

1 POOL PUMPS CONNECTED FUNCTIONALITY – DRAFT 3 CRITERIA

2 4 CONNECTED PRODUCT CRITERIA

3 This section presents connected criteria for ENERGY STAR certified pool pumps. All Section 4 criteria are
4 optional. ENERGY STAR certified pool pumps that comply with all Section 4 criteria will be identified on the
5 ENERGY STAR website as having 'Connected' functionality.

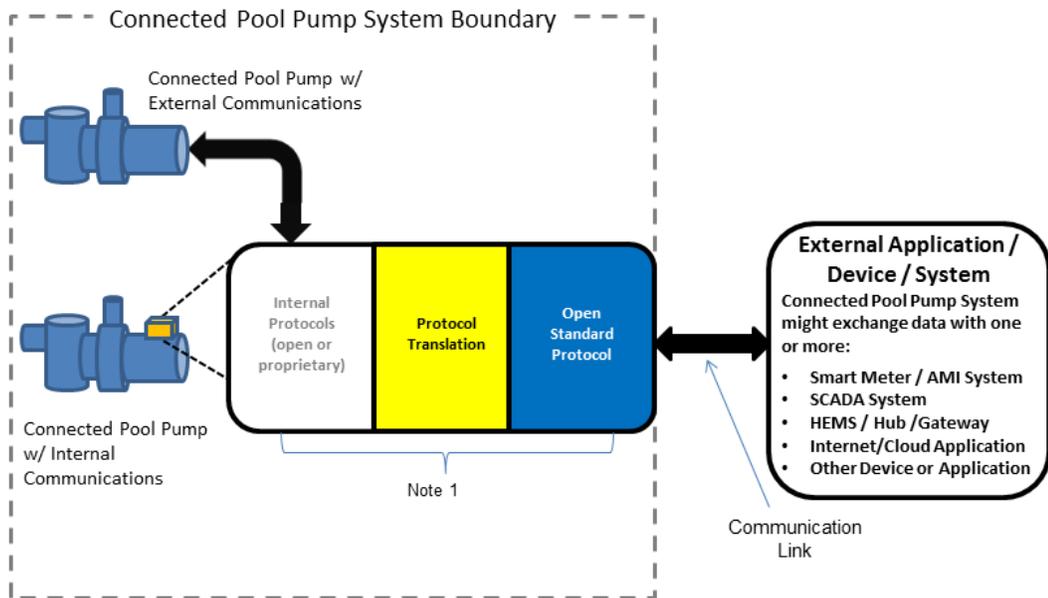
6 4.1 Acronyms

- 7 A) API – Application Programming Interface
- 8 B) CPPS – Connected Pool Pump System
- 9 C) DR – Demand Response
- 10 D) ICD – Interface Control Document

11 4.2 Definitions

12 The following definitions are applicable to Section 4 of this specification:

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



19
20 **Figure 1.** Connected Pool Pump System (CPPS)

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

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

27 D) Open Standards: Standards that are:

- 28 1. Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,¹ and/or
- 29 2. Included in the National Institute of Standards and Technology (NIST) Smart Grid framework Tables
30 4.1 and 4.2,² and/or
- 31 3. Adopted by the American National Standards Institute (ANSI) or another well-established
32 international standards organization such as the International Organization for Standardization
33 (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union
34 (ITU), Institute of Electrical and Electronics Engineers (IEEE), or Internet Engineering Task Force
35 (IETF).

36 E) Premises: Land and the improvements on it.

37 4.3 Communications

- 38 A) The CPPS Communication Link, noted in Figure 1, shall use Open Standards for all communication
39 layers to enable functionalities listed in Table 1.
- 40 B) An Interface Control Document (ICD), Application Programming Interface (API), or other
41 documentation shall be made available to interested parties that at minimum, allows access to the
42 functionalities listed in Table 1.

43 **Table 1: Functionalities Applicable to the Communications Criteria**

Functionalities
Section 4.4 Energy Consumption Reporting ICD/API/other doc. must include: <ul style="list-style-type: none">• Accuracy• Units• Measurement Interval
Section 4.6 Operational Status, User Settings, and Messages
Section 4.8 Demand Response

44 **Notes:**

- 45 1. A CPPS that enables economical and direct communications,
46 that comply with Sections 4.3.A and 4.3.B, on the consumer's
47 Premises is preferred; but alternative approaches, where the
48 CPPS only complies with Sections 4.3.A and 4.3.B outside of
49 the consumer's Premises, are also acceptable.
- 50 2. A product that includes an embedded modular communications
51 port that complies with Sections 4.3.A and 4.3.B need not be
52 supplied with a compatible communications module.

¹ http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

² http://www.nist.gov/smartgrid/upload/NIST_Framework_Release_2-0_corr.pdf

53 **Note:** Criteria mandating that the ICD/API includes accuracy, units and measurement interval for energy
54 consumption reporting has been added to this draft. This criteria appeared in Draft 1, but was unintentionally
55 removed from draft 2.

56 4.4 Energy Consumption Reporting

- 57 A) Whenever pumping, the CPPS shall be capable of transmitting measured or estimated data
58 representative of its interval energy consumption to consumers and Consumer Authorized Third
59 Parties via a Communication Link.

60 **Note:** EPA recommends that energy consumption data be reported in watt-hours for intervals of
61 15 minutes or less, however, representative data may also be reported in alternate units, (e.g. real-
62 time power) and intervals as specified in the ICD or API detailed in Section 4.3. The CPPS may also
63 provide energy use feedback to the consumer on the product itself and use any units and format
64 (e.g., dollars/month).

65 4.5 Remote Management

- 66 A) At minimum, the CPPS shall be capable of responding to consumer authorized signals received via a
67 Communication Link requesting:
- 68 1. A start or stop to pumping, and
 - 69 2. A change to Motor Speed and/or Rate of Flow.
- 70 B) The CPPS is not required to respond to remote requests that would compromise safety as
71 determined by the manufacturer.

72 4.6 Operational Status, User Settings & Messages

- 73 A) At minimum, the CPPS shall be capable of providing the following information to consumers and
74 Consumer Authorized Third Parties via a Communication Link:
- 75 1. Operational status including:
 - 76 a. On/Off/Standby, and
 - 77 b. Motor Speed, and/or Rate of Flow
 - 78 2. DR status including delay load and temporary load reduction
 - 79 3. Program schedule including schedule times and scheduled operation
- 80 B) The CPPS shall be capable of providing at least two types of messages relevant to optimizing its
81 energy consumption, either:
- 82 1. On the product (e.g. Pool Pump and/or controller), and/or
 - 83 2. Transmitted to consumers and Consumer Authorized Third Parties via a Communication Link.

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

87 4.7 Peak Period Avoidance

- 88 A) As shipped, the CPPS shall limit operation within a 6-hour, 12 Noon to 6 PM period, in accordance
89 with Table 2.
90

Table 2: Peak Period Operation Requirements

Pump Type	Allowable Operation
Single-speed Pump	Pump may operate in any sequence for up to 1/3 of the avoidance period duration (e.g. up to 2-hours for a 6-hour avoidance period)
Multi-speed Pump	Pumping shall be limited to the lowest available speed
Variable-speed Pump / Variable-flow Pump	The Pool Pump shall remain in Standby Mode or operate at less than or equal to 1/3 of full-Motor Speed/Rate of Flow

B) The CPPS shall provide an option for the consumer and/or Consumer Authorized Third Parties to modify scheduling and functional status of this capability.

Note: For example, schedule modifications may be made to respond to a short term request from the utility, align the avoidance period with on-peak periods for their utility, shift the avoidance period to align with winter peaking, or enable/disable the capability.

C) When in conflict, local settings changes and/or signals-based requests (e.g. Remote Management, Demand Response) shall take precedence over Peak Period Avoidance.

D) Upon restoration of power after an outage of 24 hours or less, a CPPS following a pumping schedule, shall not require any interaction from the consumer in order for pumping to continue to follow the most recent settings.

Note: In response to stakeholder concerns regarding maintenance of pool chemistry, EPA has revised the Peak Period Avoidance criteria in Table 2 for single-speed pumps that allows for continuous or intermittent operation for a duration that does not exceed 1/3 of the avoidance period; e.g. ≤ 2 hours total run-time for the default 6-hour deferral period.

EPA intends for Peak Period Avoidance to be an “as delivered” configuration that does not limit the consumer’s or pool professional’s ability to configure the CPPS to operate as desired based on regional and operating needs once installed. Accordingly, and in response to a stakeholder inquiry, this draft adds 4.7.C criterion clarifying that local settings changes, as well remote management and DR, take precedence over Peak Period Avoidance.

In the August 2012 connected functionality discussion document, EPA included two separate four hour avoidance periods to cover both winter and summer peaking. In ensuing stakeholder conversations various other strategies were considered, but ultimately a simpler approach with a longer noon to 6PM avoidance period was chosen, informed by feedback from both manufacturers and utilities. While it is understood that it is not possible to define a single, year-round avoidance period that aligns with local peaks in all seasons and in all regions, EPA notes that Peak Period Avoidance criteria empowers both consumers and consumer authorized 3rd parties to modify scheduling and functional status. As such, EPA envisions that pool professionals will schedule pool pump operation that both fits consumer expectations and takes local utility needs into account. In particular, where Time of Use rates apply; EPA expects installers and consumers to minimize scheduled pumping during peak price periods. EPA plans to work with stakeholders to develop and publish guidance that will encourage consumers and installers to consider utility needs and variable pricing impacts when programming pumping schedules. Similarly, EPA encourages utilities to work with local pool professionals to help ensure peak avoidance is considered in pool pump program schedules.

125 **4.8 Demand Response**

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

128 **1. Type 1 Response:**

- 129 a. Upon receipt of a signal and in accordance with consumer settings, the CPPS shall respond
130 in accordance with Table 3.
- 131 b. The CPPS shall ship with default settings that enable a response in accordance with
132 4.8.A.1.a for at least 4 hours.
- 133 c. The CPPS shall be able to provide at least one Type 1 response in a rolling 12-hour period.
- 134 d. The CPPS may either delay its response or not provide a response if responding would
135 compromise safety, or result in equipment damage as determined by the manufacturer.
- 136 e. The consumer shall be able to modify, disable, or override the product's Type 1 response
137 without limitation.

138 **Table 3: Type 1 Response Requirements**

139

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.

140 **2. Type 2 Response:**

- 141 a. Upon receipt of a Demand Response signal and in accordance with consumer settings,
142 the CPPS shall terminate pumping for the duration of the requested response period.
- 143 b. The CPPS shall ship with default settings that enable a response in accordance with
144 4.8.A.2.a for a time period of least 20 minutes.
- 145 c. The CPPS shall be able to provide at least three Type 2 responses in a rolling 24-hour
146 period.
- 147 d. The CPPS may either delay its response or not provide a response if responding would
148 compromise safety, or result in equipment damage as determined by the manufacturer.
- 149 e. The consumer shall be able to modify, disable, or override the product's Type 2 response
150 without limitation.

151 **3. Type 3 Response:**

- 152 a. Upon receipt of a Demand Response signal and in accordance with consumer settings,
153 the CPPS; if idle, shall initiate pumping, and if active, shall increase Motor Speed/Rate of
154 Flow or extend pumping duration within the requested response period.
- 155 b. This response shall be limited such that the CPPS terminates pumping when:
- 156 i. programmed daily pumping volume is reached (*CPPS with controls capable of*
157 *scheduling pumping operation based on total desired volume pumped*), or
 - 158 ii. programmed daily pumping duration is reached (*all other CPPS*).
- 159 No additional pumping shall occur prior to 12:00 AM the following day.
- 160 c. The CPPS is not required to respond if doing so would compromise safety as determined
161 by the manufacturer.
- 162 d. The consumer shall be able to modify, disable, or override the product's Type 3 response
163 without limitation.

164 **Note:** In response to stakeholder concerns regarding maintenance of pool chemistry, and in alignment to the
165 proposed criteria changes for peak period avoidance, EPA has revised the Type 1 Demand Response criteria in
166 Table 3 for single-speed pumps that allows for continuous or intermittent operation for a duration that does not
167 exceed 1/3 of the response period; e.g. ≤ 1 hour and 20 minutes total run-time for a 4-hour response period.

168 EPA has proposed modifying the minimum CPPS Type 1 response frequency from 24 hours to 12 hours, based
169 on stakeholder feedback noting that depending on when the event occurs, the 24 hours limit was too restrictive
170 especially when considering there are often multiple events during an extended situation, such as a heat wave.

171
172 EPA added latency criteria in Draft 2 with the intention of ensuring CPPSs could delay responding in order to
173 prevent equipment damage to associated equipment that may depend upon flow. EPA has since been informed
174 by stakeholders that utility load control programs range from day ahead scheduled reductions to expectations of
175 near instant signaled load-shed. While specifying required latencies on the order of 5 seconds or less would likely
176 be well received by utilities, other stakeholders have informed EPA that such low latencies may not be achievable
177 with CPPSs that respond to DR signals in the cloud. Furthermore, since such systems include variable network
178 latencies that are outside the control of the manufacturer, testing for latency would become problematic. As such,
179 EPA has removed latency requirements from this draft, while revising the 4.8.A.1.d and 4.8.A.2 criteria to allow
180 the CPPS to delay or forgo its response in cases where safety could be impacted or equipment damaged.

181 EPA welcomes stakeholder comments on the removal of DR latency criteria.

182 **4.9 Information to Installers and Consumers**

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

191 **6 TEST REQUIREMENTS**

192 Compliance with connected criteria, as specified in Section 4, shall be through examination of product and/or
193 product documentation. In addition, DR functionality shall be verified using the ENERGY STAR Test Method to
194 Validate Demand Response (Rev. TBD) once available.