



ENERGY STAR® Pool Pumps

**Draft 1 Specification,
Draft 2 Test Method,
Connected Functionality**

Stakeholder Webinar

September 28, 2012

Call-in Information



- Audio provided via conference call in:

Call in:	+1-877-423-6338 (in the US, Canada)
	+1-571-281-2578 (outside the US, Canada)
Code:	356609

- Phone lines will remain during the presentation to allow for open discussion
- Please keep phone lines on mute (*6) unless speaking

Agenda



- Specification Development Process
- Draft 1 Specification Discussion
- Draft 2 Test Method Discussion
- Connected Functionality Discussion
- Connected Functionality Test Method Discussion
- Timeline and Next Steps

Introduction



- EPA thanks all stakeholders who have been participating in the development of the ENERGY STAR specification for Pool Pumps
- Stakeholder participation is critical to the specification development

Meeting Objectives



1. Discuss issues identified in Draft 1 specification and note boxes
2. Discuss issues identified in Draft 2 test method
3. Further discussion on the Connected Functionality Discussion Document for Pool Pumps

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- **Specification Development Process**
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Guiding Principles



1. Significant energy savings can be realized on a national basis
2. Product performance can be maintained or enhanced with increased energy efficiency
3. Purchasers recover their investment in increased energy efficiency within a reasonable period of time
4. Energy-efficiency can be achieved through several technologies
5. Product energy consumption and performance can be measured and verified with testing
6. Labeling would effectively differentiate products and be visible for purchasers

Specification Development Cycle



Specification Development Cycle



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Important Process Elements

- Consistency
- Transparency
- Inclusiveness
- Responsiveness
- Clarity

ENERGY STAR's Third-Party Certification Process



January 2011: ENERGY STAR Labeled Products Program moved from self certification to third party certification.

Entities apply to become EPA-recognized laboratories, certification bodies, or accreditation bodies



Manufacturers test products with EPA-recognized laboratory or manufacturer lab (W/SMTL)



EPA-recognized certification body reviews data & certifies performance



EPA lists qualified models on website and partners market as ENERGY STAR qualified

Details available at www.energystar.gov/3rdpartycert

Specification Development Process – To Date



- EPA has been investigating pool pumps as a possible ENERGY STAR labeling product class since 2007
- In Fall 2011, launched a specification development effort:
 - Ample pool pump data from California Energy Commission (CEC)
 - Maturity and availability of high efficiency products

Framework Document and Draft 1 Test Method to Stakeholders	November 29, 2011
Framework Document and Draft 1 Test Method Webinar	December 20, 2011
Draft 1 Version 1.0 Specification, Draft 2 Test Method, Connected Functionality to stakeholders	August 30, 2012
Draft 1 Version 1.0 Specification, Draft 2 Test Method, Connected Functionality comments due to EPA	September 25, 2012
Draft 1 Version 1.0 Specification, Draft 2 Test Method, Connected Functionality Webinar	September 28, 2012

Definitions



- **Definitions are generally based on**
 - ANSI/APSP/ICC-15 2011 “American Standard for Residential Swimming Pool and Spa Energy Efficiency”
- **Current draft specification includes:**
 - General
 - Pump Types
 - Product Sub-Types
 - Product Ratings
 - Technical Definitions
 - Metric Definitions

Creating a Speed Controller Definition

EPA is interested in stakeholder input on adding a definition for “controllers” (APSP-15 does not provide a definition).

- Controllers are referenced in the Draft 1 under many names
 - Controls/controller, Motor controls/controller, Speed controller
- Other names/features to consider
 - "variable-frequency-drive", "switch“, "time-clock“, remote mountable "user interface"

Definitions



Creating a Speed Controller Definition

EPA welcomes comments and feedback on the following proposed definition for “controllers”:

Speed controller: a switch or variable frequency drive, either external to, or onboard the pump, that controls the motor speed and provides user programmable timing and speed setting capabilities.

- **Does this definition adequately characterize both onboard and external speed controllers?**

Scope of Included Products

EPA welcomes comments on the Draft 1 scope of included products:

- **Explicitly Included Products**
 - Residential Inground Pool Pump
 - Single –speed, Multi-Speed, or Variable-speed
- **Implicitly Included Products**
 - Pumps with onboard speed controls, or no onboard speed controls

• **Are there any issues with the included products?**

Exclusion of Commercial Pumps

EPA welcomes comments on limiting the Total HP to ≤ 4 HP for the purpose of excluding commercial pumps:

- Does this size limit adequately work to exclude commercial pumps?
- Are there any more technical distinctions between pumps used in residential and commercial applications that can help to exclude commercial pumps?

Exclusion of Small Size Pumps

EPA welcomes comments on limiting pump sizes to >0.5 Total HP for the purpose of excluding small pumps:

- **Are 0.5 Total HP pumps typically undersized for use as the primary filter pump?**
- **Does limiting pump sizes to >0.5 HP adequately work to exclude small single speed pumps which are usually undersized for most applications?**

Scope of Excluded Products

EPA welcomes comments on the Draft 1 scope of excluded products:

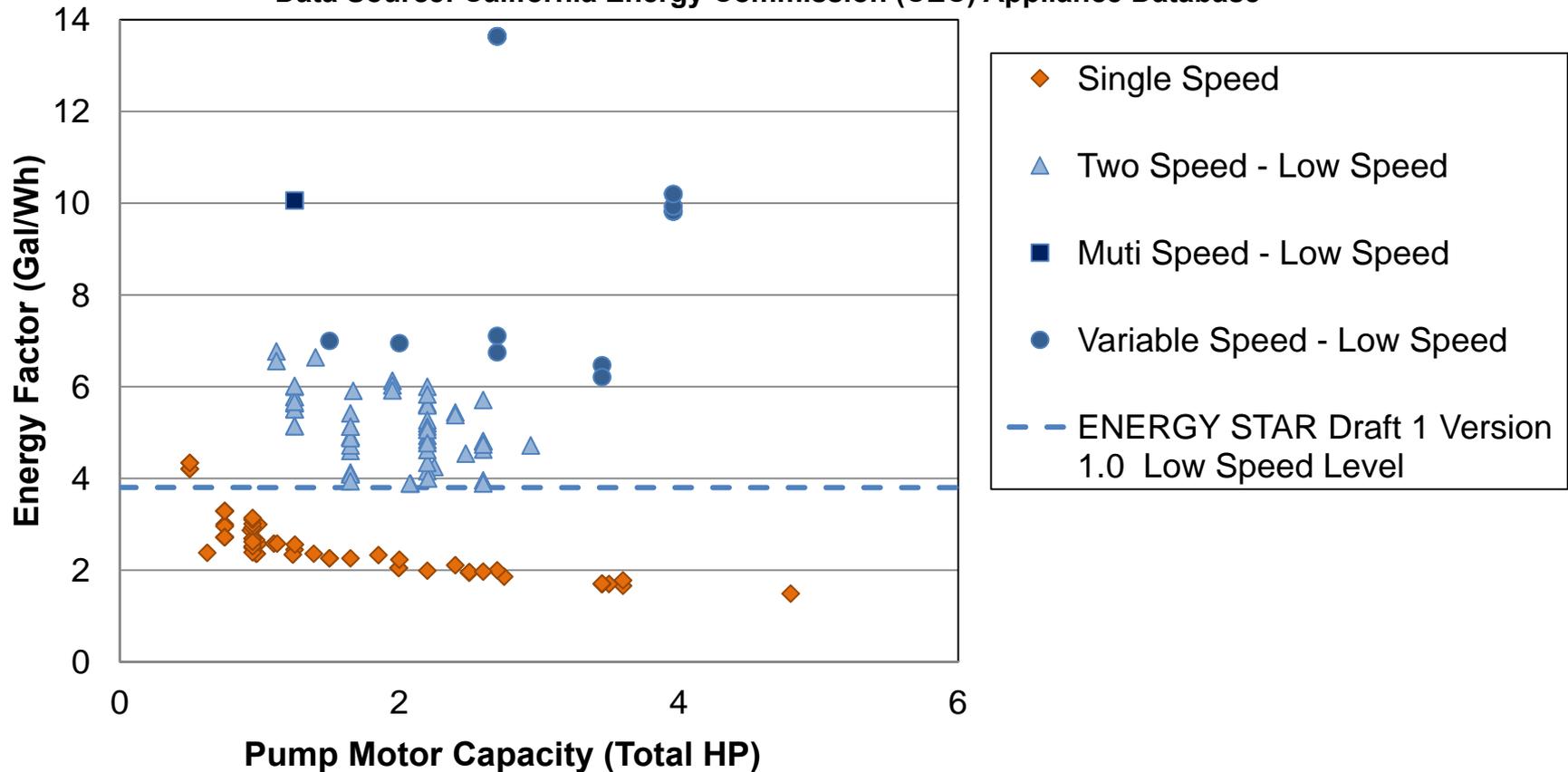
- **Explicitly Excluded Products**
 - Residential Aboveground Pool Pumps, Residential Auxiliary Pool Pumps, and Spa Pumps
 - Multi-speed Pumps with manual speed controls that are not able to connect to an external speed controller.
 - **Implicitly Excluded Products**
 - Speed controllers, Timers, Replacement motors
- Are there any issues with the excluded products?**

Default Filtration Speed/High Speed Override

- EPA welcomes comments on the following default filtration speed and high speed override requirements for onboard speed controllers:
 - Default filtration speed shall be no more than one-half of the motor's maximum rotation rate
 - High-speed override cannot exceed on 24-hour cycle without resetting to default settings
 - Same as APSP-15 and CA Title 20
- **Are there any issues with these requirements?**

Curve-A Low Speed Energy Factor vs. Pool Pump Motor Capacity

Data Source: California Energy Commission (CEC) Appliance Database

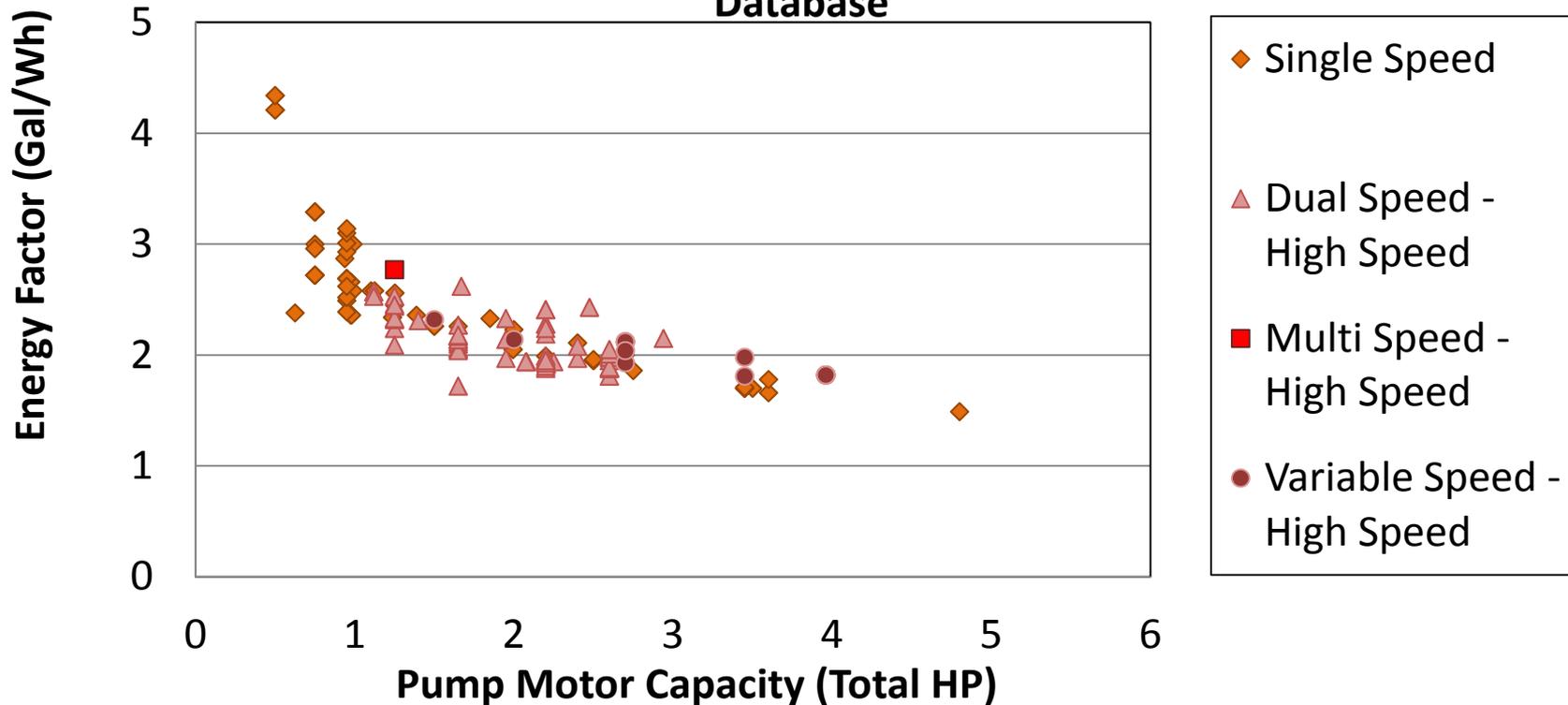


Data (High Speed)



Curve-A High Speed Energy Factor vs. Pool Pump Motor Capacity

Data Source: California Energy Commission (CEC) Appliance
Database



- EPA welcomes comments on the Draft 1 criteria**

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 \geq 3.8
Multi- and Variable Speed Pump	Low Speed	EF \geq 3.8

What are the benefits of adding the high speed EF as an additional efficiency requirement, similar to CEE?

- CEC Appliance Efficiency Database is the only currently available listing of EF data: NOT a full data set
 - only includes CA Title 20 compliant pumps
 - does not include single speed pumps >1HP, or split-phase or capacitor start – induction run type motors
 - some listings are incomplete
 - only 62 single speed pumps listed (~300 on the market)
- ENERGY STAR specifications are a data driven process
 - levels are set based on the data available

Call For Data



- EPA and DOE requested that manufacturers share EF performance data using the Draft 2 Test Procedure by **Sept 25, 2012** (contact EPA for deadline extension if needed)
- EPA will also accept data using the CA Title 20 and APSP-15 test procedures.
- Looking for more data on inground single speed, above ground pumps to round out data set.

Additional Requirements

Informational Statement

- **EPA welcomes comment on the requirement that all multi- and variable- speed pool pumps without onboard controllers are marked with the following statement:**

“This pump must be installed with a multi-, or variable-speed pump motor controller.”

- Same as APSP-15 and CA Title 20
- **Are there any concerns with the proposed additional information requirement?**

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Review of Draft 2 Test Method



- Draft 2 published on August 30, 2012
- Draft 2 contains revisions to three major areas
 - Test Speeds for Variable-speed Pumps
 - Standby Mode Testing
 - Flow Rate Measurements
- Changes based on
 - Stakeholder feedback
 - Additional DOE research

Revision #1 – Test Speeds for Pumps



- Draft 1 Proposal: Test pumps at the following speeds

Single- and Multi-speed Pumps	Variable-speed Pumps
<ul style="list-style-type: none">• All available speeds	<ul style="list-style-type: none">• 3450 rotations per minute (RPM)• 1725 RPM• Lowest available speed

- Comment Received: Proposed test speeds for Variable-speed pumps not representative of
 - Most efficient pump speeds
 - Speeds used for normal operation

Revision #1 – Test Speeds for Pumps



- Draft 2 Proposal:

Single- and Multi-speed Pumps	Variable-speed Pumps
<ul style="list-style-type: none">• All available speeds	<ul style="list-style-type: none">• Lowest• Highest• Most Efficient

- All speeds used for testing shall be reported

- Rationale:

- Aligns with Association of Pool and Spa Professionals (APSP) Standard 15

- Should any other speeds be tested to ensure full range of pumps' capabilities are measured?

Revision #2 – Standby Mode Testing



- Draft 1: Standby Mode Testing not included in Draft 1
 - Testing showed Standby power is significantly less than Active power
- Comment Received: Directed to Pacific Gas and Electric Company (PG&E) 2007 Draft Report on Residential Swimming Pools
 - Report contained hypothetical pumps and systems to model proposed energy savings options

Revision #2 – Standby Mode Testing



- PG&E report proposes 4 different profiles

Design	Flow (GPM)	Power (W)	Turnover Time (hours)	Pump Active Energy Use (kWh)	
				Daily	Annual
1	56.1	445	5.9	2.6	965
2	73.7	1649	4.5	7.5	2722
3	64.0	1779	5.2	9.3	3382
4	39.9	1512	8.4	12.6	4611

Revision #2 – Standby Mode Testing



- Based on testing, Standby Mode Power ~ 4.5 W

Design	Standby Time (hours)	Standby Energy Use (kWh)		Total (Active + Standby) Annual Pool Energy (kWh)	% of Total
		Daily	Annual		
1	18.1	0.081	29.6	994	3.0%
2	19.1	0.086	31.4	2753	1.1%
3	18.8	0.085	31.0	3413	< 1%
4	15.6	0.070	25.6	4636	< 1%

- Standby represents small portion of total estimated energy use

Revision #2 – Standby Mode Testing



- Draft 2 proposal: 10 minute Standby Mode test (5 minute stabilization, 5 minute power measurement)
- Rationale:
 - DOE does not want to ignore any energy savings opportunities
 - Pumps spend a significant amount of time in Standby Mode

Revision #2 – Feedback



- What types of units are capable of entering Standby Mode?
- What is the market penetration of these types of units?
 - Is this number expected to grow in the future?
- What consumes power in Standby Mode (e.g., pump motor, controls)?

Revision #3 – Flow Rate Measurements



- Draft 1 proposal: Starting at max flow, Q_{Max} , and ending at dead head, take measurements at 10% increments of Q_{Max}
- Comment Received: Taking measurements at 10% increments of Q_{Max} will result in different test results based on test setup

Revision #3 – Flow Rate Measurements



- Draft 2 proposal: Starting at dead head and ending at Q_{Max} , take measurements at fixed flow rate increments based on Q_{max} , as follows

Maximum Flow Rate, Q_{Max} (gallons per minute, GPM)	Flow Rate Increments, Q (GPM)
$Q_{Max} \leq 25$	2.5
$25 < Q_{Max} \leq 50$	5
$50 < Q_{Max} \leq 100$	10
$100 < Q_{Max}$	15

- Rationale: Helps to ensure pumps are tested at same rates of flow regardless of Q_{Max}

Revision #3 – Flow Rate Measurements



- Tiers included to
 - Minimize test burden
 - Ensure enough measurements are taken to accurately determine performance curves
- Number of measurements varies from 7-11 in each tier
- What is the highest flow rate reached by residential pool pumps on the market?
 - Should another tier above 100 GPM be added?

Additional Discussion – Test Setup Requirements

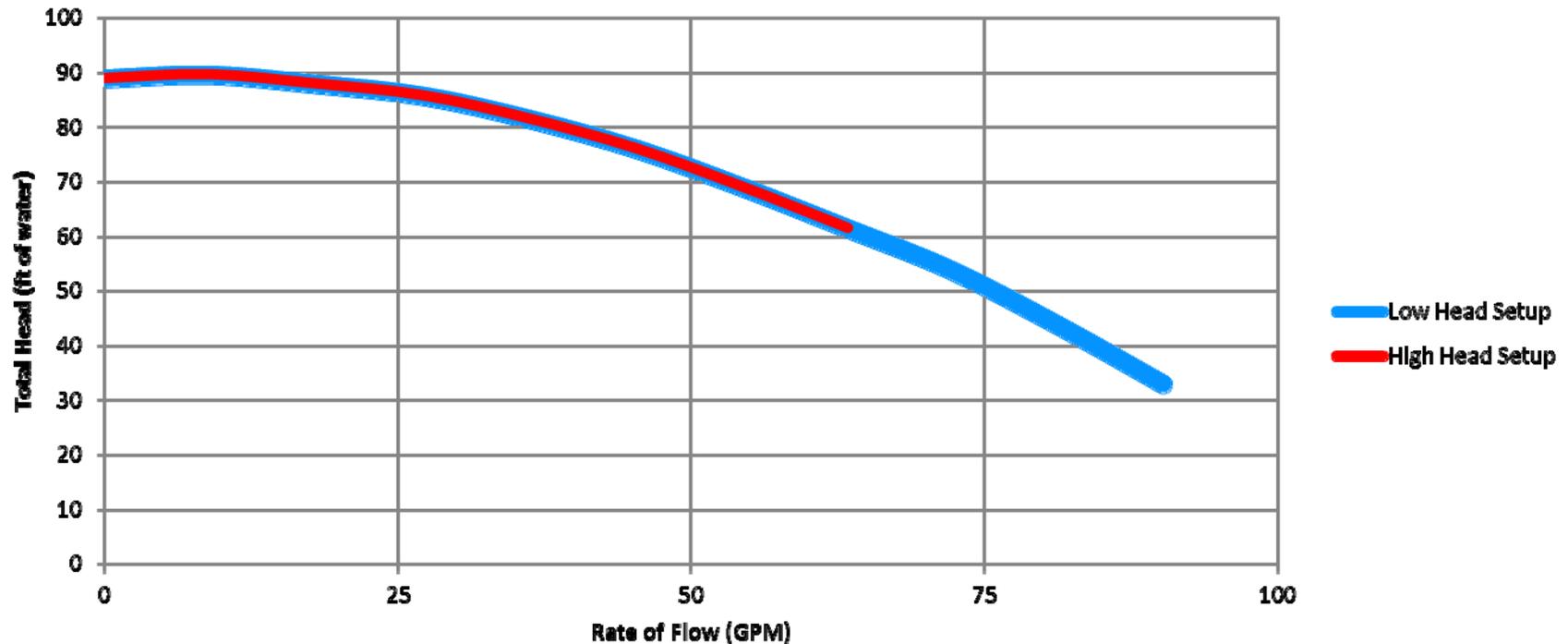


- Each test setup has a different total head value depending on:
 - Pipe width and length
 - Number of bends in pipe system
 - Type of instruments used
 - Elevation changes
- Simpler test systems result in lower total head values
- Total head value does not alter performance curve, but does alter the range of the measured performance curve

Additional Discussion – Test Setup Requirements



Pump Performance Curve



- Differences in test setup could result in Q_{Max} falling into different tiers

Additional Discussion – Feedback



- Should a total dynamic head range be specified for the test setup to ensure Q_{Max} is in the same tier for a given pump for all testing?

Summary of Proposed Changes



Topic	Draft 1 Test Method	Draft 2 Test Method
Test Speeds for Variable-speed Pumps	Test at lowest available speed, 1725, and 3450 rotations per minute (RPM)	Test at lowest, highest, and most efficient available speeds and report all speeds tested
Standby Mode Testing	Standby Mode testing not included	10 minute Standby Mode test
Flow Rate Measurements	10% increments from full flow to dead head	Discrete increments starting from dead head through Q_{Max}

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Connected Functionality – WHY

To help advance the market for products with intelligent features in ways that deliver immediate consumer benefit as well as support a low-carbon electricity grid over the long term.

- EPA is pursuing the development of Connected Functionality criteria in a number of ENERGY STAR product categories
- EPA believes that recognition of “Connected” Pool Pumps will provide consumers, rebate programs and others a way to identify and advance those products into the market.
- EPA released a Connected Functionality (CF) Discussion document for Pool Pumps on **August 30, 2012**

Connected Functionality - WHY



- Connected pumps offer consumers new functionality that can enable immediate energy savings and convenience opportunities
- EPA is engaged in this discussion to ensure the consumer is being considered on the product side of smart grid deployment (e.g., ensuring consumers have the ability to override any response)
- Encourage manufacturers to begin to make available, products with future-oriented demand response capabilities that could support a reliable, lower emissions electric grid

Connected Functionality



- EPA believes pumps with connected functionality should enable Smart Grid Demand Response and Load Control functionality as well as provide additional consumer oriented savings and functionality.
- EPA encourages manufacturers to begin to make available, Pool Pumps with CF including future-oriented demand response capabilities that could support a reliable, lower emissions electric grid
- EPA encourages utilities to collaborate with Pool Pump manufacturers to submit consensus CF recommendations to inform EPA in crafting and refining CF criteria.

Connected Functionality - WHAT



- *Optional – Not necessary for ENERGY STAR qualification*
- Pool Pump CF criteria includes:
 - **Scheduling Capability**
 - **Peak Period Avoidance**
 - **Energy Management**
 - **Remote Management and Load Control**
 - **Communications**
 - **Open Access**
 - **Information to Consumers**

Connected Functionality Discussion



Programmatic Framework

EPA believes it can play a key role in facilitating and accelerating market adoption of CF

- Long term societal benefits
- Near term consumer benefits:
 - communications to enable home energy management & remote management
 - energy savings thru scheduled operation
- Working with stakeholders to develop and refine criteria and working with DOE to develop test procedures

Connected Functionality Discussion: Scope



- Applies to pool pumps with multi-speed or variable-speed operation, scheduled operation, through the use of controls that are either integrated into and/or sold with the pool pump.
- All criteria must be met in order to be considered “Connected”
- EPA recognizes that pool controls come in various form factors (integrated, integrated but detachable, and external). EPA’s intent is for CF to cover form factors.

Connected Functionality Discussion Promoting Standardization



EPA hopes to use this stakeholder process to enable and encourage standardization.

Examples:

- requiring a standardized modular communication interface (MCI)
- requiring use of open standards-based communications

Connected Functionality Discussion: Criteria – Scheduling Capability



The pool pumps shall be delivered with consumer configurable scheduling functionality with the following **minimum** capabilities

1. Ability to set a weekday and weekend schedule
2. Two schedule periods per day
3. Two speeds available per schedule period
4. On/Off capability per schedule period

Note: Allows for peak off setting or low speed peak operation and scheduling.

Connected Functionality Discussion: Criteria – Peak Period Avoidance



The pool pump controller shall be delivered with a default schedule that limits high speed (above half speed) run-times to outside of the traditional peak load periods of 6-10 am and 3-7 pm. The consumer shall be able to modify the default schedule, without limitation.

Note: Limits high speed cleaning to outside of traditional morning winter peak and evening summer peak periods.

Connected Functionality Discussion: Criteria – Energy Management



The product shall be capable of recording data and settings changes and transmitting them upon request to connected devices external to the pool pump controller. Settings changes shall be recorded when they occur, or at least once every 24-hours, in the absence of change.

Connected Functionality Discussion: Criteria – Energy Management *cont.*



1. Unique ID
2. All programmable settings, including program schedules
3. Current operational status (e.g. off, on-low, on-high, RPMs)
4. Per day run time and gallons pumped (for prior 7 days)
5. Scheduled Demand Response (DR) and/or load management events
6. Data representative of the product's 15-minute interval energy consumption, during pumping operation only

Note: The intent of consumption reporting and energy management functionality is to enable simple, actionable energy use feedback to consumers intended to drive reduced energy consumption and cost savings.

Connected Functionality Discussion: Criteria – Energy Management *cont.*



Request for Stakeholder Feedback

- Is there potential applicability of the energy consumption reporting schema standardized by The Green Button Initiative (GBI) to Connected Pool Pumps?
- Will usefulness of energy consumption reporting data benefit from standardization?
- Are stakeholders aware of any other standardization activities applicable to energy consumption reporting?
- Are there any drawbacks to capturing energy consumption only during pumping operations?

Connected Functionality Discussion

Criteria - Remote Management and Load Control



The product shall respond to the following remote control commands from authorized devices or software applications within 5 seconds. This criteria assumes receipt of the signal within 1 second of its transmission:

1. Time Synchronization
2. Schedule Synchronization
3. Pump Control (on/off, speed)

Note: intended to ensure responsiveness to remote commands – these commands may, for example, be associated with energy management, remote management or the Smart Grid.

Connected Functionality Discussion: Criteria – Communications



The product shall use a standards-based modular communications interface to enable communications to/from external apps, devices, and systems. Communication module(s) shall be easy to install by the pump operator.

Connected Functionality Discussion: Criteria – Communications



EPA requires for all communication layers associated with the modular interface, the use of standards:

- Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,¹ and/or
- Included in the NIST Smart Grid framework Tables 4.1 and 4.2, and/or

Connected Functionality Discussion: Criteria – Communications



- Adopted by the American National Standards Institute (ANSI) or another well-established international standards organization such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE), or Internet Engineering Task Force (IETF)
 - *EPA may consider more robust criteria in a future revision as relevant standardization efforts mature.

Connected Functionality Discussion: Criteria – Open Access



To enable interconnection with the product for purposes of Energy Management and Load Control, the following shall be made available to interested parties:

- Documentation regarding the accuracy of energy consumption reporting; and
- An interface specification, API or similar documentation, that enables access to the Energy Management and Load Control capabilities described in this section.

Connected Functionality: Criteria – Information to Consumers



- Prominent labels or other forms of consumer notifications with instructions shall be displayed at the point of purchase and in the product literature.
- These shall provide specific information on what consumers must do to activate these capabilities for example:

“This product requires installation of a network module to enable interconnection with the Smart Grid, Energy Management System, and/or with other external devices, systems or applications.”

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Connected Pool Pumps – Test Method



- DOE is initiating the development of a Demand Response (DR) verification test method
- Test method development will require stakeholder input on several levels
 - DOE has contacted some stakeholders to begin discussions
 - Interested in engaging any/all stakeholders

Connected Pool Pumps – Test Method - Process



- DOE prefers to conduct validation on DR pool pumps test method prior to finalization
- DOE wants to work with manufacturers to obtain prototype connected products for use during testing and/or visit manufacturers' facilities to witness DR testing
 - All product information and data collected will be confidential and used only to support test method development

Connected Pool Pumps – Test Method - Feedback



- Are there other Connected functionalities, other than DR, that may require testing for verification?
- What pump designs, applications, and elements should be considered?
- Do any pumps currently on the market have Demand Response functionality?
 - Or any other functionalities that would be considered Connected?

Specification Development Timeline



Draft 1 Version 1.0 Specification to stakeholders	August 30, 2012
Draft 1 Version 1.0 Specification comments due to EPA	September 25, 2012
Draft 1 Version 1.0 Specification Webinar	September 28, 2012
Draft 2 Version 1.0 Specification to stakeholders	October 2012
Draft 2 Version 1.0 Stakeholder In-person Meeting at the International Pool, Spa, Patio Expo, New Orleans	November 6, 2012
Draft 2 Version 1.0 Specification comments due to EPA	Nov 2012
Draft Final Version 1.0 Specification to stakeholders	Dec 2012
Draft Final Version 1.0 Specification comments due to EPA	Jan 2013
Final Version 1.0 Specification	Feb 2013

Test Method Development Timeline



Pool Pump Launch Webinar	December 20, 2011
Deadline for Written Comments on Framework document and initial Test Method Issues	January 20, 2012
Draft 2 Version 1.0 Test Method to stakeholders	August 30, 2012
Draft 2 Version 1.0 Test Method comments due	September 25, 2012
Draft 2 Version 1.0 Test Method Webinar	September 28, 2012
Draft Final Version 1.0 Test Method to stakeholders	October 2012
Draft 2 Version 1.0 Stakeholder In-person Meeting at the International Pool, Spa, and Patio Expo, New Orleans	November 6, 2012
Draft Final Version 1.0 Test Method comments due	November 2012
Final Version 1.0 Test Method*	December 2012

*Version 1.0 will not include Demand Response

Contact Information



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