

**Appliance Standards and Rulemaking Federal Advisory Committee**  
*Circulator Pumps Working Group*  
Term Sheet – Energy Conservation Standards  
November 30, 2016

**Background**

On February 3, 2016, DOE issued a Notice of Intent to Establish the Circulator Pumps Working Group to Negotiate a Notice of Proposed Rulemaking (NOPR) for Energy Conservation Standards for Circulator Pumps. 81 FR 5658. This working group is established under the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) in accordance with the Federal Advisory Committee Act (FACA) and the Negotiated Rulemaking Act (NRA). The purpose of the working group was to discuss available industry data and, if possible, reach consensus on scope of circulator pumps in question and potential test procedure or metric.

The working group consisted of 15 members, including one member from ASRAC and one DOE representative (see Appendix A). After 7 sets of meetings, the working group successfully reached consensus on the scope, metric, and test procedure and finalized those recommendations in a preliminary term sheet, which the Working Group approved on September 7, 2016.<sup>1</sup> (Docket No. EERE-2016-BT-STD-0004, No. 58).

On October 18, 2016, ASRAC reauthorized the Working Group to continue deliberations through the end of December 2016 to negotiate federal standards. The Working Group met two more times: November 3-4 and November 29-30, 2016. This term sheet contains recommendations regarding energy conservation standards, definition, metric, labeling, and certification requirements for circulator pumps discussed during the second phase of negotiations.

**Energy Conservation Standards**

**Recommendation #1.** Each circulator pump shall be required to meet the applicable minimum energy efficiency standards ( $PEI_{CIRC}$ ) set forth in the following table on and after [INSERT DATE 4 YEARS FOLLOWING PUBLICATION OF THE FINAL RULE]:

<b>Equipment Class</b>	<b>Efficiency Level</b>	<b>Maximum <math>PEI_{CIRC}</math></b>
Circulator pumps	2	1.00

Efficiency level 2 is described by the method to calculate  $PER_{CIRC,STD}$  described in Recommendation #2.

**Vote results:** Consensus<sup>2</sup> (No thumbs down) on 11/30/2016

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<sup>1</sup> The September 2016 Circulators Term Sheet was approved by consensus (1 ‘no’ vote).

<sup>2</sup> There are 15 members of the working group. Consensus has been defined as no more than 2 negative votes.

## Test Procedure and Metric

### **Recommendation #2A.**

To determine the Pump Energy Index ( $PEI_{CIRC}$ ) as defined in the preliminary term sheet,<sup>3</sup> the Pump Energy Rating for a minimally compliant circulator pump ( $PER_{CIRC,STD}$ ) should be determined as follows:

$$PER_{CIRC,STD} = \sum_i \omega_i P_i^{in,STD}$$

Where:

- $\omega_i$  = weight at each test point  $i$ , specified in Recommendation #2B
- $P_i^{in,STD}$  = power input to the driver at test point  $i$ , calculated using the equations and method specified in Recommendation #2C
- $i$  = test point(s), defined as 25%, 50%, 75%, and 100% of the flow at best efficiency point (BEP)

**Vote results:** Consensus (No thumbs down) on 11/30/2016

### **Recommendation #2B:**

The weighting factors ( $\omega_i$ ) at each test point  $i$  used to determine  $PER_{CIRC,STD}$  should be:

Equipment Class	$\omega_i$ at Test Point $i$ (% BEP Q)			
	25	50	75	100
Circulator pumps	0.25	0.25	0.25	0.25

**Vote results:** Consensus (No thumbs down) on 11/30/2016.

### **Recommendation #2C:**

The reference input power  $P_i^{in,STD}$  at each test point  $i$  used to determine  $PER_{CIRC,STD}$  should be calculated using the following equation:

$$P_i^{in,STD} = \frac{P_{u,i}}{\alpha_i \times \frac{\eta_{WTW,100\%}}{100}}$$

<sup>3</sup> See Docket No. EERE-2016-BT-STD-0004, No. 58

Where:

- $P_{u,i}$  = tested hydraulic power output of the pump being rated at test point  $i$ , in HP
- $\eta_{WTW,100\%}$  = reference BEP pump efficiency at the recommended standard level (%), calculated using the equations and values specified in Recommendation #2D
- $\alpha_i$  = part load efficiency factor at each test point  $i$ , specified in Recommendation #2E
- $i$  = test point(s), defined as 25%, 50%, 75%, and 100% of the flow at best efficiency point (BEP)

**Vote results:** Consensus (No thumbs down) on 11/30/2016.

**Recommendation #2D**

For circulator pumps with BEP hydraulic output power  $P_{u,100\%} < 1$  HP, the reference efficiency at BEP ( $\eta_{WTW,100\%}$ ) should be determined using the following equation:

$$\eta_{WTW,100\%} [\%] = A \ln(P_{u,100\%} + B) + C$$

This equation should produce a  $\eta_{WTW,100\%}$  value of 0% at  $P_{u,i} = 0$  HP. The constants A, B, and C should be equal to the following:

Equipment Class	A	B	C
Circulator pumps	10.00	0.001141	67.78

For circulator pumps with BEP hydraulic output power  $P_{u,100\%} \geq 1$  HP, the reference efficiency at BEP ( $\eta_{WTW,100\%}$ ) should be equal to the following constant value:

Equipment Class	$\eta_{WTW,100\%}$
Circulator pumps	67.79

**Vote results:** Consensus (No thumbs down) on 11/30/2016.

**Recommendation #2E:**

The part-load efficiency factor ( $\alpha_i$ ) at each test point  $i$  should be equal to the following:

Equipment Class	$\alpha_i$ at Test Point $i$ (% BEP Q)		
	25	50	75
Circulator pumps	0.4843	0.7736	0.9417

**Vote results:** Consensus (No thumbs down) on 11/30/2016

## **Labeling Requirements**

**Recommendation #3.** Model Number and PEI would be required to be included on the circulator nameplate.

**Vote results:** Consensus (No thumbs down) on 11/30/2016

## **Certification Reporting Requirements**

**Recommendation #4.** The following information should be included in certification reports and the public CCMS database:

- Manufacturer name
- Model number
- PEI<sub>CIRC</sub>
- Flow (in GPM) and Head (in ft) at BEP
- Tested control setting
- Input power at measured data points
- True RMS current, true RMS voltage, real power, and the resultant power factor at measured data points (voluntary for manufacturers to report)

**Vote results:** Consensus (No thumbs down) on 11/30/2016

## **Additional Items**

**Recommendation #5.** The Working Group recommends that DOE make its best effort to publish both the test procedure and energy conservation standard final rules for circulator pumps no later than the end of calendar year 2017.

**Vote results:** Consensus (No thumbs down) on 11/30/2016

**Statement of Support #1.** All parties in the Working Group are fully committed to the term sheets for the test procedure and the energy conservation standard level for circulator pumps as negotiated until the Final Rules become effective.

**Vote results:** Consensus (No thumbs down) on 11/30/2016

**Non-Binding Recommendation #1.** The following definition should be incorporated as necessary by DOE:

**On-demand circulator pump** means a circulator pump that is distributed in commerce with an integral control that:

- Initiates water circulator based on receiving a signal from the action of a user [of a fixture or appliance] or sensing the presence of a user of a fixture and cannot initiate water circulation based on other inputs, such as water temperature or a pre-set schedule.
- Automatically terminates water circulation once hot water has reached the pump or desired fixture.
- Does not allow the pump to operate when the temperature in the pipe exceeds 104 °F or for more than 5 minutes continuously.

The pump must not be capable of operating without the control without physically-destructive modification of the unit, such as any modification that would violate the product's standards listing.

**Vote results:** Consensus (No thumbs down) on 11/30/2016.

*This term sheet has been approved by the ASRAC Circulator Pumps Working Group by consensus (0 'no' votes) on 11/30/2016.*

## Appendix A—Members

### U.S. Department of Energy—ASRAC Circulator Pumps Negotiated Rulemaking Working Group

<b>Name</b>	<b>Affiliation</b>	<b>Alternate</b>
Charles White	Plumbing-Heating-Cooling Contractors National Association	Mark Riso
Gabor Lechner	Armstrong Pumps, Inc.	Brent Ross
Gary Fernstrom	California Investor Owned Utilities	David Jagger
Joanna Mauer	Appliance Standards Awareness Project	Andrew deLaski
Joe Hagerman	U.S. Department of Energy	Ashley Armstrong
Laura Petrillo-Groh	Air-Conditioning, Heating, and Refrigeration Institute	Frank Stanonik
Lauren Urbanek	Natural Resources Defense Council	Rachel Fakhry
Mark Chaffee	Taco, Inc.	Steve Thompson
Mark Handzel	Xylem Inc.	Jack Kang
Peter Gaydon	Hydraulic Institute	Michael Michaud
Richard Gussert	Grundfos Americas Corporation	Kirk Vigil
Richard Miller	Wilo USA	David Bortolon
Russell Pate	Rheem Manufacturing Company	Karen Meyers or Robert Glass
Don Lanser	Nidec Motor Corporation	John Filla
Tom Eckman	Northwest Power and Conservation Council (ASRAC member)	N/A