Following is the Draft 1, Version 2.0/Version 3.0 product specification for ENERGY STAR certified 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 (the rotating part of a pump designed to move the fluid inside the pump casing), and a motor. The pump increases the “head” and “flow” (see pages 2 and 3 for definitions) 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) Self-Priming Pool Pump: A self-priming pool pump is a pool pump that is certified under NSF/ANSI 50-2015 to be self-priming or is capable of re-priming to a vertical lift of at least 5 feet with a true priming time less than or equal to 10 minutes, when tested in accordance with NSF/ANSI 50-2015, “Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational Water Facilities.”¹ Note: Pumps designated Inground Pool Pumps in previous ENERGY STAR specifications are now considered Self-Priming Pool Pumps.

B) Non-Self-Priming Pool Pump: A Non-Self-Priming pool pump is a pool pump that is not certified under NSF/ANSI 50-2015 to be self-priming and is not capable of re-priming to a vertical lift of at least 5 feet with a true priming time less than or equal to 10 minutes, when tested in accordance with NSF/ANSI 50-2015.¹ Note: Pumps designated Aboveground Pool Pumps in previous ENERGY STAR specifications are now considered Non-Self-Priming Pool Pumps.

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.

E) Pool Pump Replacement Motor: A motor designated as a specific replacement part intended for pool pump model(s) as specified by pump manufacturer and/or a motor designed and marketed to consumers for use as a pool pump motor.

F) Pressure Cleaner Booster Pump: An end suction, dry rotor pump designed and marketed for pressure-side pool cleaner applications, and which may be UL listed under ANSI/UL 1081-2014, “Standard for Swimming Pool Pumps, Filters, and Chlorinators.”¹

¹ US DOE Energy Conservation Standards for Dedicated Purpose Pool Pumps, Final Rule, 82 FR 5650, IV.A.1.b
G) **Waterfall Pump**: A waterfall pump is a pool filter pump with maximum head less than or equal to 30 feet, and a maximum speed less than or equal to 1,800 rpm.³

### 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.

D) **Hydraulic Horsepower (hp)**: The pump power output at outlet (in HP), defined at the maximum speed of the pump on Curve C (see Section 1.5 below). This measurement is the power associated with moving the nominal amount of water at maximum flow of the pump when operating at maximum speed.

### 1.5 Testing and Certification

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**: Equations which compare 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 (Q) to Total Head (H). The System Curve equations are the following, where H is total system head in feet of water and Q is flow in GPM:

- **Curve A**: \[ H = 0.0167 \times Q^2 \]
- **Curve B**: \[ H = 0.050 \times Q^2 \]
- **Curve C**: \[ H = 0.0082 \times Q^2 \]

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) **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.

G) **Total Suction Head (Hₚ):** The head in the inlet section of the pump, calculated as follows:

\[
Hₚ = zₛ + \frac{(pₛ × a)}{γ} + \frac{Uₛ²}{2g}
\]

Where:
- \(zₛ\) is the height from the water level of the suction pressure measuring device, in feet (ft),
- \(pₛ\) is the suction pressure measured by the pressure measuring device, in pounds per square inch (psi),
- \(Uₛ\) 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.

H) **Total Discharge Head (H₀):** The head in the outlet section of the pump, calculated as follows:

\[
H₀ = z₀ + \frac{(p₀ × a)}{γ} + \frac{U₀²}{2g}
\]

Where:
- \(z₀\) is the height from the water level of the discharge pressure measuring device, in ft,
- \(p₀\) is the discharge pressure measured by the pressure measuring device, in psi,
- \(U₀\) 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.

I) **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.

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

K) **Weighted Energy Factor (WEF):** Pump performance based on the EF at 2 operating points, one at a High Flow Measurement Point, the other at a Low Flow Measurement Point. These measurements are weighted differently to represent real world use. WEF is measured in gallons per watt hour (gal/Wh). See the DOE Test Procedure for Dedicated Purpose Pool Pumps for additional calculation details: EERE-2016-BT-TP-0002-0015.

L) **High Flow Measurement Point:** For Single-speed pumps, defined as the flow on Curve C at the maximum speed. For Multi-speed and Variable-speed pumps, defined as the flow on Curve C at the lowest speed able to produce a flow of at least 80% of pump maximum flow on Curve C.

M) **Low Flow Measurement Point:** For Multi-speed and Variable-speed pumps, defined as the flow on Curve C at the lowest speed able to produce a flow of at least 31.1 GPM for pumps >0.75 hhp or 24.7 GPM for pumps ≤0.75 hhp.

N) **Basic Model:** means all units of a given class of pump manufactured by one manufacturer, having the same primary energy source, and having essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency.²

Note: Changes in product color, Rated Horsepower (Not Total Horsepower) and the presence of union fittings would be covered under a basic model.

Note: EPA added definitions to align with the DOE Energy Conservation Standards for Dedicated Purpose Pool Pumps\(^1\): Pressure Cleaner Booster Pumps, Self-Priming, Non-Self-Priming, Hydraulic Horsepower (hhp), Weighted Energy Factor (WEF), High Flow Measurement Point, and Low Flow Measurement Point. Additionally, EPA added a definition for Pool Pump Replacement Motor.

EPA is proposing to use DOE definitions for pump types, switching terminology from Inground Pumps to Self-Priming Pumps and Aboveground Pumps to Non-Self-Priming Pumps. In most cases, this change will be straightforward, since Inground Pool Pumps are almost exclusively Self-Priming, and Aboveground Pool Pumps are almost exclusively Non-Self-Priming.

1.6 Connected Products

A) Communication Link: As shown in Figure 1, the mechanism for bi-directional data transfers between the CPPS and one or more external applications, devices or systems.

B) Connected Pool Pump System (CPPS): As shown in Figure 1, includes the ENERGY STAR certified pool pump, integrated or separate communications hardware, and additional hardware and software required to enable connected functionality.

Figure 1. Connected Pool Pump System (CPPS)

Note: Communication device(s), link(s) and/or processing that enables Open Standards-based communication between the CPPS and external application / device / system(s).

These elements, either individually or together, could be within the pump/controller, and/or an external communication module, a hub/gateway, or in the Internet/cloud.

C) Consumer Authorized Third Party: Any entity for which the consumer has provided explicit permission to access the CPPS connected functionality, in whole or in part, via a Communication Link.

D) Open Standards: Standards that are:
1. Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,\(^3\) and/or
2. Included in the National Institute of Standards and Technology (NIST) Smart Grid Framework Tables 4.1 and 4.2,\(^4\) and/or
3. 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).

E) Premises: Land and the improvements on it.

1.7 Acronyms

A) ac: Alternating Current
B) ANSI: American National Standards Institute
C) API: Application Programming Interface
D) APSP: Association of Pool and Spa Professionals
E) CPPS: Connected Pool Pump System
F) DR: Demand Response
G) EF: Energy Factor
H) °F: Degrees Fahrenheit
I) gal: gallons
J) GPM: Gallons per minute
K) H: Head
L) HI: Hydraulics Institute
M) HP: Horsepower
N) hhp: Hydraulic Horsepower
O) Hz: hertz
P) ICD: Interface Control Document
Q) n: Motor Speed
R) NSPI: National Spa and Pool Institute
S) Q: Rate of Flow
T) RPM: Revolutions per minute
U) UUT: Unit under test
V) V: volts
W) W: watts
X) WEF: Weighted Energy Factor
Y) Wh: watt-hours

\(^3\) http://collaborate.nist.gov/twiki-smgrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes
2 SCOPE

2.1 Included Products

Products that meet the definition of a Residential Self-Priming (Inground) Pool Pump, Residential Non-Self-Priming (Aboveground) Pool Pump, Pressure Cleaner Booster Pump or Pool Pump Replacement Motor, as specified herein, are eligible for ENERGY STAR certification, with the exception of products listed in Section 2.2. Only those pool pumps that are single phase and with a Hydraulic Horsepower (hhp) of >0 and ≤2.5 hhp can certify as ENERGY STAR under this specification.

2.2 Excluded Products

Residential Auxiliary Pool Pumps, other than Pressure Cleaner Booster Pumps, including Waterfall 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.

Note: EPA proposes including Pressure Cleaner Booster Pumps and Non-Self-Priming (Aboveground) Pool Pumps in the scope. These product types present a large opportunity for consumer energy savings. EPA estimates that including Non-Self-Priming Pumps could save US consumers up to 600 GWh/yr (approximately $75,000,000 per year). Pressure Cleaner Booster Pumps could save US consumers up to an additional 67 GWh/yr (approximately $8,300,000 per year). Additionally, they are within the scope of the DOE proposed test method\(^5\), making testing their energy performance, possible.

Additionally, for Aboveground and Inground Pumps, EPA proposes increasing the scope to cover pumps with >0 hhp and ≤2.5 hhp to harmonize with the DOE test method and final rule.

EPA proposes including Pool Pump Replacement Motors, because they also represent a large opportunity for savings. National cumulative energy savings estimates from the American Council for an Energy-Efficient Economy (ACEEE) on pool pump replacement motors total $2.8 Billion and 94 TWh for US consumers from 2020 through 2035.\(^6\)

EPA proposes to exclude Waterfall Pumps from the scope, because analysis did not identify a leadership level that would deliver cost effective savings to consumers.

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3 CERTIFICATION CRITERIA

3.1 Energy Efficiency Requirements

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

Table 1: Pool Pump Weighted Energy Factor Criteria (on Curve C)

<table>
<thead>
<tr>
<th>Pump Sub-Type</th>
<th>Size Class</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-Priming (Inground) Pool Pumps</strong></td>
<td>Small</td>
</tr>
<tr>
<td><strong>Version 2.0 Energy Efficiency Level</strong></td>
<td>Version 3.0 Energy Efficiency Level</td>
</tr>
<tr>
<td>(Effective TBD 2018)</td>
<td>(Effective July 19, 2021)</td>
</tr>
<tr>
<td>WEF ≥ -1.30 x ln (hhp) + 4.95</td>
<td>WEF ≥ -2.45 x ln (hhp) + 8.40</td>
</tr>
<tr>
<td>for hhp &gt; 0.13</td>
<td>for hhp &gt; 0.13</td>
</tr>
<tr>
<td>WEF ≥ 7.60 for hhp ≤ 0.13</td>
<td>WEF ≥ 13.40 for hhp ≤ 0.13</td>
</tr>
<tr>
<td><strong>Self-Priming (Inground) Pool Pumps</strong></td>
<td>Large</td>
</tr>
<tr>
<td>WEF ≥ 0.9 x [-2.30 x ln (hhp) + 6.59]</td>
<td>WEF ≥ -2.45 x ln (hhp) + 8.40</td>
</tr>
<tr>
<td><strong>Non-Self-Priming (Aboveground) Pool Pump</strong></td>
<td>Extra Small</td>
</tr>
<tr>
<td>WEF ≥ 4.92</td>
<td>WEF ≥ 4.92 (same as Version 2.0)</td>
</tr>
<tr>
<td><strong>Non-Self-Priming (Aboveground) Pool Pump</strong></td>
<td>Standard Size</td>
</tr>
<tr>
<td>WEF ≥ -1.00 x ln (hhp) + 3.85</td>
<td>WEF ≥ -1.00 x ln (hhp) + 3.85</td>
</tr>
<tr>
<td><strong>Pressure Cleaner Booster Pumps</strong></td>
<td>All</td>
</tr>
<tr>
<td>WEF ≥ 0.45</td>
<td>WEF ≥ 0.51</td>
</tr>
<tr>
<td><strong>Pool Pump Replacement Motors</strong></td>
<td>TBD</td>
</tr>
<tr>
<td></td>
<td>TBD</td>
</tr>
<tr>
<td></td>
<td>TBD</td>
</tr>
</tbody>
</table>

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.

Note: Since EPA finalized the Version 1.0 Pool Pumps specification in 2014, the pool pump market has advanced considerably, offering consumers a wider variety of efficient pumps, at prices that are more reasonable than ever. Reflecting this, EPA’s analysis shows an opportunity for deeper and broader energy savings through revision of this specification.

In addition, DOE has finalized minimum efficiency standards for pool pumps with a compliance date of July 19, 2021. These standards are in terms of a new test method and metric for pool pump efficiency, which DOE finalized on August 7, 2017.

7 US DOE Energy Conservation Standards for Dedicated Purpose Pool Pumps, Final Rule, 82 FR 5650
EPA proposes relying on the new metric, weighted efficiency factor (WEF) and the new test method for the Version 2.0 specification. EPA is proposing Version 2.0 levels effective in 2018 that reflect current advances in the pool pump market as well as Version 3.0 levels, aligned with the timing of new minimum efficiency standards, that ensure ENERGY STAR continues to deliver savings beyond the standard after 2021.

For the pump types included in the Version 1.1 specification, EPA estimates that 33.5% of the pool pumps sold in 2016 were ENERGY STAR certified.

EPA proposes efficiency levels that vary with hydraulic horsepower (hhp), as in the DOE Dedicated Purpose Pool Pumps Final Rule. This will distinguish pumps with exceptional performance across a range of sizes.

EPA estimated the WEF for each currently certified pump model using the ENERGY STAR qualified product list data for Version 1.1 pool pumps, with certification dates ranging from 2013 to 2017. EPA is confident that the set of data provides an accurate picture of pumps that would meet the proposed criteria. Cost data were estimated from the Final Rule Technical Support Document (TSD): Dedicated Purpose Pool Pumps. US Market information was estimated from both the ENERGY STAR Unit Shipment Data and the DOE TSD.

Self-Priming (Inground) Pool Pumps

EPA is proposing to split Inground Pool Pumps into a small hhp category and a large hhp category (see Table 1 for size definitions) to harmonize with the DOE final rule. Doing this allows additional product differentiation in small pumps. For each pump category, EPA found a level that balances energy savings, increased cost, and availability of certified products to offer consumers a choice of cost-effective products. For large pumps, the level proposed is 10% Below the 2021 DOE standard. This level distinguishes pumps with exceptional performance while ensuring certified product availability in a variety of sizes. EPA estimates that at the proposed level ENERGY STAR pumps would payback any increase in purchase price with energy savings in between 0.9 and 1.2 years.

For Version 3.0, to ensure that ENERGY STAR certified products deliver savings beyond the standard, EPA proposes that the level for these pumps change requirements from Version 2.0 to Version 3.0 when the DOE standard becomes effective to be equivalent to EL7 as identified in the DOE TSD. DOE was not able to establish a cost differential between EL6 (the upcoming DOE level) and EL7, but the technical differences in the products are such that any differential is likely to be small. Among Multi-speed pumps, similar technical differences resulted in consumer cost differences between low and high efficiency Multi-speed products of between $46 to $76 (unit cost) depending on pump size. Thus, EPA expects there to be products available at EL7 for which utility bill savings will quickly pay consumers back for any additional cost. While product availability in 2021 is difficult to predict, EPA expects that this level will provide sufficient differentiation to keep ENERGY STAR certification a meaningful distinction. We welcome stakeholder comments on the proposal to adopt EL7 at that time.

For small pumps, the proposed level is equivalent to EL5 from the DOE TSD. This level provides strong differentiation of highly efficient pumps, while ensuring products are available in a variety of sizes. EPA estimates that the pumps will provide payback of 3.6 years to consumers.

Non-Self Priming (Aboveground) Pool Pumps

Discussions with stakeholders regarding the DOE TSD provided evidence that there is now some efficiency differentiation among self-priming pumps, unlike in 2014 when Version 1.1 was released. The levels EPA proposes for aboveground pumps could save US consumers up to $50,000,000/year, while maintaining favorable payback for all pump sizes, based on the DOE TSD. The simple payback at

proposed ENERGY STAR levels is under 1 year for Standard Size (0.52 hhp) Non-Self-Priming pumps and is 1.4 years for Extra Small (0.09 hhp) Non-Self-Priming pumps. Because EPA does not have ENERGY STAR model data on these pumps, the analysis relied solely on the TSD. According to the TSD, the proposed levels represent 4% of standard size pumps and 33% of extra-small pumps. Stakeholders with additional data are particularly encouraged to provide feedback on this proposal.

Pressure Cleaner Booster Pumps

EPA proposes to add Pressure Cleaner Booster Pumps to the scope and set requirements for these products at DOE EL2, which provides the desired balance of additional energy savings while maintaining under a 2-year payback. There are a small number of high performance booster pumps which have been recently placed on the market with Multi-speed or Variable-speed technology. EPA encourages stakeholder feedback on the ability to differentiate between these advanced booster pumps vs. conventional single-speed pumps given the proposal to use DOE Efficiency Level 2. For Version 3.0 in 2021, EPA proposes a WEF level consistent with variable speed motors, which save substantial energy through avoiding the use of a flow restrictor. According to EPA analysis, the DOE TSD indicated the market is not ready now for an ENERGY STAR level recognizing variable speed pumps, so we have delayed setting that level until 2021, when Version 3.0 will be effective.

Version 3.0 requirements, effective on July 19, 2021, are listed in Table 1 above for convenient comparison. EPA requests stakeholder feedback on all of the Version 2.0 and Version 3.0 proposed levels.

Pool Pump Replacement Motors

There is energy saving potential for pool pump replacement motors. A substantial percent of the time, when a pool pump breaks, it is repaired with a replacement motor, rather than replaced in its entirety. DOE proposed a test method\(^9\) for these motors, which are designed specifically for pool pumps, but as of yet has not finalized the test method or set standards for them. EPA is proposing to include replacement motors in this specification, based on the test method proposed by DOE. Whenever data on the performance of replacement motors becomes available, EPA intends to add them to the scope.

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) As specified in 82 FR 36858\(^10\): WEF, EF, maximum head, vertical lift, and true priming time are rounded to the nearest tenths place. Rated Hydraulic Horsepower is reported to the nearest thousandths place. All other values are rounded to the hundredths place. Connected PRODUCT Criteria

This section presents connected criteria for ENERGY STAR certified pool pumps. Compliance with Section 4 criteria is optional. ENERGY STAR certified pool pumps that comply with all Section 4 criteria will be identified on the ENERGY STAR website as having ‘Connected’ functionality.

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3.3 Communications

A) The CPPS Communication Link, in Figure 1, shall use Open Standards for all communication layers to enable functions listed in Table 2.

B) An Interface Control Document (ICD), Application Programming Interface (API), or other documentation shall be made available to interested parties that, at minimum, allows access to the functions listed in Table 2.

<table>
<thead>
<tr>
<th>Table 2: Functions Applicable to the Communications Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functions</strong></td>
</tr>
<tr>
<td>Section 4.2 Real-time Power Reporting</td>
</tr>
<tr>
<td>ICD/API/other doc. must include:</td>
</tr>
<tr>
<td>• Accuracy</td>
</tr>
<tr>
<td>• Units</td>
</tr>
<tr>
<td>If Energy Consumption Reporting is also provided,</td>
</tr>
<tr>
<td>ICD/API/other doc. must include:</td>
</tr>
<tr>
<td>• Accuracy</td>
</tr>
<tr>
<td>• Units</td>
</tr>
<tr>
<td>• Measurement Interval</td>
</tr>
</tbody>
</table>

Section 4.4 Operational Status, User Settings, and Messages

Section 4.5 Demand Response

Notes:

1. A CPPS that enables economical and direct communications that comply with 4.1.A and 4.1.B on the consumer’s premises is preferred; but alternative approaches, where the CPPS only complies with 4.1.A and 4.1.B outside of the consumer’s premises are also acceptable.

2. A product that includes an embedded modular communications port that complies with 4.1.A and 4.1.B need not be supplied with a compatible communications module.

3.4 Real-time Power Reporting

Whenever pumping, the CPPS shall be capable of transmitting measured or estimated data representative of its real-time power draw to consumers and consumer authorized third parties via a communication link. The CPPS may optionally also transmit measured or estimated data representative of its interval energy consumption.

Note: Real-time power shall be reported in watts. If provided, EPA recommends that energy consumption data be reported in watt-hours for intervals of 15 minutes or less; however, representative data may also be reported in alternate intervals as specified in the ICD or API detailed in Section 4.1. The CPPS may also provide energy use feedback to the consumer on the product itself and use any units and format (e.g., dollars/month).

Note: EPA proposes modest updates to the connected criteria for pool pumps, replacing the energy consumption reporting criteria from the Version 1.1 specification with reporting of real-time power, which EPA understands is more valuable to utilities and other load-management entities, and no more difficult for the products to provide. The CPPS may optionally also transmit interval energy consumption data, which may be more useful to consumers.
3.5 Remote Management

At minimum, the CPPS shall be capable of responding to consumer authorized signals received via a communication link requesting:

- A) A start or stop to pumping, and
- B) A change to motor speed and/or rate of flow.

3.6 Operational Status, User Settings & Messages

A) At minimum, the CPPS shall be capable of providing the following information to consumers and consumer authorized third parties via a communication link:

1. Operational status including:
   - a. On/Off/Standby, and
   - b. Motor speed and/or rate of flow

2. DR status including:
   - a. Inactive
   - b. Active – Type 1
   - c. Active – Type 2
   - d. Active – Type 3
   - e. Time-stamped DR override notification

3. Program schedule including schedule times and scheduled operation

Note: EPA has clarified the DR status reporting criteria and added notification of DR override to inform utilities or other load management entities. This addition will help utilities better manage grid loads and enable pay-for-performance programs that will better reward consumers who override infrequently.

B) The CPPS shall be capable of providing at least two types of messages relevant to optimizing its energy consumption, either:

1. On the product (e.g. pool pump and/or controller), and/or
2. Transmitted to consumers and consumer authorized third parties via a communication link.

Note: For example, messages relevant to energy consumption for Pool Pumps might address a fault condition, a reminder to clean/flush the filter, or a report of energy consumption that is outside the product’s normal range.

3.7 Demand Response

At a minimum, the CPPS shall be capable of responding to Consumer Authorized Third Parties by providing the following three responses:

A) Type 1 Response:

1. Within ten seconds of receipt of a requesting signal on the consumer’s premise, the CPPS shall respond in accordance with Table 3.
2. The CPPS shall ship with default settings that enable a response for at least 4 hours.

3. The CPPS shall be able to provide at least one response in a rolling 12-hour period.

4. The CPPS may either delay its response or not provide a response if responding would compromise safety or result in equipment damage as determined by the manufacturer.

5. The CPPS shall be capable of supporting DR event override-ability.

### Table 3: Type 1 Response Requirements

<table>
<thead>
<tr>
<th>Pump Type</th>
<th>Allowable Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-speed Pump</td>
<td>• Pump may operate in any sequence for up to 1/3 of the response period duration (e.g. up to 1-hour and 20-minutes for a 4-hour response period)</td>
</tr>
<tr>
<td>Multi-speed Pump</td>
<td>• If in off / Standby Mode, the Pool Pump shall remain in off / Standby Mode.</td>
</tr>
<tr>
<td></td>
<td>• If operating above the lowest available speed, the Pool Pump shall reduce operation to the lowest available speed or switch to off / Standby Mode.</td>
</tr>
<tr>
<td>Variable-speed Pump / Variable-flow Pump</td>
<td>• If operating at greater than 1/3 of full-speed/flow, the Pool Pump shall reduce operation to less than or equal to 1/3 of full-Motor Speed/Rate of Flow.</td>
</tr>
<tr>
<td></td>
<td>• If operating at less than or equal to 1/3 of Full-Motor Speed/Rate of Flow, the Pool Pump shall not increase Motor Speed/Rate of Flow.</td>
</tr>
</tbody>
</table>

B) **Type 2 Response:**

1. Within ten seconds of receipt of a requesting signal on the consumer’s premises, the CPPS shall terminate pumping for the duration of the requested response period.

2. The CPPS shall ship with default settings that enable a response of least 20 minutes.

3. The CPPS shall be able to provide at least three responses in a rolling 24-hour period.

4. The CPPS may either delay its response or not provide a response if responding would compromise safety or result in equipment damage as determined by the manufacturer.

5. The CPPS shall be capable of supporting DR event override-ability.

C) **Type 3 Response:**

1. Within ten seconds of receipt of a requesting signal on the consumer’s premises and in accordance with consumer settings, the CPPS, if idle, shall initiate pumping, and if active, shall increase Motor Speed/Rate of Flow or extend pumping duration within the requested response period.

2. This response shall be limited such that the CPPS terminates pumping when:
   a. Programmed daily pumping volume is reached (*CPPS with controls capable of scheduling pumping operation based on total desired volume pumped*), or
   b. Programmed daily pumping duration is reached (*all other CPPS*).

   No additional pumping shall occur prior to 12:00 AM the following day.
3. The CPPS is not required to respond if doing so would compromise safety or result in equipment damage as determined by the manufacturer.

4. The CPPS shall be capable of supporting DR event override-ability.

**Note:** EPA proposes revising the DR criteria by reducing the maximum response time from five minutes to ten seconds. Though this appears to be a substantial change, lab testing of pre-production connected pool pumps has demonstrated that sub-10 second response times are being achieved. EPA notes that the response time is from the time the CPPS receives the requesting signal, since network latencies are installation dependent and outside the control of the manufacturer. In addition, notification of DR override of the control of the CPPS are now included. EPA has retained the provision for all response types that the CPPS may delay or avoid responding in order to avoid equipment damage or avert an unsafe result. For example, gas-fired pool water heaters are dependent on pumped water flow. In order to avoid damage to the water heater, the response may be delayed to facilitate a graceful shutdown of the heater.

In response to feedback from stakeholders, EPA has revised the language related to DR override. Version 1.1 language necessitated that consumers be able to override “without limitation.” EPA has learned that this language conflicts with utility programs that may, for example, call non-over-rideable DR events during grid emergencies. Revised language requires the CPPS to support DR event override for each DR type, but does not prevent qualified products from participating in utility DR programs that include non-over-rideable events.

Finally, EPA notes that the memo accompanying Version 1.1 made reference to “set and forget” override that would enable consumers to automatically override future DR events. This decision is in conflict with utilities’ need to balance grid load and would potentially enable a consumer who entered into a DR program to not provide any load shifting benefits by enabling “set and forget” override. As such, the intent for the revised language is to allow override only after a requesting signal is received and to disallow “set and forget” override.

### 3.8 Information to Installers and Consumers

If additional modules, devices, services, and/or supporting infrastructure are required in order to activate the CPPS’s communications capabilities, installation instructions and a list of these requirements shall be made available at the point of purchase and prominently displayed in the product literature. It is also suggested that information be provided on the product packaging and on the product. These instructions shall provide specific information on what must be done to activate these capabilities (e.g. a product package or product label might briefly state “This product has Wi-Fi capability and requires Internet connectivity and a wireless router to enable interconnection with external devices, systems or applications.”).

### 4 ADDITIONAL REQUIREMENTS

#### 4.1 Informational statement

A) Partner shall mark a certified 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 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 pump controls to ensure the energy savings potential is realized due to the speed reduction capabilities of the pool pump.
4.2 Additional reporting requirements

Note: EPA is proposing to eliminate the reporting requirements for Curve A and Curve B. Given the availability of a Federal test method and new metric for pool pumps, EPA does not anticipate using this additional information.

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 certification 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 certification 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.

5.2 Test Methods

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

<table>
<thead>
<tr>
<th>ENERGY STAR Requirement</th>
<th>Test Method Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighted Energy Factor (gal/Wh)</td>
<td>DOE Test Procedure for Dedicated Purpose Pool Pumps, Final Rule\textsuperscript{11}</td>
</tr>
<tr>
<td>Standby Mode Testing</td>
<td>ENERGY STAR Pool Pumps Test Method Version 2.0</td>
</tr>
<tr>
<td>Demand Response</td>
<td>ENERGY STAR Pool Pumps Test Method to Validate Demand Response (Rev. March-2015)</td>
</tr>
</tbody>
</table>

Note: EPA proposes using the DOE Test Procedure for Dedicated Purpose Pool Pumps. The DOE Test Procedure\textsuperscript{11} was published in the Federal Register on August 7, 2016. The effective date of this rule is September 6, 2017.

5.3 Compliance with Connected Criteria

Compliance with connected criteria, as specified in Section 4, shall be through examination of product and/or product documentation. In addition, DR functionality shall be verified using the ENERGY STAR Pool Pumps Test Method to Validate Demand Response, March-2015.

\textsuperscript{11} DOE Test Procedure for Dedicated Purpose Pool Pumps, Final Rule, Docket: EERE-2016-BT-TP-0002-0015.
6 EFFECTIVE DATE

The ENERGY STAR Pool Pump specification shall take effect on TBD. To certify 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 anticipates finalizing the Version 2.0 specification by December 15, 2017, with an effective date of September 15, 2018.

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 certification is not automatically granted for the life of a product model.

8 REFERENCES