ENERGY STAR® Program Requirements
Product Specification for Pool Pumps

Eligibility Criteria
Draft Version 3.1

1 Following is the Draft Version 3.1 product specification for ENERGY STAR certified Pool Pumps. A
2 product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

3 1 DEFINITIONS

4 Provided below are definitions of the relevant terms in this document. In Sections 1.1-1.4, all definitions
5 reference the definitions section of the DOE Test Procedure for Dedicated Purpose Pool Pumps at 10
6 CFR 431.462, except 1.2H, Pool Pump Replacement Motors, which has no comparable DOE definition.

7 1.1 General

8   A) <u>Pump</u>: Equipment designed to move liquids (which may include entrained gases, free solids, and
9   totally dissolved solids) by physical or mechanical action and includes a bare pump and, if
10   included by the manufacturer at the time of sale, mechanical equipment, driver, and controls.

11   B) <u>Dedicated Purpose Pool Pump</u>: Comprises self-priming pool filter pumps, non-self-priming pool
12   filter pumps, waterfall pumps, pressure cleaner booster pumps, integral sand-filter pool pumps,
13   integral-cartridge filter pool pumps, storable electric spa pumps, and rigid electric spa pumps.

14   C) <u>Pool Filter Pump</u>: Means an end suction pump that:

15   a. Either:

16   i. Includes an integrated basket strainer, or;

17   ii. Does not include an integrated basket strainer for operation, but requires a
18   basket strainer for operation, as stated in manufacturer literature provided with
19   the pump; and

20   b. May be distributed in commerce connected to, or packaged with, a sand filter, removable
21   cartridge filter, or other filtration accessory, so long as the filtration accessory are
22   connected with consumer-removable connections that allow the filtration accessory to be
23   bypassed.

24   D) <u>Control</u>: Any device that can be used to operate the driver. Examples include, but are not limited
25   to, continuous or non-continuous controls, schedule-based controls, on/off switches, and float
26   switches.

27   E) <u>Variable Speed Drive</u>: Equipment capable of varying the speed of the motor.

28   F) <u>Freeze Protection Control</u>: Controls that, at certain ambient temperature, turn on the dedicated-
29   purpose pool pump to circulate water for a period of time to prevent the pool and water in
30   plumbing from freezing.

31   G) <u>Full-Flow Rate</u>: Flow rate, in gallons per minute, at maximum speed on curve C.

32   H) <u>Pool Pump Timer</u>: Means a pool pump control that automatically turns off a dedicated-purpose
33   pool pump after a run-time of no longer than 10 hours.

1.2 Pump Types

34

35　A)　Self-Priming Pump: Means a pump that either is a self-priming pool filter pump or a pump that:

36　　a.　Is designed to lift liquid that originates below the centerline of the pump inlet;

37　　b.　Contains at least one internal recirculation passage; and

38　　c.　Requires a manual filling of the pump casing prior to initial start-up but is able to re-prime
39　　　　after the initial start-up without the use of external vacuum sources, manual filling, or a
40　　　　foot valve.

41　B)　Self-Priming Pool Filter Pump: A pool filter pump that is certified under NSF/ANSI 50-2015
42　　(incorporated by reference, see 10 CFR §431.463) to be self-priming or is capable of re-priming
43　　to a vertical lift of at least 5.0 feet with a true priming time less than or equal to 10.0 minutes,
44　　when tested in accordance with section F of appendix B or C of 10 CFR 431, and is not a
45　　waterfall pump.

46　**Note**: Pumps designated Inground Pool Pumps in previous ENERGY STAR specifications are
47　　now considered Self-Priming Pool Filter Pumps.

48　C)　Non-Self-Priming Pool Filter Pump: A pool filter pump that is not certified under NSF/ANSI 50-
49　　2015 (incorporated by reference, see 10 CFR §431.463) to be self-priming and is not capable of
50　　re-priming to a vertical lift of at least 5.0 feet with a true priming time less than or equal to 10.0
51　　minutes, when tested in accordance with section F of appendix B or C of 10 CFR 431, and is not
52　　a waterfall pump.

53　**Note**: Pumps designated Aboveground Pool Pumps in previous ENERGY STAR specifications
54　　are now considered Non-Self-Priming Pool Filter Pumps.

55　D)　Integral Cartridge Filter Pool Pump: An integral cartridge filter pool pump is a pump that requires
56　　a removable cartridge filter, installed on the suction side of the pump, for operation; and the
57　　cartridge filter cannot be bypassed.

58　E)　Integral Sand Filter Pool Pump: An integral sand filter pool pump is a pump distributed in
59　　commerce with a sand filter that cannot be bypassed for testing.

60　F)　Rigid Electric Spa Pump: An end suction pump that does not contain an integrated basket
61　　strainer or require a basket strainer for operation as stated in manufacturer literature provided
62　　with the pump and that meets the following three criteria:

63　　a.　Is assembled with four through bolts that hold the motor rear endplate, rear bearing,
64　　　　rotor, front bearing, front endplate, and the bare pump together as an integral unit;

65　　b.　Is constructed with buttress threads at the inlet and discharge of the bare pump; and

66　　c.　Uses a casing or volute and connections constructed of a non-metallic material.

67　G)　Storable Electric Spa Pump: A pump that is distributed in commerce with one or more of the
68　　following:

69　　a.　An integral heater; and

70　　b.　An integral air pump.

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

74　I)　Pressure Cleaner Booster Pump: An end suction, dry rotor pump designed and marketed for
75　　pressure-side pool cleaner applications, and which may be UL listed under ANSI/UL 1081-2016,
76　　"Standard for Swimming Pool Pumps, Filters, and Chlorinators.

77 J) <u>Waterfall Pump</u>: A waterfall pump is a pool filter pump with maximum head less than or equal to
78   30 feet, and a maximum speed less than or equal to 1,800 rpm.

1.3 Product Sub-Types

80 A) <u>Single-speed Dedicated Purpose Pool Pump</u>: A dedicated purpose pool pump that is capable of
81   operating at only one speed.

82 B) <u>Two-speed Dedicated Purpose Pool Pump</u>: A dedicated-purpose pool pump that is capable of
83   operating at only two different pre-determined operating speeds, where the low operating speed
84   is less than or equal to half of the maximum operating speed and greater than zero, and must be
85   distributed in commerce either:

86   a. With a pool pump control (e.g., variable speed drive and user interface or switch) that is
87   capable of changing the speed in response to user preferences; or

88   b. Without a pool pump control that has the capability to change speed in response to user
89   preferences but is unable to operate without the presence of such a pool pump control.

90 C) <u>Multi-speed Dedicated Purpose Pool Pump</u>: A dedicated-purpose pool pump that is capable of
91   operating at more than two discrete, pre-determined operating speeds separated by speed
92   increments greater than 100 rpm, where the lowest speed is less than or equal to half of the
93   maximum operating speed and greater than zero, and must be distributed in commerce with an
94   on-board pool pump control (i.e., variable speed drive and user interface or programmable
95   switch) that changes the speed in response to pre-programmed user preferences and allows the
96   user to select the duration of each speed and/or the on/off times.

97 D) <u>Variable-speed Dedicated Purpose Pool Pump</u>: A dedicated-purpose pool pump that is capable
98   of operating at a variety of user-determined speeds, where all the speeds are separated by at
99   most 100 rpm increments over the operating range and the lowest operating speed is less than or
100   equal to one-third of the maximum operating speed and greater than zero. Such a pump must
101   include a variable speed drive and be distributed in commerce either:

102   a. With a user interface that changes the speed in response to pre-programmed user
103   preferences and allows the user to select the duration of each speed and/or the on/off
104   times; or

105   b. Without a user interface that changes the speed in response to pre-programmed user
106   preferences and allows the user to select the duration of each speed and/or the on/off
107   times, but is unable to operate without the presence of a user interface.

1.4 Product Ratings

109 A) <u>Rated Horsepower (hp)</u>: The rated horsepower is the product of the measured full load speed and
110   torque, determined based on the maximum continuous duty motor power output rating allowable
111   for the motor's nameplate ambient rating and insulation class, as determined in accordance with
112   the test procedure in 10 CFR §431.464(b) and applicable sampling plans in 10 CFR §429.59.
113   May be less than Total Horsepower where the Service Factor is > 1.0, or equal to Total
114   Horsepower where the Service Factor = 1.0. Also known as Nominal Horsepower.

115 B) <u>Service Factor</u>: A multiplier applied to Rated Horsepower of a motor to indicate the percent above
116   Nominal Horsepower at which a pump motor may operate continuously without exceeding its
117   allowable insulation class temperature limit, provided the other design parameters such as rated
118   voltage, frequency, and ambient temperature are within limits, as determined in accordance with
119   the test procedure in 10 CFR §431.464(b) and applicable sampling plans in 10 CFR §429.59.

120   **Note**: In accordance with E.3.3, Appendix B to 10 CFR 431 Subpart Y, Service Factor shall be
121   1.0 for residential applications (Single phase AC or DC Motors).

122   C)   <u>Total Horsepower</u>: The product of the Rated Horsepower and the Service Factor of a motor used
123   on a Pool Pump (also known as Service Factor Horsepower, SFHP) based on the maximum
124   continuous duty motor power output rating allowable for nameplate ambient rating and motor
125   insulation class, as determined in accordance with the test procedure in 10 CFR §431.464(b) and
126   applicable sampling plans in 10 CFR §429.59. Total Horsepower = Rated Horsepower x Service
127   Factor. For example, a 1.5 hp pump with a 1.65 Service Factor produces 2.475 hp (Total
128   Horsepower) at the maximum Service Factor point.

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

133   **1.5 Testing and Certification**

134   A)   <u>Pump Performance Curve</u>: A curve comparing the Total Head in feet of water to the Rate of Flow
135   in gallons per minute (gpm) for a given pump at a given Motor Speed.

136   B)   <u>System Curves</u>: An equation that defines the relationship between flow and head in a fixed
137   hydraulic network. System Curves A, B, and C represent different standard plumbing systems.
138   The curves are used to help size a pump based on the pool size, pipe system, and pool features
139   present in a given pool system. They are plotted on the same graph as Pump Performance
140   Curves, which compare Rate of Flow (Q) to Total Head (H). The System Curve equations are the
141   following, where H is total system head in feet of water and Q is flow in gpm:

142   a.   <u>Curve A</u>: $H = 0.0167 * Q^2$

143   b.   <u>Curve B</u>: $H = 0.050 * Q^2$

144   c.   <u>Curve C</u>: $H = 0.0082 * Q^2$

145   C)   <u>Normal Operating Point</u>: Point that corresponds to the rate of flow, total head, and energy
146   consumption at which a pump will operate given a specific system curve and a specific pump
147   speed. It corresponds to the point of intersection of the pump performance and system curves.

148   D)   <u>Rate of Flow (Q)</u>: The total volume throughput per unit of time. For the ENERGY STAR Pool
149   Pump Test Method, Rate of Flow is expressed as gpm.

150   E)   <u>Motor Speed (n)</u>: The number of revolutions of the motor shaft in a given unit of time. For the
151   ENERGY STAR Pool Pump Test Method, Motor Speed is expressed as revolutions per minute
152   (rpm).

153   F)   <u>Head (H)</u>: Energy content of the liquid at any given point in the system, expressed in units of
154   energy per unit weight of liquid. For residential pool pumps, the measuring unit for Head is feet of
155   water.

156   G)   <u>Standby Mode</u>: A reduced power state in which the unit is connected to an AC main power
157   source and pump controls/timers remain On, but the motor remains idle, and no water is being
158   pumped through the system.

159   H)   <u>Energy Factor (EF)</u>: The volume of water pumped in gallons per watt-hour of electrical energy
160   consumed by the pump motor (gal/Wh).

161   I)   <u>Weighted Energy Factor (WEF)</u>: A measurement of pump efficiency based on performance at
162   one or two operating points, which are uniquely defined for each DPPP variety and speed
163   configuration. The performance measurements at different operating points are weighted to
164   represent real world use. WEF is measured in thousand gallons per kilowatt hour (kgal/kWh). See
165   the *DOE Test Procedure for Dedicated Purpose Pool Pumps* for additional calculation details: 10
166   CFR 431.464(b).

167 J) Basic Model: Means all units of a given class of pump manufactured by one manufacturer, having
168 the same primary energy source, and having essentially identical electrical, physical, and
169 functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water
170 consumption, or water efficiency.[1]

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

173 **Note:** For ease of use, EPA has moved definitions pertaining to connected criteria to the connected
174 section of the specification.

1.6 Acronyms

176 A) ANSI: American National Standards Institute

177 B) APSP: Association of Pool and Spa Professionals

178 C) NSPI: National Spa and Pool Institute

2 SCOPE

2.1 Included Products

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

184 A) Self-Priming Pool Filter Pump (similar to former Inground Pump category);

185 B) Non-Self-Priming Pool Filter Pump (similar to former Aboveground Pump category);

186 C) Pressure Cleaner Booster Pump; and

187 D) Replacement Motor.

2.2 Excluded Products

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

191 A) Waterfall Pump;

192 B) Integral Cartridge Filter Pump;

193 C) Integral Sand Filter Pump;

194 D) Storable Electric Spa Pump; and

195 E) Rigid Electric Spa Pump.

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[1] DOE Test Procedure for Dedicated Purpose Pool Pumps, Final Rule, 10 CFR 431 Subpart Y, Appendix B and C.

197   3   CERTIFICATION CRITERIA

198   3.1   Energy Efficiency Requirements

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

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

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

201

202   B)   Pump controls: Pump controls intended for use with a Multi-speed or Variable-speed Pump shall
203   have a default filtration speed setting of no more than one-half of the motor's maximum rotation
204   rate. Any high-speed override capability shall be for a temporary period not to exceed one 24-
205   hour cycle without resetting to default settings.

206   C)   Freeze Protection: All dedicated-purpose pool pumps distributed in commerce with freeze
207   protection controls must be shipped either with freeze protection disabled, or with the following
208   default, user-adjustable settings:

209   a.   The default dry-bulb air temperature setting for activating freeze protection is no greater
210   than 40 °F; and

211   b.   The default run time setting shall be no greater than 1 hour (before the temperature is
212   rechecked); and

213   c.   The default motor speed shall not be more than half of the maximum available speed.

214   3.2   Significant Digits and Rounding

215   A)   All calculations shall be carried out with directly measured (unrounded) values.

216   B)   Unless otherwise specified, compliance with specification limits shall be evaluated using directly
217   measured or calculated values without any benefit from rounding.

218   C)   As specified in 10 CFR 431.464(b): WEF, maximum head, vertical lift, and true priming time are
219   rounded to the nearest tenths place. Rated Hydraulic Horsepower is reported to the nearest
220   thousandths place. All other values are rounded to the hundredths place.

221 4 CONNECTED PRODUCT CRITERIA

222 This section presents connected criteria for ENERGY STAR certified pool pumps. Compliance with
223 Section 4 criteria is optional. ENERGY STAR certified pool pumps that comply with all Section 4 criteria
224 will be identified on the ENERGY STAR website as having 'Connected' functionality. As for all ENERGY
225 STAR products, these criteria define products which provide a combination of additional user functionality
226 and grid services, as appropriate for the product type.

227 4.1 Connected Product Definitions

228 A) Communication Link: As shown in Figure 1, the mechanism for bi-directional data transfers
229   between the Connected Pool Pump System and one or more external applications, devices or
230   systems.

231 B) Connected Pool Pump System (CPPS): As shown in Figure 1, includes the ENERGY STAR
232   certified pool pump, integrated or separate communications hardware, and additional hardware
233   and software required to enable connected functionality.
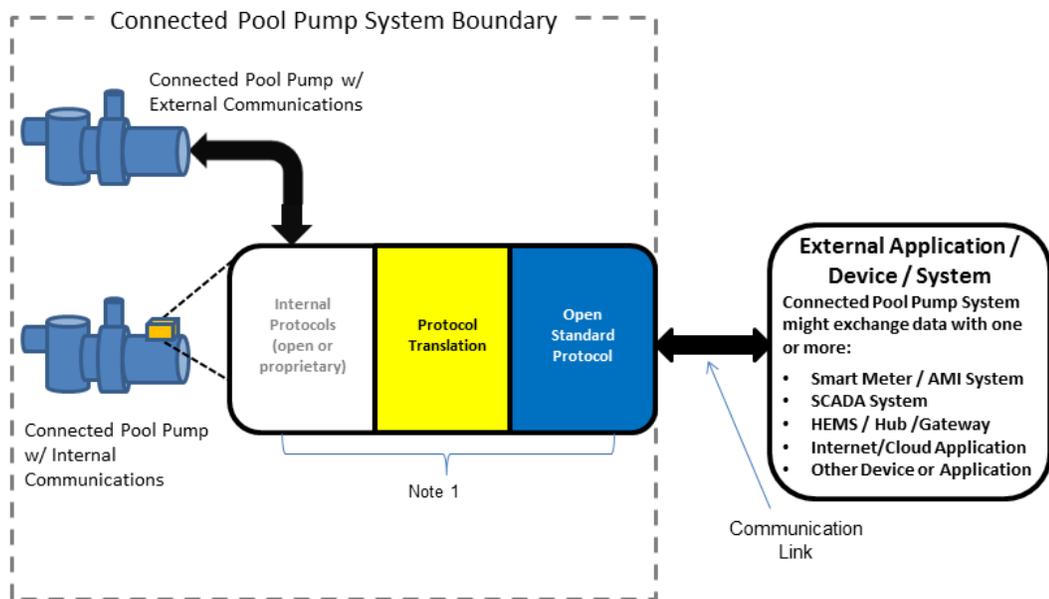
234

235 **Figure 1:** Connected Pool Pump System (CPPS)

236   **Note**: Communication device(s), link(s) and/or processing that enables Open Standards-
237   based communication between the CPPS and external application / device / system(s).
238   These elements, either individually or together, could be within the pump/controller, and/or
239   an external communication module, a hub/gateway, or in the Internet/cloud.

240 C) Consumer Authorized Third Party: Any entity for which the consumer has provided explicit
241   permission to access the CPPS connected functionality, in whole or in part, via a Communication
242   Link. *Example: A consumer may allow a Home Energy Management System (HEMS) or a*
243   *Demand Response Management System (DRMS) access to the CPPS connected functionality.*

244 D) Open Standards: Communication with entities outside the CPPS that use, for all communication
245   layers, standards:

246   1. Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,[2] and/or

247   2. Included in the National Institute of Standards and Technology (NIST) Smart Grid Framework
248   Tables 4.1 and 4.2,[3] and/or

249   3. Adopted by the American National Standards Institute (ANSI) or another well-established
250   international standards organization such as the International Organization for
251   Standardization (ISO), International Electrotechnical Commission (IEC), International
252   Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE), or
253   Internet Engineering Task Force (IETF).

254   E) <u>On-Premises</u>: Refers to a function that relies only on the equipment present at the physical
255   installed location of the ENERGY STAR certified device/ equipment.

256   F) <u>Demand Response (DR)</u>: Changes in electric usage by end-use customers from their normal
257   consumption patterns in response to changes in the price of electricity over time, or to incentive
258   payments designed to induce lower electricity use at times of high wholesale market prices or
259   when system reliability is jeopardized.

260   G) <u>Demand Response Management System (DRMS)</u>: The system operated by a consumer
261   authorized program administrator, such as the utility or third party, which dispatches signals with
262   DR instructions and/or price signals to the CPPS and receives messages from the CPPS.

263   H) <u>Interface Specification</u>: A document or collection of documents that contains detailed technical
264   information to facilitate access to relevant data and product capabilities over a communications
265   interface.

266   I) <u>Load Management Entity</u>: Consumer authorized DRMS, home energy management system, or
267   the like.

268 **Note:** In addition to moving existing definitions, EPA proposes adding the above definitions (E-I) to
269 describe connected pool pump products. These largely parallel similar material in other ENERGY
270 STAR specifications with connected criteria, developed as DR practice has developed. These added
271 definitions allow increased clarity in explaining DR criteria.

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[2] http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

[3] http://www.nist.gov/smartgrid/upload/NIST_Framework_Release_2-0_corr.pdf

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: • Accuracy • Units If Energy Consumption Reporting is also provided, ICD/API/other doc. must include: • Accuracy • Units • Measurement Interval
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.

302   **B) User Alerts:**

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

305   1. Operational status including:

306   a. On/Off/Standby, and

307   b. Motor speed and/or rate of flow

308   2. DR status including:

309   a. Inactive

310   b. Active – General Curtailment

311   c. Active – Grid Emergency

312   d. Active – Load Up

313   e. Time-stamped DR override notification

314   3. Program schedule including schedule times and scheduled operation.

315   4. The CPPS shall be capable of providing at least two types of messages relevant to optimizing
316   its energy consumption, either:

317   a. On the product (e.g. pool pump and/or controller), and/or

318   b. Transmitted to consumers and consumer authorized third parties via a communication
319   link.

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

323   **C) Real-time Power Reporting:**

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

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

333   **Note:** EPA has reorganized the consumer feedback and remote management section to be similar to
334   those appearing in connected criteria for other ENERGY STAR product types; the actual criteria are
335   unchanged.

336

4.4 Demand Response

A) DR Communication Protocols

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

B) 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.

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. 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.

Note: EPA proposes requiring either CTA 2045 or OpenADR 2.0 compliance for CPPS, to encourage national compatibility of demand response infrastructure and product combination hardware. This is aligned with EPA's strategy for large load products to provide grid services more easily. In addition, it aligns with the emerging consensus – no other standards have as widespread support among utilities and manufacturers. EPA requests stakeholder feedback on this requirement. EPA also considered adding SEP2.0 for direct connection to a smart meter and received mixed feedback regarding its application.

359   **D) DR Requests and Responses**

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

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

369   1. Within ten seconds of receipt of a response request on the consumer's premise, shall
370   execute the required response.

371   2. Be capable of supporting DR event override-ability.

372   3. Prior to or during a demand response event, return to normal operation if the consumer
373   overrides the event.

374   4. Either delay or reject a demand response request if responding would compromise safety or
375   result in equipment damages as determined by the manufacturer.

376   i. General Curtailment (Light Shed): This response is intended to curtail demand while minimizing
377   consumer impact. This type of response may be used daily to manage demand under programs
378   such as Time of Use and/or Real Time Pricing, or for peak shifting during peak demand days,
379   often 20-30 times per year. The CPPS must meet the following requirements for responding to a
380   General Curtailment request:

381   1. The CPPS shall ship with default settings that enable a response for at least 4 hours.

382   2. The CPPS shall be able to provide at least one response in a rolling 12-hour period.
383

384   **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.

385   ii.   <u>Grid Emergency (Full Shed)</u>: This response is intended to immediately shutdown pumping
386   operations. This type of response may be used daily on occasions to manage extreme peak load
387   conditions and grid emergency conditions. The CPPS must meet the following requirements for
388   response to a Grid Emergency request:

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

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

391   iii.   <u>Load Up</u>: This response is intended to increase demand temporarily to utilize excess/low cost
392   electric power, such as excess solar and/or wind power. This type of response may have varying
393   usage depending on the power generation mix of the region, and may be used daily to manage
394   excess power, or shift demand from higher use to lower use times. The CPPS must meet the
395   following requirements for responding to a Load Up request:

396   1.   Upon receipt of a requesting signal on the consumer's premises and in accordance with
397   consumer settings, the CPPS shall

398   a.   If idle, shall initiate pumping at a rate appropriate for regular filtration, and

399   b.   If active, shall increase the motor speed (rpm) by at least 10% of maximum rpm from the
400   current speed, or extend pumping duration within the requested response period. The
401   CPPS shall not increase speed to a rate outside the proper operating conditions of
402   equipment and/or filtration systems connected to the pump, as determined by the
403   manufacturer. For example, if manufacturer recommendations specify a maximum
404   recommended speed for filtration operations, a Load Up signal should not bring the pump
405   above this specified maximum speed.

406   2.   This response shall be limited such that the CPPS terminates pumping when:

407   a.   Programmed daily pumping volume is reached *(CPPS with controls capable of*
408   *scheduling pumping operation based on total desired volume pumped),* or

409   b.   Programmed daily pumping duration is reached *(all other CPPS).*

410   **Note:** EPA has updated the naming convention for the required DR responses for consistency with
411   ENERGY STAR Connected Criteria for other product categories and descriptions typically used by
412   stakeholders.

413   To ensure the ENERGY STAR connected pool pumps respond consistently to grid requests, EPA is
414   proposing that responses be mapped to DR requests according to Appendix A. Stakeholder feedback
415   regarding these proposals is welcome.

416   **E) DR Information and Messaging**

417   The CPPS shall support the following upstream messaging from the device when available.
418   Support for these messaging signals is implemented via the open standards protocol used in the
419   product. An informative mapping of these messages to the CTA 2045 Op Codes is provided in
420   **Error! Reference source not found.**. Data provided by below messaging functions shall be
421   calculated from the product state no older than 60 seconds from request.

422   • **Idle normal:** Indicates that no demand response event is in effect and the CPPD has
423   no/insignificant energy consumption.

424   • **Running Normal:** Indicates that no demand response event is in effect and the CPPD
425   has significant energy consumption.

426   • **Running Curtailed:** Indicates that a curtailment type demand response event is in effect
427   and the CPPD has significant energy consumption.

428 • **Running Heightened:** Indicates that a heightened-operation type of demand response
429 event is in effect and the CPPD has significant energy consumption.

430 • **Idle Curtailed:** Indicates that a curtailment type demand response event is in effect and
431 the CPPD has no/insignificant energy consumption.

432 • **CPPD Error Condition:** Indicates that the CPPD is not operating because it needs
433 maintenance support or is in some way disabled (i.e. no response to the grid).

434 • **Idle Heightened:** Indicates that a heightened-operation type of demand response event
435 is in effect and the CPPD has no/insignificant energy consumption.

436 • **Variable Following:** Indicates that a variable-setting type of demand response event is
437 in effect and the CPPD is presently following the specified setting.

438 • **Variable Not Following:** Indicates that a variable-setting type demand response event is
439 in effect and the CPPD is presently not following the specified setting (e.g. has
440 no/insignificant energy consumption.

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

443 • **Running, Opted Out:** Indicates that the CPPD is presently opted out of any demand
444 response events and the CPPD has significant energy consumption.

445 **Note:** In alignment with the ENERGY STAR Connected Criteria for other large loads products, including
446 Water Heaters, EPA has added the required DR messaging I/O above. Such feedback is important to
447 utilities running DR programs and pilots with connected equipment.

448 ## 4.5 Information to Installers and Consumers

449 If additional modules, devices, services, and/or supporting infrastructure are required in order to activate
450 the CPPS's communications capabilities, installation instructions and a list of these requirements shall be
451 made available at the point of purchase and prominently displayed in the product literature. It is also
452 suggested that information be provided on the product packaging and on the product. These instructions
453 shall provide specific information on what must be done to activate these capabilities (e.g. a product
454 package or product label might briefly state "This product has Wi-Fi capability and requires Internet
455 connectivity and a wireless router to enable interconnection with external devices, systems or
456 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

ENERGY STAR Requirement	Test Method Reference
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. TBD-2018)

Note: The modest updates to connected criteria will be accompanied by modest updates to the DR Test Method, which will be released with the amended specification.

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

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

501 **Table 5: Demand Response Request Mapping**

	Demand Response Message	Response Result	OpenADR (2.0b)	ANSI/CTA (2045-B)
Basic Signals	General Curtailment (Shed)	Reduce load per Table 3.	oadrDistributeEvent: SIMPLE level 1.[4]	Shed[5]
	Grid Emergency (Full Shed)	Turn off (if possible)	oadrDistributeEvent: SIMPLE level 3.[4]	Critical Peak Event[5]
	Load Up	Use more energy (if possible)	oadrDistributeEvent: NEAR / FAR flag. CHARGE STATE, LOAD_DISPATCH.[4]	Load Up[5]
Advanced Signals	Utility Peak Load Price Signal	Use/do not use energy when appropriate (follow programming)	oadrDistributeEvent: ELECTRICITY_PRICE[4]	Present Relative Price[5]
Device Properties	Consumer Override	Skip response to event within opt out	oadrCreateOpt: device sends upstream opt message[6]	Customer Override Message, in response to Operational State Query or load reduction request[5]
	Device Information	Indicates all mandatory product information	Ei:eiTargetType (endDeviceAsset)	Info Request[7] [Section 11.1.1]
	State Reporting Requirements	Provide state information to requestor	EiReport. oadrPayloadResourceStatus	Operational State Query[5]
	Hardware Requirements	Design of product & comms.		DC or AC Form Factor[8]
Device Energy	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

502 **Note:** EPA has added the normative appendix above to ensure standardization across a minimum set of
503 grid requests. EPA welcomes feedback on this proposal.

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[4] 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
[5] CTA-2045-B; Table 10-1.
[6] Section 8.5, OpenADR 2.0b EiOpt Service; Figure 17, Interaction Diagram: Create Opt
[7] CTA-2045-B; Table 11-2.
[8] CTA-2045-B, Appendix A & Appendix B