



# ENERGY STAR® Program Requirements for Pool Pumps

## Partner Commitments

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

### Certifying Products

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

### Using the ENERGY STAR Name and Marks

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

### Verifying Ongoing Product Certification

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

### Providing Information to EPA

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7. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
  - 7.1. Partner must submit the total number of ENERGY STAR certified Pool Pumps shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner.

Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).

7.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.

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

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

8. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.

9. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at [www.energystar.gov/mesa](http://www.energystar.gov/mesa).

### **Performance for Special Distinction**

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

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

building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.

- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit [www.epa.gov/smartway](http://www.epa.gov/smartway).
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit [www.epa.gov/greenpower](http://www.epa.gov/greenpower).



# ENERGY STAR® Program Requirements Product Specification for Pool Pumps

## Eligibility Criteria Version 3.1

Following is the Version 3.1 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. In Sections 1.1-1.4, all definitions reference the definitions section of the DOE Test Procedure for Dedicated Purpose Pool Pumps at 10 CFR 431.462, except 1.2H, Pool Pump Replacement Motors, which has no comparable DOE definition.

#### 1.1 General

- A) Pump: Equipment designed to move liquids (which may include entrained gases, free solids, and totally dissolved solids) by physical or mechanical action and includes a bare pump and, if included by the manufacturer at the time of sale, mechanical equipment, driver, and controls.
- B) Dedicated Purpose Pool Pump: Comprises self-priming pool filter pumps, non-self-priming pool filter pumps, waterfall pumps, pressure cleaner booster pumps, integral sand-filter pool pumps, integral-cartridge filter pool pumps, storable electric spa pumps, and rigid electric spa pumps.
- C) Pool Filter Pump: Means an end suction pump that:
  - a. Either:
    - i. Includes an integrated basket strainer, or;
    - ii. Does not include an integrated basket strainer for operation, but requires a basket strainer for operation, as stated in manufacturer literature provided with the pump; and
  - b. May be distributed in commerce connected to, or packaged with, a sand filter, removable cartridge filter, or other filtration accessory, so long as the filtration accessory are connected with consumer-removable connections that allow the filtration accessory to be bypassed.
- D) Control: Any device that can be used to operate the driver. Examples include, but are not limited to, continuous or non-continuous controls, schedule-based controls, on/off switches, and float switches.
- E) Variable Speed Drive: Equipment capable of varying the speed of the motor.
- F) Freeze Protection Control: Controls that, at certain ambient temperature, turn on the dedicated-purpose pool pump to circulate water for a period of time to prevent the pool and water in plumbing from freezing.
- G) Full-Flow Rate: Flow rate, in gallons per minute, at maximum speed on curve C.
- H) Pool Pump Timer: Means a pool pump control that automatically turns off a dedicated-purpose pool pump after a run-time of no longer than 10 hours.

## 1.2 Pump Types

- A) Self-Priming Pump: Means a pump that either is a self-priming pool filter pump or a pump that:
- Is designed to lift liquid that originates below the centerline of the pump inlet;
  - Contains at least one internal recirculation passage; and
  - Requires a manual filling of the pump casing prior to initial start-up but is able to re-prime after the initial start-up without the use of external vacuum sources, manual filling, or a foot valve.
- B) Self-Priming Pool Filter Pump: A pool filter pump that is certified under NSF/ANSI 50-2015 (incorporated by reference, see 10 CFR §431.463) to be self-priming or is capable of re-priming to a vertical lift of at least 5.0 feet with a true priming time less than or equal to 10.0 minutes, when tested in accordance with section F of appendix B or C of 10 CFR 431, and is not a waterfall pump.
- Note:** Pumps designated Inground Pool Pumps in previous ENERGY STAR specifications are now considered Self-Priming Pool Filter Pumps.
- C) Non-Self-Priming Pool Filter Pump: A pool filter pump that is not certified under NSF/ANSI 50-2015 (incorporated by reference, see 10 CFR §431.463) to be self-priming and is not capable of re-priming to a vertical lift of at least 5.0 feet with a true priming time less than or equal to 10.0 minutes, when tested in accordance with section F of appendix B or C of 10 CFR 431, and is not a waterfall pump.
- Note:** Pumps designated Aboveground Pool Pumps in previous ENERGY STAR specifications are now considered Non-Self-Priming Pool Filter Pumps.
- D) Integral Cartridge Filter Pool Pump: An integral cartridge filter pool pump is a pump that requires a removable cartridge filter, installed on the suction side of the pump, for operation; and the cartridge filter cannot be bypassed.
- E) Integral Sand Filter Pool Pump: An integral sand filter pool pump is a pump distributed in commerce with a sand filter that cannot be bypassed for testing.
- F) Rigid Electric Spa Pump: An end suction pump that does not contain an integrated basket strainer or require a basket strainer for operation as stated in manufacturer literature provided with the pump and that meets the following three criteria:
- Is assembled with four through bolts that hold the motor rear endplate, rear bearing, rotor, front bearing, front endplate, and the bare pump together as an integral unit;
  - Is constructed with buttress threads at the inlet and discharge of the bare pump; and
  - Uses a casing or volute and connections constructed of a non-metallic material.
- G) Storable Electric Spa Pump: A pump that is distributed in commerce with one or more of the following:
- An integral heater; and
  - An integral air pump.
- H) 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.
- I) 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 1081-2016, "Standard for Swimming Pool Pumps, Filters, and Chlorinators.

- J) 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.

### 1.3 Product Sub-Types

- A) Single-speed Dedicated Purpose Pool Pump: A dedicated purpose pool pump that is capable of operating at only one speed.
- B) Two-speed Dedicated Purpose Pool Pump: A dedicated-purpose pool pump that is capable of operating at only two different pre-determined operating speeds, where the low operating speed is less than or equal to half of the maximum operating speed and greater than zero, and must be distributed in commerce either:
- With a pool pump control (e.g., variable speed drive and user interface or switch) that is capable of changing the speed in response to user preferences; or
  - Without a pool pump control that has the capability to change speed in response to user preferences but is unable to operate without the presence of such a pool pump control.
- C) Multi-speed Dedicated Purpose Pool Pump: A dedicated-purpose pool pump that is capable of operating at more than two discrete, pre-determined operating speeds separated by speed increments greater than 100 rpm, where the lowest speed is less than or equal to half of the maximum operating speed and greater than zero, and must be distributed in commerce with an on-board pool pump control (i.e., variable speed drive and user interface or programmable switch) that changes the speed in response to pre-programmed user preferences and allows the user to select the duration of each speed and/or the on/off times.
- D) Variable-speed Dedicated Purpose Pool Pump: A dedicated-purpose pool pump that is capable of operating at a variety of user-determined speeds, where all the speeds are separated by at most 100 rpm increments over the operating range and the lowest operating speed is less than or equal to one-third of the maximum operating speed and greater than zero. Such a pump must include a variable speed drive and be distributed in commerce either:
- With a user interface that changes the speed in response to pre-programmed user preferences and allows the user to select the duration of each speed and/or the on/off times; or
  - Without a user interface that changes the speed in response to pre-programmed user preferences and allows the user to select the duration of each speed and/or the on/off times, but is unable to operate without the presence of a user interface.

### 1.4 Product Ratings

- A) Rated Horsepower (hp): The rated horsepower is the product of the measured full load speed and torque, determined based on the maximum continuous duty motor power output rating allowable for the motor's nameplate ambient rating and insulation class, as determined in accordance with the test procedure in 10 CFR §431.464(b) and applicable sampling plans in 10 CFR §429.59. 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 Nominal Horsepower.
- B) Service Factor: A multiplier applied to Rated Horsepower of a motor to indicate the percent above Nominal 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, as determined in accordance with the test procedure in 10 CFR §431.464(b) and applicable sampling plans in 10 CFR §429.59.

**Note:** In accordance with E.3.3, Appendix B to 10 CFR 431 Subpart Y, Service Factor shall be 1.0 for residential applications (Single phase AC or DC Motors).

- 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, as determined in accordance with the test procedure in 10 CFR §431.464(b) and applicable sampling plans in 10 CFR §429.59. 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) Rated Hydraulic Horsepower (hhp): The pump output power (in hp) as determined in accordance with the test procedure in 10 CFR §431.464(b) and applicable sampling plans in 10 CFR §429.59. This measurement is the pump power output on reference Curve C at maximum operating speed and full impeller diameter.

## 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: An equation that defines the relationship between flow and head in a fixed hydraulic network. System Curves A, B, and C represent different standard plumbing systems. 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:
  - a. Curve A:  $H = 0.0167 * Q^2$
  - b. Curve B:  $H = 0.050 * Q^2$
  - c. Curve C:  $H = 0.0082 * Q^2$
- 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 and a specific pump speed. 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) 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.
- H) Energy Factor (EF): The volume of water pumped in gallons per watt-hour of electrical energy consumed by the pump motor (gal/Wh).
- I) Weighted Energy Factor (WEF): A measurement of pump efficiency based on performance at one or two operating points, which are uniquely defined for each DPPP variety and speed configuration. The performance measurements at different operating points are weighted to represent real world use. WEF is measured in thousand gallons per kilowatt hour (kgal/kWh). See the *DOE Test Procedure for Dedicated Purpose Pool Pumps* for additional calculation details: 10 CFR 431.464(b).

- J) **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.<sup>1</sup>

**Note:** Models having a different color, rated horsepower (not total horsepower), or union fitting type may be considered a single basic model.

## 1.6 Acronyms

- A) **ANSI:** American National Standards Institute  
B) **APSP:** Association of Pool and Spa Professionals  
C) **NSPI:** National Spa and Pool Institute

## 2 SCOPE

### 2.1 Included Products

Products, with the exception of products listed in Section 2.2 Excluded Products, that are single phase with a Rated Hydraulic Horsepower (hhp) of >0 and <2.5 hhp can certify as ENERGY STAR under this specification, provided they meet one of the following definitions as defined in Section 1:

- A) Self-Priming Pool Filter Pump (similar to former Inground Pump category);  
B) Non-Self-Priming Pool Filter Pump (similar to former Aboveground Pump category);  
C) Pressure Cleaner Booster Pump; and  
D) Replacement Motor.

### 2.2 Excluded Products

The following product types, as defined in Section 1, are not eligible for certification under this specification:

- A) Waterfall Pump;  
B) Integral Cartridge Filter Pump;  
C) Integral Sand Filter Pump;  
D) Storable Electric Spa Pump; and  
E) Rigid Electric Spa Pump.

## 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.

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<sup>1</sup> DOE Test Procedure for Dedicated Purpose Pool Pumps, Final Rule, [10 CFR 431 Subpart Y, Appendix B and C](#).



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

Pump Sub-Type	Size Class	Version 3.0 Energy Efficiency Level
<b>Self-Priming (Inground) Pool Pumps</b>	Small (hhp < 0.711)	$WEF \geq -2.45 \times \ln(hhp) + 8.40$ for $hhp > 0.13$ $WEF \geq 13.40$ for $hhp \leq 0.13$
<b>Self-Priming (Inground) Pool Pumps</b>	Standard Size (hhp $\geq$ 0.711)	$WEF \geq -2.45 \times \ln(hhp) + 8.40$
<b>Non-Self-Priming (Aboveground) Pool Pumps</b>	Extra Small (hhp $\leq$ 0.13)	$WEF \geq 4.92$
<b>Non-Self-Priming (Aboveground) Pool Pumps</b>	Standard Size (hhp > 0.13)	$WEF \geq -1.00 \times \ln(hhp) + 3.85$
<b>Pressure Cleaner Booster Pumps</b>	All	$WEF \geq 0.51$
<b>Pool Pump Replacement Motors</b>	TBD	TBD

- B) Pump controls: Pump controls intended for use with a Multi-speed or Variable-speed Pump shall have a default filtration speed setting of 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.
- C) Freeze Protection: All dedicated-purpose pool pumps distributed in commerce with freeze protection controls must be shipped either with freeze protection disabled, or with the following default, user-adjustable settings:
  - a. The default dry-bulb air temperature setting for activating freeze protection is no greater than 40 °F; and
  - b. The default run time setting shall be no greater than 1 hour (before the temperature is rechecked); and
  - c. The default motor speed shall not be more than half of the maximum available speed.

### 3.2 Significant Digits and Rounding

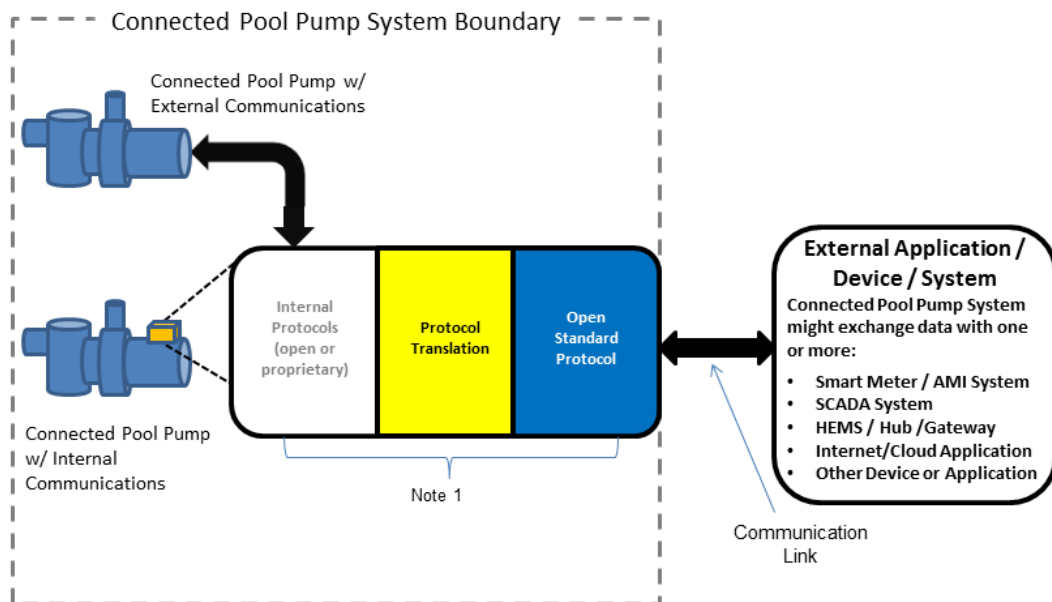
- A) All calculations shall be carried out with directly measured (unrounded) values.
- B) Unless otherwise specified, compliance with specification limits shall be evaluated using directly measured or calculated values without any benefit from rounding.
- C) As specified in 10 CFR 431.464(b): WEF, maximum 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.

## 4 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. As for all ENERGY STAR products, these criteria define products which provide a combination of additional user functionality and grid services, as appropriate for the product type.

### 4.1 Connected Product Definitions

- A) Communication Link: As shown in Figure 1, the mechanism for bi-directional data transfers between the Connected Pool Pump System 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. *Example: A consumer may allow a Home Energy Management System (HEMS) or a Demand Response Management System (DRMS) access to the CPPS connected functionality.*
- D) Open Standards: Communication with entities outside the CPPS that use, for all communication layers, standards:

1. Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,<sup>2</sup> and/or
  2. Included in the National Institute of Standards and Technology (NIST) Smart Grid Framework Tables 4.1 and 4.2,<sup>3</sup> 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) On-Premises: Refers to a function that relies only on the equipment present at the physical installed location of the ENERGY STAR certified device/ equipment.
- F) Demand Response (DR): Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized<sup>4</sup>.
- G) Demand Response Management System (DRMS): The system operated by a consumer authorized program administrator, such as the utility or third party, which dispatches signals with DR instructions and/or price signals to the CPPS and receives messages from the CPPS.
- H) Interface Specification: A document or collection of documents that contains detailed technical information to facilitate access to relevant data and product capabilities over a communications interface.
- I) Load Management Entity: Consumer authorized DRMS, home energy management system, or the like.

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<sup>2</sup> <https://www.nist.gov/programs-projects/smart-grid-national-coordination/catalog-standards>

<sup>3</sup> [http://www.nist.gov/smartgrid/upload/NIST\\_Framework\\_Release\\_2-0\\_corr.pdf](http://www.nist.gov/smartgrid/upload/NIST_Framework_Release_2-0_corr.pdf)

<sup>4</sup> Modified Federal Energy Regulatory Commission definition, <https://www.ferc.gov/electric/industry-activity/demand-response/national-assessment-and-action-plan-demand-response>

## 4.2 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 2: Functions Applicable to the Communications Criteria**

Functions
Section 4.2 Real-time Power Reporting ICD/API/other doc. must include: <ul style="list-style-type: none"> <li>• Accuracy</li> <li>• Units</li> </ul> If Energy Consumption Reporting is also provided, ICD/API/other doc. must include: <ul style="list-style-type: none"> <li>• Accuracy</li> <li>• Units</li> <li>• Measurement Interval</li> </ul>
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 4.2.A and 4.2.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.

## 4.3 Remote Management and Consumer Feedback

The CPPS shall provide the following functionality:

**A) Remote Management:**

The product shall be capable of receiving and responding to consumer authorized remote requests (not including third-party remote management which may be made available solely at the discretion of the manufacturer), via a communication link, similar to consumer controllable functions on the product. At minimum, the CPPS shall be capable of responding to consumer authorized signals received via a communication link requesting:

1. A start or stop to pumping, and
2. A change to motor speed and/or rate of flow.

## **B) User Alerts:**

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 – General Curtailment
  - c. Active – Grid Emergency
  - d. Active – Load Up
  - e. Time-stamped DR override notification
3. Program schedule including schedule times and scheduled operation.
4. The CPPS shall be capable of providing at least two types of messages relevant to optimizing its energy consumption, either:
  - a. On the product (e.g. pool pump and/or controller), and/or
  - b. 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.

## **C) 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).

## 4.4 Demand Response

### A) DR Communication Protocols

The CPPS shall meet the communication and equipment performance standards for CTA-2045-A, CTA-2045-B, or OpenADR 2.0b (Virtual End Node), or any combination thereof.

### B) Override: The product shall provide for both manual and automated (preset) override.

- a. **Manual override:** the product shall provide an easily accessible means for consumers to override demand response events during the event or ahead of time for a scheduled event, except for Grid Emergency/Off Mode events. When the event is overridden, the CPPS shall return to normal operation as set by the customer.
- b. **Automated override:** the product shall include a mechanism to automatically override demand response events (except for Grid Emergency/Off Mode events) that are likely to have significant adverse impacts on pool sanitation, heating, or other functions critical to the user experience. It is recommended that the product provide a means for installers to input information about the operating parameters of third party pool equipment or identify scenarios in which a demand response event should be overridden.

### C) Loss of connectivity: A 'loss of connectivity' event is defined as 5 consecutive polling events from the DRMS not responded to by the CPPS, or vice versa or 15 minutes without connection whichever is shorter. Note: DR program implementation may set the polling time interval, so the elapsed time for a 'loss of connectivity' event may vary.

1. If a 'loss of connectivity' event occurs while processing a DR event with a set duration or end time, product may complete DR event as planned, returning to normal operation as set by the customer afterwards, or if over-ridden.
2. If a 'loss of connectivity' event occurs while processing a DR event without a set duration or end time, product will resume normal operation within 30 minutes.

### D) DR Requests and Responses

At a minimum, the CPPS shall be capable of responding to Consumer Authorized Third Parties by providing the following three responses: General Curtailment (previously called Type 1), Grid Emergency (previously called Type 2), and Load Up (previously called Type 3), as detailed below. Support for these requests is implemented via the open standards protocol used in the product. The required mapping to open protocol commands for these requests is described in *Appendix A: Required demand response*. While the required or optional functionality may vary based on product type and either protocol may be used, the messaging must be communicated via the specified protocol command within this appendix.

While performing the required functionality of these responses, the CPPS shall:

1. Within ten seconds of receipt of a response request on the consumer's premise, shall execute the required response.
2. Be capable of supporting DR event override-ability.
3. Prior to or during a demand response event, return to normal operation if the consumer overrides the event.
4. Either delay or reject a demand response request if responding would compromise safety or result in equipment damages as determined by the manufacturer.

- i. **General Curtailment (Light Shed):** This response is intended to curtail demand while minimizing consumer impact. This type of response may be used daily to manage demand under programs such as Time of Use and/or Real Time Pricing, or for peak shifting during peak demand days, often 20-30 times per year. The CPPS must meet the following requirements for responding to a General Curtailment request:
  1. The CPPS shall ship with default settings that enable a response for at least 4 hours.
  2. The CPPS shall be able to provide at least one response in a rolling 12-hour period.

**Table 3: General Curtailment Response Requirements**

Pump Type	Response Subtype	Allowable Operation
Single-speed Pump	-	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)
Two-speed / Multi-speed Pump	A	If operating at greater than half of its maximum rpm, the Pool Pump shall reduce speed to less than or equal to half of the maximum rpm or switch to off / Standby Mode.
	B	If in off / Standby Mode, the Pool Pump shall remain in off / Standby Mode.
Variable-speed Pump	A	If operating at greater than 1/3 of its maximum rpm, the Pool Pump shall reduce operation to less than or equal to 1/3 of maximum rpm.
	B	If operating at less than or equal to 1/3 of maximum rpm, the Pool Pump shall not increase speed.

- ii. **Grid Emergency (Full Shed):** This response is intended to immediately shutdown pumping operations. This type of response may be used daily on occasions to manage extreme peak load conditions and grid emergency conditions. The CPPS must meet the following requirements for response to a Grid Emergency request:
  1. The CPPS shall ship with default settings that enable a response of least 20 minutes.
  2. The CPPS shall be able to provide at least three responses in a rolling 24-hour period.

- iii. **Load Up:** This response is intended to increase demand temporarily to utilize excess/low cost electric power, such as excess solar and/or wind power. This type of response may have varying usage depending on the power generation mix of the region, and may be used daily to manage excess power, or shift demand from higher use to lower use times. The CPPS must meet the following requirements for responding to a Load Up request:
1. Upon receipt of a requesting signal on the consumer's premises and in accordance with consumer settings, the CPPS shall
    - a. If idle, shall initiate pumping at a rate appropriate for regular filtration, and
    - b. If active, shall increase the motor speed (rpm) by at least 10% of maximum rpm from the current speed, or extend pumping duration within the requested response period. The CPPS shall not increase speed to a rate outside the proper operating conditions of equipment and/or filtration systems connected to the pump, as determined by the manufacturer. For example, if manufacturer recommendations specify a maximum recommended speed for filtration operations, a Load Up signal should not bring the pump above this specified maximum speed.
  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*).

#### E) DR Information and Messaging

The CPPS shall support the following upstream messaging from the device when available. Support for these messaging signals is implemented via the open standards protocol used in the product. An informative mapping of these messages to the CTA 2045 Op Codes is provided in Appendix A: Required demand response Request Mapping. Data provided by below messaging functions shall be calculated from the product state no older than 60 seconds from request.

- **Idle normal:** Indicates that no demand response event is in effect and the CPPD has no/insignificant energy consumption.
- **Running Normal:** Indicates that no demand response event is in effect and the CPPD has significant energy consumption.
- **Running Curtailed:** Indicates that a curtailment type demand response event is in effect and the CPPD has significant energy consumption.
- **Running Heightened:** Indicates that a heightened-operation type of demand response event is in effect and the CPPD has significant energy consumption.
- **Idle Curtailed:** Indicates that a curtailment type demand response event is in effect and the CPPD has no/insignificant energy consumption.
- **CPPD Error Condition:** Indicates that the CPPD is not operating because it needs maintenance support or is in some way disabled (i.e. no response to the grid).
- **Idle Heightened:** Indicates that a heightened-operation type of demand response event is in effect and the CPPD has no/insignificant energy consumption.
- **Variable Following:** Indicates that a variable-setting type of demand response event is in effect and the CPPD is presently following the specified setting.
- **Variable Not Following:** Indicates that a variable-setting type demand response event is in effect and the CPPD is presently not following the specified setting (e.g. has no/insignificant energy consumption).



- **Idle, Opted Out:** Indicates that the CPPD is presently opted out of any demand response events and the CPPD has no/insignificant energy consumption.
- **Running, Opted Out:** Indicates that the CPPD is presently opted out of any demand response events and the CPPD has significant energy consumption.

#### **4.5 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.").

## 5 ADDITIONAL REQUIREMENTS

### 5.1 Additional reporting requirements

- A) The Power Factor at each measured load point on Curve C shall be reported for all products when collected as part of the DOE Test Procedure (10 CFR 431.464(b)).

## 6 TEST REQUIREMENTS

### 6.1 Number of Units Required for Testing

One of the following sampling plans shall be used for the purposes of testing for ENERGY STAR certification:

- A) A single unit is selected, obtained, and tested. The measured performance of this unit and of each subsequent unit manufactured must be equal to or better than the ENERGY STAR specification requirements. Results of the tested unit may be used to certify additional model variations within a basic model as long as the definition of basic model is met (Section 1.5 J); or
- B) Units are selected for testing and results calculated according to the sampling requirements defined in 10 CFR Part 429, Subpart B § 429.59. At least two are tested, meeting DOE sampling plan minimum requirements in 10 CFR §429.11. Results of the tested model may be used to certify additional model variations within a basic model as long as the definition of basic model is met (Section 1.5 J).

### 6.2 Test Methods

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

**Table 4: Test Method for ENERGY STAR Certification**

<b>ENERGY STAR Requirement</b>	<b>Test Method Reference</b>
Weighted Energy Factor (kgal/kWh); Power Factor; Freeze Protection;	DOE Test Procedure for Dedicated Purpose Pool Pumps, (See 10 CFR 431.464(b))
Standby Mode Testing	Section 6.3 of ENERGY STAR Pool Pumps Test Method (Rev. Jan-2013)
Demand Response	ENERGY STAR Pool Pumps Test Method to Validate Demand Response (Rev. May-2021)

### 6.3 Compliance with Connected Criteria

Aside from demand response functionality, compliance with connected criteria, as specified in Section 4, shall be through examination of product and/or product documentation.

## **7 EFFECTIVE DATE**

The ENERGY STAR Version 3.1 Pool Pump specification shall take effect on July 19, 2021. 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.

## **8 FUTURE SPECIFICATION REVISIONS**

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

## **9 REFERENCES**

- 1) ANSI/UL 1081-2016. Standard for Swimming Pool Pumps, Filters, and Chlorinators
- 2) ANSI/NSF 50-2016a. Equipment for Swimming Pools, Spas, Hot Tubs, and Other Recreational Water Facilities

## APPENDIX A: REQUIRED DEMAND RESPONSE REQUEST MAPPING

This Appendix provides a mapping of the required DR Requests and Responses identified in Section 4.4 to CTA/CEA 2045 and OpenADR 2.0b commands:

**Table 5: Demand Response Request Mapping**

	<b>Demand Response Message</b>	<b>Response Result</b>	<b>OpenADR (2.0b)</b>	<b>ANSI/CTA (2045-B)</b>
<b>Basic Signals</b>	General Curtailment (Shed)	Reduce load per Table 3.	oadrDistributeEvent: SIMPLE level 1. <sup>5</sup>	Shed <sup>6</sup>
	Grid Emergency (Full Shed)	Turn off (if possible)	oadrDistributeEvent: SIMPLE level 3. <sup>5</sup>	Critical Peak Event <sup>6</sup>
	Load Up	Use more energy (if possible)	oadrDistributeEvent: NEAR / FAR flag. CHARGE STATE, LOAD_DISPATCH. <sup>5</sup>	Load Up <sup>6</sup>
<b>Advanced Signals</b>	Utility Peak Load Price Signal	Use/do not use energy when appropriate (follow programming)	oadrDistributeEvent: ELECTRICITY_PRICE <sup>5</sup>	Present Relative Price <sup>6</sup>
<b>Device Properties</b>	Consumer Override	Skip response to event within opt out	oadrCreateOpt: device sends upstream opt message <sup>7</sup>	Customer Override Message, in response to Operational State Query or load reduction request <sup>6</sup>
	Device Information	Indicates all mandatory product information	Ei:eiTargetType (endDeviceAsset)	Info Request <sup>8</sup> [Section 11.1.1]
	State Reporting Requirements	Provide state information to requestor	EiReport. OadrPayloadResourceStatus (See Table 6 and Table 7)	Operational State Query <sup>6</sup>
	Hardware Requirements	Design of product & comms.		DC or AC Form Factor <sup>9</sup>
<b>Device Energy</b>	Power (instantaneous)	Demand of product (W)	oadrPayloadResourceStatus: energyReal	GetCommodity Read, code 0
	Energy (cumulative)	Energy used by product (kWh)	oadrPayloadResourceStatus: energyReal	GetCommodity Read, code 0
	Current Energy Storage Capacity	Available energy storage (Wh)	oadrPayloadResourceStatus: oadrCapacity: oadrCurrent	GetCommodity Read, Code 7
	Total Energy Storage Capacity	Energy storage under ideal conditions (Wh)	oadrPayloadResourceStatus: oadrCapacity: oadrNormal	GetCommodity Read, Code 6

<sup>5</sup> Section 8.1, OpenADR 2.0b EiEvent Service; Figures 4 & 5, EiEvent Patterns; Section 8.2.2, OpenADR 2.0b Signal Definitions; Table 1, Signals

<sup>6</sup> CTA-2045-B; Table 10-1.

<sup>7</sup> Section 8.5, OpenADR 2.0b EiOpt Service; Figure 17, Interaction Diagram: Create Opt

<sup>8</sup> CTA-2045-B; Table 11-2.

<sup>9</sup> CTA-2045-B, Appendix A & Appendix B

**Table 6: Operational State Codes**

Op State Code	Name
0	Idle Normal
1	Running Normal
2	Running Curtailed Grid
3	Running Heightened Grid
4	Idle Grid
5	Water Heater Error
6	Idle Heightened
11	Idle, Opted Out
12	Running, Opted Out

**Table 7: OpenADR 2.0b Operational State Reporting<sup>10</sup>**

<b>OpenADR 2.0b EiReport Service</b>			
REQ	Report Name	x-CTA2045_Status	
M1.1	Report Structure	Status	Interval
	rID	<b>OperationalState</b>	<b>1-min</b>
	Report Type	Reading	
	Reading Type	Direct Read	
	Units	customUnit	
<b>ANSI/CTA-2045-A Message</b>			
Message		Operational State Query Response	
Element Mapped to rID		Opcode 2 of Basic 0x13	

<sup>10</sup> Electric Power Research Institute, Communication Protocol Mapping Guide 1.0, OpenADR 2.0 to ANSI/CTA-2045-A, Table 2-3 Measurement and Reporting Mapping Requirements