



ENERGY STAR[®] Program Requirements Product Specification for Clothes Washer Performance

Preliminary Approach for Determining Clothes Washer Performance June-2013

1 OVERVIEW

Note: This document is written and formatted as an ENERGY STAR Test Method; however, the U.S. Department of Energy (DOE) recognizes that this draft is the first opportunity stakeholders will have to formally comment. Therefore, this document does not contain the rigor that would be expected from a test method, and instead outlines a proposed approach. For simplicity, DOE will use the term “test method” throughout this document.

The following test method shall be used for determining product compliance with requirements of the ENERGY STAR Eligibility Criteria for Clothes Washers.

Note: This proposed test method will be used to produce cleaning and rinsing scores for use in the ENERGY STAR Clothes Washer Program.

DOE recognizes that it is desirable to measure clothes washer performance under test conditions that are similar to those encountered during the DOE energy efficiency test (10 CFR 430, Subpart B, Appendix J2, referred to here as “Appendix J2”) to minimize test burden and ensure that performance metrics are relevant to certified energy and water use.

Appendix J2 test conditions include: (a) general criteria, such as water temperature and pressure, electrical supply voltage, and electrical supply frequency, and (b) wash- and rinse-specific parameters such as wash/rinse cycle selections and load size. However, because Appendix J2 has no procedures for measuring cleaning or rinsing performance, this proposed ENERGY STAR test method also utilizes certain procedures from the Association of Home Appliance Manufacturers (AHAM) test method HLW-1-2010, “Performance Evaluation Procedures for Household Clothes Washers” (referred to here as “AHAM HLW-1-2010”). Specifically, the proposed test method incorporates AHAM HLW-1-2010’s Soil/Stain Removal and Rinsing Effectiveness Tests.

The general criteria specified in AHAM HLW-1-2010 are functionally equivalent to those in Appendix J2, but AHAM HLW-1-2010 does not specify the wash and rinse settings to be used for performance testing. As such, the proposed test method specifies using wash and rinse settings consistent with those that would be tested with Appendix J2.

Rinsing Performance

AHAM HLW-1-2010 includes, as Annex E, a Rinsing Effectiveness Test that is intended by AHAM to be used solely for internal engineering development purposes. Furthermore, the introductory note accompanying Annex E states that it shall not be used to prove or disprove rinsing effectiveness claims for marketing and/or other purposes.

DOE understands that the precision and bias of the AHAM Rinsing Effectiveness Test as published in AHAM HLW-1-2010 is still under investigation, and that AHAM is currently developing a revised version of the Rinsing Effectiveness Test. (DOE will consider incorporating a more recent version of the Rinsing Effectiveness Test if one is published.) DOE recognizes these potential limitations, but believes that the methodology in Annex E of AHAM HLW-1-2010 represents the best available means to measure clothes washer rinsing performance at this time.

Therefore, DOE proposes to incorporate provisions of the AHAM Rinsing Effectiveness Test into the ENERGY STAR test method, with minor modifications to ensure testing conditions that correspond, to the extent possible, to those in Appendix J2. **DOE invites comment on the appropriateness of adopting a**

41 rinsing performance test method that is based on the AHAM Rinsing Effectiveness Test in AHAM
 42 HLW-1-2010.

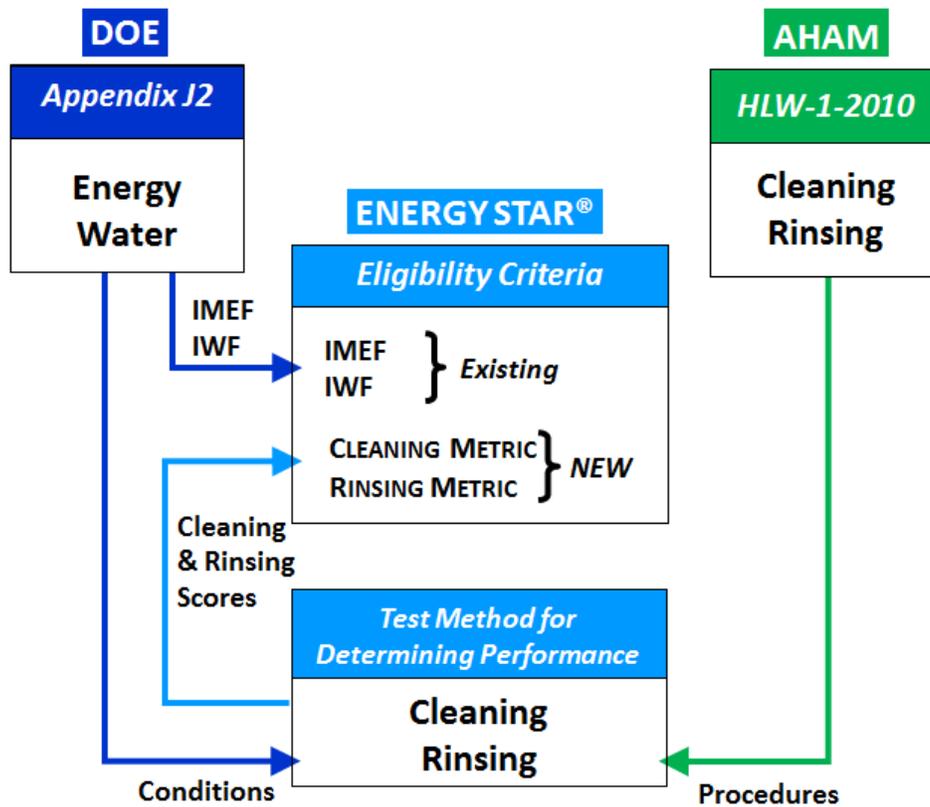
43 DOE notes that the rinsing value determined in HLW-1-2010, "Rinse Score," is a measure of residual
 44 detergent present in washed articles after the rinsing cycle is completed. As such, a *lower* value of Rinse
 45 Score represents better clothes washer performance; this contrasts with the HLW-1-2010 Cleaning Score,
 46 in which a *higher* score represents better performance. DOE believes that the terminology "Rinse Score"
 47 can thus be confusing, especially for consumers. DOE is therefore proposing a rinsing performance
 48 metric with the more precise name of "Residual Detergent Score." **DOE invites comment on this**
 49 **proposal.**

50 *Structure of the Proposed Test Method*

51 Figure 1 below illustrates how the test conditions from Appendix J2 and procedures from AHAM HLW-1-
 52 2010 are used as inputs to the proposed test method. The diagram also shows how the resulting
 53 performance test scores (cleaning, rinsing) relate to the existing Integrated Modified Energy Factor
 54 (IMEF) and Integrated Water Factor (IWF).

55 The proposed test method is to be performed *separately from* the Appendix J2 energy efficiency tests.

56 Several issues regarding the integration of AHAM HLW-1-2010 and Appendix J2 into the performance
 57 test method are discussed in more detail in the accompanying analysis document. DOE seeks
 58 stakeholder feedback on these issues, as well as other issues put forward in noteboxes throughout this
 59 document.



60
 61 **Figure 1. Test Conditions and Procedures Used as Inputs to the Proposed Test Method**

62 **2 APPLICABILITY**

63 The proposed test method shall be used to determine the cleaning and rinsing performance of all clothes
64 washers within the ENERGY STAR program.

65 **3 DEFINITIONS**

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

- 67 (1) ENERGY STAR Program Requirements, Product Specification for Clothes Washers, Eligibility
68 Criteria Version 6.1;
- 69 (2) Association of Home Appliance Manufacturers (AHAM) test method HLW-1-2010, Performance
70 Evaluation Procedures for Household Clothes Washers.” (“AHAM HLW-1-2010”); and
- 71 (3) U.S. Department of Energy (DOE) test procedure at 10 CFR 430, Subpart B, Appendix J2,
72 “Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic
73 Clothes Washers,” as published at 77 FR 13888, 13939, March 7, 2012. (“Appendix J2”).

74 **Note:** This ENERGY STAR test method incorporates definitions from the multiple sources listed above.
75 DOE has evaluated the definitions contained within the referenced publications and did not find any
76 contradictions between the sources..

77 A) Acronyms and Units:

- 78 1) AHAM: Association of Home Appliance Manufacturers
- 79 2) ANSI: American National Standards Institute
- 80 3) CFR: Code of Federal Regulations
- 81 4) DOE: U.S. Department of Energy
- 82 5) UUT: Unit under test
- 83 6) UV: Ultraviolet

84 B) Definitions:

- 85 1) Load Treatment Clothes Washer: A dedicated clothes washer used solely for the purpose of
86 pretreatment and normalization of base loads.
- 87 2) Total Cleaning Score: A measure of soil/stain removal that represents an average of individual
88 cleaning scores from test strip swatches of different stain types. An individual cleaning score
89 represents the ratio of the cleaning performance of the UUT to a calibrated reference level. A
90 higher Total Cleaning Score represents better soil/stain removal.
- 91 3) Residual Detergent Score: A measure of rinsing performance that represents the amount of
92 residual detergent remaining in the load after a complete wash cycle, per pound of load. Equal to
93 the Rinse Score calculated with equation 8-8 of Annex E of AHAM HLW-1-2010. A lower
94 Residual Detergent Score represents greater detergent removal during rinsing.

95 **4 TEST SETUP**

96 **4.1 Laboratory Test Conditions**

- 97 A) Electrical Supply: Maintain the electrical energy supply as specified in Section 2.2 of Appendix J2.
- 98 B) Supply Water Temperatures: Maintain the supply water temperatures as specified in Section 2.3 of
99 Appendix J2.
- 100 C) Supply Water Pressure: Maintain the supply water pressure as specified in Section 2.4 of Appendix
101 J2.

102 D) Supply Water Hardness: Maintain the supply water hardness as specified in Section 4.5.3 of AHAM
103 HLW-1-2010.

104 **Note:** HLW-1-2010 specifies a water hardness limit of 50 parts per million (ppm) or less. Appendix J2
105 provides no water hardness specifications for the energy cycle tests themselves; only procedures for pre-
106 conditioning DOE energy test cloth (Sections 2.6.3.1) and the Standard Extractor Remaining Moisture
107 Content (RMC) correction curve procedure (Sections 2.6.5.3.3 and 2.6.5.4) contain a water hardness
108 specification (17 ppm or less).

109 Standard Extractor RMC Tests are not performed as part of energy testing for clothes washers under
110 Appendix J2; rather, the test cloth supplier or another qualified test laboratory performs the Standard
111 Extractor RMC Test once for each new lot of test cloth to qualify the lot.

112 E) Ambient Temperature: Maintain the ambient air temperature as specified in Section 2.11 of Appendix
113 J2.

114 4.2 Required Instrumentation

116 A) Weighing Equipment: Weighing equipment shall be in accordance with the specifications in Section
117 6.2 of AHAM HLW-1-2010.

118 **Note:** AHAM HLW-1-2010 requires that base load weighing equipment be accurate to within $\pm 0.1\%$,
119 while Appendix J2 requires it to be accurate to within $\pm 0.3\%$. AHAM HLW-1-2010 additionally requires a
120 separate weighing scale for detergent. DOE believes specifying a greater accuracy for the load-weighing
121 equipment may produce more accurate and repeatable results for washing and rinsing performance
122 testing, and invites stakeholder comment on the benefits and test burden of requiring such equipment.

123 B) Tristimulus Spectrocolorimeter: Equipment for measuring light reflectance from test strips shall be in
124 accordance with the specifications in Annex A, Section A.10 of AHAM HLW-1-2010.

125 C) Water Temperature: Equipment for measuring the water supply temperatures shall be in accordance
126 with the specifications in Section 2.5.4 of Appendix J2.

127 D) Water Pressure: Equipment for measuring the water supply pressures shall be in accordance with the
128 specifications in Section 2.5.6 of Appendix J2.

129 E) Water Hardness: Equipment for confirming that the water hardness is within that specified in Section
130 4.5.3 of AHAM HLW-1-2010.

131 F) Electrical Supply Voltage: Equipment for confirming that the electrical supply voltage is within that
132 specified in Section 2.2 of Appendix J2.

133 G) UV Spectrometer (for Rinsing Performance): Equipment for measuring the ultraviolet (UV)
134 absorbance of test strips shall be in accordance with the specifications in AHAM HLW-1-2010, Annex
135 E, Section 2.

136 4.3 Other Required Test Equipment

138 A) Load Treatment Clothes Washer: A vertical-axis clothes washer that shall be in accordance with
139 Annex E, Section 5.2.1 of AHAM HLW-1-2010.

140 B) Fabric Drying Equipment: A clothes dryer capable of bone-drying the base loads, that shall be in
141 accordance with Section 3.2 of AHAM HLW-1-2010.

142 C) Fastening Equipment: Sewing machine or stapling equipment for attaching test strips to load items.
143 Metallic fasteners of any type are not permitted.

144 D) Rinsing Performance Test Equipment: Equipment as specified in AHAM HLW-1-2010, Annex E,
145 Section 2.

146 **Note:** Section 4.3.D references the list of equipment found in the AHAM Rinsing Effectiveness Test. DOE
147 does not suggest any changes to the equipment listed in Annex E, Section 2, and therefore is wholly
148 incorporating that list.

149 **4.4 Test Materials**

150 A) Base Load Composition: [*Option A* or *Option B*]

151 **Note:** *Option A* corresponds to the base load materials specified in AHAM HLW-1-2010. These consist of
152 100% cotton bed sheets, pillow cases, and towels. If AHAM base load materials are specified in this test
153 method, the base load composition would be specified by Section 4.2 of AHAM HLW-1-2010.

154 *Option B* corresponds to the load materials specified in Appendix J2. These consist of 50% cotton / 50%
155 polyester fabric test cloths. If DOE energy test cloths are used, the base load composition would be
156 specified by Section 2.6.1 of Appendix J2.

157 The accompanying discussion document discusses the advantages and disadvantages of each test
158 substrate for measuring soil/stain removal and rinsing performance. DOE invites comments from
159 stakeholders regarding whether this Test Method should require using HLW-1-2010 base load materials
160 or Appendix J2 test cloth for the base load composition. In addition to general comments, DOE
161 specifically requests information and comments regarding the following:

- 162 (1) The appropriate amount of detergent to use if DOE test cloths are required (note that International
163 Electrotechnical Commission (IEC) 60456 requires different amounts of detergent for 100% cotton
164 and for synthetic blends).
 - 165 (2) Whether and what weighted-average age requirements should be applied to base loads consisting of
166 DOE test cloths.
 - 167 (3) The impact of test substrate choice on performance test results for soil/stain removal and rinsing
168 effectiveness, including effects of fabric type and size and shape of base load articles.
 - 169 (4) Whether the presence of synthetic material in the base load would necessitate differences in test
170 methodology, as is the case in IEC 60456 (e.g., for average base load article age).
 - 171 (5) Energy test cloth supply issues if the test substrate is DOE energy test cloths.
 - 172 (6) Relative differences in testing cost and burden between using AHAM base load material or DOE
173 energy test cloth.
 - 174 (7) Key attributes of folding, loading, and test strip attachment that would govern the development of new
175 folding, loading, and test strip attachment procedures applicable to DOE energy test cloths.
 - 176 (8) Any factors that would preclude eliminating Mechanical Action test swatches from the base load.
- 177 Based on its evaluation of stakeholder comments and input, DOE will select *Option A* or *Option B* as the
178 base load composition in the Draft 1 Test Method.

179 B) Stuffer Load Composition: [*Option A* or *Option B*]

180 **Note:** *Option A* corresponds to the stuffer load materials specified in AHAM HLW-1-2010. These consist
181 of hemmed 100% cotton fabric rectangles. If AHAM base load materials are specified in Section 4.4.A of
182 this test method, the stuffer load composition would be specified by Section 4.3 of AHAM HLW-1-2010.

183 *Option B* corresponds to the stuffer load materials specified in Appendix J2. These consist of 50% cotton /
184 50% polyester fabric test cloths. If DOE energy test cloths are specified in Section 4.4.A of this test
185 method, the stuffer load composition would be specified by Section 2.6.2 of Appendix J2.

186 Based on its evaluation of stakeholder comments and input, DOE will select *Option A* or *Option B* as the
187 stuffer load composition in the Draft 1 Test Method. The proposed option will also be consistent with the
188 selection for the base load composition.

189 C) Soil/Stain Test Strips: Test strips shall be in accordance with Annex A, Sections A.6 and A.7 of AHAM
190 HLW-1-2010.

191 D) Detergent: Detergent formulation, concentration, and storage specifications shall be in accordance
192 with Section 4.7 of AHAM HLW-1-2010.

193 E) Rinsing Performance Test Materials: Materials as specified in AHAM HLW-1-2010, Annex E, Section
194 3.

195 **Note:** Section 4.4.E references the list of materials found in the AHAM Rinsing Effectiveness Test. DOE
196 does not suggest any changes to the materials listed in Annex E, Section 3, and therefore is wholly
197 incorporating that list.

198
199 **4.5 Pre-test Preparation**

200 A) Test Machine Capacity Measurement: Determine the clothes container capacity of the UUT according
201 to Section 3.1 of Appendix J2.

202 B) Test Machine Installation: Install the clothes washer in accordance with manufacturer's instructions.

203 C) Pretreatment of Textile Items for Base Loads: Before their first use, items to be used for base loads
204 shall be pretreated in accordance with Section 4.4.1 of AHAM HLW-1-2010 in the load treatment
205 clothes washer specified in Section 4.3.A of this test method.

206 D) Base Load Size: The base load size shall be the "average" load size for adaptive-fill clothes washers,
207 and the "maximum" load size for manual-fill clothes washers. "Average" and "maximum" load sizes
208 shall be determined in pounds (lb), based on the measured clothes container capacity of the UUT,
209 according to Table 5.1 of Appendix J2. All base load sizes referred to in this test method are "bone
210 dry" weights.

211 **Note:** These load sizes represent the load sizes with the highest consumer usage factors in Appendix J2
212 (Table 4.1.3). According to Appendix J2, for adaptive-fill clothes washers, the average load size is
213 selected for 74% of all wash loads. For manual-fill clothes washers, the maximum load size is selected for
214 72% of all wash loads.

215 If AHAM base load materials are used in this test method, the following will be added to Section 4.5.C
216 above: "The load sizes specified by Table 5.1 in Appendix J2 shall be rounded to the nearest pound for
217 the purposes of determining the base load composition according to AHAM HLW-1-2010."

218 DOE invites comment on the appropriateness of using the "average" or "maximum" load sizes for
219 measuring cleaning and rinsing performance.

220 E) Base Load Preparation: *Option A* or *Option B*

221 **Note:** *Option A (shown below in paragraph 1)*: If the AHAM base load is used, base load determination
222 requirements would be in accordance with Section 6.5 of AHAM HLW-1-2010.

223 *Option B*: If DOE energy test cloth is used for the base load, new base load determination requirements
224 would be developed for this test method.

225 1) Base Load Determination: Determine the size and composition of the base load as specified in
226 Sections 4.5.D, 4.4.A, and 4.4.B above. Select base load items in accordance with Sections 6.5.2
227 and 6.5.3 of AHAM HLW-1-2010.

228 2) Base Load Normalization: Normalize the base load in the load treatment clothes washer,
229 specified in Section 4.3.A of this test method, in accordance with Section 4.4.2 of AHAM HLW-1-
230 2010.

231 **Note:** To remove detergent residue, AHAM HLW-1-2010 specifies that before first use in any series of
232 tests, and subsequently after every three cycles, the base load shall be normalized. Normalization
233 consists of performing two hot/cold (wash/rinse) cycles without detergent and bone-drying the items after
234 each cycle.

235 Appendix J2 does not contain a normalization procedure because all Appendix J2 test cycles are
236 performed without detergent.

237 F) Test Strip Attachment:

238 1) Calibration: Calibration data for each lot of soil/stain test strips shall be provided by the supplier,
239 as specified in Section 6.4 of AHAM HLW-1-2010.

240 **Note:** Section 6.7 of AHAM HLW-1-2010 states that the cleaning scoring system allows for the optional
241 use of the laboratory's own calibration data for the soil/stain strips, using a reference clothes washer and
242 the wash treatments defined in Annex A, Section A.7.1, Treatment a).

243 DOE invites stakeholder input on the following: (1) whether using the supplier's calibration data for each
244 lot of soil/stain test strips would be appropriate for this test method, or whether the test method should
245 require that each laboratory measure its own calibration data for each lot of soil/stain strips; (2) whether
246 there is any data that compares supplier calibration with other lab calibrations; and (3) whether allowing
247 in-house calibration might provide opportunities to circumvent the test method.

248 DOE further invites stakeholder comment on the additional burden and reproducibility associated with the
249 calibration test.

250 2) Marking the Test Strips: Record the manufacturer-supplied calibration data for the soil/stain strips
251 and mark each soil/stain strip with a unique identifying reference in accordance with Sections
252 6.5.5 and 6.6.6 of AHAM HLW-1-2010.

253 3) Fastening the Test Strips: Fasten the test strips to the base load materials in accordance with
254 Section 6.5.7 of AHAM HLW-1-2010.

255 G) Detergent Preparation: Weigh out the specified quantity of standard test detergent in accordance with
256 Sections 4.7 and 6.5.8 of AHAM HLW-1-2010.

257 5 TEST METHOD

258 5.1 Test Cycles

259 This test method shall be separately performed on the cold wash/cold rinse and the warm wash/cold rinse
260 cycles of the DOE energy test cycle, as defined in Section 1.13 of Appendix J2.

261 For a clothes washer offering multiple warm wash cycles, as defined in Section 1.34 of Appendix J2, this
262 test method shall be performed on the warm wash/cold rinse cycle that uses the least amount of hot
263 water during the energy test cycle when tested according to Appendix J2.
264

265 **Note:** Appendix J2 requires testing additional temperature combinations, if available on the UUT, beyond
266 the cold wash/cold rinse and warm wash/cold rinse cycles proposed for this test method. DOE believes
267 that including only cold wash/cold rinse and warm wash/cold rinse cycles for performance testing
268 represents an appropriate tradeoff between minimizing test burden and the desire to maintain test
269 conditions that are as representative as possible to those in Appendix J2.

270 The accompanying analysis document discusses the advantages and disadvantages of including
271 additional available wash/rinse temperature cycles on the UUT in this test method. DOE invites
272 stakeholder comment on whether including only the cold wash/cold rinse and warm wash/cold rinse
273 cycles in this test method represents an appropriate tradeoff between minimizing test burden and
274 maintaining test conditions that are representative of those in Appendix J2.

275 5.2 Replications

277 Perform three replications of the test required for each wash and rinse temperature combination. Use the
278 same base load for each replication.

279 **Note:** Section 6.5.1 of AHAM HLW-1-2010 states that a minimum of three replications of any given cycle
280 are to be run using the same load. DOE invites stakeholder comment on whether performing only three
281 replications of each test cycle would provide repeatable and reproducible test results.
282

283 **5.3 Measuring Washing Performance**

284 A) Perform the Soil/Stain Removal Test procedure in accordance with Section 6.6 of AHAM HLW-1-
285 2010 with the following parameters:

286 1) Clothes Washer Control Setting:

287 a) Test Cycle: Perform the cycles specified in Section 5.1 of this test method. For each cycle
288 selection, the manufacturer default settings shall be used, except for the temperature
289 selection, if necessary. Settings include agitation/tumble level, soil level, spin speed(s), wash
290 times, rinse times, and all other wash parameters or optional features applicable to that cycle.

291 b) Water Fill Level: For manual-fill machines, select the maximum water fill setting. For
292 adaptive-fill machines, the fill level shall be determined automatically by the clothes washer.

293 2) Conditioning Cycle: When conditioning the UUT, perform Section 4.8 of ANSI/AHAM HLW-1-
294 2007 instead of Section 4.8 of AHAM HLW-1-2010.

295 **Note:** AHAM HLW-1-2010 defines “Conditioning Cycle” in Section 3.3 as “The cycle used to prepare a
296 washer for test.” Although labeled “Conditioning Cycle,” Section 4.8 of AHAM HLW-1-2010 contains
297 requirements for normalization of the base load rather than conditioning of the UUT.

298 However, Section 4.8 of ANSI/AHAM HLW-1-2007 does specify conditioning of the UUT as:

299 “Immediately prior to the start of the first run of a test, the test clothes washer is to be operated
300 through one cycle, using the same control settings as for the actual test but with no clothes load or
301 detergent and using the water specified in 4.5, in order to assure consistent initial conditions. A
302 conditioning cycle shall also be run if significant time has elapsed between runs, e. g. before the first
303 run of the day.”

304 DOE believes that Section 4.8 in ANSI/AHAM HLW-1-2007 is the appropriate method of performing the
305 UUT conditioning cycle for this test method because it specifies clothes washer conditioning rather than
306 base load normalization.

307 3) Folding and Loading of Test Load (AHAM HLW-1-2010, Section 6.6.5): Option A or Option B

308 **Note:** *Option A:* If AHAM base load materials are used, test load folding and loading shall be performed in
309 accordance with Section 6.6.5 of AHAM HLW-1-2010.

310
311 *Option B:* If DOE test cloth materials are used, new test load folding and loading requirements would
312 need to be developed because the AHAM HLW-1-2010 folding and loading requirements are not
313 applicable to DOE energy test cloths, and because Appendix J2 does not provide folding and loading
314 procedures that would be adequate for the purpose of conducting cleaning performance and rinsing
315 performance tests; Section 5.1 of AHAM HLW-1-2010 states:

316 “Experience has shown that the way that a washing machine is loaded can influence the results
317 obtained, especially with respect to washing performance. To achieve reproducible results it is
318 therefore necessary to specify both the loading sequence and the position and placement of all
319 load items in the test washing machine ... for all performance tests.”

320 Included in the AHAM HLW-1-2010 folding and loading procedures are specific instructions for attaching,
321 folding, locating, and orienting soil/stain test strips and the articles to which they are attached. Because
322 the DOE energy test does not use test strips, Appendix J2 has no procedures regarding test strips.

323 Appendix J2 does not specify the position or placement of energy test cloths into the UUT. Section 2.8.3
324 of Appendix J2 states:

325 “Load the energy test cloths by grasping them in the center, shaking them to hang loosely and
326 then put them into the clothes container prior to activating the clothes washer.”

327 If DOE test cloth materials are used in this test method, DOE would conduct extensive testing to develop
328 folding and loading requirements that would produce repeatable and reproducible test results.

329 B) Calculate a Total Cleaning Score for each test cycle in accordance with Section 6.7 of AHAM HLW-1-
330 2010.

331
332 **5.4 Measuring Rinsing Performance**

333 A) Perform the Rinsing Effectiveness Test in accordance with Annex E of AHAM HLW-1-2010, using the
334 white (unstained) test swatch of each of the stain strips.

335 B) Calculate the Residual Detergent Score and Standard Deviation of the Residual Detergent Score for
336 each test cycle, using equations 8-8 and 8-9, respectively, in Section 8.2 of AHAM HLW-1-2010,
337 Annex E.

338 **Note:** As noted above, the Residual Detergent Score is calculated using the “Rinse Score” formula in
339 Annex E of AHAM HLW-1-2010. The Standard Deviation of the Residual Detergent Score is calculated
340 using the “Standard Deviation of the Rinse Score” formula in Annex E of AHAM HLW-1-2010. Section
341 5.2.2 of the AHAM Rinsing Effectiveness Test (Annex E of AHAM HLW-1-2010) states that the stain strips
342 shall be labeled along the edge of the sebum stain, and explicitly states not to add markings to the
343 unstained swatch. In contrast, for measuring cleaning performance, Section 6.5.6 in the Soil/Stain
344 Removal Test of AHAM HLW-1-2010 states that each soil/stain strip shall be marked in a corner of the
345 unstained control swatch, so as not to affect the measurements obtained from the stained swatches.

346 DOE requests information from stakeholders regarding the methods they have used to perform both the
347 Soil/Stain Removal and Rinsing Effectiveness Tests in a single test cycle, using the same set of soil/stain
348 strips, rather than in two separate test cycles with two different sets of soil/stain strips.

349 **6 SCORING**

350 **6.1 Total Cold Wash Cycle Cleaning Score**

351 Calculate a Total Cleaning Score for the cold wash/cold rinse cycle in accordance with Section 5.3.B of
352 this test method.

353 **6.2 Total Warm Wash Cycle Cleaning Score**

354 Calculate a Total Cleaning Score for the warm wash/cold rinse cycle in accordance with Section 5.3.B of
355 this test method.

356 **6.3 Cold Wash Cycle Residual Detergent Score**

357 Calculate a Residual Detergent Score for the cold wash/cold rinse cycle in accordance with Section 5.4 of
358 this test method.

359 **6.4 Warm Wash Cycle Residual Detergent Score**

360 Calculate a Residual Detergent Score for the warm wash/cold rinse cycle in accordance with Section 5.4
361 of this test method.

362 **Note:** DOE invites stakeholder comments on whether the metrics in Section 6.1 through 6.4 are
363 appropriate for determining cleaning and rinsing performance within the ENERGY STAR clothes washer
364 program.

365 **7 REFERENCES**

366 A) AHAM HLW-1-2010. “Performance Evaluation Procedures for Household Clothes Washers”

367 B) ANSI/AHAM HLW-1-2007. “Performance Evaluation Procedures for Household Clothes Washers”

368 C) DOE Appendix J2 to Subpart B of 10 CFR 430, as published at 77 FR 13888, 13939, March 7,
369 2012. "Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-
370 Automatic Clothes Washers"