Following is the DRAFT 1 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.

Note: The intention of the U.S. Environmental Protection Agency (EPA) in launching this specification development effort was to write requirements for Pool Pumps used in residential applications. This continues to be EPA’s intention for this Version 1.0; however, the title of the specification has been set to cover the broader pool pump product category to more easily expand the scope beyond residential applications in the future, as appropriate. EPA will use Section 2 below, to clearly identify the current scope of ENERGY STAR coverage.

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. There usually is a leaf strainer before the impeller. The pump increases the “head” and “flow” of the water.

1.2 Pump Types


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 hot tub, but not a jetted bathtub.

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

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.
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 Technical Definitions

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) Rate of Flow (Q): The total volume throughput per unit of time. For this test method, Rate of Flow is expressed as GPM.

D) 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 RPM.

E) Head (H): Energy content of the liquid at any given point in the system. It is expressed in units of energy per unit weight of liquid. For residential pool pumps, the measuring unit for head is feet of water.

F) Total Suction Head (Hₘ): The head in the inlet section of the pump, calculated as follows:

\[ H_s = z_s + \frac{(p_s + 1000)}{\rho g} + \frac{U_s^2}{2g} \]

Where:

- \( z_s \) is the height from the water level of the suction pressure measuring device,
- \( p_s \) is the suction pressure measured by the pressure measuring device,
- \( U_s \) is the mean velocity at the suction pressure measuring device,
- \( \rho \) is the density of the water, and
- \( g \) is the gravitational acceleration constant.

G) Total Discharge Head (Hₙ): The head in the outlet section of the pump, calculated as follows:

\[ H_d = z_d + \frac{(p_d + 1000)}{\rho g} + \frac{U_d^2}{2g} \]

Where:

- \( z_d \) is the height from the water level of the discharge pressure measuring device,
• $p_D$ is the discharge pressure measured by the pressure measuring device,
• $U_D$ is the mean velocity at the discharge pressure measuring device,
• $\rho$ is the density of the water, and
• $g$ is the gravitational acceleration constant.

H) Standby Mode: A reduced power state, in multi-speed and variable speed pumps, in which the unit is connected to an ac main, but the motor remains idle, and no water is being pumped through the system.

Note: EPA and DOE are interested in stakeholder feedback regarding the proposed definition for Standby Mode and whether any product types other than Variable-speed Pumps are capable of Standby Mode. EPA and DOE assume that any power draw in this mode will be due to the speed controller required for Variable-speed Pumps and are also interested in feedback regarding this assumption.

1.6 Metric Definitions
A) Energy Factor (EF): The volume of water pumped in gallons per watt hour of electrical energy consumed by the pump motor (gal/Wh).

Note: EPA is requesting feedback from stakeholders on the definitions provided in Section 1, above. Where available, definitions were sourced from the ANSI/ICC/APSP-15 industry standard and modified to provide further clarification, as needed. EPA would like stakeholder input as to whether the current definitions for residential pumps would generally exclude commercial pumps, or whether the specification should develop more technical distinctions such as pipe connection requirements, etc.

1.7 Acronyms
A) ac: Alternating Current
B) ANSI: American National Standards Institute
C) APSP: Association of Pool and Spa Professionals
D) AS: Australian Standards
E) EF: Energy Factor
F) °F: Fahrenheit
G) gal: gallons
H) GPM: Gallons per minute
I) H: Head
J) HI: Hydraulics Institute
K) hp: Horsepower
L) Hz: hertz
M) n: Motor Speed
N) NSPI: National Spa and Pool Institute
O) Q: Rate of Flow
P) RPM: Revolutions per minute
Q) UUT: Unit under test
R) V: volts
S) W: watts
T) Wh: watt-hours
2 SCOPE

2.1 Included Products

A) Products that meet the definition of a Residential Inground Pool Pump, that are Single-speed, Multi-Speed, or Variable-speed pump, as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B. Only those pool pumps with a Total Horsepower rating of >0.5 HP and ≤ 4 HP can qualify as ENERGY STAR under this specification.

2.2 Excluded Products

A) 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. Residential Inground Pool Pumps with a total Horse Power of ≤0.5 HP and > 4 HP, are not eligible. Multi-speed Pumps with manual speed controls that are not able to connect to an external speed controller, are also not eligible.

Note:

Pump Size
Stakeholder feedback indicates that there is significant crossover between residential and commercial applications. For example, residential pool pumps are commonly used in light commercial applications, such as small apartment and hotel pools. EPA agrees with stakeholder comments requesting that motor size be used to distinguish between residential and commercial pumps. EPA's current data set is largely based on the available data from the California Energy Commission (CEC) database, which lists products up to 4 HP. EPA would like stakeholder input on limiting the scope of this specification to pumps with a total HP of 4 or less.

EPA also set a pump size limit on the low side to address small single speed pumps (0.5 Total HP) that otherwise meet the qualification levels set in this Draft 1 specification. EPA is concerned that by labeling these small single speed pumps, EPA may drive consumers towards small pumps that may be undersized for most applications. EPA understands that the smallest pumps used for primary filtration are typically ¾ Total HP, and that using pumps as small as 0.5 Total HP for primary filtration is unusual.

Above ground Pumps
EPA received comments from multiple stakeholders requesting that the scope of this Version 1.0 specification include residential Aboveground Pool Pumps. The CEC database does not include enough data to reflect the total market of Aboveground Pool Pumps and to enable the assessment of possible performance levels. Manufacturers and other interested stakeholders are encouraged to provide performance data, preferably using the ENERGY STAR Draft 2 Test Method, for currently available residential aboveground pool pumps to help build a robust data set from which EPA can better understand the performance of these pump types. Only with this additional input can EPA determine whether expanding the scope to include these product types makes programmatic sense.

Pump Controls
EPA also received comments suggesting that pumps without onboard controls be excluded under the Version 1.0 specification. EPA does not believe that this is appropriate because this would eliminate a majority of the residential pumps on the market that would otherwise meet the ENERGY STAR Energy Factor levels. EPA is instead proposing to require within the Eligibility Criteria – Section 4: Additional Labeling Requirements (see the note box in Section 4 for more details).
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>
<thead>
<tr>
<th>Pump Sub Type</th>
<th>Speed Setting</th>
<th>Energy Efficiency Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Speed Pump</td>
<td>Single Speed</td>
<td>EF ≥ 3.8</td>
</tr>
<tr>
<td>Multi- and Variable Speed Pump</td>
<td>Low Speed</td>
<td>EF ≥ 3.8</td>
</tr>
</tbody>
</table>

Note: Explanation of Table 1 Criteria

The levels proposed in Table 1, above, are representative of the top performing energy efficient pool pumps using the industry accepted Energy Factor metric. Data plots showing the CEC data and the proposed Draft 1 level lines can be found on the ENERGY STAR Pool Pumps specification development webpage, which can be accessed through www.energystar.gov/newspecs.

Similar to other ENERGY STAR specifications, EPA is taking a technology neutral approach in allowing all pump sub-types the opportunity to qualify, while rewarding inherently more efficient designs. The performance levels are based on the Pool Pump Performance Curve A, low speed Energy Factor. EPA received mixed recommendations on which curve to use, however, stakeholders generally agree that Curve A represents the typical U.S. pool. EPA decided to retain this metric because of the robust data set available and the belief that it is sufficient for testing all pump sizes.

EPA did not set a performance level at the high speed based on the understanding that pool pumps operate for the majority of their time at the low speed. Furthermore, the greatest product differentiation based on Energy Factor, and thus the greatest opportunity for energy savings, is at the low speed. EPA did consider setting a high speed EF level as a way to ensure that future products did not compromise efficiency, however our understanding is that low speed and high speed EFs trend in the same direction. EPA is interested in feedback on whether a high speed EF should be added to the efficiency requirements.

Qualification Rate

Due to the limited data on single speed pumps in the CEC database (CA Title 20 excludes pool pumps with split-phase or capacitor start – induction run type motors, and single speed pumps of a capacity of 1 HP or more), EPA estimated the total number of single speed pumps on the market by counting the models listed in online catalogues from the top three manufacturers - Pentair, Hayward, and Jandy (Energy Factors were not listed) and combining them with the CEC dataset. EPA’s analysis assumes that manufacturers are listing their most efficient single speed pumps in the CEC database and therefore non-listed pumps will have lower EF’s and will not meet the proposed levels. EPA estimates that 21% of all market available pumps are able to meet the Energy Factor levels proposed in Table 1 representing a broad selection of highly efficient, cost effective products from a range of manufacturers.
Alternative Evaluation Methods

EPA recognizes that APSP-10 may provide an alternate method for evaluating and comparing pump energy performance by standardizing a method of binning pool pumps into low, medium, and high head groups, which allows for application based comparisons in terms of Energy Factor. However, the standard is not yet complete for consideration at this time. EPA will continue to monitor the development of this evaluation method and, once a robust data set is prepared, we will determine if any changes to the approach and metric are warranted.

Other Pool Pump Performance Considerations

For qualification purposes, EPA intends to only use the Energy Factor for Curve A, but stakeholders noted that there might be informational value in listing the Energy Factors for performance Curves B and C (as well as A) on the ENERGYSTAR Qualified Product List (QPL), for appropriate pump sizing purposes for other pool designs. EPA is interested in working with stakeholders to identify opportunities to better inform consumers about best practices in sizing pumps.

In addition, EPA recognizes that energy performance can be diminished due to many external factors when performing in the field and is interested in working with stakeholders to identify opportunities to inform and educate consumers about best practices to optimize actual energy savings.

B) Pool pump motor controls for use with a Multi-speed, or Variable-speed Pumps shall have the capability of operating the Pool Pump at least at 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.

Note: EPA has proposed aligning with the ANSI/ICC/APSP -15 standard requirements in regards to default filtration speed settings and high-speed override limitations. EPA believes that these requirements ensure that low speed operation is properly prioritized and that any manual high speed override does not undermine the potential for energy savings when operating in the field. EPA welcomes comments on these requirements.

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 ENERGYSTAR website shall be rounded to the 2 decimal places.

4 ADDITIONAL REQUIREMENTS

4.1 Informational statement

A) Partner shall mark a qualifying multi- or variable-speed pool pump without onboard controllers permanently and legibly on an accessible and conspicuous place on the unit, in characters no less than ¼", 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 a controller to ensure the energy savings potential is realized due to the speed reduction capabilities of the pool pump.
EPA is proposing requiring an informational statement be placed on the pump, which is currently required by ANSI/ICC/APSP-15 and CA Title 20 for multi-speed and variable-speed pumps without onboard controllers. This statement is necessary to properly inform the installer that a pump with adjustable speeds must be installed with a controller to achieve the energy savings that it is certified to deliver.

4.2 Additional reporting requirements

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

5 TEST REQUIREMENTS

5.1 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, a product configuration equivalent to that which is intended to be marketed and labeled as ENERGY STAR is considered the Representative Model;

2) Qualification based on product family is not acceptable under this specification. Each individual model shall be tested and meet the requirements of this specification to be qualified as ENERGY STAR.

B) A single unit of each Representative Model shall be selected for testing.

Note: EPA would like input on the appropriateness of a product family approach to testing and qualifying Pool Pumps. A product family approach would require that a representative model be selected and tested to represent the performance of a larger class of similar products. This helps reduce the burden on the manufacturer when a large number of model iterations are available to consumers but product performance does not vary.

5.2 Test Methods

A) When testing Pool Pumps, the following test methods shall be used to determine ENERGY STAR qualification.

<table>
<thead>
<tr>
<th>ENERGY STAR Requirement</th>
<th>Test Method Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Factor (gal/Wh)</td>
<td>ENERGY STAR® Test Method for Determining Pool Pump Energy Use</td>
</tr>
</tbody>
</table>

Note: EPA encourages manufacturers to submit any test data available on single speed pumps preferably using new ENERGY STAR Draft 2 Test Method. This will help EPA evaluate Single-speed Pump performance against Multi- and Variable-speed Pumps.
6 EFFECTIVE DATE
The ENERGY STAR Pool Pump specification shall take effect on February 1, 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 1, 2013, at which point products may begin to qualify immediately.

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

7 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.

8 REFERENCES