ENERGY STAR® Residential Swimming Pool Pump Specification Framework
November 29, 2011

Please send comments to poolpumps@energystar.gov
no later than Friday January 20, 2012

Background

The ENERGY STAR program, managed by the U.S. Environmental Protection Agency (EPA), with support from the U.S. Department of Energy (DOE), serves to identify energy-efficient products currently available to consumers in the marketplace. For each new product category, a unique specification is developed to describe the energy performance requirements that a product must meet to receive the label. This specification process relies on rigorous market, engineering, and energy and carbon dioxide savings analyses as well as input from industry and other stakeholders. Once determined that a model meets the program requirements through an established third party certification process, the product manufacturers may use the label to identify those models as ENERGY STAR qualified.

The ENERGY STAR program follows a set of guiding principles when considering the appropriateness of developing a specification for a new product category. These principles include:

- Significant energy savings can be realized on a national basis.
- Product is fully commercialized and available to the public on a widespread basis.
- Energy efficiency can be achieved through one or more technologies such that qualifying product is broadly available and offered by more than one manufacturer;
- Significant potential energy savings and greenhouse gas reductions can be gained from including new product types or technologies.
- Product energy efficiency consumption and performance can be measured and verified using an industry accepted, widely used test procedure.
- Energy bill savings justify any increased initial cost of the higher-efficiency product or new technology so that a purchaser will recover their investment in an increased energy efficient product within a reasonable period of time.
- Labeling can effectively differentiate similar products in terms of efficiency and be visible for purchasers.

Initial analysis performed by the EPA indicates that residential inground swimming pool pumps are a good candidate for the ENERGY STAR program. Based on information from manufacturers and efficiency programs, we believe an ENERGY STAR program for pool pumps would:

- provide a level playing field for manufacturers to test and compare pump efficiencies;
- provide purchasers and efficiency program providers with a means for easily identifying high efficiency products nationwide; and
- harmonize requirements across the nation which ultimately will help manufacturers in testing and implementation.

Summary of Comments on ENERGY STAR Residential Swimming Pool Pump Specification Framework

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Overview

EPA uses a systematic framework to assess the feasibility for applying the label to a product category and then to develop performance specifications that must be met in order to earn the label. This document describes the initial key issues that EPA has identified as needing additional feedback from interested stakeholders in order to develop an effective energy efficiency program for residential swimming pool pumps.

We structured this framework document to mirror the specification structure and at the end of each section are a series of questions aimed at generating discussion about the proposed approach. Please note that this document is not intended to be a comprehensive review of the ENERGY STAR perspective on pool pumps, rather it serves as a starting point for EPA's specification development efforts.

Stakeholders are encouraged to provide written feedback on the specific concepts and questions presented in this document, and are also welcome to submit comments of a more general nature. Communication between EPA and industry stakeholders is critical to the success of the ENERGY STAR program, especially in this early stage of the specification development process. All suggestions for improvements to the basic ENERGY STAR approach outlined in this document will be considered for inclusion in subsequent draft and final specifications. ENERGY STAR representatives are available for additional technical discussions with interested parties at any time during the specification development process. Please contact Erica Porras, ICF International, at eporras@icfi.com to arrange a meeting.

Definitions

Purpose: Each product specification has its own set of definitions that explicitly describes the products covered by the specification. In this case, we are looking for feedback on ways to clearly differentiate between the different residential pool pump types. We also provide definitions for covered and non-covered products, metrics, and sub-classes of products as needed.

Initial Approach: EPA prefers to make use of existing definitions that are generally accepted by industry. As such, EPA has identified ANSI/APSP/ICC-15 2011 as an industry accepted source for definitions. In cases where industry accepted definitions are not available or appropriate, EPA has drafted some definitions but seeks feedback from stakeholders and will work with stakeholders to amend or develop appropriate definitions.

Preliminary List of Definitions[1]**:**

a. General Definitions
   1. **Residential Inground Swimming Pools:** Permanently installed residential inground swimming pools intended for use by a single-family home for noncommercial purposes and with dimensions as defined in ANSI/NSPI-5 Standard for Residential Inground Swimming Pools.
   2. **Aboveground/Onground Pool Systems**: Pool filtration equipment designed for use on permanently installed residential aboveground/onground swimming

[1] EPA is interested in feedback on industry standard, and non-industry standard definitions for all terms identified in this document. Stakeholders are also encouraged to provide additional suggestions or clarifications regarding the proposed definitions.

pools as defined in ANSI/APSP-4 2007 Standard for Aboveground/Onground Residential Swimming Pools.

3. **Residential Portable Spa.** Nonpermanently installed residential spa intended for use by a single-family home for noncommercial purposes and as defined in ANSI/NSPI-6 Standard for Portable Spas. Sometimes referred to as hot tub, but not a jetted bathtub.
4. **Pumps**: Pool pumps usually come with a leaf strainer before the impeller. The pumps contain an impeller to accelerate the water through the housing. The motors for residential pumps are included in the pump purchase but can be replaced separately. The pumps increase the "head" and "flow" of the water.

b. Products
   1. **Inground Pool Pumps:** A pump intended for installation with a Residential Inground Swimming Pool as the primary filter pump.
   2. **Aboveground Pool Pumps:** A pump intended for installation with a Residential Aboveground/Onground Swimming Pool as the primary filter pump.
   3. **Auxiliary Pool Pumps:** A pump intended for other purposes, i.e. pool cleaner booster, water feature pumps, etc.
   4. **Spa Pumps:** A pump intended for installation in a Residential Portable Spa as the primary filter pump.
   5. **Controllers:** An integrated or external device providing automated speed control and programmable timing.

c. Product Types (non-standard definitions):
   1. **Single-speed:** A pump which has an electric motor that operates at only one speed.
   2. **Multi-speed:** A pump which has an electric motor that can operate at multiple, discrete speeds.
   3. **Variable-speed:** A pump which has an electric motor that can operate at continuously variable speeds.

d. Product Ratings
   1. **Nameplate Horsepower:** The motor horsepower listed on the pump and the horsepower by which a pump is typically sold (also known as rated horsepower).
   2. **Rated Horsepower.** The motor power output designed by the manufacturer for a rated 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.
   3. **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.
   4. **Total Horsepower:** The product of the rated horsepower and the service factor of a motor used on a pool pump (also known as 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.

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Author: Shajee.Siddiqui Subject: Note Date: 3/14/2012 8:50:52 PM
Since "Multi-speed" also includes "Two-speed", it should be clearly indicated that "Multi-..." includes "Two-speed".

Author: Shajee.Siddiqui Subject: Note Date: 3/14/2012 8:25:21 PM
Is it assumed that "Rated Horsepower" would be described using the unit "HP". However, it may be clearer if this is specified in the definition. This can be achieve by simply adding the words ", measured in Horsepower (hp)" after "The motor power output".

Author: Steve.Gutai Subject: Note Date: 3/22/2012 12:50:39 PM
HP is typically NOT rated at different RPM levels. Usually 3450 or 3600 are the points.

Author: Shajee.Siddiqui Subject: Note Date: 3/22/2012 12:48:59 PM
"Service Factor Horsepower (SFHP)" should be clearly written out within this definition.
Should state THP=SFHP

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e. Technical Definitions

1. **Pump Performance Curve:** A curve comparing the total head in feet to the rate of flow in gallons per minute (GPM) for a given pump at a given motor speed.
2. **Normal Operating Point:** The normal operating point 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.
3. **Dead Head Point:** The condition of zero flow where no liquid is flowing through the pump, but the pump is primed and operating.
4. **Rate of flow (Q):** The rate of flow of a pump is the total volume throughput per unit of time. For this test method, rate of flow is expressed as GPM.
5. **Motor Speed (n):** The number of revolutions of the motor shaft in a given unit of time. For this test method, speed is expressed as revolutions per minute (RPM).
6. **Head (H):** Head is the expression of the energy content of the liquid at any given point. It is expressed in units of energy per unit weight of liquid. The measuring unit for head is feet of liquid.
7. **Total Suction Head (HS):** The head in the inlet section of the pump, calculated as follows:

$$H_S = z_S + \frac{(p_S \times 1000)}{\rho g} + \frac{U_S^2}{2g}$$

Where:

z_S is the height from the ground of the suction pressure measuring device,
p_S is the suction pressure measured by the pressure measuring device, and
U_S is the mean velocity at the suction pressure measuring device.

8. **Total Discharge Head (HD):** The head in the outlet section of the pump, calculated as follows:

$$H_D = z_D + \frac{(p_D \times 1000)}{\rho g} + \frac{U_D^2}{2g}$$

Where:

z_D is the height from the ground of the discharge pressure measuring device,
p_D is the discharge pressure measured by the pressure measuring device, and
U_D is the mean velocity at the discharge pressure measuring device.

9. **Total Head (H):** The measure of the work increase per unit weight of the liquid, imparted to the liquid by the pump. Total head is equal to the difference between total discharge head and total suction head. Total head is calculated as follows:

$$H = z_D - z_S + \frac{1000 \times (p_D - p_S)}{\rho g} + \frac{U_D^2 - U_S^2}{2g}$$

Note:

U_D and U_S are the same if the diameter of the piping is the same at the discharge and suction pressure measuring devices. In this case the last term in the above equation reduces to zero.

10. **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.
11. **Energy Factor (EF):** The volume of water pumped in gallons per watt hour of electrical energy consumed by the pump motor (gal/Wh).

Questions for Discussion:

(1) Are there any other sources that EPA should review for variations of, or additions to, this list of definitions?

(2) EPA is interested in any comments, questions or concerns related to the above definitions.

(3) Definitions based on technical attributes rather than marketing distinctions tend to be most effective at differentiating product types; therefore, EPA is interested in the key design or engineering differences, if any, that exist between pumps meant for commercial and residential applications, and between inground and above ground applications. Similarly, what key design differences are there between pool pumps and pumps meant for spa, waterfall, or booster applications? Where might there be overlap?

Eligible Product Categories

Purpose: In each product specification, EPA identifies specific product categories to be covered by the specification based on the agreed upon definitions. It is also important for the program to identify product types that are **not** eligible for ENERGY STAR qualification for reasons such as: niche product types, inability to be tested with the identified test method, and limited availability of efficiency data or inability to differentiate based on a product's efficiency.

Initial Approach: EPA's intention in developing the Version 1.0 specification is to cover the majority of the US pool pump market and to focus on those product categories where data is readily available and efforts are already underway to recognize high efficiency designs.

Based on our research, it appears that manufacturers typically divide the Swimming Pool Pump market into segments based on the speed functionality (single-speed, multi-speed, variable-speed), residential or commercial application, inground or aboveground designs, waterfall, booster, or spa applications, and various ratings such as "Full Rated", or "Up-Rated", and "Standard Efficiency" or "Energy Efficient".

EPA is initially interested in focusing in on the residential inground swimming pool pump market based on our engineering and market analysis which suggests that there is a large savings potential to end-users, high national savings potential, and there is adequate test data available.

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Author: Steve.Gutai Subject: Note Date: 3/22/2012 1:17:54 PM
Swimming pool design can be in TDH ranges from 10 - 80 ft head depending on the features, spa, water fall, fountains, etc... The low head systems have lower energy consumption with lower energy factors.

Author: David.Varnon Subject: Note Date: 3/22/2012 12:53:48 PM
Booster pump application efficiency cannot include watts to move gallons of water per se. Booster pumps are high pressure and low flow devices. The function of a booster pump is to drive a pool cleaner therefore some form of "cleaning" ability per watt may be a better measure. Since Polaris is the industry leader maybe we could choose a standard Polaris for all booster pump efficiency testing?

However, EPA also acknowledges there are large potential savings associated with the commercial and above ground pool pump markets. Absent a robust test data set, EPA is considering excluding these product categories at this time, but is open to the idea of expanding the scope to include them in possible later revisions.

Product Technologies:

a. Pumps: EPA anticipates taking a technology neutral approach which would allow the following types of residential inground swimming pool pumps to be evaluated against the same basis set of requirements:
   1. Single-speed
   2. Multi-speed
   3. Variable-speed

b. Controllers: EPA seeks stakeholder comments on the possibility of excluding external pool pump controllers in the Version 1.0 specification. Though important to achieving energy savings for pumps that lack onboard controls, due to the apparent lack of any industry test procedures, EPA intends to not include external controllers from the scope of the program.

c. Replacement Motors: Based on EPA's early assessments, there does not seem to be a way to evaluate standalone replacement motors because the wet-end energy use contribution cannot be accounted for with currently available industry test standards. EPA seeks comments on this topic and will further evaluate the role of replacement motors during the development of the specification.

Questions for Discussion:

(4) Are there any technologies or product types which are not included in this document or within the proposed program scope that should be considered for inclusion in this ENERGY STAR specification? If so, could you supply market or performance data available for those products?

(5) Certain multi-speed pumps require the installation of an aftermarket relay kit in order to function with a controller. These kits are not typically sold with the product and must be purchased separately. What percentage of multi-speed pump sales do these type of products account for? How common are systems converted using the relay kits?

(6) Current state-level energy efficiency standards, including California Energy Commission (CEC) CA Title 20 "California's Appliance Efficiency Regulations", require pumps be labeled with the following statement to encourage controller installation, "This pump, when used as a filter pump, must be installed with a two-, multi-, or variable-speed pump motor controller". Is there any data available on the prevalence of this label and the effectiveness of the messaging?

(7) Aside from labeling, what other methods may ensure proper controller implementation including but not limited to educational materials on the ENERGY STAR website?

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Author: Steve.Gutai Subject: Note Date: 3/22/2012 1:18:04 PM
including Two-speed

Author: Shajee.Siddiqui Subject: Note Date: 3/22/2012 1:14:24 PM
"Controllers" MUST be properly defined. What do we mean by "controller". Is it the "variable-frequency-drive", a "switch", a "time-clock", a remote mountable "user-interface", or a separate automation system designed to control all pool equipment at the property?

Author: Steve.Gutai Subject: Note Date: 3/22/2012 2:51:31 PM
We do not support this. Pump technology must allow for on and off- board consumer interfaces.

Author: Steve.Gutai Subject: Note Date: 3/22/2012 1:20:07 PM
We strongly support FG certification only.

Author: Steve.Gutai Subject: Note Date: 3/22/2012 1:22:14 PM
Gas Heaters for swimming pools & robotic cleaners. We will provide market and performance data in the future.

Author: David.Varnon Subject: Note Date: 3/22/2012 2:52:42 PM
Web campaigns, direct mail, dealer training, in store POP. Industry training / seminars on proper matching of motor and motor control for the intended application - pumps. "User interface" may be used for sending and receiving information and commands to the motor control by the user.

(8) Considering the importance of controls for achieving the intended energy savings, should pumps without onboard controllers be excluded?

Energy Efficiency Criteria and Test Procedures

Purpose: Once it has been determined which products are eligible to be included in the ENERGY STAR specification, the next step is to identify the performance metrics and set criteria for energy efficient performance.

Product testing has two important roles:

to yield accurate and repeatable energy consumption values for potentially qualifying products, and

to verify that labeled products are performing at the appropriate levels and delivering on ENERGY STAR's promise to consumers.

The performance efficiency metrics referenced by the product specification must be supported by generally accepted, and often DOE vetted, test procedures for determining qualification for ENERGY STAR labeling. In general , EPA sets requirements such that only the most efficient products currently available in the market at the time the specification becomes effective, are eligible to qualify. Typically this represents the top quartile of energy efficient products. By recognizing the top quartile, EPA distinguishes these products from the others, thereby adding to their intrinsic value.

Initial Approach:

Existing Standards

Whereever possible, EPA seeks opportunities to harmonize with existing standards and criteria. In regards to pool pumps, these include the Consortium for Energy Efficiency (CEE) Residential Swimming Pool Initiative (under-development), California Energy Comission (CEC) CA Title 20 "California's Appliance Efficiency Regulations", and the ANSI/ASPS/ICC-15 2011 "Residential Pool and Spa Efficiency" standard. As both the CEE and EPA efficiency criteria are in development, EPA will seek to align with their efficiency criteria, once established.

There are two general approaches to identifying energy efficient products:

1. Distinguishing minimally compliant pumps based on product attributes such as the size, the speed functionality, and motor type, such as in ANSI/APSP/ICC-15, which is essentially identical to CEC CA Title 20 and other state-level pool pump efficiency standards.

2. Identifying efficient pumps based on the tested Energy Factor.

EPA has reviewed various standards and approaches and would like stakeholder feedback on the appropriateness and benefits of each approach within the ENERGY STAR specification.

Questions for Discussion:

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Author: David.Varnon Subject: Note Date: 3/22/2012 1:42:31 PM
External motor control (not onboard) may be included as a "motor system". the motor does not function as a separate entity in the context of this framework. Again, separation may be made between "controller" and "user interface".

Author: Steve.Gutai Subject: Note Date: 3/22/2012 1:42:28 PM
Variable speed pumps can't run without a controller/interface. Some pumps include the controller/interface in the box, and some require the controller/interface to be purchased separately. The difference between on-board and off-board controllers/interfaces is merely a convenience/marketing feature. Pumps should be tested and Energy Star approved with controllers suggested by the pump manufacturer.

(9) Are there any benefits or disadvantages to using Energy Factor (EF) as an evaluating metric?

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Author: David.Varnon Subject: Note Date: 3/22/2012 2:56:36 PM
disadvantage in booster pumps - other means of efficiency is available such as "cleaning efficiency".

Test Procedure
EPA and DOE have developed a Draft ENERGY STAR Test Procedure based on industry-standard pool pump efficiency test methods. EPA and DOE will work with interested stakeholders to evaluate and finalize the test method in parallel with the specification development process. Enclosed is a draft ENERGY STAR Test Procedure which EPA is also seeking stakeholder feedback on. The development and finalization of this test method will run concurrent with the specification development process period.

The Draft ENERGY STAR test procedure combines the following industry standards:

ANSI/HI 1.6-2000 Centrifugal Pump Test

Australian Standard (AS) 5102.1-2009 Performance of household electrical appliances – Swimming pool pump-units

In both of these test procedures, EF is measured and reported. However, the AS standard provides added details regarding duration of reading, number of readings, and steady-state conditions. These additions compliment the ANSI standard by ensuring repeatability and robustness.

Questions for Discussion:

(10) Do the test procedures listed above accurately quantify residential inground swimming pool pump energy efficiency?

(11) Are any performance or energy efficiency criteria missing from existing test procedures that should be addressed by an ENERGY STAR test procedure?

Data Collection
EPA has identified the CEC appliance database as the only available source of EF performance values for swimming pool pumps. The database, however, has inherent limitations, predominately that it only includes CA Title 20 compliant pumps.

At this time, EPA will begin an effort to develop a robust data set and seeks performance data for pumps using the proposed test method. This includes products in these categories not fully compliant with CEC standards (e.g. single speed pumps that have split-phase, shaded-pole, or capacitor start-induction run motors, and single speed pumps greater than 1 HP).

EPA requests that products be tested using the proposed Draft ENERGY STAR Test Procedure, and that feedback about the proposed procedure be provided back to EPA to clarify and strengthen the test method. Through DOE's testing of this method, the Agencies believe the results provided with the new test will not vary significantly from current test methods results.

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Author: Steve.Gutai Subject: Note Date: 3/22/2012 2:59:55 PM
Maybe stay consistence with CEC or APSP15 pump list for system curves.

EPA will consider data received by January 20, 2012 using APPENDIX A test reporting template provided with the Test Method. Please submit performance data and feedback to poolpumps@energystar.gov .

Questions for Discussion:

(12) EPA understands that non-CA Title 20 compliant pumps (i.e. pumps with split-phase, shaded-pole, or capacitor start-induction run type motors, and single speed pumps greater than 1 HP) are typically not tested for EF. Are there any barriers to performing this additional testing to submit data to EPA? Is the draft ENERGY STAR Test Procedure sufficient for testing pumps with these types of motors?

(13) Currently the Draft ENERGY STAR Test Procedure calls for testing of all three curves, A, B, and C. However, if only curve A is utilized in the evaluation, is there any benefit to testing and supplying data for all curves?

(14) Is there any data to support the idea that small sized pumps will not operate on Curve A?

"Connected" Functionality

Consistent with our principle of enhanced consumer value, EPA is evaluating how best to address and encourage smart grid connected functionality in a variety of ENERGY STAR specifications. As this is a new functionality for EPA to address in its specifications, it is important to define the scope of that functionality in a way that is consistent with ENERGY STAR program principles. EPA is interested in highlighting products with connected functionality on the ENERGY STAR Qualified Product List (QPL), so that consumers, rebate program administrators and other interested stakeholders are better able to identify and advance those products into the market.

Currently direct load control programs are the most common type of demand response (DR) programs offered in the US. Some residential consumers have had the ability to "opt-in" to such programs through their local utility, receiving monetary incentive in return for participation. Such programs have usually focused on achieving "peak shaving" from central air conditioning loads, and water heaters and pool pumps.

Currently, requisite smart grid infrastructure and programs (Advanced Metering Infrastructure (AMI), active Home Area Networks (HAN), variable pricing programs, and appliance demand response (DR) programs) so not allow consumers to directly benefit from grid interconnection of smart grid enabled appliances. However, in the future when these programs and infrastructure are deployed, consumers that participate in appliance and other product DR programs have the opportunity to realize additional savings associated with shifting energy consumption of smart grid enabled appliances away from peak times.

Appliances (including pumps) that integrate with the grid will be able to receive price or event signals and reduce or delay load in response to both signals received and to consumer preferences. With proper economic incentives for residential consumers, these automated actions will enable consumers to save money on their electricity bills. Consumers will also benefit when any electric power system efficiency and reliability benefits are favorably reflected in their electricity rates. As these new demand response

opportunities evolve, EPA believes it is critical that consumers retain ultimate control over their appliances' response to such signals.

At a basic level, smart grid functionality involves the capability to receive, interpret and act upon certain demand response signals. Given the value proposition ENERGY STAR represents for consumers, EPA believes the connected functionality in an ENERGY STAR qualified appliance should enable more consumer oriented functionality.

EPA believes it is important that ENERGY STAR products be future-oriented and flexible. Pumps that are smart grid capable would need to provide consumers the option to upgrade to realize full smart grid and home energy monitor system functionality. EPA is interested in ensuring that third party devices and applications can be used with smart grid capable products that are associated with the ENERGY STAR program. Self diagnostic programs that detect and report faults, keeping pumps operating at peak efficiency could provide consumers with added value. EPA is interested in knowing if these are being incorporated into pumps currently on the market.

A preliminary list of potential consumer-oriented enhancements to the basic definition is presented below. It was developed based on EPA's initial research and builds on what EPA has proposed in the ENERGY STAR Room Air Conditioner and Residential Refrigeration and Freezer specifications.

"Connected" pumps shall have the following capabilities:

1. *Energy Consumption Reporting:* The product shall be capable of providing feedback on its energy consumption to an energy management system or other consumer authorized device, service or application via a communication link. Energy consumption data shall be reported by the product in intervals of 15 minutes or less.
2. *Remote Management:* The product shall be capable of receiving and responding to remote requests, via a communication link, similar to consumer controllable functions on the product. The product is not required to respond to remote requests that would compromise performance and/or product safety as determined by the product manufacturer.
3. *Operational Status & Alerts:* The product shall be capable of providing the following information to the consumer either on the product or via a communication link:
    a. Demand Response (DR) status (e.g., normal operation, delay load, temporary load reduction), and
    b. At least two types of alerts relevant to the energy consumption of the product. For example, alerts for maintenance, or report of energy consumption that is outside the product's normal range.

This list is intended to serve as a starting point for discussion and EPA looks forward to stakeholder input to further develop and refine a list of criteria that will ensure consumers receive a base level of value from products with connected functionality.

In addition, EPA prefers using existing industry standards, when available, and seeks feedback from stakeholders as to which industry standards could be leveraged in order to

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meet the intent of these criteria, or recommended variations to these criteria demand response functionality in appliances for the ENERGY STAR program.

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Author: Shajee.Siddiqui Subject: Note Date: 3/22/2012 1:48:21 PM
The ramifications of shutting off pumps during peak times, which may coincide with peak pool usage times and then affect water quality and safety, should be investigated and discussed further.

Questions for Discussion

(15) EPA requests stakeholder comment on this proposed approach to facilitating the deployment of connected functionality in pumps.

(16) EPA is seeking feedback from stakeholders on its initial list of criteria intended for the direct benefit of consumers.

(17) EPA seeks feedback from stakeholders as to which industry standards could be leveraged to meet the intent of the initial set of criteria discussed in this section, or recommended variations to these criteria.

Next Steps

EPA welcomes written comments from stakeholders on the issues presented above through Friday, January 20, 2012. Please send all comments and supporting information to poolpumps@energystar.gov.

EPA is also interested in hosting a web meeting with interested stakeholders to further discuss the specification development process, the issues identified in this framework document and comments received in response to these questions as well as additional input on Tuesday, December 20, 2011. Please RSVP to poolpumps@energystar.gov by Friday, December 16, to receive call-in information.

The above dates as well as further process steps are outlined below. Please note that the final schedule is dependent on a variety of factors such as: the extent of changes to the test method which could require additional testing, delays in the dataset assembly period, etc. Given these caveats, this represents our initial thoughts on the timing of this specification development process.

Pool Pump Launch Webinar	December 20, 2011
Deadline for Written Comments on Framework document and initial Test Method Issues	January 20, 2012
Draft 1 Version 1.0 Specification to stakeholders	February 2012
Draft 1 Version 1.0 Specification comments due to EPA	March 2012
Draft 2 Version 1.0 Specification to stakeholders	April 2012
Draft 2 Version 1.0 Specification comments due to EPA	May 2012
Draft Final Version 1.0 Specification to stakeholders	June 2012
Draft Final Version 1.0 Specification comments due to EPA	July 2012
Final Version 1.0 Specification	August 2012

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

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3) 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.

E) Measurement Accuracy:

1) Power measurements with a value greater than or equal to 0.5 W shall be made with an uncertainty of less than or equal to 2% at the 95% confidence level.

2) Power measurements with a value less than 0.5 W shall be made with an uncertainty of less than or equal to 0.01 W at the 95% confidence level.

3) Flow rate measurements shall be made with an uncertainty of less than or equal to 1.5% at the 95% confidence level.

4) Pressure measurements shall be made with an uncertainty of less than or equal to 1.0% at the 95% confidence level

5 TEST CONDUCT

5.1 Measurement Requirements

A) Reported Values: Values reported for each test performed in Section 6 shall follow the guidelines presented in *Australian Standards (AS) 5102.1-2009, Performance of household electrical appliances – Swimming pool pump-units, Part 1: Energy consumption and performance; Sections 4.3.2: Number of readings and Section 4.3.3: Duration of readings*.

B) Steady Conditions: For conditions to be considered stable, conditions must meet the criteria set forth in *AS 5102.1-2009, Performance of household electrical appliances – Swimming pool pump-units, 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.

5.2 ENERGY STAR Guidance for Implementation of AS 5102.1

A) Multi-speed pumps shall be tested at all possible motor speeds.

B) Variable-speed pumps shall be tested at the lowest possible speed, 1725 RPM, and 3450 RPM. If a pump is incapable of operating at either of the two higher speeds, test the pump at the closest 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.

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Author: Shajee.Siddiqui Subject: Note Date: 3/22/2012 12:23:20 PM
The approach to use specific parts of AS 5102 is good; However, the stakeholders will be better served if in addition to referencing sections of AS5102, specific/explicit verbiage/language is also added to mitigate any confusion or mis-interpretation.

There are noise testing requirements in the Australian standard, If this testing does not include this it should be spelled out explicitly.

Author: Steve.Gutai Subject: Note Date: 3/22/2012 12:24:50 PM
The Australian standard has too many conflicts to use as a baseline for the Energy Star pumps testing criteria.

1-No curve a,b, and c used.
2- Ambient noise testing
3- RPM set points different
4- Single speed pump criteria

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

Curve A: $H = 0.050 \times Q^2$
Curve B: $H = 0.0167 \times Q^2$
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 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.

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Author: Shajee.Siddiqui Subject: Note Date: 3/14/2012 9:08:02 PM
While references to sections of the Australian test standards are made here, we should ensure that the requirements are clear and don't send the reader off into unintended directions via other references which may be imbedded in the sections of the standards referenced.

7 TEST RECORDS

7.1 Test Report

The test report shall include the following information

A) Location and date of test.

B) Manufacturer's name, pump-unit model number, serial number of motor, and year of manufacture.

C) Type of pump: Single-, Multi-, or Variable-speed.

D) Nominal pump-unit ratings: motor speed(s) (RPM), input power (W), and horsepower (HP). For variable-speed pumps report the highest and lowest possible speeds.

E) Diameter of piping at measuring sections.

F) Ambient conditions: Temperature (°F) and barometric pressure (in Hg)

7.2 Calculations

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

This page contains no comments