define approaches to testing and  
160 measuring performance for these product groupings will be essential to enabling future scope  
161 expansions.

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### 3 QUALIFICATION CRITERIA

#### 3.1 Energy Efficiency Requirements

- A) The Energy Factor of the pump must meet the criteria provided in Table 1, below.

Table 1. Pool Pump Energy Factor Criteria at Pool Performance Curve A		
Pump Sub Type	Speed Setting	Energy Efficiency Level
Single-speed Pump	Single Speed	EF ≥ 3.80
Multi-speed, Variable-speed and Variable-flow Pump	Most Efficient Speed	

**Note:** EPA remains interested in working with stakeholders to identify opportunities to inform and educate both end users and pool professionals about best practices to help optimize the actual energy savings realized in the field. These best practices will focus on installing and maintaining pool pumps and other energy savings opportunities associated with pool accessories.

- B) Pump controls for use with a Multi-speed, Variable-speed, or Variable-flow Pump shall have the capability of operating the Pool Pump at a minimum of two speeds. The control's default filtration speed setting shall be no more than one-half of the motor's maximum rotation rate. Any high-speed override capability shall be for a temporary period not to exceed one 24-hour cycle without resetting to default settings.

#### 3.2 Significant Digits and Rounding:

- A) All calculations shall be carried out with directly measured (unrounded) values.
- B) Unless otherwise specified, compliance with specification limits shall be evaluated using directly measured or calculated values without any benefit from rounding.
- C) Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to 2 decimal places.

### 4 CONNECTED FUNCTIONALITY CRITERIA

EPA has developed the following optional criteria for ENERGY STAR qualified pool pumps that wish to also be recognized as 'Connected' on the ENERGY STAR website: **TBD**.

**Note:** EPA continues to be interested in highlighting products with connected functionality (CF) on the ENERGY STAR Qualified Product List (QPL) so that consumers, rebate program administrators and other interested stakeholders are better able to identify and compare products that offer these capabilities.

Initial criteria were presented in the Connected Functionality document distributed to stakeholders in August 2012. EPA will continue to work with stakeholders to refine the criteria and the development of potential connected functionality criteria for pool pumps, as well as education materials on the associated benefits. When a final set of CF criteria are developed, EPA intends to incorporate them into the ENERGY STAR Pool Pumps specification. The timeline for finalizing the CF criteria is independent of the Version 1.0 specification development timeline and will continue beyond finalization of this specification.

## 5 ADDITIONAL REQUIREMENTS

### 5.1 Informational statement

- A) Partner shall mark a qualifying Multi-speed, Variable-speed, and Variable-flow pool pump without onboard pump controls permanently and legibly on an accessible and conspicuous place on the unit, in characters no less than 1/4", with the nameplate HP of the pump with the statement, "This pump must be installed with a multi-, or variable-speed pump motor controller." This statement provides information that the pool pump product must be matched with pump controls to ensure the energy savings potential is realized due to the speed reduction capabilities of the pool pump.

### 5.2 Additional reporting requirements

- A) The Energy Factors for performance using Curve B and Curve C shall be reported for all products.

## 6 TEST REQUIREMENTS

### 6.1 Number of Units Required for Testing

- A) Representative Models shall be selected for testing per the following requirements:
- 1) For qualification of an individual product model, the Representative Model shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR.
  - 2) For qualification of a Product Family, any model within that Product Family can be tested and serve as the Representative Model. When submitting Product Families, manufacturers continue to be held accountable for any efficiency claims made about their products, including those not tested or for which data was not reported.
- B) A single unit of each Representative Model shall be selected for testing.
- C) When testing Pool Pumps, the following test methods shall be used to determine ENERGY STAR qualification.

**Table 2: Test Method for ENERGY STAR Qualification**

ENERGY STAR Requirement	Test Method Reference
Energy Factor (gal/Wh)	ENERGY STAR® Pool Pumps Test Method (Rev. Jan-2013)

## 7 EFFECTIVE DATE

The ENERGY STAR Pool Pump specification shall take effect on **February 15, 2013**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.

**Note:** EPA intends to finalize the Version 1.0 specification by February 15, 2013, at which point products may begin to qualify immediately.

229 Please note that to earn ENERGY STAR qualification manufacturers must have their products third-party  
230 certified by an EPA-recognized Certification Body (CB) to the Version 1.0 requirements. For more  
231 information, visit [www.energystar.gov/3rdpartycert](http://www.energystar.gov/3rdpartycert).

## 232 **8 FUTURE SPECIFICATION REVISIONS**

233 EPA reserves the right to change the specification should technological and/or market changes affect  
234 its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to  
235 the specification are arrived at through industry discussions. In the event of a specification revision,  
236 please note that the ENERGY STAR qualification is not automatically granted for the life of a product  
237 model.

## 238 **9 REFERENCES**

- 239 1) ANSI/NSPI – 5 2003. Residential Inground Swimming Pools  
240 2) ANSI/APSP – 4 2007. Standard for Aboveground/Onground Residential Swimming Pools  
241 3) ANSI/NSPI – 6 1999. Residential Portable Spas