



# ENERGY STAR Discussion Document Initial Approach for Measuring Clothes Washer Performance and Analysis of Primary Issues For Stakeholder Comment

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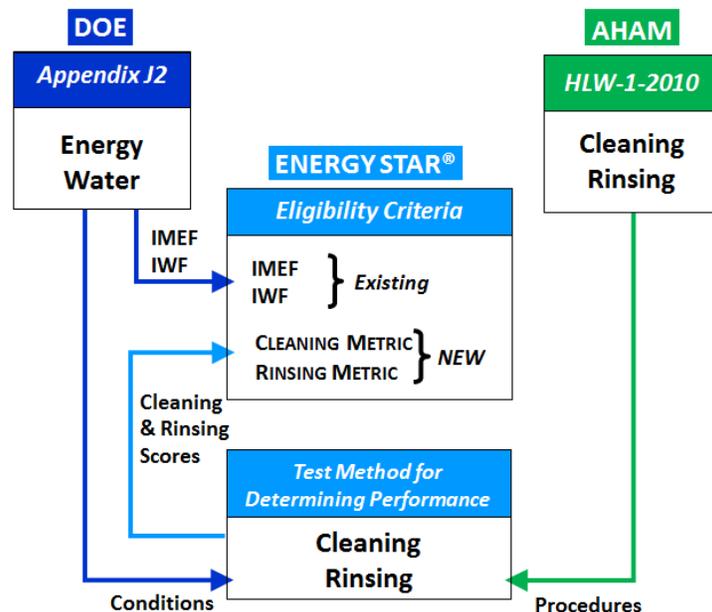
## Introduction

This document is a supplement to the ENERGY STAR Preliminary Approach for Determining Clothes Washer Performance (PA). It provides additional detail on several issues highlighted in the PA.

As noted in the PA, the U.S. Department of Energy (DOE) is proposing to combine provisions of the following test procedures for the purpose of establishing the ENERGY STAR Test Method for Determining Clothes Washer Performance:

- Association of Home Appliance Manufacturers (AHAM) test method HLW-1-2010, “Performance Evaluation Procedures for Household Clothes Washers.” (HLW-1-2010)
- 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,” as published at 77 FR 13888, 13939, March 7, 2012. (“Appendix J2”)

The methodology DOE used to integrate HLW-1-2010 and Appendix J2 is detailed in the PA, and is summarized in the diagram appearing there and reproduced in Figure 1.



**Figure 1. Test conditions and procedures used as inputs to the proposed Test Method**  
DOE seeks stakeholder feedback on the following issues related to the Test Method as proposed in the PA.

## Issue 1: Base Load Composition (See PA Section 4.4A)

DOE recognizes that it is desirable to measure cleaning and rinsing performance under conditions that are similar to those required by the DOE energy efficiency test. A key factor in both performance and energy efficiency testing is the specification of the fabric articles comprising the load. Ideally, the performance test would be conducted using the same load as the energy efficiency test. However, achieving this goal is not straightforward:

- Appendix J2 and HLW-1-2010 use different fabric articles within the clothes washer. In Appendix J2 the cloths are used as *test articles*, whereas in HLW-1-2010 the articles serve as the *substrate* for soiled test strips.
- The base load material composition is integral to the conduct and results of these test procedures. The fabric articles used for each procedure were chosen because their characteristics satisfy key criteria relevant to the purpose of the respective procedure.
- The methods for handling, preparing, loading, and measuring articles described in the test procedures are based on the fabric type, size, shape, and other properties of the articles used in each procedure.

In the DOE energy test, the articles are 50% cotton / 50% polyester fabric test cloths that were developed to exhibit consistent and repeatable moisture retention for the Remaining Moisture Content (RMC) portion of the energy test. The HLW-1-2010 base load is identical to the “cotton base load” specified by the International Electrotechnical Commission (IEC) in its clothes washer performance test method, IEC 60456<sup>1</sup>. It consists of a mixture of 100% cotton bed sheets, pillow cases, and towels. The IEC developed its cotton base load specification over several decades to ensure reproducible and repeatable results for a variety of performance-related tests, including cleaning and rinsing performance.

Fabric article characteristics and testing requirements for each of the Options listed in PA Section 4.4.A are listed in Table 1.

If AHAM base load materials are specified in the final version of this test method, the base load composition would be specified by Section 4.2 of HLW-1-2010. If DOE energy test cloths are specified, the base load composition would be specified by Section 2.6.1 of Appendix J2. Regardless of which type of base load material is used, the ENERGY STAR performance test will require the use of detergent, unlike the DOE efficiency test. However, if Appendix J2 test cloth materials are used then the amount of detergent required for the test will have to be re-evaluated.

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<sup>1</sup> IEC Standard 60456, Edition 5.0, 2010-02. “Clothes Washing Machines for Household Use – Method for Measuring the Performance”

**Table 1: Characteristics and testing requirements of HLW-1-2010 and Appendix J2 fabric articles**

Characteristic or Requirement	Option A: HLW-1-2010 Base Load Materials	Option B: Appendix J2 Test Cloth Materials
<b>Description of load materials</b>	<ul style="list-style-type: none"> <li>• <u>Composition</u>: bed sheets, pillowcases, towels</li> <li>• <u>Material</u>: 100% cotton</li> <li>• <u>Dimensions</u>:               <ul style="list-style-type: none"> <li>○ Bed sheets: 94" x 63"</li> <li>○ Pillowcases: 31" x 31"</li> <li>○ Towels: 39" x 20"</li> </ul> </li> <li>• <u>Maximum usage</u>: 84 test cycles</li> </ul>	<ul style="list-style-type: none"> <li>• <u>Composition</u>: rectangular fabric cloths</li> <li>• <u>Material</u>: 50% cotton / 50% polyester</li> <li>• <u>Dimensions</u>:               <ul style="list-style-type: none"> <li>○ Rectangular cloth: 36" x 24"</li> </ul> </li> <li>• <u>Maximum usage</u>: 60 test cycles</li> </ul>
<b>General objective</b>	Designed to simulate consumer loads using test pieces that are reproducible and facilitate test repeatability (HLW-1-2010, Section 4.2.1).	Designed to simulate an approximate average of the variety of fabric blends laundered by consumers, and to provide consistent and repeatable RMC results.
<b>Consistency with Appendix J2 test conditions</b>	100% cotton blend absorbs more water than a synthetic blend, so clothes washers with automatic water fill may consume more water during an ENERGY STAR performance test than during Appendix J2 testing at the specified cycle settings.	Using DOE test cloth would ensure equivalent test load composition and clothes washer water consumption between an ENERGY STAR performance test and Appendix J2 testing at the specified cycle settings.
<b>Material procurement</b>	AHAM base load materials are available through multiple distributors in the U.S.	DOE energy test cloth is currently distributed by a single U.S. supplier. Increased emphasis on compliance, certification, and enforcement has led to test cloth shortages in recent years.
<b>Folding, loading sequence, and test strip attachment</b>	Specifies methodologies for folding, loading and attaching test strips to base load materials, which could be used unchanged in an ENERGY STAR performance test.	Does not specify folding and loading sequences, and test strips are not used. New procedures would need to be developed for an ENERGY STAR performance test .
<b>Age profile</b>	Requires the average base load article age to be 29-51 cycles, thus implicitly requiring a sophisticated age tracking system.	Requires using test cloths from the same lot for a given test, but does not specify an average load age.

DOE invites comments from stakeholders regarding whether the ENERGY STAR Test Method should require using HLW-1-2010 base load materials or Appendix J2 test cloth for the base load composition. In addition to general comments, DOE specifically requests information and comments regarding the following:

- (1) The appropriate amount of detergent to use if DOE test cloths are required (note that IEC 60456 requires different amounts of detergent for 100% cotton and for synthetic blends.)
- (2) Whether and what weighted-average age requirements should be applied to base loads consisting of DOE test cloths.
- (3) The impact of test substrate choice on performance test results for soil/stain removal and rinsing effectiveness, including effects of fabric type and size and shape of base load articles.
- (4) Whether the presence of synthetic material in the base load would necessitate differences in test methodology, as is the case in IEC 60456 (e.g., for average base load article age).
- (5) Energy test cloth supply issues if the test substrate is DOE energy test cloths.
- (6) Relative differences in testing cost and burden between using AHAM base load material or DOE energy test cloth.
- (7) Key attributes of folding, loading, and test strip attachment that would govern the development of new folding, loading, and test strip attachment procedures applicable to DOE energy test cloths.
- (8) Any factors that would preclude eliminating Mechanical Action test swatches from the base load.

## **Issue 2: Selection of Test Cycles (See PA Section 5.1)**

DOE proposes the following test cycle specifications in the Preliminary Approach:

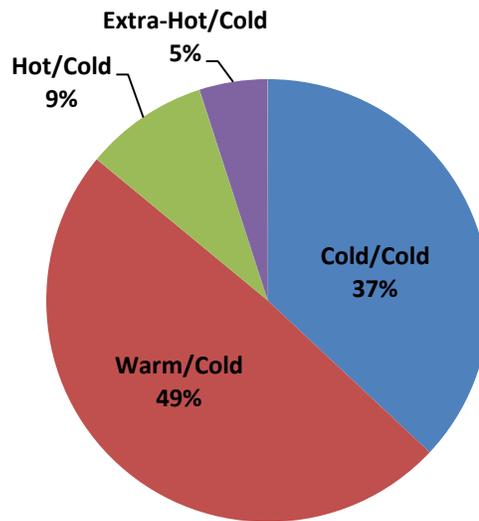
### **5.1 Test Cycles**

This test method shall be performed on the **cold wash/cold rinse** and **warm wash/cold rinse** cycles comprising the DOE energy test cycle, as defined in Section 1.13 of Appendix J2. For a clothes washer offering multiple warm wash cycles, as defined in Section 1.34 of Appendix J2, this test method shall be performed on the warm wash/cold rinse cycle that uses the least amount of hot water during the energy test cycle when tested according to Appendix J2. *[Emphasis added]*

DOE notes that Appendix J2 requires testing the following wash/rinse temperature combinations, if available on the unit under test (UUT):

- Cold/Cold
- Warm/Cold
- Warm/Warm
- Hot/Cold
- Extra-hot/Cold

Figure 2 shows the weighting applied to each of these temperature combinations on a UUT containing all of these temperature options. The weighting represents estimates of average consumer usage of each temperature combination.



**Figure 2: Appendix J2 weighting, representing average usage, applied to each wash/rinse temperature combination**

DOE considered several approaches to cycle selection in the PA. The most comprehensive approach would involve testing each of the wash/rinse temperature combinations required by Appendix J2. Other approaches involve testing a subset of the cycles required by Appendix J2. In the PA, DOE has proposed testing only the Cold/Cold and the Warm/Cold cycles.

DOE believes that requiring testing of these two wash/rinse temperature cycles represents an optimal tradeoff between minimizing test burden and maintaining test conditions that are representative of Appendix J2. Table 2 describes advantages and disadvantages associated with several approaches to cycle selection. DOE’s proposed approach is summarized in the first row.

DOE invites comment on whether including only the cold wash/cold rinse and warm wash/cold rinse cycles for performance testing represents an appropriate tradeoff between minimizing test burden and the desire to maintain test conditions that are as representative as possible to those in Appendix J2.

**Table 2: Possible Approaches to Cycle Selection**

Approach	Cycles Required	Advantages	Disadvantages
<b>Proposed approach:</b> Test a <i>minimal number</i> of temperature combinations that together represent a <u>majority of consumer cycle selections</u>	- Cold/Cold - Warm/Cold	<ul style="list-style-type: none"> <li>• Reduced test burden</li> <li>• Represents 86% of consumer cycle selections</li> <li>• Soil/stain removal tested under likely the most challenging conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Does not represent the complete set of conditions tested under Appendix J2</li> <li>• Some possibility remains that soil/stain removal and rinsing effectiveness could be worse for some other cycle (though the usage factor would be low)</li> </ul>

Approach	Cycles Required	Advantages	Disadvantages
Test <i>all</i> wash/rinse <u>temperature combinations required by Appendix J2</u>	<ul style="list-style-type: none"> <li>- Cold/Cold</li> <li>- Warm/Cold</li> <li>- Warm/Warm</li> <li>- Hot/Cold</li> <li>- Extra-hot/Cold</li> </ul>	<ul style="list-style-type: none"> <li>• Would most closely represent the performance of the clothes washer under Appendix J2 test conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Maximum test burden option. (Three replications per test condition, as specified in HLW-1-2010, would result in up to 15 total tests per UUT)</li> </ul>
Test the <i>single</i> temperature combination likely to have the <u>lowest soil/stain removal score</u>	<ul style="list-style-type: none"> <li>- Cold/Cold</li> </ul>	<ul style="list-style-type: none"> <li>• Significantly reduced test burden</li> <li>• Soil/stain removal scores for all other wash cycles are likely to be equal to or greater than the score for the Cold/Cold cycle</li> </ul>	<ul style="list-style-type: none"> <li>• Does not represent the complete set of conditions tested under Appendix J2</li> <li>• In some cases the Cold/Cold cycle may not have the lowest soil/stain removal score</li> <li>• Rinsing performance may not correlate with soil/stain removal (i.e., the cycle with the worst soil/stain removal score may not have the worst rinsing effectiveness score)</li> </ul>
Test the <i>single</i> temperature combination with the <u>highest weighting factor in Appendix J2</u>	<ul style="list-style-type: none"> <li>- Warm/Cold</li> </ul>	<ul style="list-style-type: none"> <li>• Significantly reduced test burden</li> <li>• Represents the one cycle most commonly selected by consumers</li> </ul>	<ul style="list-style-type: none"> <li>• Does not represent the complete set of conditions tested under Appendix J2</li> </ul>