



ENERGY STAR® Program Requirements Product Specification for Pool Pumps

Eligibility Criteria Draft 1, Version 2.0 and Version 3.0

1 Following is the **Draft 1, Version 2.0/Version 3.0 product** specification for ENERGY STAR certified Pool
2 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.

5 **1.1 General**

- 6 A) Pool Pump: A mechanical assembly consisting of a “wet-end,” which houses the impeller (the
7 rotating part of a pump designed to move the fluid inside the pump casing), and a motor. The
8 pump increases the “head” and “flow” (see pages 2 and 3 for definitions) of the water.
9
- 10 B) Pump Controls: A switch or variable frequency drive, either external to or onboard the pump, that
11 is capable of controlling two or more motor operating speeds.

12 **1.2 Pump Types**

- 13 A) Self-Priming Pool Pump: A self-priming pool pump is a pool pump that is certified under
14 NSF/ANSI 50-2015 to be self-priming or is capable of re-priming to a vertical lift of at least 5 feet
15 with a true priming time less than or equal to 10 minutes, when tested in accordance with
16 NSF/ANSI 50-2015, “Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational
17 Water Facilities.”¹ Note: Pumps designated Inground Pool Pumps in previous ENERGY STAR
18 specifications are now considered Self-Priming-Pool Pumps.
- 19 B) Non-Self-Priming Pool Pump: A Non-Self-Priming pool pump is a pool pump that is not certified
20 under NSF/ANSI 50-2015 to be self-priming and is not capable of re-priming to a vertical lift of at
21 least 5 feet with a true priming time less than or equal to 10 minutes, when tested in accordance
22 with NSF/ANSI 50-2015.¹ Note: Pumps designated Aboveground Pool Pumps in previous
23 ENERGY STAR specifications are now considered Non-Self-Priming Pool Pumps.
- 24 C) Residential Portable Spa Pump: A pump intended for installation with a non-permanently installed
25 residential spa as defined in ANSI/NSPI-6 Standard for Portable Spas. Sometimes referred to as
26 a hot tub pump, but not a jetted bathtub pump.
- 27 D) Residential Auxiliary Pool Pump: A pump intended for purposes other than a primary pool filter
28 pump, i.e. such as a pool cleaner booster pump or water feature pumps.
- 29 E) Pool Pump Replacement Motor: A motor designated as a specific replacement part intended for
30 pool pump model(s) as specified by pump manufacturer and/or a motor designed and marketed
31 to consumers for use as a pool pump motor.
- 32 F) Pressure Cleaner Booster Pump: An end suction, dry rotor pump designed and marketed for
33 pressure-side pool cleaner applications, and which may be UL listed under ANSI/UL 1081-2014,
34 “Standard for Swimming Pool Pumps, Filters, and Chlorinators.”¹

¹ US DOE Energy Conservation Standards for Dedicated Purpose Pool Pumps, Final Rule, [82 FR 5650](#), IV.A.1.b

- 35 G) Waterfall Pump: A waterfall pump is a pool filter pump with maximum head less than or equal to
36 30 feet, and a maximum speed less than or equal to 1,800 rpm.¹

37 1.3 Product Sub-Types

- 38 A) Single-speed Pump: A pump which has an electric motor that operates at only one speed.
39 B) Multi-speed Pump: A pump which has an electric motor that can operate at multiple, discrete
40 speeds.
41 C) Variable-speed Pump: A pump which has an electric motor that can operate at continuously
42 variable speeds.
43 D) Variable-flow Pump: A pump which has an electric motor that can operate at continuously
44 variable speeds, with added controls that automatically adjust speed to control flow.

45 1.4 Product Ratings

- 46 A) Rated Horsepower (HP): The motor power output designed by the manufacturer for rated
47 revolutions per minute (RPM), voltage, and frequency. May be less than Total Horsepower
48 where the Service Factor is > 1.0, or equal to Total Horsepower where the Service Factor = 1.0.
49 Also known as Nameplate Horsepower.
50 B) Service Factor: A multiplier applied to Rated Horsepower of a motor to indicate the percent above
51 Nameplate Horsepower at which a pump motor may operate continuously without exceeding its
52 allowable insulation class temperature limit, provided the other design parameters such as rated
53 voltage, frequency, and ambient temperature are within limits.
54 C) Total Horsepower: The product of the Rated Horsepower and the Service Factor of a motor used
55 on a Pool Pump (also known as Service Factor Horsepower, SFHP) based on the maximum
56 continuous duty motor power output rating allowable for nameplate ambient rating and motor
57 insulation class. Total Horsepower = Rated Horsepower x Service Factor. For example, a 1.5 HP
58 pump with a 1.65 Service Factor produces 2.475 HP (Total Horsepower) at the maximum Service
59 Factor point.
60 D) Hydraulic Horsepower (hhp): The pump power output at outlet (in HP), defined at the maximum
61 speed of the pump on Curve C (see Section 1.5 below). This measurement is the power
62 associated with moving the nominal amount of water at maximum flow of the pump when
63 operating at maximum speed.

64 1.5 Testing and Certification

- 65 A) Pump Performance Curve: A curve comparing the Total Head in feet of water to the Rate of Flow
66 in gallons per minute (GPM) for a given pump at a given Motor Speed.
67 B) System Curves: Equations which compare the actual head gained by the fluid from the pump to
68 the system parameters, which include elevation head and friction losses. The curves are used to
69 help size a pump based on the pool size, pipe system, and pool features present in a given pool
70 system. They are plotted on the same graph as Pump Performance Curves, which compare Rate
71 of Flow (Q) to Total Head (H). The System Curve equations are the following, where H is total
72 system head in feet of water and Q is flow in GPM:
73 a. Curve A: $H = 0.0167 * Q^2$
74 b. Curve B: $H = 0.050 * Q^2$
75 c. Curve C: $H = 0.0082 * Q^2$
76 C) Normal Operating Point: Point that corresponds to the rate of flow, total head, and energy
77 consumption at which a pump will operate given a specific system curve. It corresponds to the
78 point of intersection of the pump performance and system curves.
79 D) Rate of Flow (Q): The total volume throughput per unit of time. For the ENERGY STAR Pool
80 Pump Test Method, Rate of Flow is expressed as GPM.

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

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

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

$$88 H_s = z_s + \frac{(p_s \times a)}{\gamma} + \frac{U_s^2}{2g}$$

89 Where:

- 90 • z_s is the height from the water level of the suction pressure measuring device, in feet (ft),
- 91 • p_s is the suction pressure measured by the pressure measuring device, in pounds per square
92 inch (psi),
- 93 • U_s is the mean velocity at the suction pressure measuring device, in ft/s,
- 94 • a is a conversion constant equal to 144 in²/ft², and
- 95 • γ is the specific weight of water, in lb/ft³.

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

$$97 H_D = z_D + \frac{(p_D \times a)}{\gamma} + \frac{U_D^2}{2g}$$

98 Where:

- 99 • z_D is the height from the water level of the discharge pressure measuring device, in ft,
- 100 • p_D is the discharge pressure measured by the pressure measuring device, in psi,
- 101 • U_D is the mean velocity at the discharge pressure measuring device, in ft/s,
- 102 • a is a conversion constant equal to 144 in²/ft², and
- 103 • γ is the specific weight of water, in lb/ft³.

104 I) Standby Mode: A reduced power state in which the unit is connected to an ac main power source
105 and pump controls/timers remain On, but the motor remains idle, and no water is being pumped
106 through the system.

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

109 K) Weighted Energy Factor (WEF): Pump performance based on the EF at 2 operating points, one
110 at a High Flow Measurement Point, the other at a Low Flow Measurement Point. These
111 measurements are weighted differently to represent real world use. WEF is measured in gallons
112 per watt hour (gal/Wh). See the *DOE Test Procedure for Dedicated Purpose Pool Pumps* for
113 additional calculation details: [EERE-2016-BT-TP-0002-0001](https://www.regulations.gov/document?D=EERE-2016-BT-TP-0002-0001).

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

117 M) Low Flow Measurement Point: For Multi-speed and Variable-speed pumps, defined as the flow on
118 Curve C at the lowest speed able to produce a flow of at least 31.1 GPM for pumps >0.75 hhp or
119 24.7 GPM for pumps ≤0.75 hhp.

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

² DOE Test Procedure for Dedicated Purpose Pool Pumps, Final Rule,
<https://www.regulations.gov/document?D=EERE-2016-BT-TP-0002-0015>

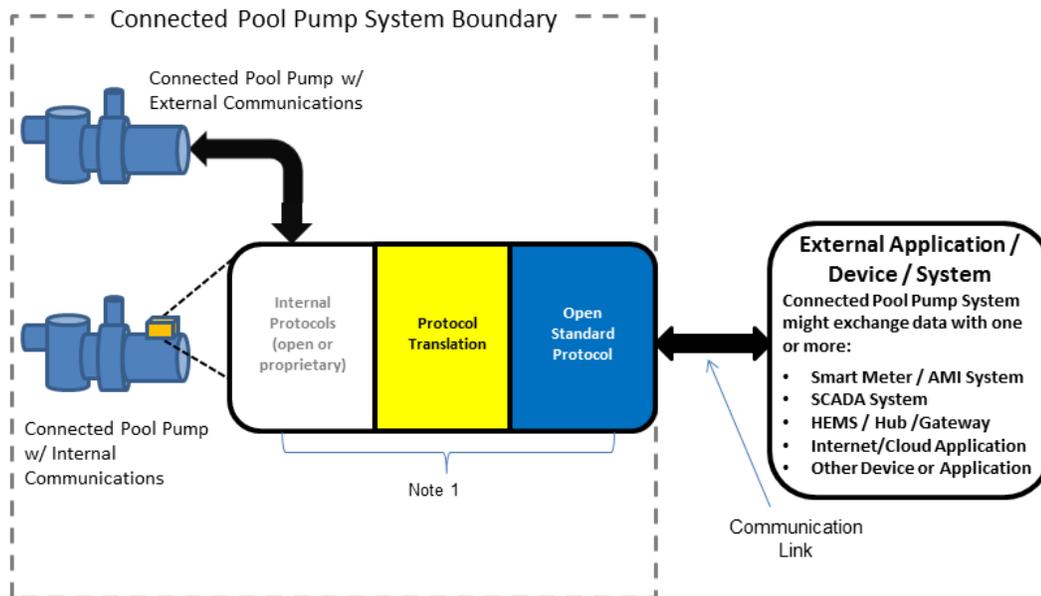
124 **Note:** Changes in product color, Rated Horsepower (Not Total Horsepower) and the type or
125 presence of union fittings would be covered under a basic model.

126 **Note:** EPA added definitions to align with the DOE Energy Conservation Standards for Dedicated
127 Purpose Pool Pumps¹: Pressure Cleaner Booster Pumps, Self-Priming, Non-Self-Priming, Hydraulic
128 Horsepower (hhp), Weighted Energy Factor (WEF), High Flow Measurement Point, and Low Flow
129 Measurement Point. Additionally, EPA added a definition for Pool Pump Replacement Motor.

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

134 1.6 Connected Products

- 135 A) Communication Link: As shown in Figure 1, the mechanism for bi-directional data transfers
136 between the CPPS and one or more external applications, devices or systems.
- 137 B) Connected Pool Pump System (CPPS): As shown in Figure 1, includes the ENERGY STAR
138 certified pool pump, integrated or separate communications hardware, and additional hardware
139 and software required to enable connected functionality.



140
141 **Figure 1.** Connected Pool Pump System (CPPS)

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

- 146 C) Consumer Authorized Third Party: Any entity for which the consumer has provided explicit
147 permission to access the CPPS connected functionality, in whole or in part, via a Communication
148 Link.
- 149 D) Open Standards: Standards that are:

- 150 1. Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,³ and/or
151 2. Included in the National Institute of Standards and Technology (NIST) Smart Grid Framework
152 Tables 4.1 and 4.2,⁴ and/or
153 3. Adopted by the American National Standards Institute (ANSI) or another well-established
154 international standards organization such as the International Organization for
155 Standardization (ISO), International Electrotechnical Commission (IEC), International
156 Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE), or
157 Internet Engineering Task Force (IETF).
- 158 E) Premises: Land and the improvements on it.

159 **1.7 Acronyms**

- 160 A) ac: Alternating Current
161 B) ANSI: American National Standards Institute
162 C) API: Application Programming Interface
163 D) APSP: Association of Pool and Spa Professionals
164 E) CPPS: Connected Pool Pump System
165 F) DR: Demand Response
166 G) EF: Energy Factor
167 H) °F: Degrees Fahrenheit
168 I) gal: gallons
169 J) GPM: Gallons per minute
170 K) H: Head
171 L) HI: Hydraulics Institute
172 M) HP: Horsepower
173 N) hhp: Hydraulic Horsepower
174 O) Hz: hertz
175 P) ICD: Interface Control Document
176 Q) n: Motor Speed
177 R) NSPI: National Spa and Pool Institute
178 S) Q: Rate of Flow
179 T) RPM: Revolutions per minute
180 U) UUT: Unit under test
181 V) V: volts
182 W) W: watts
183 X) WEF: Weighted Energy Factor
184 Y) Wh: watt-hours

³ http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

⁴ http://www.nist.gov/smartgrid/upload/NIST_Framework_Release_2-0_corr.pdf

185 2 SCOPE

186 2.1 Included Products

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

193 2.2 Excluded Products

194 Residential Auxiliary Pool Pumps, other than Pressure Cleaner Booster Pumps, including Waterfall
195 Pumps, and Spa Pumps as defined in Section 1 are not eligible for ENERGY STAR under this
196 specification. Multi-speed pumps with manual pump controls that are not sold ready to connect to
197 external pump controls are ineligible.

198 **Note:** EPA proposes including Pressure Cleaner Booster Pumps and Non-Self-Priming (Aboveground)
199 Pool Pumps in the scope. These product types present a large opportunity for consumer energy savings.
200 EPA estimates that including Non-Self-Priming Pumps could save US consumers up to 600 GWh/yr
201 (approximately \$75,000,000 per year). Pressure Cleaner Booster Pumps could save US consumers up to
202 an additional 67 GWh/yr (approximately \$8,300,000 per year). Additionally, they are within the scope of
203 the DOE proposed test method⁵, making testing their energy performance, possible.

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

206 EPA proposes including Pool Pump Replacement Motors, because they also represent a large
207 opportunity for savings. National cumulative energy savings estimates from the American Council for an
208 Energy-Efficient Economy (ACEEE) on pool pump replacement motors total \$2.8 Billion and 94 TWh for
209 US consumers from 2020 through 2035.⁶

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

⁵ US DOE, Test Procedure for Dedicated Purpose Pool Pumps, <https://www.regulations.gov/document?D=EERE-2016-BT-TP-0002-0015>

⁶ ACEEE, July 25, 2017, States Go First: How States Can Save Consumers Money, Reduce Energy and Water Waste, and Protect the Environment with New Appliance Standards, <http://aceee.org/research-report/a1702>, p. 16

212 **3 CERTIFICATION CRITERIA**

213 **3.1 Energy Efficiency Requirements**

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

215

216

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

Pump Sub-Type	Size Class	Version 2.0 Energy Efficiency Level (Effective TBD 2018)	Version 3.0 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	Large (hhp ≥ 0.711)	$WEF \geq 0.9 \times [-2.30 \times \ln(hhp) + 6.59]$	$WEF \geq -2.45 \times \ln(hhp) + 8.40$
Non-Self-Priming (Aboveground) Pool Pump	Extra Small (hhp ≤ 0.13)	$WEF \geq 4.92$	$WEF \geq 4.92$ (same as Version 2.0)
Non-Self-Priming (Aboveground)Pool Pump	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

217

218 B) Pump controls for use with a Multi-speed, Variable-speed, or Variable-flow Pump shall have the
 219 capability of operating the Pool Pump at a minimum of two speeds. The control’s default filtration
 220 speed setting shall be no more than one-half of the motor’s maximum rotation rate. Any high-
 221 speed override capability shall be for a temporary period not to exceed one 24-hour cycle without
 222 resetting to default settings.

223

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

228 In addition, DOE has finalized minimum efficiency standards for pool pumps with a compliance date of
 229 July 19, 2021⁷. These standards are in terms of a new test method and metric for pool pump efficiency,
 230 which DOE finalized on August 7, 2017.

⁷ US DOE Energy Conservation Standards for Dedicated Purpose Pool Pumps, Final Rule, [82 FR 5650](#)

231 EPA proposes relying on the new metric, weighted efficiency factor (WEF) and the new test method for
232 the Version 2.0 specification. EPA is proposing Version 2.0 levels effective in 2018 that reflect current
233 advances in the pool pump market as well as Version 3.0 levels, aligned with the timing of new minimum
234 efficiency standards, that ensure ENERGY STAR continues to deliver savings beyond the standard after
235 2021.

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

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

241 EPA estimated the WEF for each currently certified pump model using the ENERGY STAR qualified
242 product list data for Version 1.1 pool pumps, with certification dates ranging from 2013 to 2017. EPA is
243 confident that the set of data provides an accurate picture of pumps that would meet the proposed
244 criteria. Cost data were estimated from the Final Rule Technical Support Document (TSD): Dedicated
245 Purpose Pool Pumps⁸. US Market information was estimated from both the ENERGY STAR Unit
246 Shipment Data and the DOE TSD.

247 Self-Priming (Inground) Pool Pumps

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

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

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

270 Non-Self Priming (Aboveground) Pool Pumps

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

⁸ 2016-12 Final Rule Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Dedicated-Purpose Pool Pumps
<https://www.regulations.gov/document?D=EERE-2015-BT-STD-0008-0105>

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

280 Pressure Cleaner Booster Pumps

281 EPA proposes to add Pressure Cleaner Booster Pumps to the scope and set requirements for these
282 products at DOE EL2, which provides the desired balance of additional energy savings while maintaining
283 under a 2-year payback. There are a small number of high performance booster pumps which have been
284 recently placed on the market with Multi-speed or Variable-speed technology. EPA encourages
285 stakeholder feedback on the ability to differentiate between these advanced booster pumps vs.
286 conventional single-speed pumps given the proposal to use DOE Efficiency Level 2. For Version 3.0 in
287 2021, EPA proposes a WEF level consistent with variable speed motors, which save substantial energy
288 through avoiding the use of a flow restrictor. According to EPA analysis, the DOE TSD indicated the
289 market is not ready now for an ENERGY STAR level recognizing variable speed pumps, so we have
290 delayed setting that level until 2021, when Version 3.0 will be effective.

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

294 Pool Pump Replacement Motors

295 There is energy saving potential for pool pump replacement motors. A substantial percent of the time,
296 when a pool pump breaks, it is repaired with a replacement motor, rather than replaced in its entirety.
297 DOE proposed a test method⁹ for these motors, which are designed specifically for pool pumps, but as of
298 yet has not finalized the test method or set standards for them. EPA is proposing to include replacement
299 motors in this specification, based on the test method proposed by DOE. Whenever data on the
300 performance of replacement motors becomes available, EPA intends to add them to the scope.

301 **3.2 Significant Digits and Rounding:**

- 302 A) All calculations shall be carried out with directly measured (unrounded) values.
- 303 B) Unless otherwise specified, compliance with specification limits shall be evaluated using directly
304 measured or calculated values without any benefit from rounding.
- 305 C) As specified in 82 FR 36858¹⁰: WEF, EF, maximum head, vertical lift, and true priming time are
306 rounded to the nearest tenths place. Rated Hydraulic Horsepower is reported to the nearest
307 thousandths place. All other values are rounded to the hundredths place. Connected PRODUCT
308 Criteria

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

⁹ US DOE, Test Procedure for Dedicated Purpose Pool Pumps, <https://www.regulations.gov/document?D=EERE-2016-BT-TP-0002-0015>

¹⁰ US DOE, Test Procedure for Dedicated Purpose Pool Pumps, <https://www.regulations.gov/document?D=EERE-2016-BT-TP-0002-0015>, III.E.2.G.

312 **3.3 Communications**

- 313 A) The CPPS Communication Link, in Figure 1, shall use Open Standards for all communication
 314 layers to enable functions listed in Table 2.
- 315 B) An Interface Control Document (ICD), Application Programming Interface (API), or other
 316 documentation shall be made available to interested parties that, at minimum, allows access to
 317 the functions listed in Table 2.
 318
 319

320 **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

321 **Notes:**

- 322 1. A CPPS that enables economical and direct
 323 communications that comply with 4.1.A and 4.1.B on the
 324 consumer’s premises is preferred; but alternative
 325 approaches, where the CPPS only complies with 4.1.A
 326 and 4.1.B outside of the consumer’s premises are also
 327 acceptable.
- 328 2. A product that includes an embedded modular
 329 communications port that complies with 4.1.A and 4.1.B
 330 need not be supplied with a compatible communications
 331 module.

332 **3.4 Real-time Power Reporting**

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

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

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

347 **3.5 Remote Management**

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

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

352 **3.6 Operational Status, User Settings & Messages**

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

- 355 1. Operational status including:
 - 356 a. On/Off/Standby, and
 - 357 b. Motor speed and/or rate of flow
- 358 2. DR status including:
 - 359 a. Inactive
 - 360 b. Active – Type 1
 - 361 c. Active – Type 2
 - 362 d. Active – Type 3
 - 363 e. Time-stamped DR override notification
- 364 3. Program schedule including schedule times and scheduled operation

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

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

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

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

375 **3.7 Demand Response**

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

378 A) **Type 1 Response:**

- 379
- 380 1. Within ten seconds of receipt of a requesting signal on the consumer’s premise, the CPPS
381 shall respond in accordance with Table 3.

- 382 2. The CPPS shall ship with default settings that enable a response for at least 4 hours.
- 383 3. The CPPS shall be able to provide at least one response in a rolling 12-hour period.
- 384 4. The CPPS may either delay its response or not provide a response if responding would
385 compromise safety or result in equipment damage as determined by the manufacturer.
- 386 5. The CPPS shall be capable of supporting DR event override-ability.

Table 3: Type 1 Response Requirements

Pump Type	Allowable Operation
Single-speed Pump	<ul style="list-style-type: none"> 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)
Multi-speed Pump	<ul style="list-style-type: none"> If in off / Standby Mode, the Pool Pump shall remain in off / Standby Mode. If operating above the lowest available speed, the Pool Pump shall reduce operation to the lowest available speed or switch to off / Standby Mode.
Variable-speed Pump / Variable-flow Pump	<ul style="list-style-type: none"> If operating at greater than 1/3 of full-speed/flow, the Pool Pump shall reduce operation to less than or equal to 1/3 of full-Motor Speed/Rate of Flow. If operating at less than or equal to 1/3 of Full-Motor Speed/Rate of Flow, the Pool Pump shall not increase Motor Speed/Rate of Flow.

390 **B) Type 2 Response:**

- 391 1. Within ten seconds of receipt of a requesting signal on the consumer's premises, the CPPS
392 shall terminate pumping for the duration of the requested response period.
- 393 2. The CPPS shall ship with default settings that enable a response of least 20 minutes.
- 394 3. The CPPS shall be able to provide at least three responses in a rolling 24-hour period.
- 395 4. The CPPS may either delay its response or not provide a response if responding would
396 compromise safety or result in equipment damage as determined by the manufacturer.
- 397 5. The CPPS shall be capable of supporting DR event override-ability.

398 **C) Type 3 Response:**

- 399 1. Within ten seconds of receipt of a requesting signal on the consumer's premises and in
400 accordance with consumer settings, the CPPS, if idle, shall initiate pumping, and if active,
401 shall increase Motor Speed/Rate of Flow or extend pumping duration within the requested
402 response period.
- 403 2. This response shall be limited such that the CPPS terminates pumping when:
- 404 a. Programmed daily pumping volume is reached (*CPPS with controls capable of*
405 *scheduling pumping operation based on total desired volume pumped*), or
- 406 b. Programmed daily pumping duration is reached (*all other CPPS*).
- 407 No additional pumping shall occur prior to 12:00 AM the following day.

- 408 3. The CPPS is not required to respond if doing so would compromise safety or result in
409 equipment damage as determined by the manufacturer.
- 410 4. The CPPS shall be capable of supporting DR event override-ability.
411

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

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

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

433 **3.8 Information to Installers and Consumers**

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

442 **4 ADDITIONAL REQUIREMENTS**

443 **4.1 Informational statement**

- 444 A) Partner shall mark a certified Multi-speed, Variable-speed, and Variable-flow pool pump without
445 onboard pump controls permanently and legibly on an accessible and conspicuous place on the
446 unit, in characters no less than ¼”, with the nameplate HP of the pump with the statement, “This
447 pump must be installed with a multi-, or variable-speed pump motor controller.” This statement
448 provides information that the pool pump product must be matched with pump controls to ensure
449 the energy savings potential is realized due to the speed reduction capabilities of the pool pump.

450 **4.2 Additional reporting requirements**

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

454 **5 TEST REQUIREMENTS**

455 **5.1 Number of Units Required for Testing**

- 456 A) Representative Models shall be selected for testing per the following requirements:
- 457 1) For certification of an individual product model, the Representative Model shall be equivalent
458 to that which is intended to be marketed and labeled as ENERGY STAR.
 - 459 2) For certification of a Product Family, any model within that Product Family can be tested and
460 serve as the Representative Model. When submitting Product Families, manufacturers
461 continue to be held accountable for any efficiency claims made about their products,
462 including those not tested or for which data was not reported.
- 463 B) A single unit of each Representative Model shall be selected for testing.

464 **5.2 Test Methods**

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

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

ENERGY STAR Requirement	Test Method Reference
Weighted Energy Factor (gal/Wh)	DOE Test Procedure for Dedicated Purpose Pool Pumps, Final Rule ¹¹
Standby Mode Testing	ENERGY STAR Pool Pumps Test Method Version 2.0
Demand Response	ENERGY STAR Pool Pumps Test Method to Validate Demand Response (Rev. March-2015)

468 **Note:** EPA proposes using the DOE Test Procedure for Dedicated Purpose Pool Pumps. The DOE Test
469 Procedure¹¹ was published in the Federal Register on August 7, 2016. The effective date of this rule is
470 September 6, 2017.
471

472 **5.3 Compliance with Connected Criteria**

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

¹¹ DOE Test Procedure for Dedicated Purpose Pool Pumps, Final Rule, Docket: [EERE-2016-BT-TP-0002-0015](#).

476 **6 EFFECTIVE DATE**

477 The ENERGY STAR Pool Pump specification shall take effect on **TBD**. To certify for ENERGY STAR, a
478 product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture.
479 The date of manufacture is specific to each unit and is the date on which a unit is considered to be
480 completely assembled.

481 **Note:** EPA anticipates finalizing the Version 2.0 specification by December 15, 2017, with an effective
482 date of September 15, 2018.

483 **7 FUTURE SPECIFICATION REVISIONS**

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

488 **8 REFERENCES**

- 489 1) ANSI/NSPI – 5 2003. Residential Inground Swimming Pools
490 2) ANSI/APSP – 4 2007. Standard for Aboveground/Onground Residential Swimming Pools
491 3) ANSI/NSPI – 6 1999. Residential Portable Spas