# 1 POOL PUMP CONNECTED FUNCTIONALITY – DRAFT 2 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 **Note:** In response to stakeholder comments, the above language was revised to clarify that pool pumps need not
7 meet Section 4 criteria in order to be ENERGY STAR certified. Pool pumps that comply with all ENERGY STAR
8 criteria, including Section 4 will be additionally identified as having connected functionality on the ENERGY STAR
9 qualified product list.

### 10 4.1 Acronyms

11     A) <u>API</u> – Application Programming Interface

12     B) <u>CPPS</u> – Connected Pool Pump System

13     C) <u>DR </u>– Demand Response

14     D) <u>ICD</u> – Interface Control Document

15 **Note:** The DL (Delay Load), TLR (Temporary Load Reduction) and TLI (Temporary Load Increase) acronyms
16 have been removed as these terms have been superseded by Demand Response Types 1 – 3.

### 17 4.2 Definitions

18 The following definitions are applicable to Section 4 of this specification:
19

20     A) <u>Communication Link</u>: As shown in Figure 1, the mechanism for bi-directional data transfers between the
21        CPPS and one or more external applications, devices or systems.

22     B) <u>Connected Pool Pump System (CPPS)</u>: As shown in Figure 1, includes the ENERGY STAR certified
23        pool pump, integrated or separate communications hardware, and additional hardware and software
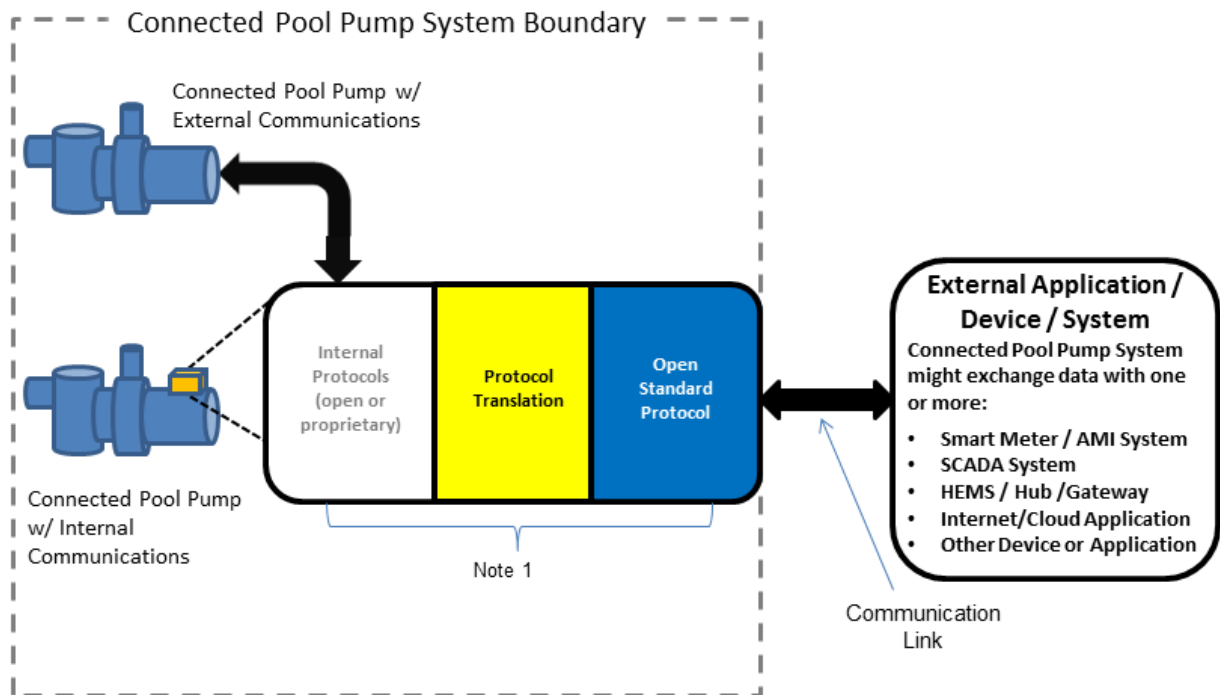24        required to enable connected functionality

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

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

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

D) Open Standards: Standards that are:

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

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

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

E) Premises: Land and the improvements on it.

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[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

## 4.3    Communications

A)  The CPPS Communication Link, noted in Figure 1, shall use Open Standards for all communication layers to enable functionalities listed in Table 1.

B)  An Interface Control Document (ICD), Application Programming Interface (API), or other documentation shall be made available to interested parties that at minimum, allows access to the functionalities listed in Table 1

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

| Functionalities |
| --- |
| Section 4.4 Energy Consumption Reporting |
| Section 4.6 Operational Status, User Settings, and Messages |
| Section 4.8 Demand Response |

**Notes:**

1.  A CPPS that enables economical and direct communications, that comply with Sections 4.3.A and 4.3.B, on the consumer's Premises is preferred; but alternative approaches, where the CPPS only complies with Sections 4.3.A and 4.3.B outside of the consumer's Premises, are also acceptable.

2.  A product that includes an embedded modular communications port that complies with Sections 4.3.A and 4.3.B need not be supplied with a compatible communications module.

## 4.4 Energy Consumption Reporting

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

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

**Note:** In response to stakeholder comments, Section 4.4 has been revised to clarify that reporting of either measured or estimated energy consumption is acceptable as is reporting either energy or real-time power draw. The reference to Section 4.2 has been corrected to 4.3.

EPA welcomes stakeholder comments on these revised criteria.

## 4.5 Remote Management

A) At minimum, the CPPS shall be capable of responding to consumer authorized signals received via a Communication Link requesting:

1. A start or stop to pumping, and

2. A change to Motor Speed and/or Rate of Flow.

B) The CPPS is not required to respond to remote requests that would compromise safety as determined by the manufacturer.

## 4.6 Operational Status, User Settings & Messages

A) At minimum, the CPPS shall be capable of providing the following information to consumers and Consumer Authorized Third Parties via a Communication Link:

1. Operational status including:

   a. On/Off/Standby, and

   b. Motor Speed, and/or Rate of Flow.

2. DR status including delay load and temporary load reduction

3. Program schedule including schedule times and scheduled operation

**Note:** In recognition that not all Pool Pumps are capable of reporting Rate of Flow, EPA has revised Section 4.6.1 criteria to allow reporting of Motor Speed and/or Rate of Flow.

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

1. On the product (e.g. Pool Pump and/or controller), and/or

2. Transmitted to consumers and Consumer Authorized Third Parties via a Communication Link.

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

## 4.7  Peak Period Avoidance

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

**Table 2: Peak Period Operation Requirements**

| Pump Type | Allowable Operation |
|---|---|
| Single-speed Pump | No pumping shall be performed |
| 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) 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.

## 4.8  Demand Response

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

   1. **Type 1 Response:**

      a. Upon receipt of a signal and in accordance with consumer settings, the CPPS shall respond in accordance with Table 3.

      b. The CPPS shall ship with default settings that enable a response in accordance with 4.8.A.1.a for at least 4 hours.

142      c. The CPPS shall be able to provide at least one Type 1 response in a rolling 24-hour period.

143      d. The CPPS is not required to respond if doing so would compromise safety as determined by
144      the manufacturer.

145      e. The consumer shall be able to modify, disable, or override the product's Type 1 response
146      without limitation.

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

| Pump Type | Allowable Operation | Latency[1] |
|---|---|---|
| Single-speed Pump | • No pumping shall be performed | ≤ 300 seconds |
| Multi-speed Pump | • If in off / Standby Mode, the Pool Pump shall remain in off / Standby Mode.<br>• If operating above the lowest available speed, the Pool Pump shall reduce operation to the lowest available speed or switch to off / Standby Mode. | ≤ 5 seconds |
| Variable-speed Pump / Variable-flow Pump | • 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.<br>• 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. | ≤ 5 seconds |

148    [1]Latency is the time interval between CPPS receipt of the Demand Response signal and initiation of the
149    allowable operation.

150      **2. Type 2 Response:**

151      a. Within 300 seconds of CPPS receipt of a Demand Response signal and in accordance
152      with consumer settings, the CPPS shall terminate pumping for the duration of the
153      requested response period.

154      b. The CPPS shall ship with default settings that enable a response in accordance with
155      4.8.A.2.a for a time period of least 20 minutes.

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

158      d. The CPPS is not required to respond if doing so would compromise safety as determined
159      by the manufacturer.

160      e. The consumer shall be able to modify, disable, or override the product's Type 2 response
161      without limitation.

162      **3. Type 3 Response:**

163      a. Within 5 seconds of CPPS receipt of a Demand Response signal and in accordance with
164      consumer settings, the CPPS; if idle, shall initiate pumping, and if active, shall increase
165      Motor Speed/Rate of Flow or extend pumping duration within the requested response
166      period.

167      b. This response shall be limited such that the CPPS terminates pumping when:

168      i. programmed daily pumping volume is reached *(CPPS with controls capable of*
169      *scheduling pumping operation based on total desired volume pumped),* or

170          ii. programmed daily pumping duration is reached *(all other CPPS)*.

171      No additional pumping shall occur prior to 12:00 AM the following day.

172        c. The CPPS is not required to respond if doing so would compromise safety as determined
173          by the manufacturer.

174        d. The consumer shall be able to modify, disable, or override the product's Type 3 response
175          without limitation.

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176 **Note:** A latency requirement of 300 seconds (5 minutes) has been added for responses that mandate termination
177 of pumping. This encompasses all of Type 2 as well as Type 1 responses for single-speed CPPS. The longer 5-
178 minute response time is consistent with the AS/NZS 4755.3.2 standard and is intended as a maximum limit that
179 enables structured shutdown of other controlled equipment such as chlorinators and heaters that may be
180 damaged if water flow is abruptly terminated. EPA encourages manufacturers to develop CPPS' that respond as
181 quickly as possible in order to maximize grid benefits. EPA has also added a latency requirement of ≤ 5 seconds
182 for Type 1 responses that do not terminate pumping and for all Type 3 responses.

183 EPA has revised Table 3 to clarify intent that in response to a Type 1 signal, the CPPS may only decrease
184 pumping speed/flow. That is, if the CPPS is off, it must remain off for the duration of the response, if it is pumping
185 at ≤ 1/3 of full-speed/flow it may further decrease pumping but may not increase speed/flow for the duration of the
186 response.

187 For each response type, EPA has clarified its intent that consumers be able to modify, disable or override the
188 products response without limitation.

189 For Type 3, EPA proposes to replace the criterion that required the CPPS to not exceed the expected daily
190 energy consumption nor decrease pumped volume as compared to scheduled pumping for that day because:

191 - Manufacturers commented that the additional controller capability would be needed and that no products today
192 have this capability; and

193 - Other stakeholders noted that the day-to-day energy consumption may change due to load variability (i.e.
194 weekdays vs. weekends).

195 In its place EPA proposes the CPPS must terminate a Type 3 response to prevent pumped volume and/or
196 pumping duration to exceed scheduled pumping for that day. In doing so, EPA expects manufacturers will be
197 better positioned to implement Type 3 response at a lower incremental cost and utilities will be able to extract
198 increased benefits from Type 3 responsiveness in order to, for example:

199 - Increase penetration of clean, night-time renewable sources such as wind; and

200 - Shift pumping to lower cost periods to relieve grid stress and provide consumer savings.

201 EPA welcomes stakeholder comments on these DR criteria.

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202 ## 4.9    Information to Installers and Consumers

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

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