ASSOCIATION OF HOME APPLIANCE MANUFACTURERS

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July 22, 2020

Via E-mail

Mr. Daniel Simmons
Department of Energy
Assistant Secretary for Energy Efficiency and Renewable Energy
Energy Efficiency and Renewable Energy
1000 Independence Avenue, SW
Washington, DC 20585-0121

Dishwashers2018STD0005@ee.doe.gov

Re: AHAM Supplemental Comments on DOE's Proposal to Grant Petition for Rulemaking on Dishwasher Product Classes; Docket No. EERE-2018-BT-STD-0005; RIN 1904-AE35

Dear Assistant Secretary Simmons:

The Association of Home Appliance Manufacturers (AHAM) respectfully submits the following supplemental comments on the Department of Energy's (DOE) proposed rule issued in response to its granting the petition regarding dishwashers from the Competitive Enterprise Institute (CEI) (Dishwasher Petition) filed on March 21, 2018; Docket No. EERE-2018-BT-STD-0005; RIN 1904-AE35; 84 Fed. Reg. 33869 (July 16, 2019) (Proposed Rule). Given that these comments respond to data DOE recently posted on the docket in this rulemaking, AHAM respectfully requests that DOE include these comments on the docket for this rulemaking and consider them in its decision-making. We recognize that DOE has already sent the final rule on this matter to the Office of Information and Regulatory Affairs (OIRA) and, thus, we will also meet with OIRA to discuss this data.

AHAM represents manufacturers of major, portable and floor care home appliances, and suppliers to the industry. AHAM's more than 150 members employ hundreds of thousands of people in the U.S. and produce more than 95% of the household appliances shipped for sale within the U.S. The factory shipment value of these products is more than $50 billion annually. The home appliance industry, through its products and innovation, is essential to U.S. consumer lifestyle, health, safety and convenience. Through its technology, employees and productivity, the industry contributes nearly $200 billion annually to the economic security of the United States. Home appliances also are a success story in terms of energy efficiency and environmental protection. New appliances often represent the most effective choice a consumer can make to reduce home energy use and costs.

AHAM supports DOE in its efforts to ensure a national marketplace through the Appliance Standards Program, which, when done correctly, prevents a patchwork of state standards and reduces manufacturing and consumer costs. We appreciate the sentiment behind the dishwasher Petition and

DOE's Proposed Rule. However, we do not support changing the product classes for residential dishwashers to include a new stand-alone product class for dishwashers defined principally by cycle times. In addition, we do not believe it is justified under 42 U.S.C. § 6295(1) or other provisions of the Energy Policy and Conservation Act or other law.

**Consumers already have access to shorter cycles when they need them**. We previously commented that a new product class for dishwashers with normal cycles of one hour or less and less stringent standards, at this time, will cause stranded investments and additional costs for manufacturers and, ultimately, consumers. The test data DOE recently posted on the docket also demonstrate that DOE's proposed rule would likely impair wash performance. Most consumer comments on the docket in this rulemaking indicate that performance is their priority, and so DOE should acknowledge this concern rather than proceed with a final rule. DOE should issue a final rule declining to adopt a new product class for residential dishwashers principally defined by the length of the normal cycle.

Importantly, the critical consumer welfare and policy issue CEI raised in its petition and DOE raises in its proposed rule is of enormous significance for future, possible DOE dishwasher energy conservation standards rulemakings (and the pending EPA proposal to increase the stringency of the ENERGY STAR criteria for residential dishwashers). In fact, AHAM raised the problems caused by lengthening cycle times for the normal cycle as a concern in our comments on the previous dishwasher rulemaking and in the pending ENERGY STAR revision process.[1] But, at present, and thankfully for consumers, manufacturers are still able to provide the desired utility of a shorter cycle option under existing product classes and standards. Further regulation is not necessary (and the ENERGY STAR program can claim success and sunset the specification for residential dishwashers in order to avoid degrading performance and unacceptably lengthening cycle times).

DOE posted data on the docket in this rulemaking in the spring, but did not publish a Notice of Data Availability or seek comment.[2] DOE appears to have tested 31 dishwashers to examine cycle length and cleaning performance using the ENERGY STAR cleaning performance test, which is based on AHAM DW-1-(2010). Table A summarizes DOE's data and DOE's full data is included at Exhibit A for reference.

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[1] *See* AHAM Comments on DOE's NOPR for Energy Conservation Standards for Residential Dishwashers; Docket No. EERE-2014-BT-STD-0021; RIN 1904-AD24 (March 25, 2015) ("The dishwasher is a holistic system—changes in one area impact other areas. The washing process, and ultimately, was performance, is a function of washing temperatures, length of washing cycles, types and amounts of detergent applied, and mechanics. As each of these factors changes, the other elements must compensate for the change or wash performance will suffer. For example, if washing temperatures and mechanics are decreased to meet stringent energy conservation standards, the length of the washing cycle will have to increase in order for performance to be maintained. And, as DOE's levels become more and more stringent, cycle length will reach a level unacceptable to consumers. It is likely that DOE's proposed levels will have that effect."); AHAM Comments on ENERGY STAR Program Requirements, Product Specification for Residential Dishwashers, Eligibility Criteria, Draft 1, Version 7.0 (May 18, 2020) (proposing EPA and DOE sunset the ENERGY STAR specification for residential dishwashers and stating that "[a]s AHAM has previously demonstrated, there are cleaning performance concerns at levels beyond the current ENERGY STAR Version 6.0 levels. Additionally, at levels beyond ENERGY STAR Version 6.0 levels, there would likely also be performance impacts beyond cleaning performance, such as increases in cycle time, decreases in drying performance, and increases in noise level.").

[2] https://www.regulations.gov/document?D=EERE-2018-BT-STD-0005-3213

**Table A: Summary of DOE Test Data**

| Under Current Manufacturer Product Settings | Duration (min) | Per-Cycle Cleaning Index | Estimated Annual Energy Use (kWh/year) | Water Consumption (gal/cycle) |
|---|---|---|---|---|
| Normal Cycle | 129.9 | 77.4 | 256.2 | 2.9 |
| Quick Cycle (greater than 1 hour, average) | 79.1 | 82.0 | 292.0 | 4.8 |
| Quick Cycle (less than 1 hour only) | 48.4 | 69.9 | 238.6 | 3.3 |

The proposed 60 minutes or less cycle showed the poorest cleaning index. This performance level will frustrate consumers and not advance EPCA's policy goals. DOE's data do not support the creation of a new product class for dishwashers with normal cycles under an hour. Instead, they support AHAM's position **that shorter dishwasher cycles are already available to consumers that clean dishes in significantly less time than the normal cycle with good cleaning performance**. Specifically, as detailed in Table B and Figure 1, DOE's data show:

- As shown in Table A, the products in DOE's sample with the quickest cycles, i.e., those with quick cycles under one hour, have the lowest total per-cycle cleaning indices. Notably, however, as shown in Table B below, those products perform much better on lighter soil levels than on heavy soil levels which may mean that those short cycles are designed for lightly soiled dishes. Thus, for the consumer, they are performing as intended—to clean a load of *lightly* soiled dishes. But, a product class with a requirement to have a normal cycle with a cycle length under one hour may not be able to adequately clean a full load of *normally* soiled dishes. For consumers that have a light load and want it done quickly, however, that option will meet their needs.

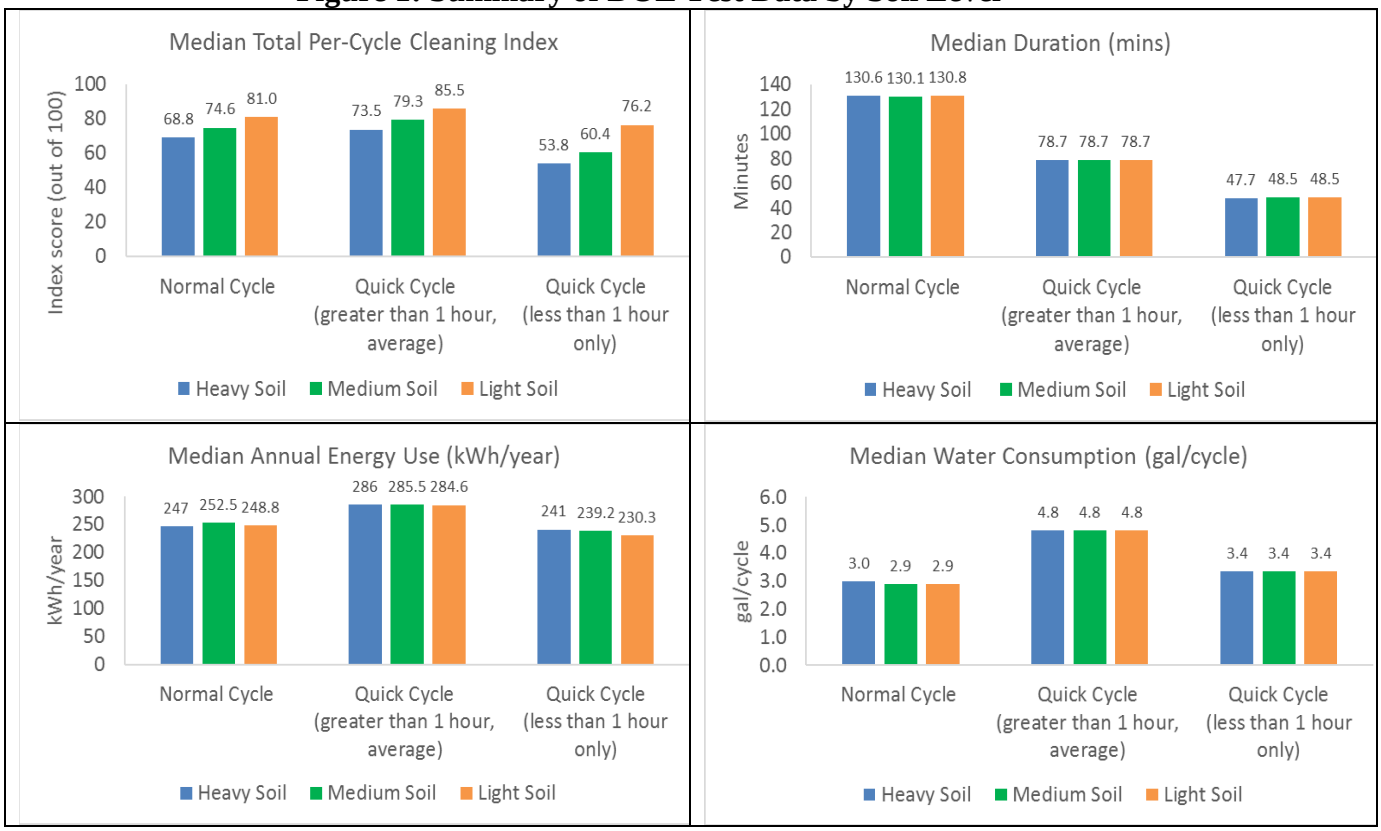
- The products in DOE's sample with short cycles slightly over one hour performed well both with heavy and light soil levels. This supports AHAM's comment that current dishwasher designs on the market offer consumers shorter cycles that perform well on normally soiled loads and can be used when a shorter cycle is appropriate. This also discredits CEI's arguments that short cycles are designed only for lightly soiled dishes rather than normally soiled loads. DOE need not step in with regulation to ensure consumers have access to shorter cycles.

- Notably, for all the units in DOE's test sample, though the quick cycle (slightly over one hour) used the most energy and water, all cycles—normal, quick, and quickest (under one hour)—met the current energy conservation standard. This supports AHAM's argument that **manufacturers are presently able to accommodate both consumer desires—the benefits of energy and water efficiency as well as access to a faster product cycle when needed—under existing energy conservation standards.**

**Table B: Summary of DOE Test Data by Soil Level**

| | Median Duration (min) | | | Median Total Per Cycle Cleaning Index | | | Median Estimated Annual Energy Use (kWh/year) | | | Median Water Consumption (gal/cycle) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Manufacturer Product Cycle Settings** | **Heavy Soil** | **Medium Soil** | **Light Soil** | **Heavy Soil** | **Medium Soil** | **Light Soil** | **Heavy Soil** | **Medium Soil** | **Light Soil** | **Heavy Soil** | **Medium Soil** | **Light Soil** |
| Normal Cycle | 130.6 | 130.1 | 130.8 | 68.8 | 74.6 | 81.0 | 246.7 | 252.5 | 248.8 | 3.0 | 2.9 | 2.9 |
| Quick Cycle (greater than 1 hour) | 78.7 | 78.7 | 78.7 | 73.5 | 79.3 | 85.5 | 285.6 | 285.5 | 284.6 | 4.8 | 4.8 | 4.8 |
| Quick Cycle *(less than 1 hour only)* | 47.7 | 48.5 | 48.5 | 53.8 | 60.4 | 76.2 | 241.0 | 239.2 | 230.3 | 3.4 | 3.4 | 3.4 |

**Figure 1: Summary of DOE Test Data by Soil Level**



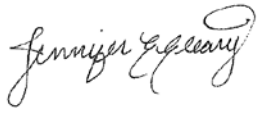

As we commented initially, AHAM wishes to reiterate that shorter cycle times are significant utilities and features that must be protected. Consumers care if their dishwasher runs for a long time and energy conservation standards (and ENERGY STAR specifications) should not unacceptably lengthen cycle times. But, at this time, energy and water efficiency need not be sacrificed to achieve an arbitrary cycle time. The normal cycle's duration is a key consideration for future rulemakings that could, if pushed too far, unacceptably extend the normal cycle.

Based on DOE's test data in addition to the other available data and information AHAM presented in our comments on DOE's proposed rule, the proposal to create a new product class defined primarily by

normal cycle length would provide no real-world benefit to consumers and would impair wash performance. Accordingly, AHAM continues to oppose DOE's proposal to create a new product class for dishwashers with normal cycles under one hour and urges DOE to issue a final rule declining to adopt a product class defined principally by the normal cycle's length.

AHAM appreciates the opportunity to submit these comments on DOE's Proposed Rule and would be glad to discuss these matters in more detail should you so request.

Respectfully Submitted,



Jennifer Cleary
Vice President, Regulatory Affairs

# Exhibit A

| UUT | Brand Identifier | Inlet Water Temperature | Annual Combined Low-power Mode Energy Consumption, $E_{TLP}$ | Normal Cycle | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Heavy Soil | | | | | | | Medium Soil | | | | | | | Light Soil | | | | | | | Weighted Average | | |
| | | | | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Estimated Annual Energy Use (kWh/year) | Water Consumption (gal/cycle) | Duration (min) |
| A | Brand 13 | 120 | 2.7 | 717.2 | 477.1 | 146.9 | 1120.9 | 2.8 | 137.1 | 72.3 | 715.7 | 475.7 | 147.0 | 1117.9 | 2.8 | 136.7 | 75.4 | 710.8 | 474.7 | 147.1 | 1111.9 | 2.8 | 136.4 | 84.0 | 242.3 | 2.8 | 136.5 |
| B | Brand 3 | 120 | 0.7 | 581.6 | 415.0 | 0.0 | 996.6 | 2.5 | 112.3 | 0.0 | 581.1 | 374.6 | 0.0 | 955.7 | 2.2 | 110.5 | 4.0 | 588.0 | 367.9 | 0.0 | 956.0 | 2.2 | 109.7 | 29.0 | 206.6 | 2.2 | 110.1 |
| C | Brand 6 | 120 | 5.5 | 661.6 | 535.9 | 127.6 | 1133.7 | 3.2 | 153.6 | 60.2 | 704.2 | 535.9 | 127.6 | 1176.3 | 3.2 | 156.8 | 64.8 | 723.0 | 544.3 | 127.6 | 1203.5 | 3.2 | 158.1 | 83.2 | 261.6 | 3.2 | 157.4 |
| D | Brand 5 | 120 | 7.4 | 710.2 | 571.2 | 67.8 | 1247.5 | 3.4 | 85.8 | 43.4 | 696.0 | 569.5 | 67.8 | 1231.7 | 3.4 | 84.8 | 53.7 | 704.6 | 569.5 | 67.8 | 1240.3 | 3.4 | 85.4 | 75.3 | 273.5 | 3.4 | 85.2 |
| E | Brand 12 | 120 | 3.5 | 563.1 | 425.9 | 0.0 | 989.0 | 2.5 | 111.5 | 48.0 | 570.5 | 386.5 | 0.0 | 957.1 | 2.3 | 117.0 | 56.8 | 579.4 | 390.2 | 0.0 | 969.5 | 2.3 | 117.1 | 71.1 | 211.2 | 2.3 | 116.8 |
| F | Brand 5 | 120 | 2.5 | 813.5 | 564.5 | 0.0 | 1377.9 | 3.4 | 155.8 | 46.8 | 852.9 | 581.3 | 0.0 | 1434.2 | 3.5 | 158.5 | 63.6 | 803.7 | 519.0 | 0.0 | 1322.7 | 3.1 | 155.3 | 73.8 | 295.4 | 3.2 | 156.4 |
| G | Brand 13 | 120 | 2.5 | 693.7 | 524.8 | 146.3 | 1145.3 | 3.1 | 136.7 | 67.2 | 737.4 | 531.2 | 146.4 | 1195.4 | 3.2 | 139.4 | 68.4 | 728.1 | 526.1 | 146.6 | 1180.9 | 3.1 | 138.7 | 79.9 | 257.1 | 3.1 | 138.8 |
| H | Brand 7 | 120 | 4.5 | 810.1 | 446.9 | 167.6 | 1173.2 | 2.7 | 159.6 | 58.6 | 807.2 | 453.6 | 167.6 | 1177.0 | 2.7 | 159.0 | 58.2 | 803.0 | 441.8 | 167.9 | 1160.9 | 2.6 | 158.6 | 78.9 | 255.4 | 2.7 | 158.8 |
| I | Brand 8 | 120 | 4.2 | 806.0 | 426.7 | 197.2 | 1134.2 | 2.5 | 122.7 | 85.8 | 810.3 | 430.1 | 197.1 | 1141.9 | 2.6 | 119.5 | 89.6 | 823.0 | 426.7 | 198.9 | 1150.3 | 2.5 | 123.9 | 89.4 | 250.8 | 2.5 | 122.4 |
| J | Brand 9 | 120 | 45.6 | 867.2 | 861.8 | 0.0 | 1729.0 | 5.1 | 211.1 | 88.0 | 728.3 | 403.2 | 0.0 | 1131.5 | 2.4 | 208.4 | 61.6 | 718.9 | 408.2 | 0.0 | 1127.1 | 2.4 | 208.7 | 81.0 | 294.7 | 2.6 | 208.7 |
| K | Brand 11 | 50 | 1.3 | 886.1 | 0.0 | 0.0 | 886.1 | 2.9 | 144.0 | 50.3 | 893.2 | 0.0 | 0.0 | 893.2 | 2.9 | 144.4 | 69.9 | 889.7 | 0.0 | 0.0 | 889.7 | 2.9 | 143.9 | 75.3 | 192.8 | 2.9 | 144.0 |
| L | Brand 8 | 120 | 5.9 | 781.9 | 445.2 | 168.4 | 1142.9 | 2.7 | 169.3 | 70.9 | 780.4 | 445.2 | 168.1 | 1141.5 | 2.7 | 169.1 | 80.3 | 774.8 | 441.8 | 168.1 | 1132.6 | 2.6 | 168.9 | 85.0 | 250.2 | 2.6 | 169.0 |
| M | Brand 10 | 120 | 3.3 | 692.8 | 495.6 | 117.2 | 1129.8 | 3.0 | 119.3 | 78.6 | 682.0 | 499.0 | 117.2 | 1122.4 | 3.0 | 118.8 | 80.2 | 686.3 | 507.4 | 117.0 | 1135.2 | 3.0 | 118.4 | 83.2 | 246.4 | 3.0 | 118.6 |
| N | Brand 3 | 120 | 0.5 | 724.7 | 539.3 | 0.0 | 1263.9 | 3.2 | 136.4 | 68.8 | 700.8 | 534.2 | 0.0 | 1235.1 | 3.2 | 135.1 | 75.9 | 718.0 | 534.2 | 0.0 | 1252.2 | 3.2 | 135.9 | 83.2 | 268.6 | 3.2 | 135.7 |
| O | Brand 6 | 120 | 5.9 | 477.8 | 682.1 | 120.5 | 1099.7 | 4.1 | 97.6 | 74.2 | 477.2 | 672.0 | 120.3 | 1089.0 | 4.0 | 97.6 | 76.6 | 478.2 | 682.1 | 120.5 | 1100.0 | 4.1 | 97.6 | 76.2 | 241.6 | 4.0 | 97.6 |
| P | Brand 11 | 120 | 11.7 | 608.0 | 552.7 | 0.0 | 1160.7 | 3.3 | 125.2 | 73.8 | 638.0 | 551.0 | 0.0 | 1189.0 | 3.3 | 125.6 | 75.0 | 603.7 | 549.4 | 0.0 | 1153.1 | 3.3 | 125.6 | 80.7 | 262.2 | 3.3 | 125.6 |
| Q | Brand 3 | 120 | 0.9 | 759.2 | 388.1 | 0.0 | 1147.3 | 2.3 | 129.1 | 52.4 | 750.9 | 394.8 | 0.0 | 1145.7 | 2.4 | 129.8 | 33.1 | 712.9 | 388.1 | 0.0 | 1101.0 | 2.3 | 129.0 | 67.2 | 241.3 | 2.3 | 129.3 |
| R | Brand 4 | 50 | 7.4 | 964.1 | 0.0 | 0.0 | 964.1 | 3.8 | 135.3 | 84.2 | 954.2 | 0.0 | 0.0 | 954.2 | 3.8 | 134.5 | 82.0 | 948.4 | 0.0 | 0.0 | 948.4 | 3.8 | 134.5 | 86.0 | 211.9 | 3.8 | 134.5 |
| S | Brand 9 | 120 | 45.6 | 857.4 | 863.5 | 0.0 | 1720.9 | 5.1 | 148.1 | 83.9 | 769.7 | 404.9 | 0.0 | 1174.6 | 2.4 | 149.9 | 67.2 | 771.2 | 408.2 | 0.0 | 1179.5 | 2.4 | 150.2 | 73.1 | 304.7 | 2.6 | 150.0 |
| T | Brand 11 | 50 | 0.8 | 1035.7 | 0.0 | 0.0 | 1035.7 | 3.0 | 130.6 | 68.0 | 1036.8 | 0.0 | 0.0 | 1036.8 | 2.9 | 130.1 | 77.5 | 1040.3 | 0.0 | 0.0 | 1040.3 | 2.9 | 130.8 | 81.5 | 224.2 | 2.9 | 130.6 |
| U | Brand 2 | 120 | 2.5 | 819.4 | 422.2 | 0.0 | 1241.6 | 2.5 | 125.3 | 35.0 | 798.9 | 420.1 | 0.0 | 1219.0 | 2.5 | 124.2 | 62.8 | 782.9 | 423.6 | 0.0 | 1206.6 | 2.5 | 123.2 | 71.5 | 263.2 | 2.5 | 123.6 |
| V | Brand 12 | 120 | 1.7 | 623.0 | 456.0 | 0.0 | 1079.0 | 2.7 | 104.2 | 54.3 | 603.1 | 456.6 | 0.0 | 1059.7 | 2.7 | 102.7 | 70.1 | 604.8 | 475.6 | 0.0 | 1080.3 | 2.8 | 94.7 | 83.0 | 232.5 | 2.8 | 97.8 |
| W | Brand 6 | 120 | 11.0 | 1034.0 | 555.2 | 0.0 | 1589.1 | 3.3 | 161.0 | 69.8 | 1021.2 | 556.2 | 0.0 | 1577.4 | 3.3 | 163.0 | 74.6 | 1028.7 | 554.2 | 0.0 | 1582.9 | 3.3 | 160.4 | 81.5 | 351.0 | 3.3 | 161.3 |
| X | Brand 13 | 120 | 2.6 | 805.4 | 483.4 | 150.4 | 1213.6 | 2.9 | 129.0 | 74.3 | 744.9 | 742.6 | 150.4 | 1412.3 | 4.4 | 123.1 | 84.2 | 757.3 | 735.3 | 150.7 | 1417.3 | 4.4 | 123.7 | 87.4 | 304.8 | 4.3 | 123.8 |
| Y | Brand 12 | 120 | 6.8 | 701.9 | 477.7 | 0.0 | 1179.6 | 2.8 | 114.8 | 69.1 | 696.2 | 479.6 | 0.0 | 1175.8 | 2.9 | 114.5 | 81.4 | 695.5 | 479.0 | 0.0 | 1174.5 | 2.9 | 113.9 | 84.0 | 259.4 | 2.9 | 114.1 |
| Z | Brand 1 | 50 | 2.5 | 805.3 | 0.0 | 0.0 | 805.3 | 3.0 | 135.8 | 71.4 | 865.2 | 0.0 | 0.0 | 865.2 | 3.0 | 138.9 | 75.3 | 852.3 | 0.0 | 0.0 | 852.3 | 3.0 | 138.2 | 81.0 | 186.2 | 3.0 | 138.3 |
| AA | Brand 6 | 120 | 1.6 | 676.2 | 805.1 | 233.5 | 1364.6 | 4.8 | 116.4 | 77.1 | 672.3 | 816.4 | 232.9 | 1372.3 | 4.9 | 116.2 | 82.4 | 674.0 | 802.2 | 232.4 | 1360.0 | 4.8 | 116.7 | 85.5 | 294.9 | 4.8 | 116.5 |
| BB | Brand 5 | 120 | 0.1 | 571.0 | 695.8 | 94.5 | 1219.5 | 4.1 | 76.1 | 52.8 | 560.3 | 697.5 | 94.5 | 1210.5 | 4.2 | 75.4 | 76.1 | 555.3 | 692.0 | 94.6 | 1200.0 | 4.1 | 75.0 | 82.6 | 259.0 | 4.1 | 75.2 |
| CC | Brand 6 | 120 | 1.6 | 716.5 | 616.0 | 220.3 | 1222.3 | 3.7 | 116.0 | 71.7 | 717.4 | 600.2 | 220.0 | 1207.6 | 3.6 | 116.3 | 78.6 | 717.0 | 592.5 | 219.7 | 1199.7 | 3.5 | 116.1 | 79.0 | 260.3 | 3.5 | 116.2 |
| DD | Brand 7 | 120 | 3.4 | 860.5 | 472.8 | 167.1 | 1249.7 | 2.8 | 163.4 | 54.7 | 872.2 | 471.0 | 167.3 | 1259.5 | 2.8 | 164.1 | 62.9 | 829.3 | 466.2 | 167.2 | 1211.9 | 2.8 | 160.0 | 74.2 | 267.7 | 2.8 | 161.5 |
| EE | Brand 13 | 120 | 2.5 | 665.7 | 448.6 | 126.7 | 1050.9 | 2.7 | 138.2 | 57.6 | 680.9 | 437.3 | 126.6 | 1054.9 | 2.6 | 139.5 | 50.8 | 672.7 | 443.9 | 126.6 | 1053.2 | 2.6 | 138.6 | 75.3 | 229.1 | 2.6 | 138.9 |

| UUT | Brand Identifier | Inlet Water Temperature | Annual Combined Low-power Mode Energy Consumption, $E_{TLP}$ | Quick Cycle (1) | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Heavy Soil | | | | | | | Medium Soil | | | | | | | Light Soil | | | | | | | Weighted Average | | |
| | | | | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Estimated Annual Energy Use (kWh/year) | Water Consumption (gal/cycle) | Duration (min) |
| A | Brand 13 | 120 | 2.7 | 527.9 | 907.4 | 76.0 | 1397.4 | 5.4 | 78.3 | 78.1 | 531.7 | 907.6 | 76.0 | 1401.2 | 5.4 | 78.3 | 84.3 | 521.4 | 906.2 | 76.2 | 1389.6 | 5.4 | 78.3 | 89.6 | 302.4 | 5.4 | 78.3 |
| B | Brand 3 | 120 | 0.7 | 568.3 | 465.4 | 0.0 | 1033.6 | 2.8 | 43.1 | 3.5 | 596.7 | 465.4 | 0.0 | 1062.1 | 2.8 | 42.3 | 16.5 | 576.8 | 471.7 | 0.0 | 1048.5 | 2.8 | 42.1 | 60.8 | 226.9 | 2.8 | 42.2 |
| C | Brand 6 | 120 | 5.5 | 558.6 | 957.6 | 33.5 | 1499.4 | 5.7 | 77.5 | 80.5 | 561.4 | 954.2 | 33.6 | 1498.8 | 5.7 | 80.0 | 84.8 | 563.7 | 950.9 | 33.6 | 1497.8 | 5.7 | 80.8 | 85.5 | 327.6 | 5.7 | 80.4 |
| D | Brand 5 | 120 | 7.4 | 399.9 | 967.7 | 78.9 | 1328.2 | 5.8 | 43.0 | 47.9 | 400.2 | 961.0 | 78.8 | 1321.8 | 5.7 | 43.0 | 55.3 | 400.4 | 959.3 | 78.8 | 1320.3 | 5.7 | 43.0 | 79.0 | 291.4 | 5.7 | 43.0 |
| E | Brand 12 | 120 | 3.5 | 627.0 | 447.2 | 0.0 | 1074.1 | 2.7 | 59.4 | 39.0 | 633.5 | 450.8 | 0.0 | 1084.3 | 2.7 | 59.7 | 50.0 | 612.2 | 446.6 | 0.0 | 1058.8 | 2.7 | 59.1 | 72.3 | 233.1 | 2.7 | 59.3 |
| F | Brand 5 | 120 | 2.5 | 300.7 | 915.6 | 0.0 | 1216.3 | 5.5 | 31.6 | 55.9 | 300.5 | 883.7 | 0.0 | 1184.2 | 5.3 | 31.5 | 69.9 | 299.3 | 784.6 | 0.0 | 1083.9 | 4.7 | 31.5 | 74.9 | 244.1 | 4.9 | 31.5 |
| G | Brand 13 | 120 | 2.5 | 529.8 | 984.5 | 74.9 | 1476.8 | 5.9 | 78.3 | 78.3 | 527.0 | 997.9 | 75.1 | 1487.4 | 5.9 | 78.3 | 80.6 | 521.7 | 986.2 | 75.1 | 1470.3 | 5.9 | 78.3 | 87.1 | 319.9 | 5.9 | 78.3 |
| H | Brand 7 | 120 | 4.5 | 420.2 | 1263.4 | 87.9 | 1639.6 | 7.5 | 98.8 | 80.5 | 420.1 | 1261.7 | 87.9 | 1637.8 | 7.5 | 98.0 | 85.0 | 419.9 | 1258.3 | 87.9 | 1634.2 | 7.5 | 97.4 | 87.4 | 356.2 | 7.5 | 97.7 |
| I | Brand 8 | 120 | 4.2 | 793.3 | 828.2 | 126.6 | 1558.2 | 4.9 | 90.5 | 89.8 | 795.2 | 824.9 | 126.5 | 1556.8 | 4.9 | 90.3 | 88.8 | 795.8 | 824.9 | 126.5 | 1557.4 | 4.9 | 90.4 | 90.4 | 339.0 | 4.9 | 90.4 |
| J | Brand 9 | 120 | 75.0 | 883.1 | 1233.1 | 0.0 | 2116.2 | 7.3 | 100.6 | 87.6 | 880.3 | 1231.4 | 0.0 | 2111.7 | 7.3 | 100.7 | 88.4 | 892.6 | 1226.4 | 0.0 | 2119.0 | 7.3 | 101.2 | 89.2 | 530.0 | 7.3 | 101.0 |
| K | Brand 11 | 50 | 1.3 | 1208.5 | 0.0 | 0.0 | 1208.5 | 3.2 | 80.6 | 65.6 | 1193.8 | 0.0 | 0.0 | 1193.8 | 3.1 | 79.6 | 74.5 | 1203.3 | 0.0 | 0.0 | 1203.3 | 3.2 | 79.3 | 85.9 | 259.4 | 3.2 | 79.5 |
| L | Brand 8 | 120 | 5.9 | 460.9 | 987.8 | 85.8 | 1405.9 | 5.9 | 102.2 | 86.8 | 461.5 | 979.4 | 85.8 | 1398.0 | 5.8 | 102.2 | 87.2 | 461.3 | 982.8 | 85.8 | 1401.2 | 5.9 | 102.2 | 88.7 | 307.0 | 5.8 | 102.2 |
| M | Brand 10 | 120 | 3.3 | 727.6 | 848.4 | 124.1 | 1514.0 | 5.1 | 93.5 | 81.8 | 729.0 | 845.0 | 124.2 | 1511.9 | 5.0 | 93.0 | 85.2 | 729.7 | 838.3 | 124.1 | 1505.9 | 5.0 | 92.3 | 87.1 | 327.6 | 5.0 | 92.6 |
| N | Brand 3 | 120 | 0.5 | 556.3 | 611.5 | 0.0 | 1167.8 | 3.6 | 41.7 | 67.3 | 534.3 | 606.5 | 0.0 | 1140.8 | 3.6 | 40.6 | 75.0 | 545.2 | 611.5 | 0.0 | 1156.7 | 3.6 | 41.1 | 84.8 | 248.2 | 3.6 | 41.0 |
| O | Brand 6 | 120 | 5.9 | 465.9 | 801.4 | 33.7 | 1250.4 | 4.8 | 80.0 | 78.2 | 465.7 | 804.7 | 33.7 | 1253.6 | 4.8 | 80.0 | 82.6 | 467.1 | 804.7 | 33.6 | 1255.0 | 4.8 | 80.0 | 85.6 | 275.6 | 4.8 | 80.0 |
| P | Brand 11 | 120 | 11.7 | 977.3 | 801.4 | 0.0 | 1778.7 | 4.8 | 52.3 | 77.8 | 1009.0 | 803.0 | 0.0 | 1812.0 | 4.8 | 53.7 | 79.4 | 991.2 | 799.7 | 0.0 | 1790.9 | 4.8 | 53.9 | 84.2 | 398.1 | 4.8 | 53.8 |
| Q | Brand 3 | 120 | 0.9 | 866.2 | 636.7 | 0.0 | 1502.9 | 3.8 | 79.2 | 56.8 | 876.4 | 641.8 | 0.0 | 1518.1 | 3.8 | 79.7 | 61.7 | 835.9 | 643.4 | 0.0 | 1479.4 | 3.8 | 78.0 | 78.1 | 322.0 | 3.8 | 78.6 |
| R | Brand 4 | 50 | 7.4 | 1244.0 | 0.0 | 0.0 | 1244.0 | 2.7 | 86.5 | 72.7 | 1259.1 | 0.0 | 0.0 | 1259.1 | 2.8 | 87.5 | 77.0 | 1277.2 | 0.0 | 0.0 | 1277.2 | 2.7 | 88.3 | 80.2 | 280.3 | 2.7 | 87.9 |
| S | Brand 9 | 120 | 78.2 | 858.6 | 1219.7 | 0.0 | 2078.3 | 7.3 | 98.5 | 88.4 | 879.2 | 1223.0 | 0.0 | 2102.2 | 7.3 | 99.6 | 85.1 | 877.9 | 1216.3 | 0.0 | 2094.2 | 7.2 | 99.4 | 87.5 | 528.9 | 7.3 | 99.4 |
| T | Brand 11 | 50 | 0.8 | 652.5 | 0.0 | 0.0 | 652.5 | 3.0 | 57.5 | 57.7 | 660.6 | 0.0 | 0.0 | 660.6 | 3.1 | 56.3 | 53.3 | 645.1 | 0.0 | 0.0 | 645.1 | 3.0 | 56.5 | 74.9 | 140.7 | 3.0 | 56.5 |
| U | Brand 2 | 120 | 2.5 | 790.0 | 576.2 | 0.0 | 1366.2 | 3.4 | 80.3 | 71.3 | 760.8 | 572.9 | 0.0 | 1333.7 | 3.4 | 78.6 | 78.2 | 808.0 | 579.9 | 0.0 | 1387.9 | 3.5 | 81.3 | 85.5 | 296.9 | 3.4 | 80.3 |
| V | Brand 12 | 120 | 1.7 | 245.3 | 628.7 | 0.0 | 874.0 | 3.7 | 55.2 | 58.8 | 245.1 | 629.5 | 0.0 | 874.6 | 3.7 | 55.2 | 67.8 | 236.4 | 632.3 | 0.0 | 868.7 | 3.8 | 54.5 | 81.9 | 188.9 | 3.8 | 54.7 |
| W | Brand 6 | 120 | 11.0 | 759.2 | 472.4 | 0.0 | 1231.6 | 2.8 | 77.1 | 68.9 | 775.0 | 484.1 | 0.0 | 1259.1 | 2.9 | 78.1 | 77.1 | 758.8 | 474.4 | 0.0 | 1233.2 | 2.8 | 73.2 | 80.6 | 278.0 | 2.8 | 75.0 |
| X | Brand 13 | 120 | 2.6 | 563.7 | 895.8 | 77.9 | 1420.6 | 5.3 | 78.7 | 81.6 | 561.7 | 889.6 | 77.9 | 1412.4 | 5.3 | 78.7 | 83.8 | 561.6 | 882.5 | 77.9 | 1405.1 | 5.3 | 78.7 | 86.7 | 305.4 | 5.3 | 78.7 |
| Y | Brand 12 | 120 | 6.8 | 717.0 | 859.9 | 0.0 | 1576.9 | 5.1 | 75.0 | 83.0 | 732.1 | 857.6 | 0.0 | 1589.7 | 5.1 | 75.6 | 85.8 | 750.1 | 853.7 | 0.0 | 1603.7 | 5.1 | 76.3 | 86.3 | 350.3 | 5.1 | 76.0 |
| Z | Brand 1 | 50 | 2.5 | 774.4 | 0.0 | 0.0 | 774.4 | 2.5 | 62.7 | 44.0 | 773.7 | 0.0 | 0.0 | 773.7 | 2.5 | 62.7 | 54.9 | 775.2 | 0.0 | 0.0 | 775.2 | 2.5 | 62.6 | 75.0 | 169.1 | 2.5 | 62.7 |
| AA | Brand 6 | 120 | 1.6 | 668.2 | 649.3 | 233.5 | 1200.8 | 3.9 | 113.4 | 69.4 | 670.0 | 663.9 | 233.4 | 1217.2 | 4.0 | 113.7 | 79.3 | 668.8 | 655.5 | 233.4 | 1207.6 | 3.9 | 113.3 | 79.5 | 261.8 | 3.9 | 113.4 |
| BB | Brand 5 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | |
| CC | Brand 6 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | |
| DD | Brand 7 | 120 | 3.4 | 387.3 | 974.5 | 85.2 | 1319.2 | 5.8 | 92.8 | 73.5 | 400.0 | 970.4 | 85.1 | 1327.9 | 5.8 | 93.1 | 81.8 | 400.3 | 965.8 | 85.1 | 1323.5 | 5.7 | 93.2 | 87.2 | 288.2 | 5.8 | 93.1 |
| EE | Brand 13 | 120 | 2.5 | 447.0 | 789.6 | 122.4 | 1175.4 | 4.7 | 97.0 | 75.5 | 437.2 | 786.5 | 122.4 | 1162.5 | 4.7 | 96.1 | 78.6 | 437.7 | 784.6 | 122.4 | 1161.1 | 4.7 | 96.2 | 80.7 | 252.4 | 4.7 | 96.2 |

| UUT | Brand Identifier | Inlet Water Temperature | Quick Cycle (2) | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Annual Combined Low-power Mode Energy Consumption, $E_{TLP}$ | Heavy Soil | | | | | | | Medium Soil | | | | | | | Light Soil | | | | | | | Weighted Average | | |
| | | | | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Machine Energy (Wh) | Water Energy (Wh) | Power Dry Energy (Wh) | Total Cycle Energy (Wh) | Water (gal) | Time (min) | Per-Cycle Cleaning Index | Estimated Annual Energy Use (kWh/year) | Water Consumption (gal/cycle) | Duration (min) |
| A | Brand 13 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B | Brand 3 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | Brand 6 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | Brand 5 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| E | Brand 12 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| F | Brand 5 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| G | Brand 13 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H | Brand 7 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| I | Brand 8 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| J | Brand 9 | 120 | 75.0 | 778.1 | 910.6 | 0.0 | 1688.7 | 5.4 | 89.3 | 85.4 | 777.9 | 913.9 | 0.0 | 1691.8 | 5.4 | 89.3 | 86.3 | 771.5 | 907.2 | 0.0 | 1678.7 | 5.4 | 88.9 | 89.8 | 437.0 | 5.4 | 89.1 |
| K | Brand 11 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L | Brand 8 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| M | Brand 10 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| N | Brand 3 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| O | Brand 6 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| P | Brand 11 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Q | Brand 3 | 120 | 0.9 | 926.4 | 469.1 | 0.0 | 1395.5 | 2.8 | 58.6 | 51.7 | 905.0 | 467.4 | 0.0 | 1372.4 | 2.8 | 57.6 | 65.4 | 875.4 | 468.9 | 0.0 | 1344.3 | 2.8 | 56.1 | 77.5 | 292.5 | 2.8 | 56.7 |
| R | Brand 4 | 50 | 7.4 | 1116.0 | 0.0 | 0.0 | 1116.0 | 2.5 | 79.0 | 66.8 | 1205.3 | 0.0 | 0.0 | 1205.3 | 2.5 | 84.1 | 67.8 | 1238.3 | 0.0 | 0.0 | 1238.3 | 2.5 | 85.8 | 74.3 | 269.9 | 2.5 | 84.9 |
| S | Brand 9 | 120 | 78.2 | 748.3 | 907.2 | 0.0 | 1655.5 | 5.4 | 87.0 | 78.5 | 810.5 | 902.2 | 0.0 | 1712.7 | 5.4 | 90.0 | 77.9 | 810.7 | 893.8 | 0.0 | 1704.5 | 5.3 | 90.0 | 84.4 | 444.7 | 5.3 | 89.9 |
| T | Brand 11 | 50 | 0.8 | 486.4 | 0.0 | 0.0 | 486.4 | 3.1 | 41.6 | 35.5 | 487.0 | 0.0 | 0.0 | 487.0 | 3.1 | 43.2 | 46.1 | 486.9 | 0.0 | 0.0 | 486.9 | 3.1 | 43.1 | 69.1 | 105.5 | 3.1 | 43.1 |
| U | Brand 2 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| V | Brand 12 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| W | Brand 6 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| X | Brand 13 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Y | Brand 12 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Z | Brand 1 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AA | Brand 6 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BB | Brand 5 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CC | Brand 6 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DD | Brand 7 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EE | Brand 13 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | Mean and Median Estimated Annual Energy Use, Water Consumption, and Cycle Duration of the Weighted Average Normal Cycle, Quick Cycle, and Quick Cycles less than 1 hour in Duration | | | | | | | | | Mean and Median Per-Cycle Cleaning Index of the Normal Cycle, Quick Cycle, and Quick Cycles less than 1 hour in Duration | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Normal Cycle | | | Quick Cycle | | | Quick Cycle < 1 hour | | | Normal Cycle | | | Quick Cycle | | | Quick Cycle < 1 hour | | |
| | Estimated Annual Energy Use (kWh/year) | Water Consumption (gal/cycle) | Duration (min) | Estimated Annual Energy Use (kWh/year) | Water Consumption (gal/cycle) | Duration (min) | Estimated Annual Energy Use (kWh/year) | Water Consumption (gal/cycle) | Duration (min) | Heavy Soil | Medium Soil | Light Soil | Heavy Soil | Medium Soil | Light Soil | Heavy Soil | Medium Soil | Light Soil |
| **Mean** | 251.7 | 3.1 | 131.1 | 300.0 | 4.5 | 75.5 | 236.9 | 3.7 | 48.2 | 63.1 | 67.9 | 78.0 | 68.2 | 73.4 | 82.1 | 49.5 | 57.9 | 75.9 |
| **Median** | 256.2 | 2.9 | 129.9 | 292.0 | 4.8 | 79.1 | 238.6 | 3.3 | 48.4 | 68.4 | 72.5 | 80.8 | 73.1 | 78.4 | 84.6 | 53.8 | 60.4 | 76.2 |

**Note: The mean and median values for the normal cycle do not include the results for UUT W, because the measured estimated annual energy use for this test unit slightly exceeded the DOE standard, and thus this particular unit's energy results were not representative of the product.**