



ENERGY STAR® Program Requirements for Pool Pumps

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture and labeling of ENERGY STAR qualified products. The ENERGY STAR Partner must adhere to the following partner commitments:

Qualifying Products

1. **Comply with current ENERGY STAR Eligibility Criteria**, which define performance requirements and test procedures for Pool Pumps. A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
2. **Prior to associating the ENERGY STAR name or mark with any product**, obtain written certification of ENERGY STAR qualification from a Certification Body recognized by EPA for Pool Pumps. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform Pool Pump testing. A list of EPA-recognized laboratories and certification bodies can be found at www.energystar.gov/testingandverification.

Using the ENERGY STAR Name and Marks

3. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at www.energystar.gov/logouse.
4. Use the ENERGY STAR name and marks only in association with qualified products. Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale in the U.S and/or ENERGY STAR partner countries.
5. Provide clear and consistent labeling of ENERGY STAR qualified Pool Pumps. The ENERGY STAR mark must be clearly displayed on the top/front of the product, in product literature (i.e, user manuals, spec sheets, etc.), on product packaging, and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed..

Verifying Ongoing Product Qualification

6. Participate in third-party verification testing through a Certification Body recognized by EPA for Pool Pumps, providing full cooperation and timely responses, EPA/DOE may also, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.

Providing Information to EPA

7. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
 - 7.1. Partner must submit the total number of ENERGY STAR qualified Pool Pumps shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).
 - 7.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.

7.3. Partner must submit unit shipment data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner.

8. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
9. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Performance for Special Distinction

In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures, and should keep EPA informed on the progress of these efforts:

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, and communicate Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.
- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.

- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.



ENERGY STAR® Program Requirements Product Specification for Pool Pumps

Eligibility Criteria Version 1.0

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

1 DEFINITIONS

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

1.1 General

- A) Pool Pump: A mechanical assembly consisting of a “wet-end,” which houses the impeller and a motor. The pump increases the “head” and “flow” of the water.
- B) Pump Controls: A switch or variable frequency drive either external to or onboard the pump that is capable of controlling two or more motor operating speeds.

1.2 Pump Types

- A) Residential Inground Pool Pump: A primary filter pump intended for installation with a permanently installed Residential Inground Swimming Pool with dimensions as defined in ANSI/NSPI-5 Standard for Residential Inground Swimming Pools.
- B) Residential Aboveground Pool Pump: A primary filter pump intended for installation with a permanently installed Residential Aboveground/Onground Swimming Pool as defined in ANSI/APSP- 4 2007.
- C) Residential Portable Spa Pump: A pump intended for installation with a non-permanently installed residential spa as defined in ANSI/NSPI-6 Standard for Portable Spas. Sometimes referred to as a hot tub pump, but not a jetted bathtub pump.
- D) Residential Auxiliary Pool Pump: A pump intended for purposes other than a primary pool filter pump, i.e. such as a pool cleaner booster pump or water feature pumps.

1.3 Product Sub-Types

- A) Single-speed Pump: A pump which has an electric motor that operates at only one speed.
- B) Multi-speed Pump: A pump which has an electric motor that can operate at multiple, discrete speeds.
- C) Variable-speed Pump: A pump which has an electric motor that can operate at continuously variable speeds.
- D) Variable-flow Pump: A pump which has an electric motor that can operate at continuously 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.
- 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. For example, a 1.5 HP pump with a 1.65 Service Factor produces 2.475 HP (Total Horsepower) at the maximum Service Factor point.

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 the ENERGY STAR Pool Pump 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 the ENERGY STAR Pool Pump 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 in²/ft², and
- γ is the specific weight of water, in lb/ft³.

- 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 in²/ft², and
- γ is the specific weight of water, in lb/ft³.

- 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

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

2 SCOPE

2.1 Included Products

Products that meet the definition of a Residential Inground Pool Pump, that are Single-speed, Multi-speed, Variable-speed, or Variable-flow as specified herein, are eligible for ENERGY STAR

qualification, with the exception of products listed in Section 2.2. Only those pool pumps that are single phase and with a Total Horsepower rating of >0.5 HP and ≤ 4 HP can qualify as ENERGY STAR under this specification.

2.2 Excluded Products

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

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	

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**.

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 STARPool 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.

8 FUTURE SPECIFICATION REVISIONS

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

9 REFERENCES

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



ENERGY STAR[®] Program Requirements Product Specification for Pool Pumps

Final Test Method Rev. Jan-2013

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.
- 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.
 - 2) A pump rated for more than one voltage shall be tested using the higher voltage source.
 - 3) 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 %

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
Japan	100 V ac	± 1.0 %	2.0 %	50 Hz or 60 Hz	± 1.0 %

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) Measurement Accuracy: An accuracy of ± 1.5% of the measured value.
 - 2) Crest Factor: Possesses an available current crest factor of 3 or more at its rated range value.
 - 3) Minimum Frequency Response: 3.0 kHz
 - 4) 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) Flow Rate Meter: Flow rate meters shall possess the following attributes:
 - 1) Measurement Accuracy: An accuracy of ± 1.5% of the measured value.

5 TEST CONDUCT

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 and Variable-flow pumps shall be tested at the minimum, maximum, and Most Efficient speeds available. Manufacturers shall report all speeds tested.

- 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 pump controls 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

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

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

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*.
 - 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 shall only be run for 30 minutes before subsequent tests.

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 is within $\pm 2.5\%$ of the flow rate calculated for the Normal Operating Point of 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.

6.3 Standby Mode Testing

- A) Perform the following steps for all pumps that are shipped with a pump control 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.

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.