ENERGY STAR® Program Requirements
Product Specification for
Pool Pumps

Test Method to Validate Demand Response
Draft 2
December-2014

1 OVERVIEW

The following test method shall be used for determining product compliance with requirements for Demand Response (DR) functionality in the ENERGY STAR Residential Pool Pumps Connected Functionality Criteria.

2 APPLICABILITY

This test method is applicable to Residential Pool Pumps designed to meet both the ENERGY STAR Residential Pool Pumps Eligibility Criteria Version 1.0 and the Connected Functionality Criteria.

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in both the ENERGY STAR Residential Pool Pumps Eligiblity Criteria Version 1.0 and the Connected Functionality Criteria.

   A) <u>Nominal Motor Speed</u>: The rated speed(s) in rotations per minute (RPM) for Single- and Multi-speed pumps, and the speed displayed on the pump controls for Variable-speed and Variable-flow pumps.

   B) <u>Utility Equivalent Communication Device</u>: Device capable of communicating with the connected pump and emulating all three signal types described in the Connected Functionality Criteria. It will be controlled by the technician during the conduct of this test procedure, allowing the technician to deliver the required signals.

   C) <u>Acronyms</u>:

      1) <u>CPPS</u>: Connected Pool Pump System

      2) <u>DR</u>: Demand Response

      3) <u>GPM</u>: Gallons Per Minute

      4) <u>RPM</u>: Rotations Per Minute

      5) <u>UECD</u>: Utility Equivalent Communication Device

      6) <u>UUT</u>: Unit Under Test

4 TEST SETUP

Unless otherwise specified, all test setup and condition requirements shall be identical to Sections 4 and 6.1 of the ENERGY STAR Program Requirements Test Method for Pool Pumps Version 1.0 (Rev. Jan-2013).

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4.1 Connected Pool Pump System (CPPS) Setup

The CPPS and Utility Equivalent Communication Device (UECD) shall be set up in accordance with manufacturer installation instructions.

  A) Connect the CPPS to the Utility Equivalent Communication Device via the applicable communication medium over which the Open Standards Communication method employed by CPPS is available.

  B) Ensure that the CPPS is properly connected and can both receive and send data to the Utility Equivalent Communication Device.

> **Note:** One stakeholder requested clarification regarding the type of network connection that should be used during testing and another proposed new language regarding the CPPS setup. DOE is aware that the network connection used to connect the CPPS to a utility will vary depending on the utility and the manufacturer of the CPPS. As such, DOE does not want to require a specific connection type and has updated the test language to indicate that the connection used for testing shall be the connection type supported by the CPPS, as long as complies with the Open Standards Communication requirements.

5   DEMAND RESPONSE VERIFICATION TESTS

The following testing shall be performed in the order of the sections, as written.

5.1 CPPS Initialization

  A) Turn on the pump, set it to its maximum speed or flow, and allow it to run for one hour.

  B) After one hour, measure and record nominal motor speed (in RPM) and the rate of flow (in gallons per minute (GPM)).

5.2 Type 1 Signal Test

  A) For CPPS with Single-speed Pumps:

    1) Initiate a 30-minute Type 1 Signal.

    2) Verify that the CPPS responds to the signal by ceasing all pumping, after receipt of the Type 1 Signal, for the duration of the 30-minute signal period.

       a) The rate of flow measured at any point during the signal period after the pump ceases pumping shall be less than 2.0 GPM.

  B) For CPPS with Multi-speed Pumps:

    1) Initiate a 30-minute Type 1 Signal.

    2) Verify that the CPPS responds to the signal by reducing its speed to the lowest available speed, as specified by the manufacturer, and remains at this speed for the duration of the 30-minute signal period.

    3) After completion of the signal period, place the CPPS in off/Standby Mode.

    4) Program the CPPS to schedule a 1-hour pumping operation at maximum speed/flow set to begin 10 minutes after completion of the previous signal period.

    5) Initiate a 30-minute Type 1 Signal.

    6) Verify that the CPPS remains in the off/Standby Mode for the duration of the 30-minute period.

| 70 | | | a) | The rate of flow measured at any point during the signal period after the pump ceases |
| 71 | | | | pumping shall be less than 2.0 GPM. |

72   C) <u>For CPPS with Variable-speed/flow Pumps:</u>

73   1) Initiate a 30-minute Type 1 Signal.

74   2) Verify the CPPS responds to the signal by reducing its speed or flow, for Variable-speed or
75   Variable-flow pumps respectively, to a speed or flow less than 1/3 that measured in Section
76   5.1.B), for the duration of the 30-minute signal period.

77   3) After completion of the signal period, reduce the CPPS speed or flow, for Variable-speed or
78   Variable-flow pumps respectively, to less than 1/3 that measured in Section 5.1.B).

79   4) Program the CPPS controls to schedule a 1-hour pumping operation at maximum speed/flow
80   set to begin 10 minutes after completion of the previous signal period.

81   a) For CPPS with controls that require a specific pumped volume, use the rate of flow
82   measured in Section 5.1.B) to calculate the necessary pumped volume for a 1-hour
83   pumping operation at maximum flow.

84   5) Initiate a 30-minute Type 1 Signal.

85   6) Verify that the CPPS does not increase speed or flow, for Variable-speed or Variable-flow
86   pumps respectively, for the duration of the 30-minute signal period.

87   **5.3 Type 2 Signal Test**

88   A) Clear the CPPS controls of all scheduled pumping operations, set the CPPS to maximum
89   speed/flow, and allow it to run for at least 10 minutes after completion of the previous signal
90   period.

91   B) Initiate a 20-minute Type 2 Signal.

92   C) Verify that the CPPS ceases all pumping after receipt of the Type 2 Signal and does not pump for
93   the duration of the 20-minute signal period.

94   1) The rate of flow measured at any point during the 20-minute signal period shall be less than
95   2.0 GPM.

96   D) Repeat steps A-C of Section 5.3 two more times, to verify compliance with the Type 2 Signal
97   requirements.

98   **5.4 Type 3 Signal Test**

99   A) <u>All CPPS – perform test 1) or 2), as applicable:</u>

100   1) <u>For CPPS with controls capable of scheduling pumping operation based on total desired</u>
101   <u>volume pumped:</u>

102   a) Program the CPPS such that it would:

103   i. Start scheduled daily pumping activities *after* initiation of the Type 3 signal in Step
104   5.4.A)1)b), and

105   ii. Deliver a specific daily pumped volume.
106   Note: configuring the CPPS to minimize programed pumping will speed testing

107   b) Initiate a Type 3 Signal with a duration that requires a pumping duration that significantly
108   exceeds that required to deliver the specific daily pumped volume.

109   c) Verify that the CPPS turns on and begins pumping.

110   i. Measure and record the rate of flow (in GPM) and time elapsed (in minutes) for the
111   duration of pumping operation.

112 113			d)	Verify that the CPPS ceases all pumping operations after the programmed daily pumping volume, ± 5%, is reached.
114 115				i. Actual pumped volume shall be calculated as the average rate of flow measured during pumping operation multiplied by the time elapsed.
116		2)	All other CPPS	
117			a)	Program the CPPS such that it would:
118 119				i. Start the scheduled pumping operation *one hour after* completion of the Type 2 Signal Test, and
120				ii. Deliver a 30-minute pumping operation.
121			b)	Set the CPPS to the off/Standby Mode and allow the CPPS to cool down for 10 minutes.
122			c)	Initiate a 1-hour Type 3 signal.
123 124			d)	Verify that the CPPS turns on, begins pumping but ceases all pumping operations after 30 minutes, ± 1 minute.
125	B)	For CPPS with Multi-speed, Variable-speed, and Variable-flow Pumps:		
126 127		1)	Program the CPPS to initiate pumping at a speed that is less than the maximum speed/flow and for a duration that exceeds 1-hour.	
128		2)	After the start of pumping, allow the CPPS to run for at least 10 minutes.	
129		3)	Measure and record the nominal motor speed (in RPM) and the rate of flow (in GPM).	
130		4)	Initiate a 30-minute Type 3 Signal.	
131 132		5)	Verify that the CPPS increases its nominal motor speed and rate of flow for the duration of the 30-minute signal period.	

6 REFERENCES

134   A) ENERGY STAR Program Requirements Test Method for Pool Pumps Version 1.0 (Rev. Jan-2013).