



ENERGY STAR® Program Requirements Product Specification for Residential Clothes Washers

Test Method for Determining Residential Clothes Washer Cleaning Performance July 2018

1. OVERVIEW

The following test method shall be used for determining the cleaning performance of residential clothes washers that meet the ENERGY STAR Eligibility Criteria for Clothes Washers. Cleaning performance shall be determined on the same test units immediately following the energy and water consumption tests for ENERGY STAR qualification. Cleaning performance is measured under test conditions that are consistent with certain test conditions used to determine the energy and water performance.

2. APPLICABILITY

The test method shall be used to determine the cleaning performance of residential clothes washers within the ENERGY STAR program.

3. DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in:

- (1) ENERGY STAR Program Requirements, Product Specification for Clothes Washers, Eligibility Criteria Version 8.0
- (2) U.S. Department of Energy (DOE) test procedure at 10 CFR 430, Subpart B, Appendix J2, "Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers." ("Appendix J2")
- (3) Association of Home Appliance Manufacturers (AHAM) HLW-1-2013, "Performance Evaluation Procedures for Household Clothes Washers." ("AHAM HLW-1-2013")

A) Acronyms and Units:

- 1) AHAM: Association of Home Appliance Manufacturers
- 2) CFR: Code of Federal Regulations
- 3) DOE: U.S. Department of Energy
- 4) IMEF: Integrated Modified Energy Factor
- 5) IWF: Integrated Water Factor
- 6) UUT: Unit under test

B) Definitions:

- 1) Performance Test Load: The maximum load size of energy test cloth as defined in Table 5.1 of Appendix J2, based on the UUT's capacity as measured in Section 3.1 of Appendix J2, plus the required amount of soil/stain removal test strips, as determined in Section 4.E of this test method.
- 2) Total Cleaning Score: A measure of soil/stain removal that represents an average of individual cleaning scores from soil/stain removal test strip swatches of different stain types. An individual cleaning score represents the ratio of the cleaning performance of the UUT to a calibrated reference level. A higher Total Cleaning Score represents better soil/stain removal (*i.e.*, better cleaning performance).

4. TEST SETUP

Testing conditions, instrumentation, and materials for all portions of this method shall follow Section 2 of Appendix J2, with the following additions.

A) Test Conditions

- 1) Maintain the supply water hardness as specified in Section 4.5.3 of AHAM HLW-1-2013.

B) Instrumentation and Equipment

- 1) The scale used for weighing test cloth must have a resolution of no larger than 0.2 oz. (5.7 g) and a maximum error no greater than 0.1 percent of the measured value.
- 2) The scale used for weighing detergent must be in accordance with the specifications in Section 6.2.d of AHAM HLW-1-2013.
- 3) The Tristimulus Colorimeter/Spectrocolorimeter used to measure post-wash reflectance must be in accordance with the specifications in Annex A, Section A.10 of AHAM HLW-1-2013.
- 4) The sewing machine or stapling equipment for attaching soil/stain removal test strips to load items must be in accordance with the specifications in Section 6.2.c of AHAM HLW-1-2013.

C) Test Materials: Test Cloth

- 1) The test cloth must be in accordance with the specifications in Sections 2.7 and 2.8 of Appendix J2.

D) Test Materials: Detergent

- 1) Detergent formulation, concentration and storage specifications must be in accordance with Section 4.7 of AHAM HLW-1-2013.
- 2) When loading the detergent into the clothes washer, follow Section 6.6.4.1 of AHAM HLW-1-2013 for a clothes washer with a detergent dispenser or Section 6.6.4.2 of AHAM HLW-1-2013 for a clothes washer without a detergent dispenser.

E) Test Materials: Soil/Stain Removal Test Strips

- 1) Soil/stain removal test strips (hereafter referred to as "test strips") must be in accordance with Annex A, Sections A.6 and A.7 of AHAM HLW-1-2013.
- 2) Mark each test strip with a unique identifying reference in accordance with Section 6.5.6 of AHAM HLW-1-2013.
- 3) Table 1 of this test method indicates the quantity of test strips to use based on the capacity of the UUT, as measured in Section 3.1 of Appendix J2, and the associated maximum load size.

Table 1: Number of test strips based on clothes washer capacity

Container volume (cu. ft.)		Maximum load (lb.)	Number of test strips
≥	<		
0	0.80	3.00	2
0.80	0.90	3.50	
0.90	1.00	3.90	
1.00	1.10	4.30	
1.10	1.20	4.70	
1.20	1.30	5.10	3
1.30	1.40	5.50	
1.40	1.50	5.90	
1.50	1.60	6.40	
1.60	1.70	6.80	
1.70	1.80	7.20	4
1.80	1.90	7.60	
1.90	2.00	8.00	
2.00	2.10	8.40	
2.10	2.20	8.80	
2.20	2.30	9.20	5
2.30	2.40	9.60	
2.40	2.50	10.00	
2.50	2.60	10.50	
2.60	2.70	10.90	
2.70	2.80	11.30	6
2.80	2.90	11.70	
2.90	3.00	12.10	
3.00	3.10	12.50	
3.10	3.20	12.90	
3.20	3.30	13.30	7
3.30	3.40	13.70	
3.40	3.50	14.10	
3.50	3.60	14.60	
3.60	3.70	15.00	8
3.70	3.80	15.40	
3.80	3.90	15.80	
3.90	4.00	16.20	
4.00	4.10	16.60	
4.10	4.20	17.00	9
4.20	4.30	17.40	
4.30	4.40	17.80	
4.40	4.50	18.20	
4.50	4.60	18.70	
4.60	4.70	19.10	10
4.70	4.80	19.50	
4.80	4.90	19.90	
4.90	5.00	20.30	
5.00	5.10	20.70	
5.10	5.20	21.10	11
5.20	5.30	21.50	
5.30	5.40	21.90	
5.40	5.50	22.30	
5.50	5.60	22.80	
5.60	5.70	23.20	12
5.70	5.80	23.60	
5.80	5.90	24.00	
5.90	6.00	24.40	
6.00	6.10	24.80	

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Table 2, continued:

Container volume (cu. ft.)		Maximum load (lb.)	Number of test strips
≥	<		
6.10	6.20	25.20	13
6.20	6.30	25.60	
6.30	6.40	26.00	
6.40	6.50	26.40	
6.50	6.60	26.90	
6.60	6.70	27.30	14
6.70	6.80	27.70	
6.80	6.90	28.10	
6.90	7.00	28.50	
7.00	7.10	28.90	
7.10	7.20	29.30	15
7.20	7.30	29.70	
7.30	7.40	30.10	
7.40	7.50	30.60	
7.50	7.60	31.00	16
7.60	7.70	31.40	
7.70	7.80	31.80	
7.80	7.90	32.20	
7.90	8.00	32.60	

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71 **F) Loading the Performance Test Load**

- 72 1) Attach each test strip to an energy test cloth from the maximum test load, as defined in Table
73 5.1 of Appendix J2, in accordance with Section 6.5.7 of AHAM HLW-1-2013, substituting
74 “energy test cloth” for “towel.”
- 75 2) Fold the energy test cloths with attached test strips in accordance with Figure 1 of AHAM
76 HLW-1-2013, substituting “energy test cloth” for “towel.”
- 77 3) Load the test cloths as follows:
- 78 a) Top-loading clothes washer: Load 7 test cloths without test strips followed by 1 test cloth
79 with an attached test strip, ensuring an even distribution of test cloths without test strips,
80 and that test cloths with attached test strips are not placed on top of each other. Repeat
81 this sequence until the final test cloth with an attached test strip is loaded; the last
82 sequence may include fewer than 7 test cloths without test strips. Load any remaining
83 test cloths without test strips, including any energy stuffer cloths, on top.
- 84 i) To load test cloths without test strips, follow the instructions provided in Section
85 2.9.2.1 of Appendix J2.
- 86 ii) To load test cloths with attached test strips, follow the instructions provided in
87 Sections 5.3.2.2 and 5.3.2.2.2 of AHAM HLW-1-2013. Test cloths with attached test
88 strips must be placed in one of the 4 quadrants around the vertical axis, shown in
89 Figure 11 of AHAM HLW-1-2013. Place the first test cloth with an attached test strip
90 in the left quadrant; the second test cloth with an attached test strip in the back
91 quadrant; and so forth, placing each subsequent test cloth with an attached test strip
92 in the next quadrant in the clockwise direction.
- 93 b) Front-loading clothes washer: Load 14 test cloths without test strips followed by 2 test
94 cloths with attached test strips, ensuring an even distribution of test cloths without test
95 strips. Repeat this sequence until the final test cloths with attached test strips are loaded;
96 the last sequence may include fewer than 14 test cloths without test strips, or only one
97 test cloth with an attached test strip. Load any remaining test cloths without test strips,
98 including any energy stuffer cloths, on top.

- 99 i) To load test cloths without test strips, use alternating orientations according to the
100 "towels" illustration in Figure 9 of AHAM HLW-1-2013.
- 101 ii) To load test cloths with attached test strips, follow the instructions provided in
102 Sections 5.3.2.2 and 5.3.2.2.1 of AHAM HLW-1-2013. Test cloths with attached test
103 strips must be placed into the UUT according to Figure 10 of AHAM HLW-1-2013.
104 Avoid overlapping the 2 test cloths with attached test strips in each sequence. If
105 overlapping is unavoidable, minimize any overlap. If an odd number of test strips are
106 required, position the last test cloth with an attached test strip midway between the
107 front and back of the wash drum.

108 5. TEST METHOD

109 The hottest Warm Wash/Cold Rinse ("Warm/Cold") temperature selection used for Section 3.5.1 of
110 Appendix J2 shall be performed 3 times immediately after performing all test cycles required for Appendix
111 J2, as follows:

- 112 A) Use the performance test load and detergent, as specified in Sections 3.B.1 and 4.D of this test
113 method.
- 114 B) After completion of each wash cycle separate the test strips from the test cloth and dry them
115 according to Sections 6.6.6 and 6.6.7 of AHAM HLW-1-2013.
- 116 1) Measure the post-wash reflectance of each soiled swatch on each test strip according to
117 Section 6.6.8 of AHAM HLW-1-2013.

118 6. CALCULATIONS AND SCORING

119 Calculation of results shall be as follows:

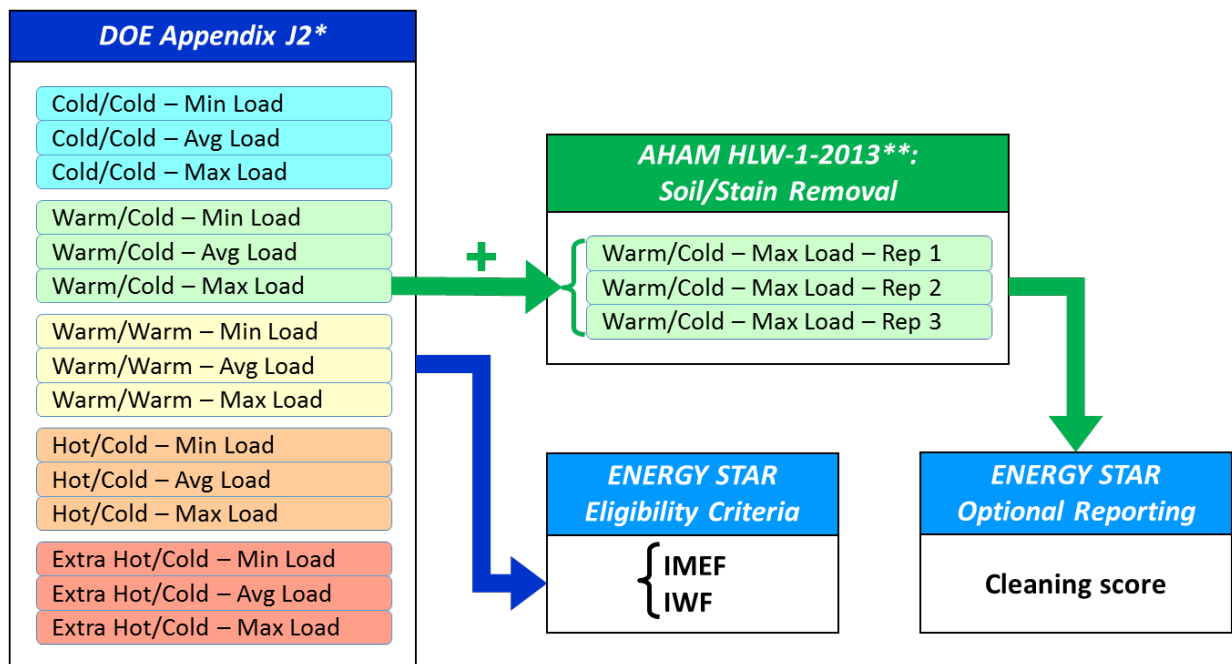
- 120 A) Total Cleaning Score: Calculate a Total Cleaning Score (CS_T) for the UUT in accordance with
121 Section 6.7 and Figure 14 of AHAM HLW-1-2013, using the post-wash reflectance values
122 obtained in Section 5.B.1 of this test method.
- 123 1) Round the Total Cleaning Score to the nearest 0.1.

124 7. REFERENCES

- 125 A) AHAM HLW-1-2013. "Performance Evaluation Procedures for Household Clothes Washers"
- 126 B) DOE Appendix J2 to Subpart B of 10 CFR 430, "Uniform Test Method for Measuring the Energy
127 Consumption of Automatic and Semi-Automatic Clothes Washers"
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APPENDIX A: TEST METHOD STRUCTURE

The following figure illustrates the structure of the cleaning performance test method, and shows its relationship with Appendix J2 test cycles performed to determine IMEF and IWF scores.



* Depending on the available temperature selections and water fill control system, Appendix J2 may require only a subset of the cycles depicted here.

** HLW-1-2013 Soil/Stain Removal Test Procedure has been modified as described in this test method.

Figure 1: Overall test method structure