



ENERGY STAR® Program Requirements Product Specification for Pool Pumps

Eligibility Criteria Final Draft Version 2.0 and Version 3.0

1 Following is the **Final Draft Version 2.0/Version 3.0** product specification for ENERGY STAR certified
2 Pool Pumps. A 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) Pump: 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) Dedicated Purpose Pool Pump: 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) Pool Filter Pump: 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) Control: 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) Variable Speed Drive: Equipment capable of varying the speed of the motor.
- 28 F) Freeze Protection Control: 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) Full-Flow Rate: Flow rate, in gallons per minute, at maximum speed on curve C.
- 32 H) Pool Pump Timer: 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.

34 **1.2 Pump Types**

- 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) Waterfall Pump: 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.

79 **Note:** EPA has moved integral cartridge filter and integral sand filter pool pumps from Section 1.3 Product
80 Sub-Types to Section 1.2 Pump Types. This change is to clarify that integral filter pumps are not a subset
81 of non-self-priming pool filter pumps, since these products must have a bypassable filter assembly, and
82 integral filter pumps cannot bypass the filter by definition.

83 1.3 Product Sub-Types

- 84 A) Single-speed Dedicated Purpose Pool Pump: A dedicated purpose pool pump that is capable of
85 operating at only one speed.
- 86 B) Two-speed Dedicated Purpose Pool Pump: A dedicated-purpose pool pump that is capable of
87 operating at only two different pre-determined operating speeds, where the low operating speed
88 is less than or equal to half of the maximum operating speed and greater than zero, and must be
89 distributed in commerce either:
- 90 a. With a pool pump control (e.g., variable speed drive and user interface or switch) that is
91 capable of changing the speed in response to user preferences; or
- 92 b. Without a pool pump control that has the capability to change speed in response to user
93 preferences, but is unable to operate without the presence of such a pool pump control.
- 94 C) Multi-speed Dedicated Purpose Pool Pump: A dedicated-purpose pool pump that is capable of
95 operating at more than two discrete, pre-determined operating speeds separated by speed
96 increments greater than 100 rpm, where the lowest speed is less than or equal to half of the
97 maximum operating speed and greater than zero, and must be distributed in commerce with an
98 on-board pool pump control (i.e., variable speed drive and user interface or programmable
99 switch) that changes the speed in response to pre-programmed user preferences and allows the
100 user to select the duration of each speed and/or the on/off times.
- 101 D) Variable-speed Dedicated Purpose Pool Pump: A dedicated-purpose pool pump that is capable
102 of operating at a variety of user-determined speeds, where all the speeds are separated by at
103 most 100 rpm increments over the operating range and the lowest operating speed is less than or
104 equal to one-third of the maximum operating speed and greater than zero. Such a pump must
105 include a variable speed drive and be distributed in commerce either:
- 106 a. With a user interface that changes the speed in response to pre-programmed user
107 preferences and allows the user to select the duration of each speed and/or the on/off
108 times; or
- 109 b. Without a user interface that changes the speed in response to pre-programmed user
110 preferences and allows the user to select the duration of each speed and/or the on/off
111 times, but is unable to operate without the presence of a user interface.

112 1.4 Product Ratings

- 113 A) Rated Horsepower (HP): The rated horsepower is the product of the measured full load speed
114 and torque, determined based on the maximum continuous duty motor power output rating
115 allowable for the motor's nameplate ambient rating and insulation class, as determined in
116 accordance with the test procedure in 10 CFR §431.464(b) and applicable sampling plans in 10
117 CFR §429.59. May be less than Total Horsepower where the Service Factor is > 1.0, or equal to
118 Total Horsepower where the Service Factor = 1.0. Also known as Nominal Horsepower.
- 119 B) Service Factor: A multiplier applied to Rated Horsepower of a motor to indicate the percent above
120 Nominal Horsepower at which a pump motor may operate continuously without exceeding its
121 allowable insulation class temperature limit, provided the other design parameters such as rated
122 voltage, frequency, and ambient temperature are within limits, as determined in accordance with
123 the test procedure in 10 CFR §431.464(b) and applicable sampling plans in 10 CFR §429.59.
- 124 **Note:** In accordance with E.3.3, Appendix B to 10 CFR 431 Subpart Y, Service Factor shall be
125 1.0 for residential applications (Single phase AC or DC Motors).
- 126 C) Total Horsepower: The product of the Rated Horsepower and the Service Factor of a motor used
127 on a Pool Pump (also known as Service Factor Horsepower, SFHP) based on the maximum

128 continuous duty motor power output rating allowable for nameplate ambient rating and motor
129 insulation class, as determined in accordance with the test procedure in 10 CFR §431.464(b) and
130 applicable sampling plans in 10 CFR §429.59. Total Horsepower = Rated Horsepower x Service
131 Factor. For example, a 1.5 HP pump with a 1.65 Service Factor produces 2.475 HP (Total
132 Horsepower) at the maximum Service Factor point.

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

137 1.5 Testing and Certification

138 A) Pump Performance Curve: A curve comparing the Total Head in feet of water to the Rate of Flow
139 in gallons per minute (GPM) for a given pump at a given Motor Speed.

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

146 a. Curve A: $H = 0.0167 * Q^2$

147 b. Curve B: $H = 0.050 * Q^2$

148 c. Curve C: $H = 0.0082 * Q^2$

149 C) Normal Operating Point: Point that corresponds to the rate of flow, total head, and energy
150 consumption at which a pump will operate given a specific system curve and a specific pump
151 speed. It corresponds to the point of intersection of the pump performance and system curves.

152 D) Rate of Flow (Q): The total volume throughput per unit of time. For the ENERGY STAR Pool
153 Pump Test Method, Rate of Flow is expressed as GPM.

154 E) Motor Speed (n): The number of revolutions of the motor shaft in a given unit of time. For the
155 ENERGY STAR Pool Pump Test Method, Motor Speed is expressed as revolutions per minute
156 (RPM).

157 F) Head (H): Energy content of the liquid at any given point in the system, expressed in units of
158 energy per unit weight of liquid. For residential pool pumps, the measuring unit for Head is feet of
159 water.

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

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

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

171 J) Basic Model: Means all units of a given class of pump manufactured by one manufacturer, having
172 the same primary energy source, and having essentially identical electrical, physical, and

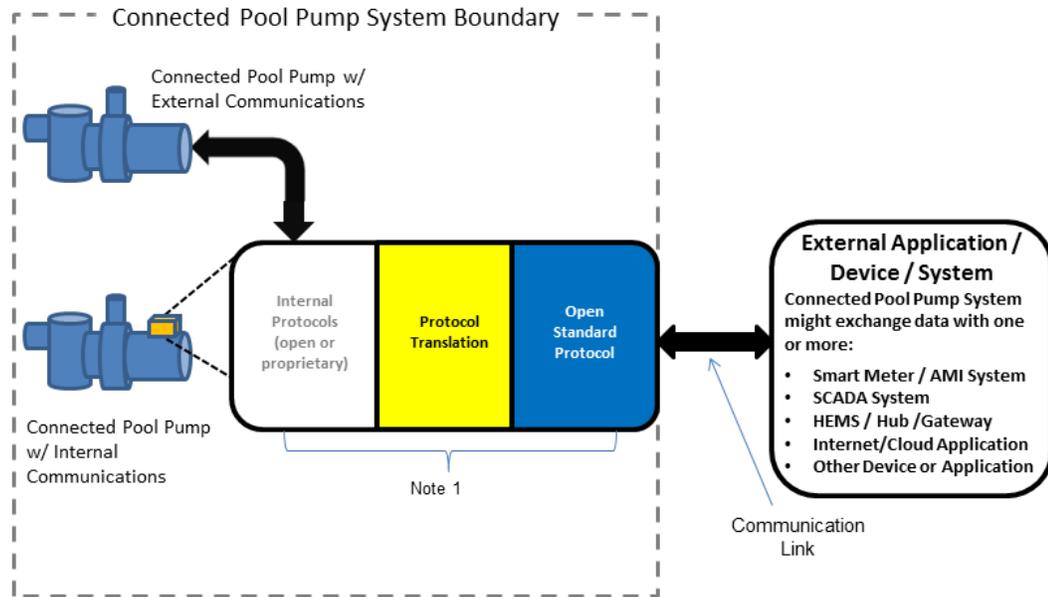
173 functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water
174 consumption, or water efficiency.¹

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

177 1.6 Connected Products

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

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



183

184

Figure 1: Connected Pool Pump System (CPPS)

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

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

192 D) Open Standards: Standards that are:

- 193 1. Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,² and/or
194 2. Included in the National Institute of Standards and Technology (NIST) Smart Grid Framework
195 Tables 4.1 and 4.2,³ and/or

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

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

- 196 3. Adopted by the American National Standards Institute (ANSI) or another well-established
197 international standards organization such as the International Organization for
198 Standardization (ISO), International Electrotechnical Commission (IEC), International
199 Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE), or
200 Internet Engineering Task Force (IETF).
- 201 E) Premises: Land and the improvements on it.
- 202 F) Demand Response Override-ability: The capability for a user to modify the Demand Response
203 (DR) functionality of their DR equipped and activated product, to opt out of a scheduled and/or
204 active DR event the product would otherwise respond to. Any system that allows event override
205 without canceling program enrollment would meet this definition, but overrides that can be
206 activated per event or programmed for particular times or conditions are preferred over blanket
207 overrides that remain active until cancelled.
- 208 G) Time-Stamped Demand Response Override Notification: A message capable of being sent to a
209 Consumer Authorized Third Party which signifies a particular instance of a Demand Response
210 Override, and at minimum includes the time or interval of the override or a reference to the event
211 that is being overridden.

212 1.7 Acronyms

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

216 2 SCOPE

217 2.1 Included Products

218 Products that meet the definition of a Self-Priming Pool Filter Pump (similar to former Inground Pump
219 category), Non-Self-Priming Pool Filter Pump (similar to former Aboveground Pump category), Pressure
220 Cleaner Booster Pump or Pool Pump Replacement Motor, as specified herein, are eligible for ENERGY
221 STAR certification, with the exception of products listed in Section 2.2. Only those pool pumps that are
222 single phase and with a Rated Hydraulic Horsepower (hhp) of >0 and <2.5 hhp can certify as ENERGY
223 STAR under this specification.

224 2.2 Excluded Products

225 Waterfall Pumps, Integral Cartridge Filter Pumps, Integral Sand Filter Pumps, Storable Electric Spa
226 Pumps, and Rigid Electric Spa Pumps, as defined in Section 1, are not eligible for ENERGY STAR under
227 this specification.

228 **Note:** Some commenters requested that EPA clarify the potential savings of integral cartridge or integral
229 sand filter pumps. Upon further consideration, in light of limited long-term opportunities for efficiency
230 beyond DOE's imminent standard, it is not a good fit to include these types of pumps. Thus, EPA is
231 excluding these pumps from Version 2.0.

232 3 CERTIFICATION CRITERIA

233 3.1 Energy Efficiency Requirements

- 234 A) The Weighted Energy Factor of the pump must meet the criteria provided in Table 1, below.
235

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

Pump Sub-Type	Size Class	Version 2.0	Version 3.0
		Energy Efficiency Level (Effective TBD 2018)	Energy Efficiency Level (Effective July 19, 2021)
Self-Priming (Inground) Pool Pumps	Small (hhp < 0.711)	$WEF \geq -1.30 \times \ln(hhp) + 4.95$ <i>for hhp > 0.13</i> $WEF \geq 7.60$ <i>for hhp ≤ 0.13</i>	$WEF \geq -2.45 \times \ln(hhp) + 8.40$ <i>for hhp > 0.13</i> $WEF \geq 13.40$ <i>for hhp ≤ 0.13</i>
Self-Priming (Inground) Pool Pumps	Standard Size (hhp ≥ 0.711)	$WEF \geq -2.30 \times \ln(hhp) + 6.59$	$WEF \geq -2.45 \times \ln(hhp) + 8.40$
Non-Self-Priming (Aboveground) Pool Pumps	Extra Small (hhp ≤ 0.13)	$WEF \geq 4.92$	$WEF \geq 4.92$ (same as Version 2.0)
Non-Self-Priming (Aboveground) Pool Pumps	Standard Size (hhp > 0.13)	$WEF \geq -1.00 \times \ln(hhp) + 3.85$	$WEF \geq -1.00 \times \ln(hhp) + 3.85$ (same as Version 2.0)
Pressure Cleaner Booster Pumps	All	$WEF \geq 0.45$	$WEF \geq 0.51$
Pool Pump Replacement Motors	TBD	TBD	TBD

237

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

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

- 245 a. The default dry-bulb air temperature setting for activating freeze protection is no greater
 246 than 40 °F; and
- 247 b. The default run time setting shall be no greater than 1 hour (before the temperature is
 248 rechecked); and
- 249 c. The default motor speed shall not be more than half of the maximum available speed.

250 3.2 Significant Digits and Rounding

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

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

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

257 **4 CONNECTED PRODUCT CRITERIA**

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

261 **4.1 Communications**

- 262 A) The CPPS Communication Link, in Figure 1, shall use Open Standards for all communication
263 layers to enable functions listed in Table 2.
- 264 B) An Interface Control Document (ICD), Application Programming Interface (API), or other
265 documentation shall be made available to interested parties that, at minimum, allows access to
266 the functions listed in Table 2.

267 **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"> • Accuracy • Units If Energy Consumption Reporting is also provided, ICD/API/other doc. must include: <ul style="list-style-type: none"> • Accuracy • Units • Measurement Interval
Section 4.4 Operational Status, User Settings, and Messages
Section 4.5 Demand Response

269 **Notes:**

- 270 1. A CPPS that enables economical and direct
271 communications that comply with 4.1.A and 4.1.B on the
272 consumer's premises is preferred; but alternative
273 approaches, where the CPPS only complies with 4.1.A
274 and 4.1.B outside of the consumer's premises are also
275 acceptable.
- 276 2. A product that includes an embedded modular
277 communications port that complies with 4.1.A and 4.1.B
278 need not be supplied with a compatible communications
279 module.

280 **4.2 Real-time Power Reporting**

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

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

290 **4.3 Remote Management**

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

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

295 **4.4 Operational Status, User Settings & Messages**

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

- 298 1. Operational status including:
 - 299 a. On/Off/Standby, and
 - 300 b. Motor speed and/or rate of flow
- 301 2. DR status including:
 - 302 a. Inactive
 - 303 b. Active – Type 1
 - 304 c. Active – Type 2
 - 305 d. Active – Type 3
 - 306 e. Time-stamped DR override notification
- 307 3. Program schedule including schedule times and scheduled operation

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

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

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

315 **4.5 Demand Response**

316 At a minimum, the CPPS shall be capable of responding to Consumer Authorized Third Parties by
 317 providing the following three responses: Type 1, Type 2, and Type 3, as detailed below.

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

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

326 **A) Type 1 Response:** This response is intended to curtail demand while minimizing consumer
 327 impact. This type of response may be used daily to manage demand under programs such as
 328 Time of Use and/or Real Time Pricing, or for peak shifting during peak demand days, often 20-30
 329 times per year. The CPPS must meet the following requirements for Type 1 response:

- 330 1. The CPPS shall ship with default settings that enable a response for at least 4 hours.
- 331 2. The CPPS shall be able to provide at least one response in a rolling 12-hour period.

332 **Table 3: Type 1 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 full-flow rate, the Pool Pump shall reduce flow rate to less than or equal to half of the full-flow rate 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 full-flow rate, the Pool Pump shall reduce operation to less than or equal to 1/3 of full-flow rate.
	B	If operating at less than or equal to 1/3 of full-flow rate, the Pool Pump shall not increase flow.

334 **B) Type 2 Response:** This response is intended to immediately shutdown pumping operations. This
 335 type of response may be used daily on occasions to manage extreme peak load conditions and
 336 grid emergency conditions. The CPPS must meet the following requirements for Type 2
 337 response:

- 338 1. The CPPS shall ship with default settings that enable a response of least 20 minutes.
- 339 2. The CPPS shall be able to provide at least three responses in a rolling 24-hour period.

340 **C) Type 3 Response:** This response is intended to increase demand temporarily to utilize
341 excess/low cost electric power, such as excess solar and/or wind power. This type of response
342 may have varying usage depending on the power generation mix of the region, and may be used
343 daily to manage excess power, or shift demand from higher use to lower use times. The CPPS
344 must meet the following requirements for Type 3 response:

- 345 1. Upon receipt of a requesting signal on the consumer's premises and in accordance with
346 consumer settings, the CPPS shall
- 347 a. If idle, shall initiate pumping at a rate appropriate for regular filtration, and
- 348 b. If active, shall increase the rate of flow by at least 10% of Full Flow Rate from the current
349 flow rate, or extend pumping duration within the requested response period. The CPPS
350 shall not increase flow to a rate outside the proper operating conditions of equipment
351 and/or filtration systems connected to the pump, as determined by the manufacturer. For
352 example, if manufacturer recommendations specify a maximum recommended flow rate
353 for filtration operations, a Type 3 signal should not bring the pump above this specified
354 maximum flow rate.
- 355 2. This response shall be limited such that the CPPS terminates pumping when:
- 356 a. Programmed daily pumping volume is reached (*CPPS with controls capable of*
357 *scheduling pumping operation based on total desired volume pumped*), or
- 358 b. Programmed daily pumping duration is reached (*all other CPPS*).

359 **Note:** EPA has incorporated clarifying edits to the Demand Response sections, per stakeholder
360 comments. This included the addition of intent and anticipated frequency of use items, and the
361 consolidation of Demand Response requirements into a new top level summary section.

362 **4.6 Information to Installers and Consumers**

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

371 5 ADDITIONAL REQUIREMENTS

372 5.1 Additional reporting requirements

- 373 A) The Energy Factor, Flow, and Power using Curves A, B, and C shall be reported for all products
374 at Max Speed on each of the curves.
375
- 376 B) The Power Factor at each load point shall be reported for all products on Curve C, as collected
377 in the DOE Test Procedure (10 CFR 431.464(b)).

378 6 TEST REQUIREMENTS

379 6.1 Number of Units Required for Testing

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

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

391 **Note:** EPA has updated the sampling requirements to reflect that the DOE DPPP Test Procedure is able
392 to evaluate a single unit if needed. EPA notes that DOE compliance according to 10 CFR §429.59 does
393 require a minimum of 2 units, and provides additional tolerances to reported values. Therefore, a DOE
394 sampling plan option according to 10 CFR 429.59 is also allowed for ENERGY STAR certification. EPA
395 also streamlined this section, in accordance with standard practice for federally regulated products,
396 eliminating the terminology of “product family”.

397 6.2 Test Methods

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

Table 4: Test Method for ENERGY STAR Certification

ENERGY STAR Requirement	Test Method Reference
Weighted Energy Factor (kgal/kWh); Power Factor; Freeze Protection; Curve A/B/C Flow and Power	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)

401

402 **Note:** EPA notes that an update of the ENERGY STAR Pool Pumps Test Method to Validate Demand
403 Response is underway. It is possible that it may be included in the Version 2 Pool Pumps Specification
404 prior to the Version 2 effective date.

405

406 Compliance with the DOE Test Procedure is required on February 5, 2018, for representations of energy
407 use or efficiency with respect to Dedicated Purpose Pool Pumps.

408 **6.3 Compliance with Connected Criteria**

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

411 **7 EFFECTIVE DATE**

412 The ENERGY STAR Pool Pump specification shall take effect on January 1, 2019. To certify for ENERGY
413 STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of
414 manufacture. The date of manufacture is specific to each unit and is the date on which a unit is
415 considered to be completely assembled.

416 **Note:** EPA anticipates finalizing the Version 2.0 specification by March 30, 2018, with an effective date
417 January 1, 2019. Version 3 will have an effective date of July 19, 2021 which will coincide with the
418 effective date of the DOE Dedicated Purpose Pool Pump Regulation. Note that when finalized, Version 2
419 and Version 3 will be released as separate documents.

420 **8 FUTURE SPECIFICATION REVISIONS**

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

425 **9 REFERENCES**

- 426 1) ANSI/NSPI – 5 2003. Residential Inground Swimming Pools
427 2) ANSI/APSP – 4 2007. Standard for Aboveground/Onground Residential Swimming Pools
428 3) ANSI/NSPI – 6 1999. Residential Portable Spas
429 4) ANSI/UL 1081-2016. Standard for Swimming Pool Pumps, Filters, and Chlorinators
430 5) ANSI/NSF 50-2016a. Equipment for Swimming Pools, Spas, Hot Tubs, and Other Recreational
431 Water Facilities

432

APPENDIX A: DEMAND RESPONSE REFERENCE INFORMATION

433 This Appendix is informational only. In Section 4.4 Operational Status, User Settings & Messages, a
 434 useful framework for demand response state messaging, can be extracted from CTA/CEA 2045 Op
 435 States:

436

Table 5: CTA Op State Codes (Table 8.2.4)⁴

Op State Code	Name	Section 4.4 Corresponding Item	Description
0	Idle Normal	Off/Standby	Indicates that no demand response event is in effect and the CPPD has no/insignificant energy consumption.
1	Running Normal	On	Indicates that no demand response event is in effect and the CPPD has significant energy consumption.
2	Running Curtailed	Active Type 1 or Active Type 2; Pump Running	Indicates that a curtailment type demand response event is in effect and the CPPD has significant energy consumption.
3	Running Heightened	Active Type 3; Pump Running	Indicates that a heightened-operation type of demand response event is in effect and the CPPD has significant energy consumption.
4	Idle Curtailed	Active Type 1 or Active Type 2; Pump Not Running	Indicates that a curtailment type demand response event is in effect and the CPPD has no/insignificant energy consumption.
5	CPPD Error Condition	Messages (4.4 B)	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).
6	Idle Heightened	Active Type 3; Pump Not Running	Indicates that a heightened-operation type of demand response event is in effect and the CPPD has no/insignificant energy consumption.
9	Variable Following	(No Entry)	Indicates that a variable-setting type of demand response event is in effect and the CPPD is presently following the specified setting.
10	Variable Not Following	(No Entry)	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).
11	Idle, Opted Out	Timestamped DR Over-ride Notification; Off/Standby	Indicates that the CPPD is presently opted out of any demand response events and the CPPD has no/insignificant energy consumption.
12	Running, Opted Out	Timestamped DR Over-ride Notification; On	Indicates that the CPPD is presently opted out of any demand response events and the CPPD has significant energy consumption.
13:125	Not Used	(No Entry)	Future use
126:255	Reserved	(No Entry)	Reserved for manufacturer use.

437 Opt Out Messaging Example, CTA 2045:

438 When a user places their CTA 2045 connected device into an opt-out state, the Customer Override
 439 message (Bytecode 0X11, Value 1 (Override)) is sent when the customer changes the products override
 440 state to Opt-out.

441 If a load reduction message is sent to this device, the device will acknowledge receipt of the message,

⁴ Cycling On/Off (code 7/8) omitted, since not relevant to pool pumps. Smart Grid Device (SGD) changed to CPPD for clarity.

442 and re-send this Customer Override message while an Opt-out state is in effect.

443 When a device is in an Opt-out state, and receives an Operational State Query (0x12), the device will
444 respond with the State Query Response (0x13, Message: Op Code from Table 5 (CTA 8.2.4)). For
445 example, if the product is opted out and running, the response would be (0x13 Message: 12).

446 Opt Out Messaging Example, Open ADR 2.0:

447 Open ADR 2.0 stores long term DR enrollment in EiAvail and short term Opt-out in EiOpt messages. The
448 EiOpt message would contain the ID.

449 In Open ADR 2.0, this requirement would translate to the need of the CPPS to be able to create short
450 term EiOpt events if needed by the user, to override long term (EiAvail) DR enrollment status.