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Energy Conservation Program for Consumer Products: Test Procedure for Residential Clothes Washers; Proposed Rule

DEPARTMENT OF ENERGY

10 CFR Part 430

[Docket No. EERE–2010–BT–TP–0021]

RIN 1904–AC08

Energy Conservation Program for Consumer Products: Test Procedure for Residential Clothes Washers

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notice of proposed rulemaking (NOPR) and public meeting.

SUMMARY: The U.S. Department of Energy (DOE) proposes amending its test procedure for residential clothes washers under the Energy Policy and Conservation Act to provide for measuring standby mode and off mode energy consumption, and to update the active mode test procedure. DOE is also proposing to eliminate an obsolete clothes washer test procedure currently codified in the Code of Federal Regulations, and is announcing a public meeting to discuss and receive comments on the issues presented in this NOPR.

DATES: DOE will hold a public meeting on Thursday, October 28, 2010, from 9 a.m. to 4 p.m., in Washington, DC. DOE must receive requests to speak at the public meeting before 4 p.m., Thursday, October 14, 2010. DOE must receive a signed original and an electronic copy of statements to be given at the public meeting before 4 p.m., Thursday, October 21, 2010.

DOE will accept comments, data, and information regarding the NOPR before and after the public meeting, but no later than December 6, 2010. For details, see section V, "Public Participation," of this NOPR.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 1E–245, 1000 Independence Avenue, SW., Washington, DC 20585–0121. To attend the public meeting, please notify Ms. Brenda Edwards at (202) 586–2945. Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. Any foreign national wishing to participate in the meeting should advise DOE as soon as possible by contacting Ms. Edwards to initiate the necessary procedures.

Any comments submitted must identify the NOPR on Test Procedures for Residential Clothes Washers, and provide the docket number EERE–2010–BT–TP–0021 and/or regulatory information number (RIN) 1904–AC08. Comments may be submitted using any of the following methods:

1. *Federal eRulemaking Portal: http://www.regulations.gov.* Follow the instructions for submitting comments.

2. *E-mail: RES-CW-2010-TP-0021@ee.doe.gov.* Include docket number EERE–2010–BT–TP–0021 and/or RIN 1904–AC08 in the subject line of the message.

3. *Mail:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Please submit one signed original paper copy.

4. *Hand Delivery/Courier:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 6th Floor, 950 L'Enfant Plaza, SW., Washington, DC 20024. *Telephone:* (202) 586–2945. Please submit one signed original paper copy.

For detailed instructions on submitting comments and additional information on the rulemaking process, see Section V, "Public Participation," of this document.

Docket: For access to the docket to read background documents or comments received, visit the U.S. Department of Energy, Resource Room of the Building Technologies Program, 6th Floor, 950 L'Enfant Plaza, SW., Washington, DC 20024, (202) 586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Please call Ms. Brenda Edwards at the above telephone number for additional information about visiting the Resource Room.

FOR FURTHER INFORMATION CONTACT:

Mr. Stephen L. Witkowski, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Telephone: (202) 586–7463. E-mail: *mailto:Stephen.Witkowski@ee.doe.gov.*

Ms. Jennifer Tiedeman, U.S. Department of Energy, Office of the General Counsel, GC–71, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Telephone: (202) 287–6111. E-mail: *mailto:Jennifer.Tiedeman@hq.doe.gov.*

For information on how to submit or review public comments and on how to participate in the public meeting, contact Ms. Brenda Edwards, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Telephone: (202) 586–2945. E-mail: *Brenda.Edwards@ee.doe.gov.*

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I. Background and Legal Authority

Title III of the Energy Policy and Conservation Act (42 U.S.C. 6291 *et seq.*) (EPCA or the Act) sets forth a variety of provisions designed to improve energy efficiency. Part A of Title III (42 U.S.C. 6291–6309) establishes the "Energy Conservation Program for Consumer Products Other Than Automobiles," which covers consumer products and certain commercial products (all of which are referred to below as "covered products"). These include residential clothes washers, the subject of today's notice. (42 U.S.C. 6292(a)(7))

Under the Act, this program consists essentially of three parts: (1) Testing, (2) labeling, and (3) Federal energy conservation standards. The testing requirements consist of test procedures that, pursuant to EPCA, manufacturers of covered products must use as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and for representations about the efficiency of those products. DOE also must use these test requirements to determine whether the products comply with EPCA standards. Section 323 of EPCA (42 U.S.C. 6293) sets forth criteria and procedures for DOE's adoption and amendment of such test procedures. EPCA provides that "[a]ny test procedures prescribed or amended under this section shall be reasonably designed to produce test results which measure energy efficiency, energy use * * * or estimated annual operating cost of a covered product during a representative average use cycle or period of use, as determined by the Secretary [of Energy], and shall not be unduly burdensome to conduct." (42 U.S.C. 6293(b)(3)) In addition, if DOE determines that a test procedure amendment is warranted, it must publish proposed test procedures and offer the public an opportunity to present oral and written comments on them. (42 U.S.C. 6293(b)(2))

Finally, in any rulemaking to amend a test procedure, DOE must determine "to what extent, if any, the proposed test procedure would alter the measured energy efficiency * * * of any covered product as determined under the existing test procedure." (42 U.S.C. 6293(e)(1)) If DOE determines that the amended test procedure would alter the measured efficiency of a covered product, DOE must amend the applicable energy conservation standard accordingly. In determining the amended energy conservation standard, the Secretary shall measure, pursuant to the amended test procedure, the energy efficiency, energy use, or water use of a representative sample of covered products that minimally comply with the existing standard. The average of such energy efficiency, energy use, or water use levels determined under the amended test procedure shall constitute the amended energy conservation standard for the applicable covered products. (42 U.S.C. 6293(e)(2)) EPCA also states that "models of covered products in use before the date on which the amended energy conservation standard becomes effective (or revisions of such models that come into use after such date and have the same energy efficiency, energy use, or water use characteristics) that comply with the energy conservation standard applicable to such covered products on the day before such date shall be deemed to comply with the amended energy conservation standard." (42 U.S.C. 6293(e)(2))

The DOE test procedure for clothes washers currently being manufactured is found at 10 CFR part 430, subpart B, appendix J1. DOE adopted appendix J1 in 1997 to correct for changes in consumer habits that resulted in an overstatement of average annual energy consumption when using the methods specified in appendix J. 62 FR 45508 (Aug. 27, 1997). DOE added appendix J1, rather than amending appendix J, to accommodate continued use of appendix J until DOE amended the residential clothes washer conservation standards to reference the new appendix J1. On January 12, 2001, DOE published a final rule (hereinafter referred to as the January 2001 final rule), to amend the energy conservation standards for residential clothes washers to reference the efficiency metrics as defined in appendix J1. 66 FR 3314. Use of the amended J1 test procedure was required to demonstrate compliance with these amended energy conservation standards as of January 1, 2004. Since 1997, DOE has amended the test procedure in appendix J1 three times, twice substantively to address test cloth correlation procedures, and once to correct the introductory note. 63 FR 16669 (Apr. 6, 1998); 66 FR 3330 (Jan. 12, 2001); 68 FR 62204 (Oct. 31, 2003). One of these amendments also included an amendment to Appendix J. 66 FR 3330 (Jan. 12, 2001). Because appendix J applies only to clothes washers manufactured before January 1, 2004, however, appendix J is now obsolete. 10 CFR 430 appendix J1.

The current applicable test procedure includes provisions for determining the modified energy factor (MEF) for clothes washers, which is a function of the total energy used for each cubic foot (ft^3) of clothes washer capacity. The test procedure measures the total energy consumption of the clothes washer. It also accounts for the amount of energy required to heat the water and subsequently dry the load based on the remaining moisture content (RMC) of the clothes at the completion of the machine's full cycle. The test procedure does not currently address energy use in the standby or off modes.

Clothes washer energy conservation standards were originally established by the National Appliance Energy Conservation Act of 1987, which amended EPCA to prescribe that clothes washers manufactured on or after January 1, 1988, have an unheated rinse option. (42 U.S.C. 6295 (g)) The amendments to EPCA also required DOE to conduct a rulemaking by January 1, 1990, to determine if the above mentioned standards should be amended. A final rule was issued on May 14, 1991, (hereinafter referred to as the May 1991 final rule) establishing the first set of performance standards for residential clothes washers. Compliance with these standards was required for products manufactured on or after May 14, 1994. 56 FR 22279. EPCA also

required DOE to conduct a subsequent rulemaking no later than 5 years after the date of publication of the previous final rule to determine whether to amend those standards. A final rule establishing revised standards for residential clothes washers was published in the January 2001 final rule. 66 FR 3313. The January 2001 final rule required all new residential clothes washers manufactured after January 1, 2007 to be 35 percent more efficient than clothes washers minimally compliant with the efficiency standards established in the May 1991 final rule.

The Energy Independence and Security Act of 2007 (EISA 2007), Public Law 110–140, amended EPCA and, in relevant part, revised the energy conservation standards for residential clothes washers. The revised standards established a maximum water consumption factor (WF) of 9.5, effective January 1, 2011. EISA 2007 further required that DOE publish a final rule no later than December 31, 2011 determining whether to amend the standards in effect for clothes washers manufactured on or after January 1, 2015. (42 U.S.C. 6295(g)(9)) Consequently, DOE is conducting a separate standards rulemaking for these products.

The EISA 2007 amendments to EPCA also direct DOE to amend its test procedures to integrate measures of standby mode and off mode energy consumption into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product unless the current test procedure already fully accounts for and incorporates standby and off mode energy consumption or such integration is technically infeasible. If an integrated test procedure is technically infeasible, DOE must prescribe a separate standby mode and off mode energy use test procedure for the covered product, if technically feasible. (42 U.S.C. 6295(gg)(2)(A))

Any such amendment must consider the most current versions of the International Electrotechnical Commission (IEC) Standard 62301, "Household electrical appliances—measurement of standby power," First Edition 2005–06, and IEC Standard 62087, "Methods of measurement for the power consumption of audio, video, and related equipment," Second Edition, 2008–09.[1] [2] In developing these test procedure amendments for clothes washers, DOE initially determined that it would consider a revised IEC Standard 62301 expected to be released in July 2009. DOE subsequently found that this revision is expected to be delayed until late-2010, so DOE determined it appropriate to proceed with an amended test procedure based on the current version of IEC Standard 62301, First Edition 2005–06. DOE is also considering a draft version of IEC Standard 62301, Final Draft International Standard (IEC Standard 62301 FDIS), for updated mode definitions, which are expected to be included in the final revised IEC Standard 62301, Second Edition.

On August 28, 2009, DOE published a notice in the **Federal Register** announcing the availability of a framework document to initiate a rulemaking to consider amended energy conservation standards for residential clothes washers (hereafter the August 2009 framework document). 74 FR 44306. In the August 2009 framework document, DOE requested comments on the merits of revising the clothes washer test procedure, and sought input regarding how the test procedure could be improved. DOE held a public meeting on September 21, 2009 (September 2009 public meeting). In addition, DOE requested written comments, data, and information on the August 2009 framework document, which it accepted through September 28, 2009.

DOE received comments in response to the August 2009 framework document stating that it should consider changes to the active mode test procedure. As a result, in addition to amending its test procedure for clothes washers to include measures for standby and off mode power consumption, DOE proposes to address issues regarding the active mode provisions of the test procedure.

II. Summary of the Proposal

In today's NOPR, DOE proposes amending the test procedure for clothes washers to assist DOE in the concurrent development and implementation of standards that address use of standby mode and off mode power by these products. Specifically, DOE proposes to integrate measures of standby mode and off mode power consumption, as well as measures of power consumption in certain additional modes determined to be part of active mode, into the test procedure. DOE also proposes, for the measurement of energy use in active mode, to: (1) Adopt technical changes and procedures for accurately measuring the energy consumption of clothes washers with technologies not covered by the current procedure; (2) more accurately reflect current consumer behavior and clothes washer capabilities; (3) address issues related to the test cloth, detergent, and certain test equipment; (4) revise and clarify the existing methods and calculations; and (5) delete obsolete appendix J to subpart B of CFR part 430 and references thereto. The following paragraphs summarize these proposed changes.

To integrate measures of standby mode and off mode power consumption into the test procedure, DOE proposes to incorporate by reference into the clothes washer test procedure specific provisions from IEC Standard 62301 regarding test conditions and test procedures for measuring standby mode and off mode power consumption. DOE also proposes to incorporate into the test procedure the definitions of "active mode," "standby mode," and "off mode" that are based on the definitions provided in IEC Standard 62301 FDIS. Further, DOE proposes to include in the test procedure additional language that would clarify the application of clauses from IEC Standard 62301 for measuring standby mode and off mode power consumption.[3] In addition, DOE proposes to incorporate energy consumption associated with delay start and cycle finished modes. Although these modes would be considered part of active mode, the measurements and calculations proposed for them are similar to those proposed for standby and off modes. DOE also proposes to: (1) Establish a new measure of energy use to calculate the per-cycle standby mode, off mode, delay start mode, and cycle finished mode energy consumption; and (2) adopt a new measure of energy efficiency (integrated modified energy factor (IMEF)) that includes the energy used in the active, standby, and off modes. As indicated above, DOE energy conservation standards currently do not address the energy use of clothes washers in the standby or off modes. Section 325(gg)(2)(C) of EPCA provides that amendments to the test procedures to include standby and off mode energy

[1] IEC standards are available online at *http://www.iec.ch*.

[2] Multiple editions of this standard are referenced in this notice. Unless otherwise indicated, the terms "IEC Standard 62301" or "IEC Standard 62301 First Edition" refer to "Household electrical appliances–measurement of standby power," First Edition 2005–06.

[3] EISA 2007 directs DOE to also consider IEC Standard 62087 when amending its test procedure to include standby mode and off mode energy consumption. *See* 42 U.S.C. 6295(gg)(2)(A). DOE considered IEC Standard 62087 and concluded that because IEC Standard 62087 addresses the methods of measuring the power consumption of audio, video, and related equipment, the narrow scope of this particular IEC Standard reduces its relevance to today's proposal. Further details are provided later in this notice.

consumption will not be used to determine compliance with previously established standards. (42 U.S.C. 6295(gg)(2(C)).

For the measurement of active mode energy use other than in delay start and cycle finished modes, DOE proposes to:

(1) Update the test procedure to address technologies not covered by the current procedure, based upon comments from interested parties in response to the August 2009 framework document and further review by DOE. These technologies include steam wash and self-cleaning cycles. Steam wash cycles inject steam into the wash basket, and claim to offer more effective cleaning. Self-clean cycles enable consumers to intermittently, typically once per month, run a self-clean cycle to prevent odor, bacteria, and mildew from building up in the clothes washer. DOE proposes to amend the test procedure to measure energy use in steam and self-clean cycles. DOE also received comments regarding demand response technologies, and investigated adaptive controls other than adaptive fill control. Demand response features enable an appliance to shift its activity based on interaction with the electric grid, utilities, or user programming. Adaptive controls enable a clothes washer to adjust parameters such as agitation speed, number of rinses, wash time, and wash and rinse temperatures based on the size, fabric mix, and soil level of a wash load. However, for reasons discussed in sections III.D.1.c and III.D.1.d, DOE is not proposing to update the test procedure to include provisions for measuring the energy consumption of clothes washers offering demand response technologies or adaptive controls other than adaptive fill control.

(2) Amend the test procedure for clothes washers to reflect current usage patterns and capabilities. DOE received multiple comments on this issue in response to the August 2009 framework document, and reviewed current consumer data from surveys conducted in 2004 and 2005 to determine whether such updates are appropriate. The proposed amendments address the following specific issues: Representative average-use cycles per year for a clothes washer, test load size specifications, and consumer use factors. The proposed amendments are based on recent data that more accurately describe current consumer behavior and updated clothes washer capabilities.

(3) Amend the test procedure to update the procedure and specifications for determining test cloth correlations, change the tolerances regarding the size and weight of the test cloth, and revise the detergent and preconditioning clothes washer specifications due to obsolescence or anticipated obsolescence of the existing test materials and equipment specified in the test procedure. These proposed amendments are based on multiple comments received in response to the August 2009 framework document and at the September 2009 public meeting regarding the test cloth used in the current test procedure.

(4) Update the test procedure to clarify or revise the existing methods and calculations for measuring clothes container capacity, calculating water consumption factor, determining the energy test cycle, and setting the supply water test conditions. The current capacity measurement provisions can be interpreted in multiple ways. Different allowable interpretations of the maximum water fill level used for the measurement can produce inconsistent results that may not accurately reflect the actual usable volume of a clothes washer. The proposed revisions revise the capacity measurement specifications so that interpretations are more likely to be uniform, repeatable, and representative, thereby ensuring the data is reported consistently. DOE proposes to adopt a new measure of water consumption, integrated water consumption factor (IWF) that would include water used in self-clean cycles. The IWF would also include water consumption from all energy test cycles, rather than only from the cold wash/cold rinse cycle as the test procedure currently requires. DOE also proposes to clarify the energy test cycle definition and the supply water test conditions specification.

DOE has also investigated how each of the proposed amendments to the active mode provisions for clothes washers, discussed above would affect the measured efficiency of products. See section III.D for further details. Because of the potential for significant impacts to the measured efficiency of products, DOE proposes to codify the amended clothes washer test procedure as appendix J2 in 10 CFR part 430 subpart B. Manufacturers would not be required to use appendix J2 to demonstrate compliance with clothes washer energy conservation standards until the compliance date of new standards, which would take into account any test procedure amendments. Until that time, manufacturers would be required to use existing appendix J1.

Finally, DOE proposes to delete appendix J to subpart B of CFR part 430, along with all references to appendix J in 10 CFR part 430.23. Appendix J only applies to clothes washers manufactured before January 1, 2004, and is now obsolete. Appendix J1 would retain its current designation and not be re-designated as Appendix J.

III. Discussion

A. Products Covered by This Test Procedure Change

Today's proposed amendments to the DOE test procedure cover residential clothes washers, which DOE's regulations define as follows:

Clothes washer means a consumer product designed to clean clothes, utilizing a water solution of soap and/or detergent and mechanical agitation or other movement, and must be one of the following classes: automatic clothes washers, semi-automatic clothes washers, and other clothes washers.

Automatic clothes washer means a class of clothes washer which has a control system which is capable of scheduling a preselected combination of operations, such as regulation of water temperature, regulation of the water fill level, and performance of wash, rinse, drain, and spin functions without the need for user intervention subsequent to the initiation of machine operation. Some models may require user intervention to initiate these different segments of the cycle after the machine has begun operation, but they do not require the user to intervene to regulate the water temperature by adjusting the external water faucet valves.

Semi-automatic clothes washer means a class of clothes washer that is the same as an automatic clothes washer except that user intervention is required to regulate the water temperature by adjusting the external water faucet valves.

Other clothes washer means a class of clothes washer which is not an automatic or semi-automatic clothes washer. 10 CFR 430.2.

DOE is not proposing any amendments to these definitions in today's NOPR. The clothes washers covered by these definitions, and by today's proposed amendments, include top-loading compact (less than 1.6 ft^3 capacity); top-loading standard size (1.6 ft^3 or greater capacity); top-loading, semi-automatic; front-loading; and suds-saving clothes washers.

B. Compliance Date of Proposed Test Procedure

As stated previously, DOE originally considered reviewing a revised IEC Standard 62301, expected to be released in July 2009, in the development of these test procedure amendments. DOE received comments in response to the August 2009 framework document

jointly from the Appliance Standards Awareness Project (ASAP), the Natural Resources Defense Council (NRDC) and the National Consumer Law Center (NCLC) (Joint Comment); and the Alliance to Save Energy (ASE), stating that the IEC 62301 revision process may take longer than previously thought and that DOE should proceed with updating the clothes washer test procedure. (Joint Comment, No. 14 at p. 1 [4]; ASE, No. 22 at p. 1) Additionally, Northeast Energy Efficiency Partnerships (NEEP) commented that waiting for the IEC process to finalize could be detrimental to the standards rulemaking, and that DOE should consider quickly revising the test procedure independently after the IEC procedure is finalized. (NEEP, No. 20 at p. 1)

DOE agrees that the revision to IEC Standard 62301 is expected to be delayed; the revision is currently expected in late 2010. Therefore, DOE proposes basing the amendments to the clothes washer test on the first edition of IEC Standard 62301, as well as draft versions of the second edition, in the issuance of this NOPR. Such action is necessary to permit manufacturers to certify that their products comply with any newly established energy conservation standards that take into account standby and off mode energy use.

The amended test procedure would become effective 30 days after the date of publication in the **Federal Register** of the final rule in this test procedure rulemaking. However, DOE would clarify in the published amended test procedure in 10 CFR part 430 subpart B appendix J2 that it need not be used to determine compliance with current energy conservation standards. Instead, manufacturers would be required to begin using the test procedures in appendix J2 on the compliance date of any final rule establishing amended energy conservation standards that would, in part, address standby and off mode power consumption for these products. 42 U.S.C. 6295(gg)(2)(C).

C. Standby Mode, Off Mode, and Additional Active Mode Test Procedures

1. Incorporating by Reference IEC Standard 62301 for Measuring Standby Mode and Off Mode Power Consumption

As required by EPCA, as amended by EISA 2007, DOE considered the most current versions of IEC Standard 62301 and IEC Standard 62087 for measuring power consumption in standby mode and off mode when developing today's proposed amendments to the clothes washer test procedure. (42 U.S.C. 6295(gg)(2)(A)) DOE noted that IEC Standard 62301 provides for measuring standby power in electrical appliances, including clothes washers, and thus is relevant here. DOE also reviewed IEC Standard 62087, which specifies methods of measuring the power consumption of TV receivers, video cassette recorders (VCRs), set top boxes, audio equipment, and multi-function equipment for consumer use. IEC Standard 62087 does not, however, include methods for measuring the power consumption of electrical appliances such as clothes washers. Therefore, DOE has determined that IEC Standard 62087 is inapplicable to this rulemaking, and has not included any of its provisions in today's proposed test procedure.

DOE proposes to incorporate by reference into this test procedure all applicable provisions from Sections 4 and 5 of IEC Standard 62301. Specifically, DOE proposes to incorporate, from section 4, ("General conditions for measurements"), paragraph 4.2, "Test room;" paragraph 4.4, "Supply voltage waveform;" paragraph 4.5, "Power measurement accuracy;" and from section 5, ("Measurements"), paragraph 5.1, "General," Note 1; and paragraph 5.3, "Procedure." These clauses provide test conditions and test procedures for measuring average standby mode and average off mode power consumption. With respect to test conditions, section 4 of IEC Standard 62301 provides specifications for the test room conditions, supply voltage waveform, and power measurement meter tolerances to ensure repeatable and precise measurements of standby mode and off mode power consumption. With respect to test procedures, section 5 of IEC Standard 62301 provides methods for measuring power consumption when the power measurement is stable and when it is unstable.

DOE invites comment on whether IEC Standard 62301 measures standby and off mode power consumption for clothes washers adequately, and whether incorporating these specific provisions into the DOE test procedure is appropriate.

2. Determination of Modes To Be Incorporated

EPCA provides the following mode definitions:

"Active mode" is defined as the condition in which an energy-using product is connected to a main power source, has been activated, and provides one or more main functions. (42 U.S.C. 6295(gg)(1)(A)(i))

"Standby mode" is defined as the condition in which an energy-using product is connected to a main power source and offers one or more of the following user-oriented or protective functions: to facilitate the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer; or continuous functions, including information or status displays (including clocks) or sensor-based functions. (42 U.S.C. 6295(gg)(1)(A)(iii))

"Off mode" is defined as the condition in which an energy-using product is connected to a main power source and is not providing any standby mode or active mode function. (42 U.S.C. 6295(gg)(1)(A)(ii))

During the September 2009 Public Meeting, ASAP commented that the definitions provided in IEC Standard 62301 do not conform to the statutory definitions provided by EPCA, so ASAP believed it was not entirely clear that DOE should adopt the IEC definitions word-for-word. (ASAP, Public Meeting Transcript, No. 7 at p. 19) [5]

DOE notes that the EPCA definition of standby mode differs from the one provided in IEC Standard 62301, which defines standby mode as the "lowest power consumption mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when an appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions." However, DOE expects significant changes to the mode

[4] A notation in the form "Joint Comment, No. 14 at p. 1" identifies a written comment (1) made by ASAP, NRDC, and NCLC jointly; (2) recorded in document number 14 that is filed in the docket of the clothes washer energy conservation standards rulemaking (Docket No. EERE–2008–BT–STD–0019) and maintained in the Resource Room of the Building Technologies Program; and (3) which appears on page 1 of document number 14.

[5] A notation in the form "ASAP, Public Meeting Transcript, No. 7 at p. 19" identifies an oral comment that DOE received during the September 21, 2009, Framework public meeting, was recorded in the public meeting transcript in the docket for the clothes washer energy conservation standards rulemaking (Docket No. EERE–2008–BT–STD–0019), and is maintained in the Resource Room of the Building Technologies Program. This particular notation refers to a comment (1) made by ASAP during the public meeting; (2) recorded in document number 7, which is the public meeting transcript that is filed in the docket of the clothes washer energy conservation standards rulemaking; and (3) which appears on page 19 of document number 7.

definitions included in IEC Standard 62301, based on review of IEC Standard 62301 FDIS. The definitions provided in IEC Standard 62301 FDIS are likely to be included in the final revised IEC Standard 62301, Second Edition. DOE considered the definitions provided by IEC Standard 62301 FDIS as the most current when determining the mode definitions proposed to be included in the test procedure.

EPCA authorizes DOE to amend mode definitions, as appropriate, considering the most current versions of IEC Standards 62301 and 62087. (42 U.S.C. 6295(gg)(1)(B)) DOE recognizes that the EPCA definitions for active mode, standby mode, and off mode were developed to be broadly applicable for many energy-using products. However, for specific products with multiple functions, these broad definitions could be interpreted in different ways. For these reasons, DOE proposes amending the test procedure to include definitions for these modes based on the definitions provided in IEC Standard 62301 FDIS, with added clarifications specific to clothes washers.

Active Mode

DOE proposes to define active mode as a mode in which the clothes washer is connected to a mains power source; has been activated; and is performing one or more of the main functions of washing, soaking, tumbling, agitating, rinsing, and/or removing water from the clothing, or is involved in functions necessary for these main functions, such as admitting water into the washer or pumping water out of the washer. DOE is proposing to refer to the typical clothes washing operation (*i.e.,* a complete wash cycle intended for washing a clothing load, including washing, rinsing, and spinning) as the active washing mode. DOE is aware of three additional relevant modes that it proposes to define as a part of active mode: delay start mode, cycle finished mode, and self-clean mode. DOE is proposing to include these modes in the measures of clothes washer energy consumption, as discussed in section III.C.4.

i. Delay Start Mode

DOE proposes to define delay start mode as a mode in which activation of the active washing mode is facilitated by a timer. Because delay start mode is not a mode that may persist for an indefinite time, DOE believes it would not be considered as part of a standby mode based on the proposed definition discussed below. DOE also notes that IEC Standard 62301 Committee Draft 2 (IEC Standard 62301 CD2) provides the additional clarification that "delay start mode is a one off user initiated short duration function that is associated with an active mode." The subsequent IEC Standard 62301 Committee Draft for Vote (IEC Standard 62301 CDV) removes this clarification; however, in response to comments on IEC Standard 62301 CD2 that led to IEC Standard 62301 CDV, IEC states that delay start mode is a one off function of limited duration. DOE infers that delay start mode should therefore be considered part of active mode. DOE notes that IEC 62301 FDIS classifies delay start as a secondary function and therefore not part of active mode. DOE continues to believe, however, that because delay start is of limited duration and is uniquely associated with the initiation of a main function (*i.e.,* washing cycle), it should be considered part of active mode. The proposed methods for measuring energy consumption in delay start mode are discussed in III.C.3.

ii. Cycle Finished Mode

DOE proposes to define cycle finished mode as a mode that provides continuous status display following operation in the active washing mode. However, as with delay start mode, cycle finished mode is not a mode that may persist for an indefinite time, and would therefore not be considered as a part of standby mode. Additionally, operation in cycle finished mode occurs only after operation in the active washing mode. DOE believes cycle finished mode, similar to delay start mode, would be considered a one off short duration function that is associated with an active mode. DOE is therefore proposing to define cycle finished mode as a part of active mode. The proposed methods for measuring energy consumption in cycle finished mode are discussed in III.C.3.

DOE is aware that some clothes washers currently available offer energy-consuming features in cycle finished mode other than a continuous status display. For example, certain models may employ a low-power fan to circulate air around the damp clothes to prevent odors. These models may also periodically tumble the clothes to prevent wrinkles for up to 10 hours after the completion of the wash cycle. These functions, while enabled, would use more energy than the continuous display normally associated with cycle finished mode. However, DOE does not propose amending the test procedure to address these specific cycle finished mode functions, because DOE believes measuring the energy use from these functions would significantly increase the test cycle duration to capture a negligible contributor to annual energy consumption. In addition, DOE research indicates that only eight out of the 94 residential clothes washer models currently produced by manufacturers representing more than 92 percent of the residential clothes washer market incorporate such a circulation or tumbling function. Because these models are also higher priced and recently introduced, DOE believes that the shipment-weighted percentage of residential clothes washers with a circulation or tumbling function in cycle finished mode is less than 5 percent. Therefore, DOE believes the energy consumed by these features in cycle finished mode represents a negligible portion of the overall energy consumption of clothes washers.

iii. Self-Clean Mode

DOE proposes to define self-clean mode as a clothes washer operating mode that:

- Is dedicated to cleaning, deodorizing, or sanitizing the clothes washer by eliminating sources of odor, bacteria, mold, and mildew;
- Is recommended to be run intermittently by the manufacturer; and
- Is separate from clothes washing cycles.

Self-clean mode is considered a part of the active mode because it is a function necessary for the main functions associated with washing clothes. A clothes washer with excessive bacteria, mildew, or odor cannot effectively wash clothes. A further discussion of self-clean mode, including its incorporation in the clothes washer test procedure, is included in section III.D.1.b.

Standby Mode

DOE proposes to define standby mode as any mode in which the clothes washer is connected to a mains power source and offers one or more of the following user-oriented or protective functions which may persist for an indefinite time: [6]

- Facilitation of the activation of other modes (including activation or deactivation of active mode) by remote

[6] The actual language for the standby mode definition in IEC Standard 62301 FDIS describes "* * *user oriented or protective functions which usually persist" rather than "* * * user oriented or protective functions which may persist for an indefinite time." DOE notes, however, that section 5.1 of IEC Standard 62301 FDIS states that "a mode is considered to be persistent where the power level is constant or where there are several power levels that occur in a regular sequence for an indefinite period of time." DOE believes that the proposed language, which was originally included in IEC Standard 62301 CD2, encompasses the possible scenarios foreseen by section 5.1 of IEC Standard 62301 FDIS without unnecessary specificity.

switch (including remote control), internal sensor, or timer;

- Continuous function: Information or status displays including clocks; and
- Continuous function: Sensor-based functions.

DOE proposes adding a clarification of what would be considered a timer under this definition of standby mode. DOE would clarify that a timer is a continuous clock function (which may or may not be associated with a display) that provides regular scheduled tasks (*e.g.,* switching) and that operates on a continuous basis. As noted earlier in this section, this proposed definition was developed based on the definition provided in IEC Standard 62301 FDIS. It expands on the EPCA mode definition to provide additional clarifications as to which functions are associated with standby mode.

The proposed definition of standby mode based on IEC Standard 62301 FDIS allows for multiple modes to be considered a standby mode. DOE has identified only one mode that would be considered a standby mode under the proposed definition. DOE proposes to define this "inactive mode" as a standby mode that facilitates the activation of active mode by remote switch (including remote control), internal sensor, or timer, or that provides continuous status display. DOE proposes amending the test procedure for clothes washers to include provisions for measuring energy use in inactive mode as the measurement of standby energy use. Although it identified only this one particular standby mode, DOE remains open to consideration of additional standby modes.

Off Mode

As discussed in section III.C.1, DOE proposes in today's NOPR to amend the DOE test procedure for clothes washers to define "off mode" as any mode in which the clothes washer is connected to a mains power source and is not providing any standby mode or active mode function and the mode may persist for an indefinite time. An indicator that only shows the user that the product is in the off position is included within the off mode classification. As noted in section III.C.1, this definition was developed based on the definitions provided in IEC Standard 62301 FDIS. It expands on the EPCA mode definitions to provide additional clarifications as to which functions are associated with off mode.

Under the proposed definitions, a clothes washer equipped with a mechanical on/off switch that can disconnect power to the display and/or control components would be considered as operating in the off mode when the switch is in the "off" position, provided that no other standby or active mode functions are energized. An energized light-emitting diode (LED) or other indicator that only shows the user that the product is in the off position would be considered part of off mode under the proposed definition, again provided that no other standby or active mode functions are energized. As stated above, however, if any energy is consumed by the appliance in the presence of a one-way remote control, the unit would be operating in standby mode under the proposed definition. That definition would include remote controls that facilitate the activation or deactivation of other functions (including active mode) as a feature of standby mode.

IEC Standard 62301 FDIS also provides definitions for additional modes that DOE determined are not applicable to the clothes washer test procedure. Section 3.7 of IEC Standard 62301 FDIS defines network mode as a mode category that includes "any product modes where the energy using product is connected to a mains power source and at least one network function is activated (such as reactivation via network command or network integrity communication) but where the primary function is not active." IEC Standard 62301 FDIS also provides a note, stating that "[w]here a network function is provided but is not active and/or not connected to a network, then this mode is not applicable. A network function could become active intermittently according to a fixed schedule or in response to a network requirement. A 'network' in this context includes communication between two or more separate independently powered devices or products. A network does not include one or more controls which are dedicated to a single product. Network mode may include one or more standby functions." As discussed further in section III.D.1.c, DOE is not proposing any amendments to include provisions for testing network mode energy consumption in clothes washers.

DOE also notes that section 3.9 of IEC Standard 62301 FDIS provides a definition of "disconnected mode", which is "the state where all connections to mains power sources of the energy using product are removed or interrupted." IEC Standard 62301 FDIS also adds a note that common terms such as "unplugged" or "cut off from mains" also describe this mode and that this mode is not part of the lower power mode category. DOE believes that there would be no energy use in a disconnected mode, and therefore, is not proposing a definition or testing methods for such a mode in the DOE test procedure for clothes washers.

DOE welcomes comment on the proposed establishment of the modes as discussed above, including inactive mode as the only standby mode for clothes washers. DOE also invites comment on the determination that delay start mode and cycle finished mode would be considered part of active mode. DOE further invites comment on the proposed mode definitions, including the definition of self-clean mode, and whether there are any modes that have not been identified in this NOPR that represent significant energy use and are consistent with the proposed active mode, standby mode, or off mode definitions.

3. Adding Specifications for the Test Methods and Measurements for Standby Mode, Off Mode, and Additional Active Mode Testing

This section discusses the provisions DOE proposes to include in the test procedure to clarify the IEC Standard 62301 methods when used to measure standby mode and off mode energy use in clothes washers. These proposed procedures also include provisions for measuring energy use in delay start mode and cycle finished mode. Although these modes are considered a part of active mode under the proposed definitions, the methods for measuring their associated energy consumptions are similar to those used for standby mode and off mode.

Paragraph 5.3.1 of section 5.3 of IEC Standard 62301 contains provisions for measuring power. It specifies, for products in which the power is stable (*i.e.,* power varies by not more than 5 percent from a maximum level during a period of 5 minutes), waiting at least 5 minutes for the product to stabilize and then measuring the power at the end of an additional time period of not less than 5 minutes. Paragraph 5.3.2 contains provisions for measuring average power in cases where the power is not stable (*i.e.,* power varies by more than 5 percent from a maximum level during a period of 5 minutes). In such cases, IEC Standard 62301 requires a measurement period of no less than 5 minutes, or one or more complete operating cycles of several minutes or hours. DOE notes these provisions do not preclude manufacturers from testing products with a longer stabilization period, or a longer measurement period (if the power varies by not more than 5 percent or if that period represents one or more complete cycles).

Displays on residential clothes washers may reduce power consumption by dimming or turning off after a certain period of user inactivity ("automatic power-down"). For clothes washers whose power input in standby, off, and cycle finished modes varies in this manner during testing, DOE proposes that the test be conducted after the power level has dropped to its lowest level, as discussed in IEC Standard 62301, section 5, ("Measurements"), paragraph 5.1, "General," Note 1. DOE is aware that IEC Standard 62301 does not provide guidance on how long to wait for the appliance to drop to the lower-power state. DOE observed during tests of 17 residential clothes washers that in units with an automatic power-down feature the higher-power state persists for less than 10 minutes of inactivity after the display has been energized. Thus, the energy consumption at the low-power level is most representative of standby mode, off mode, and cycle finished mode power. However, DOE notes the test sample of 17 clothes washers was relatively small. It is possible that some clothes washers may remain in the higher-power state for the duration of a 5-minute stabilization period and 5-minute measurement period, and then drop to the lower-power state that is more representative of standby mode, off mode, or cycle finished mode. In contrast, IEC Standard 62301 CDV specifies for each testing method that the product be allowed to stabilize for at least 30 minutes prior to a measurement period of not less than 10 minutes. DOE believes this method would allow sufficient time for displays that automatically dim or power down after a period of user inactivity to reach the lower-power state prior to measurement. Based on the automatic power-down time periods observed in its own testing, DOE believes that the IEC Standard 62301 CDV 30-minute stabilization and 10-minute measurement periods provide a clearer and more consistent testing procedure than the corresponding time periods specified in IEC Standard 62301. Those periods allow for representative measurements to be made among products that may have varying time periods before the power drops to a lower level more representative of standby, off, or cycle finished mode. DOE notes that IEC Standard 62301 FDIS establishes an overall test period of not less than 15 minutes for products in which power consumption in the mode being tested is not cyclic. Data collected during the first third of the total period is discarded (and thus this time could be inferred to be a stabilization period), and data from the remaining two-thirds of the total period are used to determine whether the power is stable. If stability is not achieved, the total period is extended continuously until the stability criteria are achieved, to a maximum of 3 hours. Modes that are known to be non-cyclic and of varying power consumption shall follow this same procedure, but with a total test period not less than 60 minutes. If power consumption in a mode is cyclic, measurements must be conducted with an initial operation period (analogous to a stabilization period) of at least 10 minutes, and the average power measured over at least four complete cycles. The measurement period must be at least 20 minutes. DOE believes that the specifications provided in IEC Standard 62301 FDIS would not produce power consumption measurements as accurate, repeatable, and enforceable as the specifications provided in IEC Standard 62301 CDV. Therefore, DOE proposes to require that: (1) the product be allowed to stabilize for at least 30 minutes, then (2) the power measurement be made for a period not less than 10 minutes for inactive, off, and cycle finished modes.

DOE's test procedures are developed to measure representative energy use for the typical consumer, and cannot capture all possible consumer actions and appliance usage patterns that might increase energy use. For example, certain residential clothes washer models featuring a display power-down may allow consumers to alter the display settings to increase the amount of time in the high-power state, or to make the high-power state permanent. Because DOE does not have information regarding the likelihood consumer will alter the default display settings, DOE has not proposed additional provisions in today's NOPR to address the possibility of increased energy use as a result of consumers adjusting the display power-down settings or other features. DOE welcomes comment on the suitability of using the default settings in testing standby energy consumption. It also welcomes comment on any methodologies that can account for consumer actions that might increase energy use, and requests data on the repeatability of such testing procedures.

DOE understands that clothes washers with a delay start capability may use varying amounts of power during delay start mode, depending on the delay time entered, the amount of remaining delay time displayed, and/or display indication of mode status. To ensure comparable and valid results, DOE proposes to include in its clothes washer test procedure a specification for the delay start time to be set at 5 hours, and for power to be monitored for 60 minutes after waiting at least 5 minutes for power input to stabilize. In determining the specification for delay start parameters, DOE considered the possibility that display power input would depend on the time displayed, which is typically the time in hours remaining before the start. Displays may be one or two digits. Some two-digit displays may show whole numbers for remaining delay hours of 10 or more and both the ones and tenths digits for the remaining delay hours of 9.9 or less. DOE analyzed the number of LEDs activated in LED displays of the remaining hours over a range of delay times. It concluded that the average number of LEDs lit for the range of all possible delay times would be best approximated by determining the average number of LEDs lit for either single-digit or two-digit displays in a 60-minute test if the delay time is set at 5 hours. DOE welcomes comment on this approach to measuring delay start mode.

DOE is also proposing that test room ambient temperatures for standby mode and off mode testing, as well as delay start mode and cycle finished mode testing, be specified for all clothes washers according to section 4, paragraph 4.2 of IEC Standard 62301. The current DOE test procedure includes a test room ambient air temperature specification only for water-heating clothes washers, for which the requirement is 75 ± 5 degrees Fahrenheit (°F). This falls within the range specified by IEC Standard 62301 of 73.4 ± 9 °F. Today's proposed test procedure would allow manufacturers of water-heating clothes washers to use the more stringent ambient temperature range in the current DOE test procedure if tests of active washing mode performance and standby, off, delay start, and cycle finished mode power are conducted simultaneously in the same room on multiple clothes washers. Alternatively, the proposed temperature specifications taken from IEC Standard 62301 would allow a manufacturer that opts to conduct standby, off, delay start, and cycle finished mode testing separately from active washing mode testing more latitude in maintaining ambient conditions. DOE requests comment on the appropriateness of this proposed modified test room ambient temperature range.

4. Calculation of Energy Use Associated With Each Operating Mode

To combine active washing mode energy consumption with energy

consumption from inactive, off, and additional active modes (delay start, cycle finished, and self-clean modes), DOE estimated the representative energy use for each of these modes. The total energy consumption in each of these modes depends on both the power level of that mode and the time spent in that mode. This section discusses the approach DOE proposes for calculating energy use associated with each operating mode for clothes washers and the numbers of hours proposed to be associated with each mode.

Energy use for clothes washers is expressed in terms of ft^3 of wash load capacity per total energy use per wash cycle.[7] As discussed further in section III.E.2, DOE has tentatively determined that it is technically feasible to integrate measures of standby mode and off mode energy use into the overall energy use metric, as required by the EISA 2007 amendments to EPCA. (42 U.S.C. 6295(gg)(2)(A)) Therefore, DOE has examined standby mode and off mode power consumption in terms of annual energy use apportioned on a per-cycle basis. DOE has also examined energy consumption from delay start, cycle finished, and self-clean modes on a per-cycle basis. Energy used during an active washing mode test cycle is directly measured in the current DOE test procedure, and a weighted average is calculated under different load sizes, fill levels, and wash temperature conditions according to the specific machine's capacity and features. (*See* section 4.1 of appendix J1 of subpart B of 10 CFR 430 for details.) The calculation of MEF also includes nominal energy used by a water heater to heat the water supplied to the clothes washer, and by a dryer to remove the remaining moisture after the clothes washer completes its full cycle (weighted by a dryer usage factor (DUF) to account for loads not dried in a clothes dryer).

Average cycle times can vary significantly based on the axis of basket rotation and type of load. One 1997 study compared a 37-minute normal cycle for a vertical-axis, top-loading clothes washer with 40 to 110-minute cycles for eight different front-loading, horizontal-axis machines.[8] The U.S. Environmental Protection Agency (EPA) reported in 2005 on three studies in the magazine "Consumer Reports"[9] that determined top-loading clothes washers have "normal" cycle times of 37–55 minutes, and front-loading washers have "normal" cycle times of 51–105 minutes.[10] Therefore, DOE proposes to adopt the estimate of 1 hour per cycle associated with a residential clothes washer's typical active washing mode (*i.e.,* a complete wash cycle including washing, rinsing, and spinning). DOE is proposing a single cycle duration for both top-loading and front-loading clothes washers rather than more accurate cycle times specific to each product class to simplify the test procedure and calculations. Additionally, proposing cycle times for each product class would have an insignificant effect on the calculations proposed in the test procedure because it is used only to allocate the number of annual hours associated with inactive/off mode. For example, using cycle times of 45 minutes for top-loaders and 75 minutes for front-loaders would change the number of hours allocated to inactive/off mode (the only modes affected by the number of active mode hours) by less than 1 percent.

In the January 2001 final rule, 66 FR 3314, DOE estimated the representative number of annual wash cycles per clothes washer as 392. DOE is proposing to update the number of wash cycles per year from 392 to 295 to reflect more current consumer behavior, which is discussed in detail in section III.D.2.a. One hour per cycle would result in a total of 295 hours per year associated with active mode. DOE is proposing to associate the remaining 8,465 (8,760 minus 295) hours of the year with all modes other than the active washing mode.

DOE is aware of five modes other than active washing mode in which residential clothes washers use energy: (1) Inactive mode, (2) cycle finished mode, (3) delay start mode, (4) off mode, and (5) self-clean mode. DOE is aware of only limited studies of the time clothes washers spend in these different modes. One household survey conducted by the National Appliance and Equipment Energy Efficiency Committee (NAEEEC) in Australia in 2000, for example, measured the time associated with different modes for 61 clothes washers with an average age of 9 years. The daily time spent in each mode in this study averaged 1 hour for washing (active washing mode), zero time for delay start and "active standby" modes, and the remaining time split 20 percent for "end of program" mode and 80 percent for off mode.[11] Self-clean mode was not explicitly addressed. The active standby mode of the washers in this study is equivalent to the inactive mode defined in section III.C.2 of this notice, and the end of program mode is equivalent to cycle finished mode.

The average age of the clothes washers in the study suggests that many of them have electromechanical rather than electronic controls, and thus would not likely have been capable of inactive mode. Hence, DOE does not infer from those results that more modern clothes washers spend negligible time in inactive mode. DOE believes that because current clothes washer models offer both mechanical and electronic controls, the time apportioned to off mode in this study would actually be split between off mode and inactive mode. Clothes washers with electromechanical controllers can have a delayed start feature, although its implementation appears to be market-specific. Markets with a long history of residential time-of-day electricity pricing are more likely to have appliances with delayed start features than in markets where household electricity prices are constant. The clothes washers in the NAEEEC study would have been less likely to have a delay start mode because differential power pricing is a relatively recent development in the Australian residential power market. Thus, the findings in the Australian clothes washer study regarding delayed start are inconclusive regarding the time current models of clothes washers spend in delay start mode.

To help address this uncertainty, DOE examined a more recent 2005 Australian study that noted a small number of usage hours associated with delay start mode. This study used dataloggers to monitor time clothes washers spent in different modes in Australia and New Zealand. The study showed that the average amount of time spent in delay start mode per wash cycle was approximately 5 minutes.[12] DOE

[7] *See* section III.C.5 for a detailed description of how the efficiency metric is calculated.

[8] J. Dieckmann, D. Westphalen. 1997. "Laboratory Testing of Clothes Washers." *The High-Efficiency Laundry Metering and Market Analysis (THELMA).* Volume 2. Final Report to the Electric Power Research Institute (EPRI). Report No. TR–109147–V2. December 29, 1997. Available for purchase at *http://www.epri.com.*

[9] These studies appeared in the July 1998, July 1999, and August 2000 issues of *Consumer Reports.*

[10] C. Wilkes *et al.* 2005. "Quantification of Exposure-Related Water Uses for Various U.S. Subpopulations." U.S. Environmental Protection Agency, Office of Research and Development. Report No. EPA/600/R–06/003. Washington, DC. December 2005. Available at *http://www.wilkestech.com/205edrb06_Final_Water_Use_Report.pdf.*

[11] Australia's National Appliance and Equipment Energy Efficiency Committee (NAEEEC). *Standby Product Profile—Clothes Washers.* October 2003. Available at *http://www.energyrating.gov.au/library/pubs/sb200308-washers.pdf.*

[12] Australian Electrical and Electronic Manufacturer's Association. *A Submission to NAEEEC on Mode Times for Use When Determining Standby Energy Consumption of Clothes Washers,*

expects similar low usage patterns of delayed start functionality for clothes washers in U.S. households because DOE research suggests that most U.S. residential electricity customers have fixed-rate electricity pricing (*i.e.,* the cost of electricity does not change with time of day, day of week, or time of year). However, delayed start functionality usage could increase in the United States as more electric utilities offer residential customers variable-rate pricing plans that encourage shifting electricity consumption to off-peak hours.

DOE welcomes comment on whether the sources cited provide a reasonable indication of residential clothes washer mode usage patterns, and also welcomes any additional information about such usage patterns.

Based on these two studies, DOE concludes that a typical modern residential clothes washer spends a small amount of time in delay start mode. Using an estimated 5 minutes per cycle, the total annual amount of time spent in delay start mode, using the proposed representative 295 cycles per year, is 25 hours.

The NAEEEC study suggests that 20 percent of the total use cycle time not allocated to active washing or delay start mode would be associated with cycle finished mode. However, DOE testing of multiple residential clothes washers showed that the time spent in a cycle finished mode per use cycle is very short. Several models tested had no cycle finished mode, and immediately reverted to off/inactive mode after the wash cycle completed. All of the tested units with cycle finished mode remained in that state for less than 5 minutes before switching back to off/inactive mode. Based on these results, DOE is proposing to allocate 3 minutes per average use cycle to cycle finished mode, for a total of 15 hours per year.

In addition, DOE is aware that some residential clothes washers offer a self-clean mode, as further discussed in section III.D.1.b. These self-clean cycles are not accounted for in the proposed 295 active mode washing hours per year. DOE tested seven machines that had these cycles, and found an average self-clean cycle time of 1.3 hours. DOE proposes to account for the time spent in self-cleaning cycles, if applicable, based on an estimated average manufacturer recommendation of 12 self-clean cycles per year, resulting in 16 hours per year. Therefore, machines offering a self-cleaning cycle will spend 16 fewer hours per year in standby mode or off mode.

In summary, DOE is proposing to allocate 295 hours per year to the active washing mode, 16 hours to self-clean mode (if applicable), 25 hours to delay start mode, 15 hours to cycle finished mode, and the remainder (8,409 hours for clothes washers offering other modes) to off and/or inactive mode.

Table III.1 presents DOE's estimate of the annual energy use associated with all modes for a clothes washer that is capable of each of these functions. The approximate ranges of power associated with the different modes are based on DOE testing of residential clothes washers with the exception of active washing mode, as noted below. Where ranges of average power are listed, the highest and lowest average measured values for both top- and front-loading clothes washers are provided. Active washing mode annual energy use is calculated based on the proposed 295 cycles per year in a standard-size, top-loading or front-loading clothes washer. Active washing mode per-cycle energy use is determined from a 2006 study that referenced data provided in 2005 by the Association of Home Appliance Manufacturers (AHAM) and Whirlpool Corporation (Whirlpool).[13] This study estimated that, in 2005, average per-cycle energy use was 2.23 kWh for a typical residential clothes washer in the United States with an average MEF of 1.37 and a capacity of 3.06 ft^3.

TABLE III.1—ESTIMATE OF ANNUAL ENERGY USE OF RESIDENTIAL CLOTHES WASHER MODES

Mode	Hours	Typical average power *W*	Annual energy use *kWh*
Active Washing	295	2,230	** 657.9.
Self-Clean	16	75 to 2,081	† 1.2 to 33.3
Delay Start	25	1.4 to 8.9	0.04 to 0.2.
Cycle Finished	15	0 to 5.2	0 to 0.08.
Off and Inactive	* 8,409	0 to 1.7	0 to 14.3.

* Remaining time = 8,760 − 295 − 16 − 25 − 15 = 8409.

** Includes energy consumption for water heating and moisture removal in the dryer as well as machine electrical energy consumption.

† Based on DOE testing of seven units with self-clean cycles, and 12 cycles per year. Values include energy consumption for water heating and machine electrical energy consumption.

To determine the annual hours per mode for clothes washers that do not utilize all possible modes, DOE estimated values based upon reallocating the hours for modes that are not present to off/inactive modes. Table III.2 summarizes the allocation of hours to different possible modes under each scenario.

TABLE III.2—ESTIMATE OF ANNUAL HOURS OF POSSIBLE CLOTHES WASHER MODES

Mode	All modes possible	No delay start mode	No cycle finished mode	No delay start or cycle finished modes
No Self-Clean Available				
Active Washing	295	295	295	295
Delay Start	25	0	25	0
Cycle Finished	15	15	0	0
Off and Inactive	8,425	8,450	8,440	8,465

Dishwashers, and Dryers. Appendix B. March 11, 2005. Available at *http://www.aeema.asn.au/ArticleDocuments/258/standby.pdf.*

[13] R. Bole. *Life-Cycle Optimization of Residential Clothes Washer Replacement.* Center for Sustainable Systems, University of Michigan. Report. No. CSS06–03. Appendix C. April 21, 2006. Available at *css.snre.umich.edu/css_doc/CSS06-03.pdf.*

TABLE III.2—ESTIMATE OF ANNUAL HOURS OF POSSIBLE CLOTHES WASHER MODES—Continued

Mode	All modes possible	No delay start mode	No cycle finished mode	No delay start or cycle finished modes
Self-Clean Available				
Active Washing	295	295	295	295
Self-Clean	16	16	16	16
Delay Start	25	0	25	0
Cycle Finished	15	15	0	0
Off and Inactive	8,409	8,434	8,424	8,449

DOE believes the proposed definition of off mode as applied to residential clothes washers refers to units with mechanical rather than electronic controls, or units with electronic controls combined with a mechanical switch with which the user can de-energize the electronic controls. Reactivation of the clothes washer with a pushbutton sensor, touch sensor, or other similar device that consumes power is considered to be a standby mode feature under the proposed definition. DOE believes there are few clothes washers with electronic controls that have an additional mechanical on/off switch. Therefore, the combined inactive/off hours would most likely be allocated fully either to inactive mode or off mode, depending on the type of controls present on the clothes washer. DOE does not have market share information to determine how many residential clothes washers are currently shipped with electromechanical controls. For clothes washers with electronic controls plus a mechanical on/off switch, DOE is proposing to allocate half of the inactive/off hours each to inactive and off modes. DOE welcomes comment and additional information on this point.

In conclusion, DOE is proposing to calculate residential clothes washer energy use per cycle associated with inactive, off, delay start, and cycle finished modes by (1) Calculating the product of wattage and allocated hours for all possible inactive, off, delay start and cycle finished modes; (2) summing the results; (3) dividing the sum by 1,000 to convert from Wh to kWh; and (4) dividing by the proposed 295 use cycles per year. DOE is also proposing to calculate energy use per cycle associated with self-clean mode, if available, by (1) multiplying the energy use per self-clean cycle in kWh by 12 (the number of self-clean cycles estimated per year); and (2) dividing by the proposed 295 use cycles per year.

DOE invites comments on this proposed methodology and associated factors, including accuracy, allocation of annual hours, and test burden. DOE may also consider the following alternative methodology based on comments received:

The comparison of annual energy use of different clothes washer modes shows that delay start and cycle finished modes represent a relatively small number of hours at low power consumption levels. For clothes washers currently on the market, these levels are distinct from, but comparable to, those for off/inactive modes. Thus, DOE could adopt an approach that would be limited to specifying hours for only off and inactive modes when calculating energy use. In that case, all of the hours not associated with active washing mode or self-clean mode (8,465 hours total) would be allocated to the inactive and off modes. DOE invites comment on whether such an alternative would be representative of the power consumption of clothes washers currently on the market.

5. Measures of Energy Consumption

The DOE test procedure for clothes washers currently incorporates various measures of per-cycle energy consumption including total weighted per-cycle hot water energy consumption (for electric-, gas-, or oil-heated water), total weighted per-cycle machine electrical energy consumption, and per-cycle energy consumption for removing moisture from a test load in a dryer. (*See* sections 4.1 and 4.3 of appendix J1 of subpart B of 10 CFR 430 for details.) The test procedure also provides a calculation for MEF, which is equal to the clothes container capacity in ft^3 divided by the sum, expressed in kWh, of the total weighted per-cycle hot water energy consumption, the total weighted per-cycle machine electrical energy consumption, and the per-cycle energy consumption for removing moisture from a test load. (See section 4.4 of appendix J1 of subpart B of 10 CFR 430 for details.) The current Federal energy conservation standards for clothes washers are expressed in MEF. (10 CFR 430.32(g)(3)).

In response to the August 2009 framework document, Whirlpool commented that DOE should incorporate standby power into the MEF calculation, and that standby power should not be accounted for separately. (Whirlpool, No. 21 at p. 2) Additionally, the Joint Comment and ASE commented that DOE should integrate standby and no-load mode power into a single energy metric based on the revisions to IEC Standard 62301. (Joint Comment, No. 14 at p. 1; ASE, No. 22 at p. 1).

Under 42 U.S.C. 6295(gg)(2)(A), EPCA directs that the "[t]est procedures for all covered products shall be amended pursuant to section 323 to include standby mode and off mode energy consumption * * * with such energy consumption integrated into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product, unless the Secretary determines that—(i) the current test procedures for a covered product already fully account for and incorporate the standby mode and off mode energy consumption of the covered product; or (ii) such an integrated test procedure is technically infeasible for a particular covered product, in which case the Secretary shall prescribe a separate standby mode and off mode energy use test procedure for the covered product, if technically feasible."

DOE proposes to establish the following measure of energy consumption for clothes washers. It integrates energy use of standby mode and off, modes with the energy use of the product's main functions, including delay start and cycle finished modes as well as any self-clean function available. DOE would define a "per-cycle standby, off, delay start and cycle finished mode energy consumption," and a "per-cycle self-clean mode energy consumption" measure, as applicable, expressed in kWh. DOE would also define integrated modified energy factor (IMEF) as the clothes container capacity in ft^3 divided by the sum, expressed in kWh, of:

• The total weighted per-cycle hot water energy consumption;
• The total weighted per-cycle machine electrical energy consumption;
• The per-cycle energy consumption for removing moisture from a test load;
• The per-cycle standby, off, delay start and cycle finished mode energy consumption; and
• The per-cycle self-clean mode energy consumption, as applicable (discussed in III.D.1.b).

DOE proposes an amended clothes washer test procedure, appendix J2 to subpart B of 10 CFR part 430, to include the measurement of the energy consumption in these additional modes and the calculation of IMEF.

DOE does not propose to amend the estimated annual operating cost calculation in 10 CFR 430.23 to include the cost of energy consumed in the non-active washing modes because:
• DOE believes that the cost of energy consumed in self-clean, standby, off, delay start, and cycle finished modes is small relative to the total annual energy cost for clothes washers and, therefore, would make little difference in the estimated annual operating cost calculation; and
• The Federal Trade Commission's (FTC's) EnergyGuide Label for clothes washers includes as its primary indicator of product energy efficiency the estimated annual operating cost, compared to a range of annual operating costs of similar products. Appendix F1 to 16 CFR part 305. An estimated annual operating cost incorporating self-clean, standby, off, delay start, and cycle finished mode energy use would no longer be directly comparable to the minimum and maximum energy costs prescribed for the EnergyGuide Label.

D. Clothes Washer Active Mode Test Procedure

1. Technologies Not Covered by the Current Clothes Washer Test Procedure

a. Steam Wash Cycles

Multiple clothes washer models currently available on the market offer a steam function via pre-set cycles or as an optional addition to conventional wash cycles. During these cycles, steam is injected into the basket, which manufacturers claim provides enhanced cleaning and/or sterilization. The steam is produced in a generator that requires a significant amount of energy to heat and vaporize the water. The current clothes washer test procedure does not account for energy or water consumption during this type of wash cycle.

In response to the August 2009 framework document, DOE received comments from the Joint Comment and ASE supporting revisions to the test procedure to measure energy and water consumption during steam wash cycles. (Joint Comment, No. 14 at p. 3; ASE, No. 22 at p. 1).

The current clothes washer test procedure specifies methods for measuring energy and water consumption over a range of wash temperatures based on the temperature selections available on a clothes washer, as specified in Table 3.2 of the test procedure, Test Section Reference. DOE proposes amending the test procedure to include an additional measurement of energy and water consumption during a steam wash cycle for clothes washers offering this feature, included in section 3.9. In the proposed amendments, Table 3.2 of the test procedure is updated to include a column that specifies the test sections to be followed for clothes washers offering a steam wash cycle, to update the footnotes, and to correct an error in the current organization of the table. The test sections required for clothes washers without a steam wash cycle would remain unchanged. The proposed updated Table 3.2 from the test procedure is shown below as table III.3.

TABLE III.3—TEST SECTION REFERENCE

Max. wash temp. available	≤135 °F (57.2 °C)			** >135 °F (57.2 °C)	
Number of wash temp. selections	1	2	>2	3	>3
Test Sections Required to be Followed	.....	.....	.....	3.3	3.3
	.....	3.4	3.4	.....	3.4
	.....	.....	3.5	3.5	3.5
	3.6	3.6	3.6	3.6	3.6
	.....	.....	*3.7	*3.7	*3.7
	3.8	3.8	3.8	3.8	3.8
	.....	.....	.....	†3.9	†3.9

** Only applicable to machines with a warm wash/warm rinse cycle.
** Only applicable to water heating clothes washers on which the maximum wash temperature available exceeds 135 °F (57.2 °C)
† Only applicable to machines equipped with a steam wash cycle.

DOE also proposes to include the energy and water consumption from steam wash cycles in the final calculations for the energy and water use metrics. For clothes washers capable of steam wash cycles, the measurements of energy and water consumption from the steam wash cycle with the hottest wash temperature would be included in the overall energy and water use calculations based on the temperature use factor (TUF) for steam wash. Table 4.1.1 of the test procedure specifies the current weight given to the consumption measurements for the different wash cycles. DOE believes extra hot and steam cycles would be reserved for the most heavily soiled loads, and would have similar use factors. However, DOE has tentatively assumed that the steam wash cycles would be selected somewhat fewer times than the extra hot cycle because on some models steam is available only as an option on certain settings. DOE is proposing to update Table 4.1.1 to include 0.02 as the TUF of a steam wash cycle, when available. Although DOE lacks data on consumer use of steam wash cycles, DOE believes these cycles would decrease the use of extra hot cycles, but would leave the use of hot, warm, and cold cycles unchanged. DOE therefore believes the 0.02 TUF associated with steam washes would correspond to a 0.02 decrease in the current TUFs associated with extra hot cycles, from 0.05 to 0.03 or 0.14 to 0.12, for a steam-capable clothes washer Table III.4 below shows the proposed Table 4.1.1, including specifications for a steam wash cycle, and updated warm rinse TUFs, as discussed below in section III.D.2.c.

TABLE III.4—TEMPERATURE USE FACTORS

Max wash temp available	≤135 °F (57.2 °C)	≤135 °F (57.2 °C)	≤135 °F (57.2 °C)	>135 °F (57.2 °C)	>135 °F (57.2 °C)	Steam	Steam
Number wash temp selections	Single	2 Temps	>2 Temps	3 Temps	>3 Temps	3 Temps	>3 Temps
TUF_s (steam)	NA	NA	NA	NA	NA	0.02	0.02
TUF_m (extra hot)	NA	NA	NA	0.14	0.05	0.12	0.03
TUF_h (hot)	NA	0.63	0.14	NA	0.09	NA	0.09
TUF_{ww} (warm/warm)	NA	NA	*0.27	*0.27	*0.27	*0.27	*0.27
TUF_w (warm)	NA	NA	0.22	0.22	0.22	0.22	0.22
TUF_c (cold)	1.00	0.37	0.37	0.37	0.37	0.37	0.37

*Only applicable to machines offering a warm/warm cycle. For machines with no warm/warm cycle, this value would be zero and the warm/cold TUF should be increased by 0.27.

DOE requests comment on the following issues: Whether the energy and water consumption of a steam wash cycle should be included in the test procedure; whether the proposed TUF associated with steam wash cycles is appropriate; and whether any data are available regarding consumer usage patterns of such cycles.

b. Self-Clean Cycles

Many residential clothes washers currently on the market offer a self-clean cycle. These cycles are used periodically with bleach and/or detergent but no clothes load to clean, deodorize, or sanitize the components that come into contact with water by preventing or eliminating mold, bacteria, and mildew. Self-clean cycles may require higher water temperatures and greater volumes of water than a normal cycle, and therefore potentially consume a substantial amount of energy. The current test procedure does not account for energy or water consumption attributable to self-clean cycles.

In response to the August 2009 framework document, DOE received comments from the Joint Comment and ASE recommending that DOE amend the test procedure to account for energy and water consumption from these periodic cleansing or sanitizing cycles. According to both commenters, the test procedure should also be amended to credit clothes washer designs that address mold and odor issues without the use of periodic sanitizing cycles. (Joint Comment, No. 14 at p. 3; ASE, No. 22 at p. 1).

In its research, DOE noted that many clothes washer user manuals include a recommendation for how frequently the consumer should run a self-clean cycle. DOE observed that the manufacturer-recommended frequency typically is once a month. Some manufacturers also recommend a cleaning cycle every certain number of wash cycles. DOE believes that these self-clean cycles are not accounted for in the proposed 295 wash cycles per year. Because these cycles may consume a significant amount of energy and water, DOE is proposing to include them in the calculation of the efficiency metric.

DOE is proposing to define a "self-clean mode" as a clothes washer operating mode that:

- Is dedicated to cleaning, deodorizing, or sanitizing the clothes washer by eliminating sources of odor, bacteria, mold, and mildew;
- Is recommended to be run intermittently by the manufacturer; and
- Is separate from clothes washing cycles.

DOE also proposes to integrate energy and water consumption in self-clean cycles into the overall energy efficiency metric, under the assumption that these cycles are typically run once per month. As discussed in section III.C.5, DOE proposes to define IMEF as the clothes container capacity in ft^3 divided by the sum, expressed in kWh, of:

- The total weighted per-cycle hot water energy consumption,
- The total weighted per-cycle machine electrical energy consumption,
- The per-cycle energy consumption for removing moisture from a test load,
- The per-cycle standby mode and off mode energy consumption, and
- The per-cycle energy consumption from any self-clean cycles.

DOE proposes to calculate the per-cycle energy consumption from self-clean cycles by:

- Measuring the hot and cold water consumption and the electrical energy consumption for a self-clean cycle,
- Calculating the per-cycle hot water energy consumption and summing with the per-cycle machine electrical energy consumption for the self-clean cycle, and
- Multiplying by the number of self-clean cycles per year (12) divided by 295 annual active washing mode cycles.

This approach apportions the annual energy use in self-clean mode to each annual active washing mode cycle. DOE notes that it only proposes to account for self-clean cycles in the IMEF calculation for clothes washers for which the manufacturer provides and/or recommends such cycles. If a clothes washer is designed to address mold and odor problems without the need for separate dedicated cleaning cycles, the per-cycle self-clean energy consumption will be zero.

DOE proposes to use a similar approach for including self-clean water consumption in the calculation of IWF (*see* section III.D.4.b). The total measured hot and cold water consumption for a self-clean cycle would be multiplied by 12 self-clean cycles per year divided by 295 annual active washing mode cycles. This per-cycle self-clean water consumption would be summed with the total weighted per-cycle water consumption in the active washing mode, then divided by clothes container capacity to obtain IWF.

DOE requests comment on self-clean cycles, including the proposed definition, the inclusion of self-clean cycle energy and water use into the overall energy efficiency metrics, and on whether any relevant data are available regarding self-clean cycles.

c. Adaptive Control Technologies

Adaptive control technologies can adjust parameters such as agitation speed, number of rinses, wash time, and wash and rinse temperatures based on the size, fabric mix, and soil level of a wash load. The current test procedure accounts for adaptive fill technologies, but no other types of adaptive controls.

AHAM, BSH Home Appliances Corporation (BSH), and Whirlpool commented in response to the August 2009 framework document that adaptive controls are already widely used in residential clothes washers. DOE agrees that multiple models are available on the market that use adaptive control technologies to respond to measured or inferred load size and fabric mix. However, DOE lacks data on the distribution of load size and fabric

content representative of actual consumer usage. DOE is also not aware of any residential clothes washers that currently incorporate soil sensing systems. According to multiple manufacturers that DOE interviewed, implementing soil sensing systems requires overcoming several technical challenges. For example, typical soil sensors have difficulty identifying a single soiled clothing item. Also, detergent foaming can interfere with control systems using turbidity sensors to monitor the clarity of the wash water.

DOE is aware that other consumer products employ adaptive controls, and that these are addressed in their respective test procedures. For example, many dishwashers incorporate adaptive controls by means of a turbidity sensor which adjusts the number and duration of wash and rinse cycles. The dishwasher test procedure accounts for these models through the use of soiled dishware loads. (10 CFR part 430, subpart B, appendix C)

If clothes washers become available that offer adaptive controls using a turbidity sensor, DOE could consider amending the clothes washer test procedure to measure energy and water consumption with a soiled wash load. DOE is aware of other industry and international clothes washer test procedures that use a soiled wash load to determine wash performance, including AHAM HLW–1, "Performance Evaluation Procedures for Household Clothes Washers," IEC 60456, "Clothes washing machines for household use—Methods for measuring the performance," and Standards Australia/Standards New Zealand (AS/NZS) 2040.1, "Performance of household electrical appliances—Clothes washing machines—Methods for measuring performance, energy and water consumption." [14] DOE could, for example, incorporate the test cloth soiling method from one of these test procedures into the DOE clothes washer test procedure to capture the energy and water consumption effects of adaptive controls.

DOE welcomes comment on whether there are any clothes washers available on the market offering soil-sensing adaptive controls, and on its tentative decision to account for only adaptive fill controls in the test procedure. DOE further invites information on the size distribution and fabric content of wash loads typical of consumer use, and comment on using a soiled test load to determine energy and water consumption in the presence of adaptive controls.

d. Demand Response Technology

Demand response technology enables an appliance to shift its activity based on interaction with the electric grid, utilities, or user programming. Appliances that can communicate with the electric grid or any other network would be considered to have a network mode as defined by IEC Standard 62301 FDIS. This standard defines network mode as a mode category that includes "any product modes where the energy using product is connected to a mains power source and at least one network function is activated (such as reactivation via network command or network integrity communication) but where the primary function is not active." IEC Standard 62301 FDIS also provides a note stating, "[w]here a network function is provided but is not active and/or not connected to a network, then this mode is not applicable. A network function could become active intermittently according to a fixed schedule or in response to a network requirement. A 'network' in this context includes communication between two or more separate independently powered devices or products. A network does not include one or more controls which are dedicated to a single product. Network mode may include one or more standby functions."

In response to the August 2009 framework document, DOE received multiple comments regarding demand response technologies in clothes washers. Energy Solutions, Pacific Gas and Electric Company (PG&E), Southern California Gas Company (SoCal Gas), San Diego Gas and Electric Company (SDG&E), and Southern California Edison Design & Engineering Services (SoCal Edison) (jointly, the California Utilities) commented that it is important for DOE standards to give credit not only to energy conservation, but to the reduction of peak demand from demand responsive controls. (California Utilities, No. 18 at p. 6) AHAM commented that DOE should evaluate the capability of residential clothes washers to provide peak load shedding capabilities through a "smart grid" infrastructure. (AHAM, No. 15 at p. 4) General Electric (GE) also commented in support of DOE considering demand responsiveness as a technology associated with residential clothes washers. (GE, No. 19 at p. 3) Samsung Electronics America (Samsung) commented that DOE should consider smart grid or grid-enabled appliance technologies for their effect on energy use as it drafts DOE's clothes washer test procedure. (Samsung, No. 22 at p. 4)

However, as mentioned in section III.C.2, DOE does not propose amending the test procedure to include any provisions for measuring energy consumption in network mode because it is unaware of any clothes washers currently available on the market that incorporate a networking function. At this time, DOE is unaware of any data regarding network mode in clothes washers that would enable it to determine appropriate testing procedures and mode definitions for incorporation into the test procedure. In particular, DOE is unaware of:

- Data and methods for the appropriate configuration of networks;
- Whether network connection speed or the number and type of network connections affect power consumption;
- Whether wireless network devices may have different power consumptions when the device is looking for a connection and when the network connection is actually established;
- How the energy consumption for clothes washers in a network environment may be affected by their product design and user interaction as well as network interaction; and
- Whether the network function could become active intermittently according to a fixed schedule or in response to a network requirement.

For these reasons, the proposed amendments in today's NOPR do not include the measurement of energy use in network mode. Provisions for testing power consumption in network mode could be incorporated into the test procedure through future amendments, once the appropriate data and testing methodologies become available. DOE welcomes comment on whether clothes washers that incorporate a networking function are currently available, and whether definitions and testing procedures for a network mode should be incorporated into the DOE test procedure. DOE also requests comment on appropriate methodologies for measuring energy consumption in a network mode, and data on the repeatability of such testing methodology.

2. Changes To Reflect Current Usage Patterns and Capabilities

a. Representative Annual Cycles

In the January 2001 final rule, DOE estimated the representative number of annual wash cycles per clothes washer as 392. 66 FR 3314. This number is not used in the calculations for the current energy efficiency metric, because MEF is calculated on a per cycle basis. In this

[14] AHAM and AS/NZS standards are available online at *http://webstore.ansi.org/*.

NOPR, DOE is proposing to include power consumption from modes other than active washing mode in the energy efficiency metric. As discussed above, doing so requires an estimate of the time a typical clothes washer spends in active washing, inactive, off, delay start, cycle finished, and self-clean modes. The number of annual wash cycles is used to determine the time spent in the active washing mode, and determines the remaining time to be allocated to the other possible modes.

DOE received comments in response to the August 2009 framework document on the number of average clothes washer cycles per year. Alliance Laundry Systems, LLC (ALS) commented that the annual cycles value should be revised to approximately 300 cycles per year, referring to Procter & Gamble (P&G) consumer studies which have been used by DOE in prior test procedure rulemakings. (ALS, No. 12 at p. 1) The Joint Comment and ASE stated that DOE should acquire data for an updated annual number of wash cycles because the current value in the test procedure is based on outdated consumer usage patterns and machine characteristics. (Joint Comment, No. 14 at p. 1; ASE, No. 22 at p. 1) AHAM stated that it supported the use of data from the 2005 "Residential Energy Consumption Survey" (RECS) in determining the annual energy and water consumption of residential clothes washers. (AHAM, No. 15 at p. 6) Additionally, Whirlpool commented that the RECS data has limitations, but that it was unaware of any more robust alternatives to determine annual energy and water consumption of residential clothes washers. (Whirlpool, No. 21 at p. 7)

The 2005 RECS compiles data on energy use in residential buildings from households across the United States. The survey has a section devoted to appliance usage, including residential clothes washer usage. The survey asked respondents to identify the average number of loads per week that they wash, with response options of 1 or fewer, 2 to 4, 5 to 9, 10 to 15, and more than 15 loads per week. DOE assigned a representative average number of wash cycles per year to each of these response categories, and calculated the weighted average. Using this method, DOE determined that the data show an average of 295 wash cycles per year.

DOE is aware that the "California Residential Appliance Saturation Survey" (California RASS) from 2004 also provides data on the use of residential appliances. For clothes washer use, the survey asks for the number of loads washed in the household during a typical week using hot, warm, and cold wash water temperature settings. There are 11 response options, ranging from zero to 10+ per week. DOE summed the average number of wash loads per week for each water temperature and scaled this weekly value to an annual value to determine the average number of wash cycles per year. Using this method, the California RASS data show an average of 283 wash cycles per year.

P&G also supplied DOE with data on typical consumer use of clothes washers. The P&G data show an average of 308 wash cycles per year. DOE review determined that the P&G data set contains fewer single-person households and more multiple-person households than the 2005 RECS data, which more closely approximates the household sizes shown in the latest sampling performed by the U.S. Census Bureau and the American Housing Survey in 2007.[15] DOE believes that the larger average household size in the P&G study could lead to the higher average annual wash cycles value found in the P&G data.

In today's notice, DOE is proposing 295 as the representative number of wash cycles per year based on the 2005 RECS data. DOE believes this is a more representative value than the results of the California RASS because the survey is nationwide rather than limited to a single State. DOE also believes the 2005 RECS value is more representative of average use than the value based on the P&G study due to the household size distribution of the data sets. Overall, however, the relatively small variation among the three estimates of annual clothes washer cycles supports DOE's tentative conclusion that 295 cycles per year is a reasonable value to include in its clothes washer test procedure.

DOE welcomes comment on whether 295 wash cycles per year is representative of typical consumer use, and whether the 2005 RECS is an appropriate source of data for this issue. DOE also seeks any additional data relevant to the representative number of annual clothes washer cycles.

b. Test Load Size Specifications

The current DOE clothes washer test procedure specifies the test load size for the active washing mode energy tests based on the clothes washer's container volume. The table specifying the test load sizes in the test procedure, Table 5.1, currently only covers clothes washer container volumes up to 3.8 ft^3. DOE is aware that multiple clothes washers available on the market have container volumes exceeding 3.8 ft^3.

ALS commented in response to the August 2009 framework document that it supports revising Table 5.1 to account for larger capacities because larger capacity clothes washers exist in the marketplace, for which Whirlpool filed a petition for waiver on November 21, 2005. 71 FR 48913. ALS also stated that it supports Whirlpool's petition. (ALS, No. 12 at p. 1) AHAM and Whirlpool commented that DOE should expand Table 5.1 to include washer capacities up to 6 ft^3. AHAM stated that the larger capacities should be addressed by continuing the linear relationship used in the current table. (AHAM, No. 15 at p. 2; Whirlpool, No. 21 at p. 1)

DOE also received comments from the Joint Comment and ASE opposing the expansion of the test load size specifications to cover container volumes up to 6 ft^3 unless DOE verifies the validity of the calculations used in Table 5.1 with current consumer data. Specifically, these commenters request that DOE verify the average load calculations across machines of different capacities. These commenters also stated that DOE should ensure that the calculations do not introduce a bias favoring clothes washers with larger capacities. (Joint Comment, No. 14 at pp. 1–2; ASE, No. 22 at p. 1)

In response to Whirlpool's November 2005 request for waiver, DOE granted an interim test procedure waiver to Whirlpool for three of Whirlpool's clothes washer models with container capacities greater than 3.8 ft^3. 71 FR 48913 (August 22, 2006). This notice contained an alternate test procedure, which extended the linear relationship between maximum test load size and clothes washer container volume in Table 5.1 to include a maximum test load size of 15.4 pounds (lbs) for clothes washer container volumes of 3.8 to 3.9 ft^3.

DOE is aware of limited data regarding typical clothes washer load sizes. In 2003, P&G conducted a survey on load size with 510 respondents, comprising 3367 loads of laundry. The data from this survey show an average load size of 7.2 lbs for top-loading machines, and 8.4 lbs for front-loading machines. These load sizes correspond to the average test loads for the 2.7–2.8 ft^3 and 3.3–3.4 ft^3 clothes washer capacity bins, respectively, in Table 5.1. These results are consistent with the shipment-weighted average tub volume of 3.05 ft^3 from the 2005 AHAM *Factbook.*

[15] Information on the American Housing Survey can be found on the U.S. Census Bureau Web site at *http://www.census.gov/hhes/www/housing/ahs/ahs.html.*

P&G has also noted that increases in average load size tend to correlate with increases in clothes washer capacities. DOE has found that from 1993 to 2005, tub capacities have increased by 14 percent, based on AHAM data, while the number of cycles per year has decreased by 17 percent, based on RECS data. Assuming that households continued to wash the same volume of clothes each year, the data imply that, on average, the wash loads were larger.

The limited data on this subject suggest that the current values in the test load size chart are appropriate, and extending the linear relationship between test load size and container capacity to larger capacities is valid. Thus, DOE proposes amending the clothes washer test procedure to establish test load size specifications for clothes washer container volumes up to 6.0 ft^3. The amendment would be based on a continuation of the linear relationship between test load size and clothes washer container volume currently in the DOE clothes washer test procedure. DOE welcomes comment on the proposed test load sizes, including whether the linear relationship between test load size and clothes washer container volume is representative of actual consumer use, and additional consumer use data relevant to this topic.

c. Use Factors

The clothes washer test procedure relies on use factors to weight different consumer behaviors in the overall energy and water consumption calculations. The factors are based on consumer use data and represent the fraction of all cycles that are run with certain settings or characteristics. The use factors in the test procedure cover wash and rinse temperatures, load sizes, and dryer use.

DOE received comments from the Joint Comment and ASE regarding usage factors in the current clothes washer test procedure. They stated that DOE should validate the use factors for minimum, average, and maximum loads, TUFs, and the DUF based on current data. They also stated that DOE should verify that the current use factors for load size—12 percent for minimum load size, 74 percent for average load size, and 14 percent for maximum load size—do not introduce a systematic bias favoring large capacity clothes washers. These factors also might not reflect current consumer usage because they were established in the 1990s and because the assumed downward trend in the number of annual wash cycles may indicate that loads are, on average, larger. The Joint Comment and ASE also suggested that DOE should reassess the load adjustment factor (LAF) used in the RMC calculation. This factor is intended to represent the ratio of maximum load size to average load size, but a fixed value of 0.52 is used despite the ratio changing as capacity increases according to the data in Table 5.1. (Joint Comment, No. 14 at pp. 1–3; ASE, No. 22 at p. 1)

DOE's responses to these comments on use factors are discussed separately in the following sections.

i. Load Size Use Factors

The load size use factors in the DOE test procedure represent the fraction of all wash cycles a typical consumer runs for the minimum, average, and maximum load sizes. DOE is not aware of recent data characterizing such usage patterns. Therefore, DOE is not proposing in today's notice to change the load size use factors. DOE welcomes input and data on consumer selection of load sizes.

ii. Temperature Use Factors

As stated in section III.D.1.a, DOE proposes amending the TUFs in its clothes washer test procedure to account for steam wash cycles, and to revise the warm rinse TUF. DOE believes the steam wash cycle TUF only affects the extra hot TUF, leaving the other TUFs unchanged.

Among the limited data on consumer wash and rinse temperature selections, the 2005 RECS and the 2004 California RASS both provide some information on temperature selections. However, each of these surveys only disaggregate temperature use into hot, warm, and cold cycle settings, providing no information on extra hot or steam use. Further, the RECS questionnaire asks respondents only for the water temperature selections usually used for the wash and rinse cycles of a clothes washer, which may not account for the less-frequent use of the hot wash cycle. Hot wash cycles are generally used for the most heavily soiled loads, which DOE believes would not represent the water temperature selection usually used by consumers. As a result, the 2005 RECS data may support a hot wash use factor that is lower than the actual value. The California RASS questionnaire asks for the number of wash loads per week typically washed at hot, warm, and cold temperature settings. While this phrasing captures the use of all three temperature selections, the California RASS only represents one State, and may not reflect consumer use nationwide. Table III.5 compares the TUFs from these two surveys with the current values in the DOE clothes washer test procedure for hot, warm, and cold washes, and for warm rinse.

TABLE III.5—TEMPERATURE USE FACTORS

Temperature setting	TUF, current test procedure	TUF, 2005 RECS	TUF, 2004 California RASS
Hot Wash	0.14	0.062	0.2
Warm Wash	0.49	0.542	0.41
Cold Wash	0.37	0.397	0.39
Warm Rinse	0.27	0.2	N/A

Because the factors from each source demonstrate general agreement, DOE believes that the TUFs in its test procedure are a reasonable estimate of current consumer use. While DOE is therefore proposing to amend only the TUFs for clothes washers offering a steam wash cycle as discussed in section III.D.1.a and shown in Table III.4, DOE welcomes comment on the proposed TUFs.

DOE also notes that it has recently received consumer usage survey data from a manufacturer which indicate that, for one clothes washer model with no cold rinse option on the cycle recommended for cotton clothes and a default cold rinse on all other cycles, users participating in the survey reported using warm rinse for 1.6 percent of all cycles. Although DOE does not believe that this conclusion necessarily applies to all consumers and residential clothes washer models, it remains open to considering the warm rinse TUF and welcomes further data

regarding consumer usage of warm rinse.

In addition, DOE proposes to revise the methods for measuring warm rinse and incorporating the revised measurement into the test procedure's calculations. The current test procedure addresses warm rinses by applying a TUF of 0.27 to account for the incremental energy consumption of a warm rinse over that of a cold rinse. This indicates that 27 percent of all loads across all temperatures use a warm rinse. Because the test procedure incrementally accounts for warm rinses, the relevant provisions require the measurement of hot water consumption for the warm rinse only and the measurement of the electrical energy consumed by the clothes washer to heat the rinse water only. For some clothes washers, though, it is not entirely clear when water consumption for the wash cycle ends and rinse begins because multiple fill and drain events may occur in various sequences.

To address this uncertainty, DOE believes that it is more appropriate to measure energy and water consumption over an entire cycle that utilizes warm rinse. DOE believes that most clothes washers currently available on the market allow users to select a warm rinse only with a warm wash cycle. DOE is, therefore, proposing to establish a TUF for a full warm wash/warm rinse cycle and to eliminate the incremental use factor currently attributed to warm rinse. DOE believes that the value of this incremental use factor of 0.27 would represent a valid TUF for the warm wash/warm rinse cycle. For those clothes washers with such an option, DOE is also proposing to decrement the warm wash/cold rinse TUF by a corresponding amount, reducing it from 0.49 to 0.22. DOE further proposes that the warm wash/warm rinse TUF would not be applicable for clothes washers with one or two wash temperature settings because these washers would not be capable of warm wash.

DOE is not proposing to amend the TUFs for wash temperature selections other than the warm wash. Additionally, the proposed TUFs for warm/cold and warm/warm sum to the current warm wash TUF. Overall, the warm wash temperature selection would receive the same weight in the energy and water consumption calculations.

DOE recognizes that not all clothes washers offer a warm/warm temperature selection under the normal wash cycle setting recommended for washing cotton or linen clothes (hereafter, the "Normal" setting). For these clothes washers, if a warm/warm cycle is available in any other wash cycle setting that employs agitation/tumble operation, spin speed(s), wash times, and rinse times that are largely similar to the "Normal" cycle, the warm/warm cycle would be tested using the wash cycle setting that would best reflect typical consumer use. Under the current test procedure, only the hot water consumption for the warm rinse and the electrical energy consumed by the clothes washer to heat the rinse water are required to be measured for this cycle. The proposed test procedure would require measuring energy and water consumption over the complete warm wash/warm rinse cycle. As a result, MEF measured under the current test procedure could differ from the MEF measured with under the proposed revisions. During the ongoing energy conservation standards rulemaking, DOE expects to analyze potential effects of the proposed warm rinse methodology on measured MEF and incorporate any such effects, as appropriate, into any amended standards.

As stated above, DOE welcomes comment on these proposed TUFs, including steam wash and warm wash/warm rinse cycles, and on whether any other consumer use data regarding temperature setting selection is available. DOE also requests comment and any relevant data on whether the proposed method of incorporating warm rinse would affect MEF ratings.

iii. Dryer Use Factor

DOE investigated whether the DUF of 0.84 in its clothes washer test procedure reflects current consumer usage. The 2005 RECS includes data on both clothes washer and clothes dryer use. As stated previously in section III.D.2.a, AHAM and Whirlpool both commented in support of using RECS data for representative annual cycles, because they believe no other alternative data set is available. (AHAM, No. 15 at p. 6; Whirlpool, No. 21 at p. 7)

Analysis of the RECS data shows that, for households with both a clothes washer and dryer, the average DUF is 0.96. For all households with a clothes washer, the average DUF is 0.91. This use factor is lower because it includes households with only a clothes washer and no dryer. DOE also analyzed the 2004 California RASS to determine that its data show a DUF of 0.86 for households with both a clothes washer and dryer. This dryer use factor is based on 283 clothes washer cycles per year as supported by the California RASS, not the proposed 295 cycles per year in today's NOPR. Including households without a clothes dryer, the California RASS data show a DUF of 0.76.

DOE proposes amending its clothes washer test procedure to include a DUF of 0.91, based on the 2005 RECS. DOE is proposing 0.91 rather than 0.96 because the clothes washer test procedure aims to estimate the energy use of all clothes washers, regardless of clothes dryer ownership. DOE is proposing to use the value derived from the 2005 RECS rather than the 2004 California RASS to be consistent with the proposed number of wash cycles per year and because, as stated in section III.D.2.a, the RECS data represent the entire country rather than one State. DOE welcomes comment on the proposed value of 0.91 for the DUF and using the RECS data to calculate this value.

iv. Load Adjustment Factor

Load Adjustment Factor (LAF) represents the ratio of maximum load size to average load size. This ratio is used in the calculation of the energy required to remove moisture from the test load. The RMC value used in this calculation is based only on tests using the maximum test load, so the LAF is used to scale this value down to the average load size. DOE lacks information warranting adjusting this value or changing it from a fixed value to one that varies as a function of average load size, and is therefore not proposing to amend the LAF in the test procedure. DOE welcomes comments on appropriate adjustments that could be made to the LAF.

3. Test Cloth

The current clothes washer test procedure requires the use of closely-specified test cloth for the energy test cycles. The test cloth affects the calculated energy consumption largely through the RMC value. RMC is calculated as the ratio of the weight of water absorbed by the test cloth after a complete energy cycle to the initial weight of the "bone dry" test cloth, multiplied by 100 percent. The RMC is then used to calculate the per-cycle energy consumption for removal of moisture from the test load. Because the test cloth plays a central role in determining energy consumption, the test procedure includes provisions to ensure consistent and accurate results. The test cloth characteristics can vary based on production lot, or even within the same lot, so the test procedure includes a calibration procedure to provide consistent results for all test cloth.

DOE received multiple comments in response to the August 2009 framework

document regarding the test cloth used in its clothes washer test procedure. ALS commented that DOE should revise the test procedure to improve test cloth calibration auditing. (ALS, No. 12 at p. 1) AHAM submitted detailed comments on this issue, including a proposal it sent to DOE on September 22, 2008, that addresses energy test cloth tolerances, provides additional detail for determining RMC, and removes redundant sections regarding preconditioning the test cloths. AHAM also commented that DOE should provide guidance and/or support on the annual test cloth correlation work, including a proposal for the creation of a DOE Test Cloth Advisory Panel. (AHAM, No. 15 at pp. 2, 10, 14–18, 34) In a letter to DOE sent March 29, 2010, AHAM confirmed that the AHAM DOE Test Cloth Task Force, which includes AHAM members, BSH, Electrolux Home Products, GE, Samsung, Whirlpool, and SDL Atlas, supported the test cloth-related changes to the test procedure that were proposed in AHAM's comments submitted for the framework document. Whirlpool commented in support of the AHAM test cloth proposal. Whirlpool also commented that DOE should provide guidance and/or support on the test cloth issues not addressed by the current test cloth supplier, which include quality, correlation coefficients, and the availability of new fabric lots. (Whirlpool, No. 21 at pp. 1–2)

DOE believes that the test cloth specifications that AHAM proposed represent the industry's consensus on the available means to limit uncertainty in the test procedure due to variations in the test cloth properties. DOE is therefore proposing to update the sections of the test procedure regarding test cloth to reflect the changes in September 22, 2008, proposal included in the AHAM comment and supported by Whirlpool and the Test Cloth Task Force. The current test procedure does not specify any tolerances for the size and weight of the energy test cloths. DOE is proposing the following tolerances:

- In section 2.6.1, "Energy Test Cloth," the energy test cloth shall be 24 ± ½ inches by 36 ± ½ inches (61.0 ± 1.3 cm by 91.4 ± 1.3 cm) and hemmed to 22 ± ½ inches by 34 ± ½ inches (55.9 ± 1.3 cm by 86.4 ± 1.3 cm) before washing;
- In section 2.6.2, "Energy Stuffer Cloth," the energy stuffer cloth shall be 12 ± ¼ inches by 12 ± ¼ inches (30.5 ± .6 cm by 30.5 ± .6 cm) and hemmed to 10 ± ¼ inches by 10 ± ¼ inches (25.4 ± .6 cm by 25.4 ± 0.6 cm) before washing; and
- In section 2.6.4.2, the fabric weight specification shall be 5.60 ± 0.25 ounces per square yard (190.0 ± 8.4 g/m^2).

According to AHAM, these tolerances are supported by test cloth supplier data. DOE believes that manufacturers generally agree with these updated tolerances, as they were proposed through AHAM. It also believes that specified tolerances will result in consistency across lots of test cloth.

The current test procedure also contains redundant sections regarding the test cloth specifications and preconditioning. DOE proposes to delete the redundant sections 2.6.1.1–2.6.1.2.4. These sections were made obsolete in the 2001 Final Rule, which added sections 2.6.3 through 2.6.7.2 into Appendix J1. 66 FR 3314. However, DOE proposes to use in section 2.6.4.3 the thread count specification from deleted section 2.6.1.1(A), of 65 × 57 per inch (warp × fill), based on supplier data. Additionally, DOE proposes to maintain a shrinkage limit, relocated from section 2.6.1.1(B) to new section 2.6.4.7, but to increase the limit from 4 percent to 5 percent on the length and width. DOE also proposes to require the cloth shrinkage be measured as per the American Association of Textile Chemists and Colorists (AATCC) Test Method 135–2004, "Dimensional Changes of Fabrics after Home Laundering." These revisions are also supported by supplier data, according to AHAM. (AHAM, No. 15 at p. 15)

The current DOE test procedure uses extractor tests of up to 500 units of gravitational acceleration (g) in determining the RMC correlation curve for test cloth lots. Clothes washers currently available on the market are capable of higher spin speeds that achieve g-forces higher than 500 g. DOE is therefore proposing to include an additional set of extraction tests at 650 g. Because of the prevalence of higher spin speeds, DOE is also proposing to remove the requirement that the 500 g requirement be used only if a clothes washer can achieve spin speeds in the 500 g range. These proposed amendments will result in 60 extractor RMC test runs required for correlation testing rather than the currently required 48. DOE is also proposing to update Tables 2.6.5—Matrix of Extractor RMC Test Conditions, and Table 2.6.6.1—Standard RMC Values (RMC Standard) to include tests at 650 g. The proposed updated Table 2.6.6.1 is shown below in Table III.6, and it contains the additional standard RMC values at 650 g that were suggested by AHAM and supported by the AHAM DOE Test Cloth Task Force.

TABLE III.6—STANDARD RMC VALUES (RMC STANDARD)

"g Force"	RMC percentage			
	Warm soak		Cold soak	
	15 min. spin	4 min. spin	15 min. spin	4 min. spin
100	45.9	49.9	49.7	52.8
200	35.7	40.4	37.9	43.1
350	29.6	33.1	30.7	35.8
500	24.2	28.7	25.5	30.0
650	23.0	26.4	24.1	28.0

AHAM also commented on certain equipment necessary for extractor RMC tests. Specifically, AHAM suggested updating the manufacturer specified for the extractor from Bock Engineered Products to North Star Engineered Products, Inc., although the extractor model number remains the same. AHAM also suggested updating the requirements for bone drying the test cloth in preparation for determining the RMC of the test loads in the extractor tests, including a requirement for using a clothes dryer capable of heating the test cloth to over 210 degrees Fahrenheit (°F) (99 degrees Celsius (°C)). AHAM also suggested clarifications to the requirements for bundling and draining the test cloth prior to completing the extractor spin cycles. These clarifications include procedures to create loose bundles of four test clothes each, as well as a time limit of 5 seconds for gravity draining the bundles after

soaking and 1 minute for overall draining and loading of all bundles into the extractor. Whirlpool stated that it supports these revisions and clarifications. (AHAM, No. 15 at pp. 17–18; Whirlpool, No. 21 at p. 1) DOE concurs that these revisions are appropriate. In particular, DOE conducted extractor testing and observed that handling the test cloth as specified by AHAM produces consistent and repeatable RMC measurements for use in developing RMC correction curves. DOE also notes that North Star Engineered Products, Inc. operates at the same location and supplies the same model of extractor as the previously specified Bock Engineered Products, and that AHAM's proposed requirements for a bone dryer add specificity that was previously lacking in the test procedure and have general industry approval. Therefore, DOE proposes in today's notice to amend its clothes washer test procedure in sections 2.6.5.1 and 2.6.5.3 as discussed above, and add new section 2.12 with the bone dryer specifications.

AHAM also recommended that DOE add a section 2.6.5.3.1.2 to include a "Bone Drying Procedure." (AHAM, No. 15 at p. 17) DOE finds that this procedure is duplicative of the definition of "bone-dry" in section 1 of its test procedure, and, therefore, is not proposing to amend section 2.6.5.3.1 as suggested by AHAM.

DOE requests comment on the proposed updated test cloth tolerances and correlation procedure. DOE also requests any data related to the test cloth and correlation procedures.

4. Other Revisions and Clarifications

a. Clothes Washer Capacity Measurement Method

The current clothes washer test procedure requires measuring clothes container capacity as "the entire volume which a dry clothes load could occupy within the clothes container during washer operation." 10 CFR part 430, subpart B, appendix J1. The procedure involves filling the clothes washer with water, and determining the volume based on the added weight of water divided by its density. Specifically, the test procedure requires that the clothes container be filled manually with either 60 °F ± 5 °F (15.6 °C ± 2.8 °C) or 100 °F ± 10 °F (37.8 °C ± 5.5 °C) water to its "uppermost edge". *Id.*

DOE became aware that this general specification of the water fill level could lead to multiple capacity measurements that do not reflect the actual capacity available for washing clothes. DOE conducted capacity tests on a small sample of clothes washers to observe the different possible fill levels and to determine the variability associated with the current capacity test method. Comparison of measured capacities to rated values for the models in DOE's test sample showed that the majority of the reported capacities varied from DOE's measurements, some by as much as 0.5 ft^3. To provide more specific instructions on measuring the clothes container capacity, DOE issued draft guidance interpreting the maximum fill level required by the existing test procedure, available at *http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/frequently_asked_questions_cw_final_05-13-2010.pdf.* This draft guidance determines the maximum fill level (*i.e.,* the "uppermost edge") as the highest horizontal plane that a clothes load could occupy with the clothes container oriented vertically.

Separate from development of the guidance interpreting the fill level required by the existing test procedure, DOE sought comment in the August 2009 framework document on whether improvements to the existing test procedure were warranted. BSH commented that a performance assessment related to claimed load size would significantly benefit the consumer. According to BSH, comparing clothes container volumes between "regular efficiency" vertical-axis, high efficiency vertical-axis, and horizontal-axis clothes washers can be misleading. BSH stated that capacity should be linked to performance to better describe the utility of the appliance. (BSH, No. 9 at p. 2) The Joint Comment and ASE stated that the test procedure capacity measurement should reflect the useful volume of the clothes container that is actually available for clothes washing. The two comments noted that in 1995 DOE received information from Maytag that the clothes container volumes for vertical-axis machines could be overstated by 15 to 20 percent. The two comments stated that DOE should modify the test procedure to provide more accurate measurements if this overstatement is still occurring today. (Joint Comment, No. 14 at pp. 2–3; ASE, No. 22 at p. 1) Samsung also commented that DOE should propose to clarify how clothes container capacity for vertical-axis clothes washers is measured so that the result would reflect the usable capacity of the clothes washer. Samsung suggested the Committee Draft for Vote of IEC Standard 60456, Fifth Edition as a possible source for the clarification. That document specifies filling the clothes container with water "to its uppermost edge which may be used to fill in clothes, respecting manufacturer instructions." Samsung notes that manufacturers instruct consumers to fill clothes to the top of the clothes container's internal basket. (Samsung, No. 24 at pp. 1–2) ALS commented that DOE should revise the test procedure to clarify that, for vertical-axis clothes washers, the "uppermost edge" terminating point for the "capacity" measurement should be defined as the "top of the tub cover." (ALS, No. 12 at p. 1) ASAP expressed concern that the advertised capacity of a specific model is typically larger than the capacity that's reported to ENERGY STAR, CEC, and other public databases. (ASAP, Public Meeting Transcript, No. 7 at p. 20) According to the Joint Comment, the advertised capacity may be based on the DOE capacity, multiplied by an IEC conversion factor of 15/13, but that this conversion may not be made apparent. (Joint Comment, No. 14 at p. 2)

DOE believes that these comments indicate that improvements to the description of the fill level required by the current test procedure could result in more stable, accurate, representative, and repeatable capacity measurements. The following paragraphs describe DOE's proposed changes to the test measurements for both horizontal-axis and vertical-axis clothes washers.

For vertical-axis clothes washers, DOE proposes that the clothes container be filled to the uppermost edge of the rotating portion, including any balance ring. In tests DOE conducted on a limited sample of residential clothes washers for this rulemaking, DOE observed the maximum height to which the dry clothes could be filled in a vertical-axis clothes washer technically includes space above the upper surface of the stationary portion over the wash tub (commonly referred to as the tub cover.) However, in most cases, if clothes were placed in that region during a wash cycle, it is likely that portion of the load would not interact with water and detergent properly, and that entanglement would also likely occur. Based on its tests and review of manufacturer recommendations provided in product manuals, DOE believes the uppermost edge of the rotating portion of the clothes container for a vertical-axis clothes washer would be the highest horizontal plane that a clothes load could occupy while maintaining proper wash performance and ensuring a stable, accurate, and repeatable measurement. This would include the uppermost edge of any balance ring attached to the clothes container. Additionally, any volume

within the clothes container that a clothing load could not occupy during active washing mode operation should be excluded from the measurement.

For horizontal-axis clothes washers, DOE proposes that the clothes container be filled to the uppermost edge that is in contact with the door seal. DOE believes that the uppermost edge of the clothes container would typically be the portion of the door seal in contact with the door during operation. DOE also considered using the inner surface of the closed door as a possible definition of the uppermost edge of the clothes container. However, DOE observed during testing that small variations in the leveling of the clothes container's upper edge can make it difficult to determine in a repeatable way the water level that just meets the inner door surface. Additionally, measuring to the innermost surface of the closed door would not account for the extra volume available due to other parts of the door not projecting as far into the clothes container. Therefore, DOE believes that the uppermost edge of the clothes container that is in contact with the door seal for a horizontal-axis clothes washer would be the highest horizontal plane that a clothes load could occupy, as determined with the door open. Any volume within the clothes container that the clothing load could not occupy during active washing mode operation must be excluded.

DOE believes the proposed amendments would provide a consistent approach to determining the fill level and result in a representative capacity measurement. DOE is aware of other methods for measuring the clothes container capacity, such as those contained in IEC Standard 60456, but believes these other methods create an unnecessary test burden by using uncommon materials to measure the container capacity, and may not result in a capacity that is representative of actual use. DOE welcomes comment on whether the proposed method for measuring clothes container capacity provides a representative measurement of the volume which a dry clothes load could occupy within the clothes container during washer operation. DOE also welcomes comment on whether any other valid measurement method is available.

b. New Measure of Water Consumption

The calculation for WF currently set forth in the clothes washer test procedure is derived from only the water consumed during the cold wash/cold rinse wash cycle. 10 CFR part 430, subpart B, appendix J1. Hot water consumption is measured for all wash cycles, including warm, hot, and extra hot washes, but it is only used to determine the energy needed to heat the water. This presents an opportunity to bias the test procedure results by setting cold wash water consumption very low, while using more water at higher temperatures, in order to minimize the weighted average water consumption on which the WF is based.

To prevent such bias and to produce the most representative value of water consumption, DOE proposes to include water consumption from all energy test cycles in the calculation of the new integrated metric, IWF. DOE believes the proposed IWF calculation will provide a more representative measure of water consumption and will not substantially increase manufacturers' test burden. This is because hot water consumption is already recorded for all wash cycles and the equipment for measuring cold water consumption must be in place for the cold wash cycles. DOE believes that, in practice, manufacturers likely record the data for cold water consumption at other wash temperatures as well even though it is not required by the current test procedure.

DOE therefore proposes to measure both the hot and cold water consumption for each test cycle in order to calculate IWF. Doing so will provide total water consumption for each test cycle, including self-clean cycles. The total weighted per-cycle water consumption will equal the self-clean cycle water consumption multiplied by the number of self-clean cycles per year divided by 295 annual use cycles, plus the total water consumption for each test cycle multiplied by its TUF and load usage factor. IWF is then equal to this total weighted per-cycle water consumption divided by the clothes container volume.

DOE welcomes comment on the validity of including water consumption from all test cycles, including self-clean cycles, in the proposed calculation of IWF. DOE also requests comment on whether the IWF calculation would result in a significant test burden.

c. Energy Test Cycle

The energy test cycle is the cycle used in determining the MEF and WF for a clothes washer. The current clothes washer test procedure defines the energy test cycle as "(A) the cycle recommended by the manufacturer for washing cotton or linen clothes, and includes all wash/rinse temperature selections and water levels offered in that cycle, and (B) for each other wash/rinse temperature selection or water level available on that basic model, the portion(s) of other cycle(s) with that temperature selection or water level that, when tested pursuant to these test procedures, will contribute to an accurate representation of the energy consumption of the basic model as used by consumers. Any cycle under (A) or (B) shall include the agitation/tumble operation, spin speed(s), wash times, and rinse times applicable to that cycle, including water heating time for water heating clothes washers." 10 CFR 430, subpart B, appendix J1.

Many machines provide a "normal" cycle setting, or some equivalent, which is typically used for washing cotton or linen clothes. Testing conducted using the normal cycle setting satisfies part A of the energy test cycle definition. However, many of these normal cycle settings limit range of wash and rinse temperature selections. For example, they may offer cold and warm wash temperatures with cold rinse, but may not allow the user to select a hot or extra hot wash, or a warm wash with warm rinse. Testing only the wash temperature options available to the normal cycle, despite being able to access the other temperature options by switching out of the normal cycle, may neglect part B of the energy test cycle definition, which requires manufacturers to switch out of the normal cycle to a different setting that allows the other temperature settings to be selected and tested if such testing contributes to an accurate representation of energy consumption as used by consumers.

DOE understands that the requirement to test different temperature options "if such testing contributes to an accurate representation of energy consumption as used by consumers" has caused some confusion. As a result, DOE proposes to amend part B of the energy test cycle definition to definitively account for temperature options available only outside the normal cycle. The proposed part (B) would read "* * * (B) if the cycle described in (A) does not include all wash/rinse temperature settings available on the clothes washer, and required for testing as described in this test procedure, the energy test cycle shall also include the portions of a cycle setting offering these wash/rinse temperature settings with agitation/tumble operation, spin speed(s), wash times, and rinse times that are largely comparable to those for the cycle recommended by the manufacturer for washing cotton or linen clothes. Any cycle under (A) or (B) shall include the default agitation/tumble operation, soil level, spin speed(s), wash times, and rinse times applicable to that cycle,

including water heating time for water heating clothes washers." DOE believes that requiring manufacturers to test temperature options available outside the normal cycle would result in clear testing requirements. Combined with appropriate TUFs, the proposed test procedure would produce results that measure energy consumption of clothes washers during a representative average use cycle or period of use, as required by 42 U.S.C. 6923(b)(3).

DOE notes that it has issued draft guidance, available at *http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/warm_rinse_guidance_july_30.pdf,* interpreting the definition of energy test cycle under the existing clothes washer test procedure. This draft guidance states DOE's view that under the existing test procedure, the energy test cycle should include the warm rinse of the cycle most comparable to the cycle recommended by the manufacturer for washing cotton or linen clothes if warm rinse is not available on the cotton or linen cycle. In addition, DOE reiterates in the guidance that under the existing test procedure, warm rinse is to be measured as being used 27 percent of the time, regardless of whether the warm rinse is available on the cotton or linen cycle.

DOE also notes that it has received information from a manufacturer that suggests that cycles that vary from the cotton or linen cycle by means of lower spin speed result in a higher RMC than would be measured for the cotton or linen cycle, and therefore would not be largely comparable to those for the cycle recommended by the manufacturer for washing cotton or linen clothes or contribute to an accurate representation of energy consumption as used by consumers if they were included in the energy test cycle.

DOE requests comment on the proposed definition of the energy test cycle and on how manufacturers currently address wash/rinse temperature selection under the current definition, as well as the percentage of loads in which consumers use warm rinse, as represented by the TUFs discussed in section III.D.2.c.ii. DOE also requests comment on the selection of cycles to be included in the energy test cycle under section 1.7(B) of the test procedure to definitively account for temperature options available only outside the normal cycle.

d. Detergent Specifications for Test Cloth Preconditioning

The DOE clothes washer test procedure currently specifies that the test cloth be preconditioned by performing two normal wash-rinse-spin cycles using AHAM Standard detergent IIA. 10 CFR part 430, subpart B, appendix J1. This detergent is obsolete and no longer supplied by AHAM or other suppliers. The current AHAM standard detergent is identified as AHAM standard test detergent Formula 3. Because AHAM Standard detergent IIA is no longer available to manufacturers, DOE proposes amending the clothes washer test procedure to specify the use of AHAM standard test detergent Formula 3 in test cloth preconditioning.

Tests that DOE conducted with AHAM standard test detergent Formula 3 according to the existing DOE clothes washer test procedure suggest that the dosage that is specified in section 2.6.3.1 for AHAM Standard detergent IIA—6.0 grams (g) per gallon of water—may no longer be appropriate. At the end of test cloth preconditioning, undissolved clumps of detergent were observed in the cloth load. Further, DOE conducted extractor tests that indicate that detergent dosage affects RMC measurements by as much as several percent.

Instructions provided with AHAM standard test detergent Formula 3 by one supplier of standard test materials, SDL Atlas, indicate that the appropriate dosage for this detergent is 27.0 g + 4.0 g per pound of cloth load. In addition, AHAM's clothes dryer test standard, AHAM HLD–1–2009, specifies the same dosage of AHAM standard test detergent Formula 3 for test cloth pre-treatment. Due to the problems associated with the current dosage specification in the DOE clothes washer test procedure, DOE is tentatively proposing to amend the test procedure to require 27.0 g + 4.0 g/lb of AHAM standard test detergent Formula 3 for test cloth preconditioning. However, DOE is also seeking further information on the appropriate detergent concentration.

e. Clothes Washer for Test Cloth Preconditioning

Section 2.6.3.1 of the current DOE clothes washer test procedure delineates the requirements for preconditioning the test cloths using a clothes washer for which a maximum water level can be set, the load can be washed for 10 minutes, and the wash temperature can be controlled to 135 °F ± 5 °F (57.2 °C ± 2.8 °C). 10 CFR part 430, subpart B, appendix J1. In interviews with DOE, multiple manufacturers expressed concern that there are currently few clothes washers commercially available that meet these requirements. They also expressed concern that the more stringent energy conservation standards that may result from the residential clothes washer standards rulemaking may eliminate such clothes washer models from the market entirely. DOE seeks information regarding an alternative specification for the clothes washer to be used for preconditioning that would allow for the use of more recent models.

f. Water Supply Pressure

Section 2.4 of the current DOE clothes washer test procedure provides the water pressure test conditions. According to this section, "[t]he static water pressure at the hot and cold water inlet connection of the clothes washer shall be maintained at 35 pounds per square inch gauge (psig) ±/− 2.5 psig (241.3 kPa ± 17.2 kPa) during the test. The static water pressure for a single water inlet connection shall be maintained at the 35 psig ± 2.5 psig (241.3 kPa ± 17.2 kPa) during the test. A water pressure gauge shall be installed in both the hot and cold water lines to measure water pressure." 10 CFR part 430, subpart B, appendix J1. DOE believes this description is ambiguous as to whether the nominal 35 psig water pressure is to be set under static (non-flow) conditions and allowed to drop during flow due to the head losses in the line, or whether the 35 psig is to be maintained continuously under all flow conditions during the test. In addition, the test procedure does not specify where the pressure measurement is to be taken, which could lead to different results depending on the pressure drops associated with the water supply lines between the gauge and the connection to the clothes washer.

Tests conducted by DOE on a small sample of both front- and top-loading clothes washers indicate that water supply pressure can affect water consumption during a wash cycle, and the effect of water supply pressure on total water use can vary depending on the temperature settings selected. For tests at 10, 20, and 35 psig water supply pressure under flow conditions, water consumption varied by 10–30 percent among the different pressure conditions for either hot wash/cold rinse or cold wash/cold rinse cycles.

The test data suggest that a water supply pressure of 20 psig under flow conditions results in the most consistent water use among different cycles for a given clothes washer. DOE believes that 20 psig may represent typical static pressure under flow conditions that would result from 35 psig at non-flow conditions. DOE further believes that these conditions may be more representative of water supply

conditions that would be found in typical residential settings than a constant static pressure of 35 psig even under flow conditions.

However, DOE test procedures for other residential appliances more closely specify the 35 psig requirement as being applicable under flow conditions. For example, section 2.4 of the DOE test procedure for dishwashers (10 CFR part 430 subpart B, appendix C) specifies to "maintain the pressure of the water supply at 35 ± 2.5 pounds per square inch gauge (psig) when the water is flowing." Dishwashers and clothes washers would likely have the same water supply pressure when installed in a house, so the test procedures for these products should include consistent water supply pressure specifications.

DOE is uncertain about which interpretation of the water supply pressure (*i.e.,* 35 psig only for no-flow conditions, or 35 psig under all flow conditions) has been assumed by manufacturers and certification laboratories. DOE also lacks sufficient information as to which interpretation produces representative, repeatable water consumption measurements. For these reasons, DOE is not proposing in today's notice amendments to its clothes washer test procedure to more closely specify water supply pressure. DOE seeks information about the conditions under which clothes washers are currently tested and invites comment on the appropriate specification of the water supply pressure.

g. Additional Revisions and Clarifications

Section 2.6.4.5.3 of the current test procedure discusses standards incorporated by reference for verifying the absence of water repellent finishes on the energy test cloth: AATCC Test Method 118–1997, "Oil Repellency: Hydrocarbon Resistance Test" and AATCC Test Method 79–2000, "Absorbency of Bleached Textiles." 10 CFR part 430, subpart B, appendix J1. To be consistent with referenced standards in other DOE test procedures, DOE proposes to remove this paragraph from the clothes washer test procedure and, instead, include these two AATCC test procedures in 10 CFR 430.3, "Materials Incorporated by Reference." In addition, DOE proposes adding to 10 CFR 430.3 the newly referenced AATCC Test Method 135–2004, "Dimensional Changes of Fabrics after Home Laundering" for measuring shrinkage of the energy test cloth.

Section 3.8.4 provides test methods for measuring RMC for clothes washers that have options that result in different RMC values, such as multiple selection of spin speeds or spin times. The methodology requires conducting tests to measure RMC at maximum spin settings with the maximum test load size for cold rinse and, if any, for warm rinse, and then repeating the tests at minimum spin settings. These tests would result in two values of RMC at maximum load size, which are weighted to obtain final RMC. These two values are currently identified as $RMC_{max\ extraction}$ and $RMC_{min\ extraction}$, which do not correspond to the nomenclature used in the sections from which they are derived, sections 3.8.2 or section 3.8.3, respectively. In those sections, the measurement is designated as RMC_{max}. DOE proposes to modify the nomenclature in section 3.8.4 to clarify that these are the values obtained from either section 3.8.2 or section 3.8.3.

Section 4.1.4 of the current clothes washer test procedure calculates the total per-cycle hot water energy consumption using gas-heated or oil-heated water. The equation listed in this section contains a clerical error in the symbol for total weighted per-cycle hot water energy consumption. DOE proposes amending the equation to replace the incorrect symbol, H_T, with the correct symbol, HE_T. DOE would apply this amendment to both existing appendix J1 and new appendix J2 in 10 CFR part 430 subpart B.

Section 4.5 of the current clothes washer test procedure provides for the calculation of Energy Factor (EF). EF was the energy efficiency metric used to establish energy conservation standards for clothes washers manufactured before January 1, 2004. 10 CFR 430.32(g). This metric is no longer used to determine compliance with energy conservation standards, or in any other related metrics. For example, the EnergyGuide labeling requirements specify identification of annual operating costs. 16 CFR part 305, appendix F1, appendix F2. Annual operating cost is based on the per-cycle energy consumption, rather than EF or MEF. 10 CFR 430.23(j). Therefore, DOE proposes to remove the obsolete calculation of EF from the clothes washer test procedure.

5. Test Procedure Performance Specifications

The current DOE clothes washer test procedure does not include any provisions for evaluating the wash quality of a clothes washer. The intent of the test procedure is to determine the water and energy consumption of a clothes washer, regardless of its wash capabilities.

In response to the August 2009 framework document, DOE received multiple comments regarding adding performance measures to the clothes washer test procedure. AHAM and BSH commented that DOE should evaluate the feasibility of incorporating a performance measure into the test procedure because, according to both, the efficiency level 4 and max-tech MEFs and WFs proposed in the August 2009 framework document are approaching limits at which product performance and consumer satisfaction may become an issue. AHAM noted it has a standard addressing performance, AHAM HLW–1, which is harmonized with IEC Standard 60456, "Clothes washing machines for household use—Methods for measuring the performance." Additionally, AHAM and BSH stated that Europe requires a performance rating in addition to energy and water consumption requirements. BSH stated that DOE should review IEC Standard 60456 for methods of assessing performance. (AHAM, No. 15 at p. 2; BSH, No. 9 at p. 1) ALS also expressed concern that the standards have reached a point where increased efficiency levels will result in unacceptable washing, rinsing, and expected consumer utility performance, especially in the standard capacity vertical-axis product class. According to ALS, washing clothes requires both water and thermal energy, but higher efficiency standards require decreasing both. ALS commented that there already appears to be "consumer backlash" from some owners of high-efficiency clothes washers regarding the ability of these washers to clean their laundry as expected. ALS recommended that DOE examine AHAM HLW–1, IEC Standard 60456, and AS/NZS 2040.1 as possible performance test procedures. (ALS, No. 12 at pp. 1–2) Whirlpool commented that many of the candidate standard levels in the August 2009 framework document could only be met by significantly compromising product performance, and therefore provisions to ensure proper wash performance, rinse performance, and an absence of fabric damage must be added to the test procedure. The comment referenced the AHAM test procedure, HLW–1–2007, as a source for such performance criteria. (Whirlpool, No. 21 at p. 2)

DOE has carefully considered these comments and recognizes the benefits of wash performance characterization, but is not proposing to incorporate measures of wash performance into the clothes washer test procedure. As stated in EPCA, "[a]ny test procedures prescribed or amended under this section shall be reasonably designed to produce test results which measure energy efficiency, energy use * * * or

estimated annual operating cost of a covered product during a representative average use cycle or period of use * * * and shall not be unduly burdensome to conduct." 42 U.S.C. 6293(b)(3). DOE will, however, consider wash performance and related impacts to consumer utility in developing any future energy conservation standards for residential clothes washers.

E. Compliance With Other EPCA Requirements

1. Test Burden

As noted previously, under 42 U.S.C. 6293(b)(3), EPCA requires that "[a]ny test procedures prescribed or amended under this section shall be reasonably designed to produce test results which measure energy efficiency, energy use * * * or estimated annual operating cost of a covered product during a representative average use cycle or period of use * * * and shall not be unduly burdensome to conduct." For the reasons that follow, DOE has tentatively concluded that amending the relevant DOE test procedures to incorporate clauses regarding test conditions and methods found in IEC Standard 62301, along with the proposed modifications to the active washing mode test procedure, would satisfy this requirement.

The proposed amendments to the DOE test procedure incorporate a test standard that is accepted internationally for measuring power consumption in standby mode and off mode. Based on its analysis of IEC Standard 62301, DOE determined that the proposed amendments to the clothes washer test procedure will produce standby mode and off mode average power consumption measurements that are representative of an average use cycle, both when the measured power is stable and when the measured power is unstable (*i.e.,* when the measured power varies by 5 percent or more during 30 minutes.) Additionally, DOE is proposing similar provisions for measuring power in additional active modes (delay start and cycle finished modes). The test methods and equipment that the amendments would require for measuring power in these modes are not substantially different from the test methods and equipment required in the current DOE test procedure for measuring the product's energy consumption in active washing mode. Therefore, the proposed test procedure would not require manufacturers to make a major investment in test facilities and new equipment. For these reasons, DOE has tentatively concluded that the proposed amended test procedure would produce test results that measure the standby, off, delay start and cycle finished mode power consumption of a clothes washer during a representative average use cycle, and that the test procedure would not be unduly burdensome to conduct.

DOE is also proposing amendments to the active washing mode portion of the clothes washer test procedure. Because these amendments would require manufacturers to make the same measurements as specified by the current test procedure, DOE believes that manufacturers likely would not require additional investment or equipment purchases to conduct the energy testing as proposed in this notice. The proposed water pressure requirement may require some manufacturers to purchase additional pressure regulators, but DOE believes this expense would not be significant—on the order of hundreds of dollars. The proposed amendments would also require additional time to conduct, because manufacturers would need to test additional cycles not included in the current test procedure, such as self-clean or steam wash cycles. DOE believes, however, that including these additional cycles in the test procedure would provide for a more representative measurement of machine energy efficiency and water use, and that the time commitment required to test these additional cycles would not represent a significant burden on manufacturers. The current test procedure already requires multiple energy test cycles. Testing self-clean and steam wash cycles, only on clothes washers offering these features, would likely increase the total test time for these units by approximately 25 percent.

2. Integration of Standby Mode and Off Mode Energy Consumption Into the Efficiency Metrics

Section 325(gg)(2)(A) of EPCA requires that standby mode and off mode energy consumption be "integrated into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product" unless the current test procedures already fully account for the standby mode and off mode energy consumption or if such an integrated test procedure is technically infeasible. (42 U.S.C. 6295(gg)(2)(A)) DOE proposes to incorporate the clothes washer standby and off mode energy consumption, in addition to energy consumption in delay start and cycle finished modes, into a "per-cycle standby, off, delay start and cycle finished mode energy consumption," expressed in kWh, and into an IMEF, as discussed in section III.C.5 of this notice.

EPCA provides that test procedure amendments adopted to comply with the new EPCA requirements for standby and off mode energy consumption will not determine compliance with previously established standards. (42 U.S.C. 6295(gg)(2)(C)) Because DOE is proposing to adopt the amendments as a new appendix J1 to 10 CFR part 430 subpart B that manufacturers would not be required to use until the compliance date of amended energy conservation standards for residential clothes washers, the test procedure amendments pertaining to standby mode and off mode energy consumption that DOE proposes to adopt in this rulemaking would not apply to, and would have no effect on, existing standards.

3. Commercial Clothes Washers

The test procedure for commercial clothes washers is required to be the same test procedure established for residential clothes washers. (42 U.S.C. 6314(a)(8)) Thus, the test procedure set forth in appendix J1 of subpart B of 10 CFR part 430 is also currently used to test commercial clothes washers. (10 CFR part 431.154) If DOE were to apply the proposed new appendix J2 to commercial clothes washers, the impacts would be limited to the proposed amendments associated with active washing mode because commercial clothes washer standards are based on MEF and WF. These include proposed changes to the test load size specification, TUFs, DUF, test cloth specification, capacity measurement, detergent specification, and water supply pressure specification, which will have some effect on the measured energy and water efficiencies of a commercial clothes washer. DOE believes that the most significant impacts could be associated with the proposed amendments for capacity measurement and usage factors, but does not have information to evaluate any impacts for commercial clothes washers. Therefore, DOE welcomes inputs on the effects of the proposed amendments in appendix J2 on the measured energy and water efficiencies of commercial clothes washers.

F. Impact of the Proposed Amendments on EnergyGuide and ENERGY STAR

DOE considered potential impacts of the proposed test procedure amendments to the FTC EnergyGuide requirements and determined that there will be no impact. DOE also considered potential impacts of the proposed test procedure amendments to the EPA/DOE

ENERGY STAR voluntary labeling program. The ENERGY STAR program for clothes washers is based on MEF and WF. DOE notes that the calculation of MEF could be affected by the proposed revisions incorporating the energy and water consumption for warm wash/warm rinse cycles. These proposed revisions should not affect the calculated MEF for the majority of clothes washers, but could have some effect on clothes washers offering a warm/warm temperature selection only for cycle setting(s) other than the cycle setting recommended by the manufacturer for cotton or linen clothing. The calculations of both MEF and WF could also be affected by the proposed revision to the clothes container capacity measurement, depending on how manufacturers are currently interpreting the nonspecific water fill level specification. As part of the current residential clothes washer energy conservation standards rulemaking, DOE would analyze any potential impact of the proposed test procedure on calculated MEF values.

G. Elimination of the Obsolete Clothes Washer Test Procedure

DOE proposes to delete appendix J to subpart B of 10 CFR part 430 along with all references to appendix J in 10 CFR 430.23. Appendix J applies only to clothes washers manufactured before January 1, 2004 and is therefore obsolete. Appendix J1 to subpart B of 10 CFR part 430 provides an applicable test procedure for all clothes washers currently available on the market. DOE proposes to maintain the current naming of appendix J1, rather than renaming it as appendix J, and to establish new appendix J2 to simplify the changes required. DOE has previously used this approach of retaining later versions of appendices to subpart B of 10 CFR part 430 when deleting the original version, including appendix A1, "Uniform Test Method for Measuring the Energy Consumption of Electric Refrigerators and Electric Refrigerator-Freezers," and appendix B1, "Uniform Test Method for Measuring the Energy Consumption of Freezers."

IV. Procedural Requirements

A. Review Under Executive Order 12866

Today's regulatory action is not a "significant regulatory action" under section 3(f) of Executive Order 12866, Regulatory Planning and Review, 58 FR 51735 (October 4, 1993). Accordingly, this proposed action was not subject to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB).

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis for any rule that by law must be proposed for public comment, unless the agency certifies that the proposed rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE's procedures and policies may be viewed on the Office of the General Counsel's Web site (*http://www.gc.doe.gov*).

DOE reviewed today's proposed rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. DOE has tentatively concluded that the proposed rule would not have a significant impact on a substantial number of small entities. The factual basis for this certification is as follows:

The Small Business Administration (SBA) considers a business entity to be small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. These size standards and codes are established by the North American Industry Classification System (NAICS). The threshold number for NAICS classification code 335224, which applies to household laundry equipment manufacturers and includes clothes washer manufacturers, is 1,000 employees. Searches of the SBA Web site [16] to identify clothes washer manufacturers within these NAICS codes identified, out of approximately 17 manufacturers supplying clothes washers in the United States, only one small business. This small business manufactures laundry appliances, including clothes washers. The other manufacturers supplying clothes washers are large multinational corporations.

The proposed rule would amend DOE's test procedure by incorporating testing provisions to address active mode, standby mode, and off mode energy and water consumption that will be used to demonstrate compliance with energy conservation standards. The proposed test procedure amendments for standby, off, delay start and cycle finished modes involve measuring power input when the clothes washer is in these modes. These tests can be conducted in the same facilities used for the current energy testing of these products, so it is anticipated that manufacturers would not incur any additional facilities costs as a result of the proposed test procedure amendments. The power meter required for these tests might require greater accuracy than the power meter used for current energy testing, but the investment required for a possible instrumentation upgrade is a one-time cost, expected to be approximately a few thousand dollars. The duration of each test period is roughly 40 minutes (comprising a 30-minute stabilization period and 10-minute test period). This is comparable to approximately half the time required to conduct a single energy test cycle. Each clothes washer tested requires, on average, approximately 15 test cycles for energy testing, which equates to about three days of testing. For clothes washers offering all relevant non-active washing modes—inactive, off, delay start, and cycle finished—DOE estimates roughly an 11-percent increase in total test period duration. DOE also estimates that it costs a manufacturer approximately $2,300 on average, including the cost of consumables, to conduct energy testing for a particular clothes washer. DOE further estimates that the cost of additional testing for non-active washing modes would average $200 per machine, a 9-percent increase over current test costs. DOE believes these additional requirements for equipment and time and additional cost to conduct the proposed non-active washing mode tests would not be expected to impose a significant economic burden on entities subject to the applicable testing requirements. Although the small business has significantly lower sales than other manufacturers over which to amortize these additional costs, it only produces a single platform which would be subject to the proposed non-active washing mode tests and thus the total additional cost for these tests would be on the order of $2,500.

The proposed test procedure amendments for the active washing mode would increase test burden by imposing a requirement for conducting test cycles under two additional conditions, steam and self-clean, for those clothes washers equipped with such features. The testing conditions

[16] A searchable database of certified small businesses is available online at: *http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm.*

and equipment for these cycles are the same as already required for the other energy test cycles, and manufacturers are already required to conduct measurements for multiple energy test cycles. Additionally, as discussed in section III.E.1, the additional time required for the testing steam and self-clean cycles would increase the test period by roughly 25 percent, from approximately three days to nearly four days total duration. DOE estimates that the average test cost increment per machine for these proposed active mode amendments would be approximately $600. Test burden could potentially also be increased by the proposed amendment to the water supply pressure requirement if a manufacturer were required to install additional equipment to maintain 35 psig under flow conditions. The cost of this equipment, as discussed in section III.E.1, would not be significant, on the order of hundreds of dollars. The proposed amendments for additional extractor tests for determining RMC coefficients also represent an increased burden for the limited number of entities that conduct such tests. However, these tests are limited to qualification of a new test cloth lot, and do not need to be performed by every manufacturer because the coefficients are made available to the public on DOE's website. Therefore, DOE does not believe these proposed amendments would have a significant impact on a substantial number of small entities. Because the one small business only manufactures a single platform, it would be subject to total additional costs of approximately $1,000 associated with the proposed active washing mode amendments.

For these reasons, DOE tentatively concludes and certifies that the proposed rule would not have a significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared a regulatory flexibility analysis for this rulemaking. DOE seeks comment on its certification and will transmit the certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the SBA for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act of 1995

This NOPR contains a collection-of-information requirement subject to the Paperwork Reduction Act (PRA) which has been approved by OMB under control number 1910–1400. Public reporting burden for compliance reporting for energy and water conservation standards is estimated to average 30 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate, or any other aspect of this data collection, including suggestions for reducing the burden, to DOE (*see* **ADDRESSES**) and by e-mail to *Christine_J._Kymn@omb.eop.gov.*

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

In this proposed rule, DOE proposes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for clothes washers. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, this rule amends an existing rule without changing its environmental effect and, therefore, is covered by the Categorical Exclusion in 10 CFR part 1021, subpart D, paragraph A5. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, "Federalism," imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. 64 FR 43255 (August 4, 1999). The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States, and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process that it will follow in developing such regulations. 65 FR 13735. DOE examined this proposed rule and determined that it would not preempt State law and would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of today's proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) Therefore, Executive Order 13132 requires no further action.

F. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, "Civil Justice Reform," 61 FR 4729 (February 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity, (2) write regulations to minimize litigation, (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. Section 3(b) of Executive Order 12988 specifically requires that executive agencies make every reasonable effort to ensure that the regulation specifies the following: (1) The preemptive effect, if any; (2) any effect on existing Federal law or regulation; (3) a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) the retroactive effect, if any; (5) definitions of key terms; and (6) other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or whether it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) (Pub. L. 104–4; 2 U.S.C. 1501 *et seq.*) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. For a proposed regulatory action likely to result in a rule that may

cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish estimates of the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a),(b)) UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect such governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. (The policy is also available at *http://www.gc.doe.gov*). Today's proposed rule contains neither an intergovernmental mandate nor a mandate that may result in an expenditure of $100 million or more in any year, so these requirements do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. Today's proposed rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (March 18, 1988), that this proposed regulation would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (February 22, 2002), and DOE's guidelines were published at 67 FR 62446 (October 7, 2002). DOE has reviewed today's notice under OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that (1) Is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use if the proposal is implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use. Today's proposed regulatory action, which proposes amendments to the test procedure for measuring the energy efficiency of residential clothes washers, is not a significant regulatory action under Executive Order 12866 or any successor order; would not have a significant adverse effect on the supply, distribution, or use of energy; and has not been designated by the Administrator of OIRA as a significant energy action. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

L. Review Under Section 32 of the Federal Energy Administration (FEA) Act of 1974

Under section 301 of the DOE Organization Act (Pub. L. 95–91; 42 U.S.C. 7101 *et seq.*), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977 (FEAA). (15 U.S.C. 788) Section 32 essentially provides that, where a proposed rule authorizes or requires use of commercial standards, the rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (FTC) concerning the impact of the commercial or industry standards on competition.

The proposed modifications to the test procedure addressed by this action incorporate testing methods contained in the commercial standard, IEC Standard 62301. DOE has evaluated this standard and is unable to conclude whether it fully complies with the requirements of section 32(b) of the FEAA (*i.e.,* whether it was developed in a manner that fully provides for public participation, comment, and review.) DOE will consult with the Attorney General and the Chairman of the FTC about the impact on competition of using the methods contained in this standard, before prescribing a final rule.

V. Public Participation

A. Attendance at Public Meeting

The time, date, and location of the public meeting are listed in the **DATES** and **ADDRESSES** sections at the beginning of this NOPR. To attend the public meeting, please notify Ms. Brenda Edwards at (202) 586–2945. As explained in the **ADDRESSES** section, foreign nationals visiting DOE Headquarters are subject to advance security screening procedures.

B. Procedure for Submitting Requests To Speak

Any person who has an interest in today's NOPR, or who is a representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the public meeting. Such persons may hand-deliver requests to speak to the address shown in the **ADDRESSES** section at the beginning of this NOPR between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Requests may also be sent by mail or e-mail to Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121, or *Brenda.Edwards@ee.doe.gov.* Persons who wish to speak should include in their request a computer diskette or CD in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least one week before the public meeting. DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Program. Requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. After the public meeting, interested parties may submit further comments on the proceedings as well as on any aspect of the rulemaking until the end of the comment period.

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, allow time for presentations by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a prepared general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit other participants to comment briefly on any general statements. At the end of all prepared statements on each specific topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others.

Participants should be prepared to answer DOE's and other participants' questions. DOE representatives may also ask participants about other matters relevant to this rulemaking. The official conducting the public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

DOE will make the entire record of this proposed rulemaking, including the transcript from the public meeting, available for inspection at the U.S. Department of Energy, 6th Floor, 950 L'Enfant Plaza, SW., Washington, DC 20024, (202) 586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays. Copies of the transcript are available for purchase from the transcribing reporter and will also be made available on DOE's Web site at *http://www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html.*

D. Submission of Comments

DOE will accept comments, data, and information regarding the proposed rule before or after the public meeting, but no later than the date provided at the beginning of this notice. Comments, data, and information submitted to DOE's e-mail address for this rulemaking should be provided in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format. Interested parties should avoid the use of special characters or any form of encryption, and wherever possible comments should include the electronic signature of the author. Comments, data, and information submitted to DOE via mail or hand delivery/courier should include one signed original paper copy. No telefacsimiles (faxes) will be accepted.

According to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit two copies: one copy of the document that includes all of the information believed to be confidential, and one copy of the document with that information deleted. DOE will determine the confidential status of the information and treat it accordingly.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include (1) A description of the items, (2) whether and why such items are customarily treated as confidential within the industry, (3) whether the information is generally known by or available from other sources, (4) whether the information was previously made available to others without obligation concerning its confidentiality, (5) an explanation of the competitive injury to the submitting person that would result from public disclosure, (6) when such information might lose its confidential character due to the passage of time, and (7) why disclosure of the information would be contrary to the public interest.

E. Issues on Which DOE Seeks Comment

DOE is particularly interested in receiving comments and views of interested parties on the following issues:

1. *Incorporation of IEC Standard 62301.* DOE invites comment on the adequacy of IEC Standard 62301 to measure standby and off mode power consumption for clothes washers, and the suitability of incorporating into DOE regulations the specific provisions described in section III.C.1 of this notice;

2. *Clothes washer modes.* DOE invites comment on the proposed establishment of inactive mode as the only standby mode for clothes washers and the determination that "delay start mode" and "cycle finished mode" and "self-clean mode" would be considered additional active modes. DOE further invites comment on the proposed mode definitions, including the definition of "self-clean" mode, and on the question of whether there are any modes consistent with the "active mode," "standby mode," or "off mode" definitions that have not been identified in this NOPR that represent significant energy use (*see* section III.C.2.);

3. *Default settings.* DOE welcomes comment on the suitability of using the default settings in testing standby energy consumption, and on any methodologies that can account for consumer actions that might increase energy use and data on the repeatability of such testing procedures (*see* section III.C.3.);

4. *Delay start mode.* DOE welcomes comment on the methodology proposed for measuring delay start mode (*see* section III.C.3);

5. *Test room ambient temperature.* DOE seeks comment on the appropriateness of the proposed modified test room ambient temperature range, which would allow manufacturers to conduct standby and off mode testing separately from performance testing under the less stringent ambient conditions specified in the IEC Standard 62301 (73.4 ± 9 °F) (*see* section III.C.3.);

6. *Energy use calculation.* DOE invites comment on the approach for calculating energy use for the various operating modes for clothes washers. DOE also invites comment on the allocation of annual hours and test burden, as well as the alternative methodology for allocation of annual hours (*see* section III.C.4.);

7. *New integrated measures of energy consumption and energy efficiency.* DOE invites comment on the proposed plan to establish new integrated measures of energy consumption for clothes washers: "per-cycle standby, off, delay start, and cycle finished mode energy consumption" and "per-cycle self-clean mode energy consumption," expressed in kWh, and a new integrated measure of energy efficiency for clothes washers: "integrated modified energy

factor" expressed in ft^3 per kWh per cycle. (*see* section III.C.5);

8. *Annual energy cost calculation.* DOE invites comment on the proposed decision to maintain the existing annual energy cost calculation set forth in 10 CFR 430.23, which does not include self-clean, standby, off, delay start, or cycle finished mode energy consumption. One alternative way of incorporating self-clean, standby, off, delay start, and cycle finished mode energy consumption in the annual energy cost calculation would be to add per-cycle standby, off, delay start, and cycle finished mode energy consumption and per-cycle self-clean mode energy consumption to the total per-cycle energy consumption in the annual energy cost calculations in 10 CFR 430.23(j)(1)(i) and (ii) (*see* section III.C.5);

9. *Steam wash cycles.* DOE requests comment on the proposed inclusion of the energy and water consumption of a steam wash cycle to the clothes washer test procedure, including the associated use factor. DOE also requests any data available regarding consumer use of steam wash cycles (*see* section III.D.1.a);

10. *Self-clean cycles.* DOE invites comment on self-clean cycles for clothes washers, including the proposed definition, inclusion of self-clean cycle energy and water use into the IMEF and IWF calculations, and on whether any relevant data is available regarding availability and consumer use of self-clean cycles (*see* section III.D.1.b);

11. *Adaptive control and demand response technologies.* DOE requests comment on whether any clothes washers are currently available on the market offering soil-sensing adaptive controls or demand response features. DOE also requests information on load size and fabric content, the possible use of a soiled test load to determine energy and water use in the presence of soil-sensing adaptive controls, appropriate methodologies for measuring energy consumption in a network mode, and data on the repeatability of such testing (*see* sections III.D.1.c and III.D.1.d);

12. *Representative number of annual cycles.* DOE welcomes comment on the appropriateness of the proposed 295 clothes washer cycles per year, and on the validity of using the 2005 Residential Energy Consumption Survey (RECS) to establish this estimate. DOE also seeks any additional data available on this issue (*see* section III.D.2.a);

13. *Test load size specifications.* DOE invites comment on the proposed test load sizes, and on whether the linear relationship between test load size and clothes washer container volume is representative of actual consumer use. DOE welcomes any relevant data on this topic (*see* section III.D.2.b);

14. *Use factors.* DOE requests comment on the validity of the proposed use factors for temperature, load size, and dryer use, and of the data sources used to estimate these values. Additionally, DOE seeks comment on the proposed revision to the warm rinse measurements, including the validity of the proposed warm wash/warm rinse TUF of 0.27. DOE also welcomes comment regarding the proposed load adjustment factor to be used in the RMC calculation. Stakeholders may submit any additional relevant data regarding these use factors (*see* section III.D.2.c);

15. *Test cloth.* DOE invites comment on and data regarding the proposed updated test cloth specifications and correlation procedure (*see* section III.D.3);

16. *Capacity measurement method.* DOE welcomes comment on whether the proposed method for measuring clothes container capacity provides for a representative measurement of the volume that a dry clothes load could occupy within the clothes container during washer operation, and on whether any other valid measurement method is available (*see* section III.D.4.a);

17. *New integrated measure of water consumption.* DOE invites comment on the proposal to establish a new integrated measure of water consumption for clothes washers, "integrated water consumption factor" expressed in gallons per cubic foot. DOE requests comment on the validity of including water consumption from all test cycles, including self-clean cycles, into the proposed calculation of IWF. DOE also requests comment on whether the IWF calculation would result in a significant test burden (*see* section III.D.4.b);

18. *Energy test cycle definition.* DOE welcomes comment on the proposed definition of the energy test cycle, and on how manufacturers currently address wash and rinse temperature selection under the current definition. DOE also requests comment on the selection cycles to be included in the energy test cycle under section 1.7(B) of the test procedure to definitively account for temperature options available only outside the normal cycle. (*see* section III.D.4.c);

19. *Detergent specifications.* DOE welcomes comment on the proposed updated detergent formulation and associated dosage for test cloth preconditioning (*see* section III.D.4.d);

20. *Clothes washer for preconditioning.* DOE requests comment on the proposed revisions to the specifications for the clothes washer used in test cloth preconditioning, including whether clothes washers currently meeting the specifications may be rendered obsolete by potential new residential clothes washer energy conservation standards (*see* section III.D.4.e);

21. *Water supply pressure.* DOE seeks information about the conditions under which clothes washers are currently tested, and invites comment on the appropriate specification of the water supply pressure (*see* section III.D.4.f); and

22. *Impact on commercial clothes washers.* DOE requests comment on how the proposed amendments in new appendix J2 of subpart B to 10 CFR part 430 would impact the measured energy and water efficiencies of commercial clothes washers. DOE welcomes any relevant data on this topic (*see* section III.E.2).

VI. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of today's notice of proposed rulemaking.

List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Energy conservation, Household appliances.

Issued in Washington, DC, on August 27, 2010.

Cathy Zoi,

Assistant Secretary, Energy Efficiency and Renewable Energy.

For the reasons stated in the preamble, DOE proposes amending part 430 of chapter II of title 10, Code of Federal Regulations, to read as set forth below:

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

1. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

2. Section 430.3 is amended by:

a. Redesignating paragraphs (b) through (o) as (c) through (p);

b. Adding new paragraph (b).

The additions read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

(b) *AATCC.* American Association of Textile Chemists and Colorists, P.O. Box 1215, Research Triangle Park, NC 27709, 919–549–8141, or go to *http://www.aatcc.org.*

(1) AATCC Test Method 79–2000, Absorbency of Bleached Textiles, (reaffirmed 2000), IBR approved for Appendix J1 to Subpart B.

(2) AATCC Test Method 118–1997, Oil Repellency: Hydrocarbon Resistance Test, reaffirmed (1997), IBR approved for Appendix J1 to Subpart B.

(3) AATCC Test Method 135–2004, Dimensional Changes of Fabrics after Home Laundering, reaffirmed (2004), IBR approved for Appendix J1 to Subpart B.

* * * * *

3. Section 430.23 is amended by revising paragraph (j) to read as follows:

§ 430.23 Test procedures for the measurement of energy and water consumption.

* * * * *

(j) *Clothes washers.* (1) The estimated annual operating cost for automatic and semi-automatic clothes washers shall be—

(i) When electrically heated water is used, the product of the following three factors:

(A) The representative average-use of 392 cycles per year,

(B) The total per-cycle energy consumption when electrically heated water is used, determined according to 4.1.7 of appendix J1 before appendix J2 becomes mandatory and 4.1.7 of appendix J2 when appendix J2 becomes mandatory (see the note at the beginning of appendix J2), and

(C) The representative average unit cost in dollars per kilowatt-hour as provided by the Secretary, the resulting product then being rounded off to the nearest dollar per year, and

(ii) When gas-heated or oil-heated water is used, the product of: the representative average-use of 392 cycles per year and the sum of both:

(A) The product of the per-cycle machine electrical energy consumption in kilowatt-hours per cycle, determined according to 4.1.6 of appendix J1 before appendix J2 becomes mandatory and 4.1.6 of appendix J2 when appendix J2 becomes mandatory, and the representative average unit cost in dollars per kilowatt-hours as provided by the Secretary, and

(B) The product of the per-cycle water energy consumption for gas-heated or oil-heated water in Btu per cycle, determined according to 4.1.4 of appendix J1 before appendix J2 becomes mandatory and 4.1.4 of appendix J2 when appendix J2 becomes mandatory, and the representative average unit cost in dollars per Btu for oil or gas, as appropriate, as provided by the Secretary, the resulting product then being rounded off to the nearest dollar per year.

(2)(i) The modified energy factor for automatic and semi-automatic clothes washers is determined in accordance with 4.4 of appendix J1 before appendix J2 becomes mandatory and 4.6 of appendix J2 when appendix J2 becomes mandatory. The result shall be rounded off to the nearest 0.01 cubic foot per kilowatt-hours.

(ii) The integrated modified energy factor for automatic and semi-automatic clothes washers is determined in accordance with 4.7 of appendix J2 when appendix J2 becomes mandatory. The result shall be rounded off to the nearest 0.01 cubic foot per kilowatt-hours.

(3) Other useful measures of energy consumption for automatic or semi-automatic clothes washers shall be those measures of energy consumption which the Secretary determines are likely to assist consumers in making purchasing decisions and which are derived from the application of appendix J1 before the date that appendix J2 becomes mandatory or appendix J2 upon the date that appendix J2 becomes mandatory. In addition, the annual water consumption of a clothes washer can be determined by the product of:

(A) The representative average-use of 392 cycles per year, and

(B) The total weighted per-cycle water consumption for cold wash in gallons per cycle determined according to 4.2.2 of appendix J1 before appendix J2 becomes mandatory and 4.2.12 of appendix J2 when appendix J2 becomes mandatory. The water consumption factor can be determined in accordance with 4.2.3 of appendix J1 before appendix J2 becomes mandatory and 4.2.15 of appendix J2 when appendix J2 becomes mandatory. The integrated water consumption factor can be determined in accordance with 4.2.16 of appendix J2 when appendix J2 becomes mandatory. The remaining moisture content can be determined in accordance with 3.8 of appendix J1 before appendix J2 becomes mandatory and 3.8 of appendix J2 when appendix J2 becomes mandatory.

* * * * *

Appendix J—[Removed]

4. Appendix J to subpart B of part 430 is removed.

Appendix J1—[Amended]

5. Appendix J1 to subpart B of part 430 is amended by revising the introductory text after the heading; and section 4.1.4. to read as follows.

Appendix J1 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers

Appendix J1 is effective until the compliance date of any amended standards for residential clothes washers. After this date, all residential clothes washers shall be tested using the provisions of Appendix J2 of this appendix.

* * * * *

4. Calculation of Derived Results From Test Measurements.

* * * * *

4.1.4 *Total per-cycle hot water energy consumption using gas-heated or oil-heated water.* Calculate for the energy test cycle the per-cycle hot water consumption, $HE_{TG,}$ using gas-heated or oil-heated water, expressed in Btu per cycle (or megajoules per cycle) and defined as:

$HE_{TG} = HE_T \times 1/e \times 3412$ Btu/kWh or $HE_{TG} = HE_T \times 1/e \times 3.6$ MJ/kWh

Where:

e = Nominal gas or oil water heater efficiency = 0.75.

HE_T = As defined in 4.1.3.

* * * * *

6. Add a new Appendix J2 to subpart B of part 430 to read as follows:

Appendix J2 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers

Appendix J1 is effective until the compliance date of any amended standards for residential clothes washers. After this date, all residential clothes washers shall be tested using the provisions of Appendix J2.

1. Definitions and Symbols

1.1 *Active mode* means a mode in which the clothes washer is connected to a main power source, has been activated, and is performing one or more of the main functions of washing, soaking, tumbling, agitating, rinsing, and/or removing water from the clothing, or is involved in functions necessary for these main functions, such as admitting water into the washer or pumping water out of the washer. Active mode also includes delay start, cycle finished, and self-clean modes.

1.2 *Active washing mode* means a mode in which the clothes washer is performing any of the operations included in a complete cycle intended for washing a clothing load, including the main functions of washing, soaking, tumbling, agitating, rinsing, and/or removing water from the clothing.

1.3 *Adaptive control system* means a clothes washer control system, other than an adaptive water fill control system, which is capable of automatically adjusting washer operation or washing conditions based on characteristics of the clothes load placed in the clothes container, without allowing or requiring consumer intervention or actions. The automatic adjustments may, for example, include automatic selection, modification, or control of any of the following: Wash water temperature, agitation or tumble cycle time,

number of rinse cycles, and spin speed. The characteristics of the clothes load, which could trigger such adjustments, could, for example, consist of or be indicated by the presence of either soil, soap, suds, or any other additive laundering substitute or complementary product.

Note: Appendix J1 does not provide a means for determining the energy consumption of a clothes washer with an adaptive control system. Therefore, pursuant to 10 CFR 430.27, a waiver must be obtained to establish an acceptable test procedure for each such clothes washer.

1.4 *Adaptive water fill control system* means a clothes washer water fill control system which is capable of automatically adjusting the water fill level based on the size or weight of the clothes load placed in the clothes container, without allowing or requiring consumer intervention or actions.

1.5 *Bone-dry* means a condition of a load of test cloth which has been dried in a dryer at maximum temperature for a minimum of 10 minutes, removed and weighed before cool down, and then dried again for 10 minute periods until the final weight change of the load is 1 percent or less.

1.6 *Clothes container* means the compartment within the clothes washer that holds the clothes during the operation of the machine.

1.7 *Cold rinse* means the coldest rinse temperature available on the machine (and should be the same rinse temperature selection tested in 3.7 of this appendix).

1.8 *Compact* means a clothes washer which has a clothes container capacity of less than 1.6 ft^3 (45 L).

1.9 *Cycle finished mode* means an active mode which provides continuous status display following operation in active washing mode.

1.10 *Deep rinse cycle* means a rinse cycle in which the clothes container is filled with water to a selected level and the clothes load is rinsed by agitating it or tumbling it through the water.

1.11 *Delay start mode* means an active mode in which activation of active washing mode is facilitated by a timer.

1.12 *Energy test cycle* for a basic model means (A) the cycle recommended by the manufacturer for washing cotton or linen clothes, and includes all wash/rinse temperature selections and water levels offered in that cycle, and (B) if the cycle described in (A) does not include all wash/rinse temperature settings available on the clothes washer, and required for testing as described in this test procedure, the energy test cycle shall also include the portions of a cycle setting offering these wash/rinse temperature settings with agitation/tumble operation, spin speed(s), wash times, and rinse times that are largely comparable to those for the cycle recommended by the manufacturer for washing cotton or linen clothes. Any cycle under (A) or (B) shall include the default agitation/tumble operation, soil level, spin speed(s), wash times, and rinse times applicable to that cycle, including water heating time for water heating clothes washers.

1.13 *IEC 62301* means the test standard published by the International Electrotechnical Commission, entitled "Household electrical appliances—Measurement of standby power," Publication 62301 First Edition 2005–06 (incorporated by reference; see § 430.3).

1.14 *Inactive mode* means a standby mode that facilitates the activation of active mode by remote switch (including remote control), internal sensor, or timer, or that provides continuous status display.

1.15 *Integrated modified energy factor* means the quotient of the cubic foot (or liter) capacity of the clothes container divided by the total clothes washer energy consumption per cycle, with such energy consumption expressed as the sum of:

(a) The machine electrical energy consumption;

(b) The hot water energy consumption;

(c) The energy required for removal of the remaining moisture in the wash load;

(d) The standby mode energy consumption;

(e) The off mode energy consumption;

(f) The delay start mode energy consumption;

(g) The cycle finished mode energy consumption; and

(h) The self-clean energy consumption, as applicable.

1.16 *Integrated water consumption factor* means the quotient of the total clothes washer water consumption per cycle in gallons, with such water consumption expressed as the sum of the total weighted per-cycle water consumption and the per-cycle self-clean water consumption, divided by the cubic foot (or liter) capacity of the clothes washer.

1.17 *Load use factor* means the percentage of the total number of wash loads that a user would wash a particular size (weight) load.

1.18 *Manual control system* means a clothes washer control system which requires that the consumer make the choices that determine washer operation or washing conditions, such as, for example, wash/rinse temperature selections, and wash time before starting the cycle.

1.19 *Manual water fill control system* means a clothes washer water fill control system which requires the consumer to determine or select the water fill level.

1.20 *Modified energy factor* means the quotient of the cubic foot (or liter) capacity of the clothes container divided by the total clothes washer energy consumption per cycle, with such energy consumption expressed as the sum of the machine electrical energy consumption, the hot water energy consumption, and the energy required for removal of the remaining moisture in the wash load.

1.21 *Non-water-heating clothes washer* means a clothes washer which does not have an internal water heating device to generate hot water.

1.22 *Off mode* means a mode in which the clothes washer is connected to a mains power source and is not providing any active or standby mode function, and where the mode may persist for an indefinite time. An indicator that only shows the user that the product is in the off position is included within the classification of an off mode.

1.23 *Self-clean mode* means an active clothes washer operating mode that is:

(a) Dedicated to cleaning, deodorizing, or sanitizing the clothes washer by eliminating sources of odor, bacteria, mold, and mildew;

(b) Recommended to be run intermittently by the manufacturer; and

(c) Separate from clothes washing cycles.

1.24 *Spray rinse cycle* means a rinse cycle in which water is sprayed onto the clothes for a period of time without maintaining any specific water level in the clothes container.

1.25 *Standard* means a clothes washer which has a clothes container capacity of 1.6 ft^3 (45 L) or greater.

1.26 *Standby mode* means any modes in which the clothes washer is connected to a mains power source and offers one or more of the following user oriented or protective functions that may persist for an indefinite time:

(a) To facilitate the activation of other modes (including activation or deactivation of active mode) by remote switch (including remote control), internal sensor, or timer;

(b) Continuous functions, including information or status displays (including clocks) or sensor-based functions. A timer is a continuous clock function (which may or may not be associated with a display) that provides regular scheduled tasks (*e.g.,* switching) and that operates on a continuous basis.

1.27 *Steam cycle* means a wash cycle in which steam is injected into the clothes container.

1.28 *Symbol usage.* The following identity relationships are provided to help clarify the symbology used throughout this procedure.

E—Electrical Energy Consumption
H—Hot Water Consumption
C—Cold Water Consumption
R—Hot Water Consumed by Warm Rinse
TUF—Temperature Use Factor
HE—Hot Water Energy Consumption
F—Load Usage Factor
Q—Total Water Consumption
ME—Machine Electrical Energy Consumption
RMC—Remaining Moisture Content
WI—Initial Weight of Dry Test Load
WC—Weight of Test Load After Extraction
P—Power
S—Annual Hours
s—Steam Wash
m—Extra Hot Wash (maximum wash temp. > 135 °F (57.2 °C))
h—Hot Wash (maximum wash temp. ≤135 °F (57.2 °C))
w—Warm Wash
c—Cold Wash (minimum wash temp.)
r—Warm Rinse (hottest rinse temp.)
sc—Self Clean
x or max—Maximum Test Load
a or avg—Average Test Load
n or min—Minimum Test Load
cf—Cycle Finished Mode
ds—Delay Start Mode
ia—Inactive Mode
o—Off Mode
oi—Combined Off and Inactive Modes
so—Combined Standby and Off Modes

The following examples are provided to show how the above symbols can be used to define variables:

Em_x = "Electrical Energy Consumption" for an Extra Hot Wash" and "Maximum Test Load"
R_a = "Hot Water Consumed by Warm Rinse" for the "Average Test Load"
TUF_m = "Temperature Use Factor" for an "Extra Hot Wash"
HE_{min} = "Hot Water Energy Consumption" for the "Minimum Test Load"
Q_{sc} = "Total Water Consumption" for "Self Clean"
P_{ds} = "Power" in "Delay Start Mode"
S_o = "Annual Hours" in "Off Mode"

1.29 *Temperature use factor* means, for a particular wash/rinse temperature setting, the percentage of the total number of wash loads that an average user would wash with that setting.

1.30 *Thermostatically controlled water valves* means clothes washer controls that have the ability to sense and adjust the hot and cold supply water.

1.31 *Uniformly distributed warm wash temperature selection(s)* means (A) multiple warm wash selections for which the warm wash water temperatures have a linear relationship with all discrete warm wash selections when the water temperatures are plotted against equally spaced consecutive warm wash selections between the hottest warm wash and the coldest warm wash. If the warm wash has infinite selections, the warm wash water temperature has a linear relationship with the distance on the selection device (*e.g.* dial angle or slide movement) between the hottest warm wash and the coldest warm wash. The criteria for a linear relationship as specified above is that the difference between the actual water temperature at any warm wash selection and the point where that temperature is depicted on the temperature/selection line formed by connecting the warmest and the coldest warm selections is less than ± 5 percent. In all cases, the mean water temperature of the warmest and the coldest warm selections must coincide with the mean of the "hot wash" (maximum wash temperature ≤ 135 °F (57.2 °C)) and "cold wash" (minimum wash temperature) water temperatures within ± 3.8 °F (± 2.1 °C); or (B) on a clothes washer with only one warm wash temperature selection, a warm wash temperature selection with a water temperature that coincides with the mean of the "hot wash" (maximum wash temperature ≤ 135 °F (57.2 °C)) and "cold wash" (minimum wash temperature) water temperatures within ± 3.8 °F (± 2.1 °C).

1.32 *Warm rinse* means the hottest rinse temperature available on the machine.

1.33 *Warm wash* means all wash temperature selections that are below the maximum wash temperature ≤ 135 °F (57.2 °C) and above the minimum wash temperature.

1.34 *Water consumption factor* means the quotient of the total weighted per-cycle water consumption divided by the cubic foot (or liter) capacity of the clothes washer.

1.35 *Water-heating clothes washer* means a clothes washer where some or all of the hot water for clothes washing is generated by a water heating device internal to the clothes washer.

2. Testing Conditions

2.1 *Installation.* Install the clothes washer in accordance with manufacturer's instructions.

2.2 *Electrical energy supply.*

2.2.1 *Supply voltage and frequency.* Maintain the electrical supply at the clothes washer terminal block within 2 percent of 120, 120/240, or 120/208Y volts as applicable to the particular terminal block wiring system and within 2 percent of the nameplate frequency as specified by the manufacturer. If the clothes washer has a dual voltage conversion capability, conduct test at the highest voltage specified by the manufacturer.

2.2.2 *Supply voltage waveform.* For the standby, off, delay start, and cycle finished mode testing, maintain the electrical supply voltage waveform indicated in section 4, paragraph 4.4 of IEC 62301 (incorporated by reference; see § 430.3).

2.3 *Supply Water.*

2.3.1 *Clothes washers in which electrical energy consumption or water energy consumption are affected by the inlet water temperature. (For example, water heating clothes washers or clothes washers with thermostatically controlled water valves.).* The temperature of the hot water supply at the water inlets shall not exceed 135 °F (57.2 °C) and the cold water supply at the water inlets shall not exceed 60 °F (15.6 °C). A water meter shall be installed in both the hot and cold water lines to measure water consumption.

2.3.2 *Clothes washers in which electrical energy consumption and water energy consumption are not affected by the inlet water temperature.* The temperature of the hot water supply shall be maintained at 135 °F ± 5 °F (57.2 °C ± 2.8 °C) and the cold water supply shall be maintained at 60 °F ± 5 °F (15.6 °C ± 2.8 °C). A water meter shall be installed in both the hot and cold water lines to measure water consumption.

2.4 *Water pressure.* The static water pressure at the hot and cold water inlet connection of the clothes washer shall be maintained at 35 pounds per square inch gauge (psig) ± 2.5 psig (241.3 kPa ± 17.2 kPa) when the water is flowing. The static water pressure for a single water inlet connection shall be maintained at 35 psig ± 2.5 psig (241.3 kPa ± 17.2 kPa) when the water is flowing. A water pressure gauge shall be installed in both the hot and cold water lines to measure water pressure.

2.5 *Instrumentation.* Perform all test measurements using the following instruments as appropriate:

2.5.1 *Weighing scales.*

2.5.1.1 *Weighing scale for test cloth.* The scale shall have a resolution of no larger than 0.2 oz (5.7 g) and a maximum error no greater than 0.3 percent of the measured value.

2.5.1.2 *Weighing scale for clothes container capacity measurement.* The scale should have a resolution no larger than 0.50 lbs (0.23 kg) and a maximum error no greater than 0.5 percent of the measured value.

2.5.2 *Watt-hour meter.* The watt-hour meter shall have a resolution no larger than 1 Wh (3.6 kJ) and a maximum error no greater than 2 percent of the measured value for any demand greater than 50 Wh (180.0 kJ).

2.5.3 *Watt meter.* The watt meter used to measure standby, off, delay start, and cycle finished mode power consumption shall have the resolution specified in section 4, paragraph 4.5 of IEC 62301 (incorporated by reference, see § 430.3). The watt meter shall also be able to record a "true" average power as specified in section 5, paragraph 5.3.2(a) of IEC 62301.

2.5.4 *Temperature measuring device.* The device shall have an error no greater than ± 1 °F (± 0.6 °C) over the range being measured.

2.5.5 *Water meter.* The water meter shall have a resolution no larger than 0.1 gallons (0.4 liters) and a maximum error no greater than 2 percent for the water flow rates being measured.

2.5.6 *Water pressure gauge.* The water pressure gauge shall have a resolution of 1 pound per square inch gauge (psig) (6.9 kPa) and shall have an error no greater than 5 percent of any measured value.

2.6 *Test cloths.*

2.6.1 *Energy Test Cloth.* The energy test cloth shall be made from energy test cloth material, as specified in 2.6.4, that is 24 ± ½ inches by 36 ± ½ inches (61.0 ± 1.3 cm by 91.4 ± 1.3 cm) and has been hemmed to 22 ± ½ inches by 34 ± ½ inches (55.9 ± 1.3 cm by 86.4 ± 1.3 cm) before washing. The energy test cloth shall be clean and shall not be used for more than 60 test runs (after preconditioning as specified in 2.6.3 of this appendix). All energy test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material shall not be used for testing the clothes washers.

2.6.2 *Energy Stuffer Cloth.* The energy stuffer cloth shall be made from energy test cloth material, as specified in 2.6.4, and shall consist of pieces of material that are 12 ± ¼ inches by 12 ± ¼ inches (30.5 ± 0.6 cm by 30.5 ± 0.6 cm) and have been hemmed to 10 ± ¼ inches by 10 ± ¼ inches (25.4 ± 0.6 cm by 25.4 ± 0.6 cm) before washing. The energy stuffer cloth shall be clean and shall not be used for more than 60 test runs (after preconditioning as specified in 2.6.3 of this appendix). All energy stuffer cloth must be permanently marked identifying the lot number of the material. Mixed lots of material shall not be used for testing the clothes washers.

2.6.3 *Preconditioning of Test Cloths.* The new test cloths, including energy test cloths and energy stuffer cloths, shall be pre-conditioned in a clothes washer in the following manner:

2.6.3.1 Perform 5 complete normal wash-rinse-spin cycles, the first two with current AHAM Standard detergent Formula 3 and the last three without detergent. Place the test cloth in a clothes washer set at the maximum water level. Wash the load for ten minutes in soft water (17 ppm hardness or less) using 27.0 grams + 4.0 grams per lb of cloth load of AHAM Standard detergent Formula 3. The wash temperature is to be controlled to 135 °F ± 5 °F (57.2 °C ± 2.8 °C) and the rinse temperature is to be controlled to 60 °F ± 5 °F (15.6 °C ± 2.8 °C). Repeat the cycle with detergent and then repeat the cycle three additional times without detergent, bone drying the load between cycles (total of five wash and rinse cycles).

2.6.4 *Energy test cloth material.* The energy test cloths and energy stuffer cloths shall be made from fabric meeting the following specifications. The material should come from a roll of material with a width of approximately 63 inches and approximately 500 yards per roll. However, other sizes may be used if they fall within the specifications.

2.6.4.1 *Nominal fabric type.* Pure finished bleached cloth made with a momie or granite weave, which is nominally 50 percent cotton and 50 percent polyester.

2.6.4.2 The fabric weight specification shall be 5.60 ± 0.25 ounces per square yard (190.0 ± 8.4 g/m^2).

2.6.4.3 The thread count shall be 65 × 57 per inch (warp × fill), ±2 percent.

2.6.4.4 The warp yarn and filling yarn shall each have fiber content of 50 percent ± 4 percent cotton, with the balance being polyester, and be open end spun, 15/1 ± 5 percent cotton count blended yarn.

2.6.4.5 Water repellent finishes, such as fluoropolymer stain resistant finishes shall not be applied to the test cloth. The absence of such finishes shall be verified by:

2.6.4.5.1 American Association of Textile Chemists and Colorists (AATCC) Test Method 118–1997, *Oil Repellency: Hydrocarbon Resistance Test* (incorporated by reference; *see* § 430.3), of each new lot of test cloth (when purchased from the mill) to confirm the absence of Scotchguard™ or other water repellent finish (required scores of "D" across the board).

2.6.4.5.2 American Association of Textile Chemists and Colorists (AATCC) Test Method 79–2000, *Absorbency of Bleached Textiles* (incorporated by reference; see § 430.3), of each new lot of test cloth (when purchased from the mill) to confirm the absence of Scotchguard™ or other water repellent finish (time to absorb one drop should be on the order of 1 second).

2.6.4.6 The moisture absorption and retention shall be evaluated for each new lot of test cloth by the Standard Extractor Remaining Moisture Content (RMC) Test specified in 2.6.5 of this appendix.

2.6.4.6.1 Repeat the Standard Extractor RMC Test in 2.6.5 of this appendix three times.

2.6.4.6.2 An RMC correction curve shall be calculated as specified in 2.6.6 of this appendix.

2.6.4.7 The maximum shrinkage after preconditioning shall not be more than 5 percent on the length and width. Measure per AATCC Test Method 135–2004, *Dimensional Changes of Fabrics after Home Laundering* (incorporated by reference; *see* § 430.3).

2.6.5 *Standard Extractor RMC Test Procedure.* The following procedure is used to evaluate the moisture absorption and retention characteristics of a lot of test cloth by measuring the RMC in a standard extractor at a specified set of conditions. Table 2.6.5 of this appendix is the matrix of test conditions. When this matrix is repeated 3 times, a total of 60 extractor RMC test runs are required. For the purpose of the extractor RMC test, the test cloths may be used for up to 60 test runs (after preconditioning as specified in 2.6.3 of this appendix).

TABLE 2.6.5—MATRIX OF EXTRACTOR RMC TEST CONDITIONS

	Warm soak		Cold soak	
	15 min. spin	4 min. spin	15 min. spin	4 min. spin
100				
200				
350				
500				
650				

2.6.5.1 The standard extractor RMC tests shall be run in a North Star Engineered Products Inc. (formerly Bock) Model 215 extractor (having a basket diameter of 19.5 inches, length of 12 inches, and volume of 2.1 ft^3), with a variable speed drive (North Star Engineered Products, P.O. Box 5127, Toledo, OH 43611) or an equivalent extractor with same basket design (*i.e.* diameter, length, volume, and hole configuration) and variable speed drive.

2.6.5.2 *Test Load.* Test cloths shall be preconditioned in accordance with 2.6.3 of this appendix. The load size shall be 8.4 lbs, consistent with 3.8.1 of this appendix.

2.6.5.3 *Procedure.*

2.6.5.3.1 Record the "bone-dry" weight of the test load (WI).

2.6.5.3.2 Prepare the test load for soak by grouping four test cloths into loose bundles. Bundles are created by hanging four cloths vertically from one corner and loosely wrapping the test cloth onto itself to form the bundle. Bundles are then placed into the water for soak. Eight to nine bundles will be formed depending on the test load. The ninth bundle may not equal four cloths but can incorporate energy stuffer cloths to help offset the size difference.

2.6.5.3.3 Soak the test load for 20 minutes in 10 gallons of soft (< 17 ppm) water. The entire test load shall be submerged. The water temperature shall be 100 °F ± 5 °F (38 °C ± 3 °C)

2.6.5.3.4 Remove the test load and allow each of the test cloth bundles to drain over the water bath for a maximum of 5 seconds.

2.6.5.3.5 Manually place the test cloth bundles in the basket of the extractor, distributing them evenly by eye. The draining and loading process should take less than 1 minute. Spin the load at a fixed speed corresponding to the intended centripetal acceleration level (measured in units of the acceleration of gravity, g) ± 1g for the intended time period ± 5 seconds.

2.6.5.3.6 Record the weight of the test load immediately after the completion of the extractor spin cycle (WC).

2.6.5.3.7 Calculate the RMC as (WC–WI)/WI.

2.6.5.3.8 It is not necessary to drain the soak tub if the water bath is corrected for water level and temperature before the next extraction.

2.6.5.3.9 It is not necessary to dry the test load in between extraction runs. However, the bone dry weight shall be checked after every 12 extraction runs to make sure the bone dry weight is within tolerance (8.4 ± 0.1 lb).

2.6.5.3.10 The RMC of the test load shall be measured at five g levels: 100 g, 200 g, 350 g, 500 g, and 650 g, using two different spin times at each g level: 4 minutes and 15 minutes.

2.6.5.4 Repeat 2.6.5.3 of this appendix using soft (< 17 ppm) water at 60 °F ± 5 °F.

2.6.6 *Calculation of RMC correction curve.*

2.6.6.1 Average the values of 3 test runs and fill in Table 2.6.5 of this appendix. Perform a linear least-squares fit to relate the standard RMC ($RMC_{standard}$) values (shown in Table 2.6.6.1 of this appendix) to the values measured in 2.6.5 of this appendix:

(RMC_{cloth}): $RMC_{standard} - A \times RMC_{cloth} + B$

Where A and B are coefficients of the linear least-squares fit.

TABLE 2.6.6.1—STANDARD RMC VALUES (RMC STANDARD)

"g Force"	RMC percentage			
	Warm soak		Cold soak	
	15 min. spin	4 min. spin	15 min. spin	4 min. spin
100	45.9	49.9	49.7	52.8

TABLE 2.6.6.1—STANDARD RMC VALUES (RMC STANDARD)—Continued

"g Force"	RMC percentage			
	Warm soak		Cold soak	
	15 min. spin	4 min. spin	15 min. spin	4 min. spin
200	35.7	40.4	37.9	43.1
350	29.6	33.1	30.7	35.8
500	24.2	28.7	25.5	30.0
650	23.0	26.4	24.1	28.0

2.6.6.2 Perform an analysis of variance test using two factors, spin speed and lot, to check the interaction of speed and lot. Use the values from Table 2.6.5 and Table 2.6.6.1 in the calculation. The "P" value in the variance analysis shall be greater than or equal to 0.1. If the "P" value is less than 0.1, the test cloth is unacceptable. "P" is a theoretically based probability of interaction based on an analysis of variance.

2.6.7 *Application of the RMC correction curve.*

2.6.7.1 Using the coefficients A and B calculated in 2.6.6.1 of this appendix:

$RMC_{corr} = A \times RMC + B$

2.6.7.2 Substitute RMC_{corr} values in calculations in 3.8 of this appendix.

2.7 *Test Load Sizes.* Maximum, minimum, and, when required, average test load sizes shall be determined using Table 5.1 of this appendix and the clothes container capacity as measured in 3.1.1 through 3.1.5. Test loads shall consist of energy test cloths, except that adjustments to the test loads to achieve proper weight can be made by the use of energy stuffer cloths with no more than 5 stuffer cloths per load.

2.8 *Use of Test Loads.* Table 2.8 defines the test load sizes and corresponding water fill settings which are to be used when measuring water and energy consumptions. Adaptive water fill control system and manual water fill control system are defined in section 1 of this appendix:

TABLE 2.8—TEST LOAD SIZES AND WATER FILL SETTINGS REQUIRED

Manual water fill control system		Adaptive water fill control system	
Test load size	Water fill setting	Test load size	Water fill setting
Max	Max	Max	As determined by the Clothes Washer.
Min	Min	Avg Min	

2.8.1 The test load sizes to be used to measure RMC are specified in section 3.8.1.

2.8.2 Test loads for energy and water consumption measurements shall be bone dry prior to the first cycle of the test, and dried to a maximum of 104 percent of bone dry weight for subsequent testing.

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

2.9 *Pre-conditioning.*

2.9.1 *Non-water-heating clothes washer.* If the clothes washer has not been filled with water in the preceding 96 hours, pre-condition it by running it through a cold rinse cycle and then draining it to ensure that the hose, pump, and sump are filled with water.

2.9.2 *Water-heating clothes washer.* If the clothes washer has not been filled with water in the preceding 96 hours, or if it has not been in the test room at the specified ambient conditions for 8 hours, pre-condition it by running it through a cold rinse cycle and then draining it to ensure that the hose, pump, and sump are filled with water.

2.10 *Wash time setting.* If one wash time is prescribed in the energy test cycle, that shall be the wash time setting; otherwise, the wash time setting shall be the higher of either the minimum or 70 percent of the maximum wash time available in the energy test cycle.

2.11 *Test room temperature.*

2.11.1 *Non-water-heating clothes washer.* For standby, off, delay start, and cycle finished mode testing, maintain room ambient air temperature conditions as specified in section 4, paragraph 4.2 of IEC 62301 (incorporated by reference; see § 430.3).

2.11.2 *Water-heating clothes washer.* Maintain the test room ambient air temperature at 75 °F ± 5 °F (23.9 °C ± 2.8 °C). For standby, off, delay start, and cycle finished mode testing, maintain room ambient air temperature conditions as specified in section 4, paragraph 4.2 of IEC 62301 (incorporated by reference; see § 430.3).

2.12 *Bone dryer temperature.* The dryer used for bone drying must heat the test cloth and energy stuffer cloths above 210 °F (99 °C).

3. Test Measurements

3.1 *Clothes container capacity.* Measure the entire volume which a dry clothes load could occupy within the clothes container during washer operation according to the following procedures:

3.1.1 Place the clothes washer in such a position that the uppermost edge of the clothes container opening is leveled horizontally, so that the container will hold the maximum amount of water.

3.1.2 Line the inside of the clothes container with 2 mil (0.051 mm) plastic sheet. All clothes washer components which occupy space within the clothes container and which are recommended for use with the energy test cycle shall be in place and shall be lined with 2 mil (0.051 mm) plastic sheet to prevent water from entering any void space.

3.1.3 Record the total weight of the machine before adding water.

3.1.4 Fill the clothes container manually with either 60 °F ± 5 °F (15.6 °C ± 2.8 °C) or 100 °F ± 10 °F (37.8 °C ± 5.5 °C) water, with the door open. For a top-loading, vertical-axis clothes washer, fill the clothes container to the uppermost edge of the rotating portion, including any balance ring. For a front-loading, horizontal-axis clothes washer, fill the clothes container to the uppermost edge that is in contact with the door seal. For all clothes washers, any volume which cannot be occupied by the clothing load during operation must be excluded from the measurement. Measure and record the weight of water, W, in pounds.

3.1.5 The clothes container capacity is calculated as follows:

$C = W/d$

Where:

C = Capacity in cubic feet (liters).
W = Mass of water in pounds (kilograms).
d = Density of water (62.0 lbs/ft^3 for 100 °F (993 kg/m^3 for 37.8 °C) or 62.3 lbs/ft^3 for 60 °F (998 kg/m^3 for 15.6 °C)).

3.2 *Procedure for measuring water and energy consumption values on all automatic and semi-automatic washers.* All energy consumption tests shall be performed under the energy test cycle(s), unless otherwise specified. Table 3.2 of this appendix defines the sections below which govern tests of

particular clothes washers, based on the number of wash/rinse temperature selections available on the model, and also, in some instances, method of water heating. The procedures prescribed are applicable regardless of a clothes washer's washing capacity, loading port location, primary axis of rotation of the clothes container, and type of control system.

3.2.1 *Inlet water temperature and the wash/rinse temperature settings.*

3.2.1.1 For automatic clothes washers set the wash/rinse temperature selection control to obtain the wash water temperature selection control to obtain the wash water temperature desired (extra hot, hot, warm, or cold) and cold rinse, and open both the hot and cold water faucets.

3.2.1.2 For semi-automatic washers: (1) For hot water temperature, open the hot water faucet completely and close the cold water faucet; (2) for warm inlet water temperature, open both hot and cold water faucets completely; (3) for cold water temperature, close the hot water faucet and open the cold water faucet completely.

3.2.1.3 *Determination of warm wash water temperature(s) to decide whether a clothes washer has uniformly distributed warm wash temperature selections.* The wash water temperature, Tw, of each warm water wash selection shall be calculated or measured.

For non-water heating clothes washers, calculate Tw as follows:

$Tw(°F) = ((Hw \times 135\ °F) + (Cw \times 60\ °F))/(Hw + Cw)$

or

$Tw(°C) = ((Hw \times 57.2\ °C) + (Cw \times 15.6\ °C))/(Hw + Cw)$

Where:

Hw = Hot water consumption of a warm wash.

Cw = Cold water consumption of a warm wash.

For water-heating clothes washers, measure and record the temperature of each warm wash selection after fill.

3.2.2 Total water consumption during the energy test cycle shall be measured, including hot and cold water consumption during wash, deep rinse, and spray rinse.

3.2.3 *Clothes washers with adaptive water fill/manual water fill control systems.*

3.2.3.1 *Clothes washers with adaptive water fill control system and alternate manual water fill control systems.* If a clothes washer with an adaptive water fill control system allows consumer selection of manual controls as an alternative, then both manual and adaptive modes shall be tested and, for each mode, the energy consumption (HE_T, ME_T, and D_E) and water consumption (Q_T), values shall be calculated as set forth in section 4. Then the average of the two values (one from each mode, adaptive and manual) for each variable shall be used in section 4 for the clothes washer.

3.2.3.2 *Clothes washers with adaptive water fill control system.*

3.2.3.2.1 Not user adjustable. The maximum, minimum, and average water levels as defined in the following sections shall be interpreted to mean that amount of water fill which is selected by the control system when the respective test loads are used, as defined in Table 2.8 of this appendix. The load usage factors which shall be used when calculating energy consumption values are defined in Table 4.1.3 of this appendix.

3.2.3.2.2 User adjustable. Four tests shall be conducted on clothes washers with user adjustable adaptive water fill controls which affect the relative wash water levels. The first test shall be conducted with the maximum test load and with the adaptive water fill control system set in the setting that will give the most energy intensive result. The second test shall be conducted with the minimum test load and with the adaptive water fill control system set in the setting that will give the least energy intensive result. The third test shall be conducted with the average test load and with the adaptive water fill control system set in the setting that will give the most energy intensive result for the given test load. The fourth test shall be conducted with the average test load and with the adaptive water fill control system set in the setting that will give the least energy intensive result for the given test load. The energy and water consumption for the average test load and water level shall be the average of the third and fourth tests.

3.2.3.3 *Clothes washers with manual water fill control system.* In accordance with Table 2.8 of this appendix, the water fill selector shall be set to the maximum water level available on the clothes washer for the maximum test load size and set to the minimum water level for the minimum test load size. The load usage factors which shall be used when calculating energy consumption values are defined in Table 4.1.3 of this appendix.

TABLE 3.2—TEST SECTION REFERENCE

Max. Wash Temp. Available	≤ 135 °F (57.2 °C)			**>135 °F (57.2 °C)	
Number of Wash Temp. Selections	1	2	>2	3	>3
Test Sections Required to be Followed	.....	.....	.....	3.3	3.3
	.....	3.4	3.4	.....	3.4
	.....	.....	3.5	3.5	3.5
	3.6	3.6	3.6	3.6	3.6
	.....	.....	*3.7	*3.7	*3.7
	3.8	3.8	3.8	3.8	3.8
	.....	.....	.....	†3.9	†3.9

* Only applicable to machines with warm rinse.
** Only applicable to water heating clothes washers on which the maximum wash temperature available exceeds 135 °F (57.2 °C).
† Only applicable to machines equipped with a steam cycle.

3.3 "*Extra Hot Wash*" *(Max Wash Temp >135 °F (57.2 °C)) for water heating clothes washers only.* Water and electrical energy consumption shall be measured for each water fill level and/or test load size as specified in 3.3.1 through 3.3.3 for the hottest wash setting available.

3.3.1 *Maximum test load and water fill.* Hot water consumption (Hm_x), cold water consumption (Cm_x), and electrical energy consumption (Em_x) shall be measured for an extra hot wash/cold rinse energy test cycle, with the controls set for the maximum water fill level. The maximum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.3.2 *Minimum test load and water fill.* Hot water consumption (Hm_n), cold water consumption (Cm_n), and electrical energy consumption (Em_n) shall be measured for an extra hot wash/cold rinse energy test cycle, with the controls set for the minimum water fill level. The minimum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.3.3 *Average test load and water fill.* For clothes washers with an adaptive water fill control system, measure the values for hot water consumption (Hm_a), cold water consumption (Cm_a), and electrical energy consumption (Em_a) for an extra hot wash/cold rinse energy test cycle, with an average test load size as determined per Table 5.1 of this appendix.

3.4 "*Hot Wash*" *(Max Wash Temp ≤135 °F (57.2 °C)).* Water and electrical energy consumption shall be measured for each water fill level or test load size as specified in 3.4.1 through 3.4.3 for a *135 °F (57.2 °C)* wash, if available, or for the hottest selection less than *135 °F (57.2 °C).*

3.4.1 *Maximum test load and water fill.* Hot water consumption (Hh_x), cold water consumption (Ch_x), and electrical energy consumption (Eh_x) shall be measured for a hot wash/cold rinse energy test cycle, with the controls set for the maximum water fill level. The maximum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.4.2 *Minimum test load and water fill.* Hot water consumption (Hh_n), cold water consumption (Ch_n), and electrical energy consumption (Eh_n) shall be measured for a

hot wash/cold rinse energy test cycle, with the controls set for the minimum water fill level. The minimum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.4.3 *Average test load and water fill.* For clothes washers with an adaptive water fill control system, measure the values for hot water consumption (Hh_a), cold water consumption (Ch_a), and electrical energy consumption (Eh_a) for a hot wash/cold rinse energy test cycle, with an average test load size as determined per Table 5.1 of this appendix.

3.5 "*Warm Wash.*" Water and electrical energy consumption shall be determined for each water fill level and/or test load size as specified in 3.5.1 through 3.5.2.3 for the applicable warm water wash temperature(s) with a cold rinse.

3.5.1 *Clothes washers with uniformly distributed warm wash temperature selection(s).* The reportable values to be used for the warm water wash setting shall be the arithmetic average of the measurements for the hot and cold wash selections. This is a calculation only, no testing is required.

3.5.2 *Clothes washers that lack uniformly distributed warm wash temperature selections.* For a clothes washer with fewer than four discrete warm wash selections, test all warm wash temperature selections. For a clothes washer that offers four or more warm wash selections, test at all discrete selections, or test at 25 percent, 50 percent, and 75 percent positions of the temperature selection device between the hottest hot (≤135 °F (57.2 °C)) wash and the coldest cold wash. If a selection is not available at the 25, 50 or 75 percent position, in place of each such unavailable selection use the next warmer setting. Each reportable value to be used for the warm water wash setting shall be the arithmetic average of all tests conducted pursuant to this section.

3.5.2.1 *Maximum test load and water fill.* Hot water consumption (Hw_x), cold water consumption (Cw_x), and electrical energy consumption (Ew_x) shall be measured with the controls set for the maximum water fill level. The maximum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.5.2.2 *Minimum test load and water fill.* Hot water consumption (Hw_n), cold water consumption (Cw_n), and electrical energy consumption (Ew_n) shall be measured with the controls set for the minimum water fill level. The minimum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.5.2.3 *Average test load and water fill.* For clothes washers with an adaptive water fill control system, measure the values for hot water consumption (Hw_a), cold water consumption (Cw_a), and electrical energy consumption (Ew_a) with an average test load size as determined per Table 5.1 of this appendix.

3.6 "*Cold Wash*" *(Minimum Wash Temperature Selection).* Water and electrical energy consumption shall be measured for each water fill level or test load size as specified in 3.6.1 through 3.6.3 for the coldest wash temperature selection available.

3.6.1 *Maximum test load and water fill.* Hot water consumption (Hc_x), cold water consumption (Cc_x), and electrical energy consumption (Ec_x) shall be measured for a cold wash/cold rinse energy test cycle, with the controls set for the maximum water fill level. The maximum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.6.2 *Minimum test load and water fill.* Hot water consumption (Hc_n), cold water consumption (Cc_n), and electrical energy consumption (Ec_n) shall be measured for a cold wash/cold rinse energy test cycle, with the controls set for the minimum water fill level. The minimum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.6.3 *Average test load and water fill.* For clothes washers with an adaptive water fill control system, measure the values for hot water consumption (Hc_a), cold water consumption (Cc_a), and electrical energy consumption (Ec_a) for a cold wash/cold rinse energy test cycle, with an average test load size as determined per Table 5.1 of this appendix.

3.7 "*Warm Wash/Warm Rinse.*" Water and electrical energy consumption shall be determined for each water fill level and/or test load size as specified in 3.7.2.1 through 3.7.2.3 for the applicable warm wash temperature selection as described in 3.7.1 or 3.7.2 and the hottest available rinse temperature selection.

3.7.1 *Clothes washers with uniformly distributed warm wash temperature selection(s).* Test the warm wash warm rinse cycle at the wash temperature selection with the temperature selection device at the 50 percent position between the hottest hot (≤135 °F (57.2 °C)) wash and the coldest cold wash.

3.7.2 *Clothes washers that lack uniformly distributed warm wash temperature selections.* For a clothes washer with fewer than four discrete warm wash selections, test all warm wash temperature selections. For a clothes washer that offers four or more warm wash selections, test at all discrete selections, or test at 25 percent, 50 percent, and 75 percent positions of the temperature selection device between the hottest hot (≤135 °F (57.2 °C)) wash and the coldest cold wash. If a selection is not available at the 25, 50, or 75 percent position, in place of each such unavailable selection use the next warmer setting. Each reportable value to be used for the warm water wash setting shall be the arithmetic average of all tests conducted pursuant to this section.

3.7.2.1 *Maximum test load and water fill.* Hot water consumption (Hww_x), cold water consumption (Cww_x), and electrical energy consumption (Eww_x) shall be measured with the controls set for the maximum water fill level. The maximum test load size is to be used and shall be determine per Table 5.1 of this appendix.

3.7.2.2 *Minimum test load and water fill.* Hot water consumption (Hww_n), cold water consumption (Cww_n), and electrical energy consumption (Eww_n) shall be measured with the controls set for the minimum water fill level. The minimum test load size is to be used and shall be determine per Table 5.1 of this appendix.

3.7.2.3 *Average test load and water fill.* For clothes washers with an adaptive water fill control system, measure the values for hot water consumption (Hww_a), cold water consumption (Cww_a), and electrical energy consumption (Eww_a) with an average test load size as determined per Table 5.1 of this appendix.

3.8 *Remaining Moisture Content:*

3.8.1 The wash temperature will be the same as the rinse temperature for all testing. Use the maximum test load as defined in Table 5.1 of this appendix and section 3.1 for testing.

3.8.2 *For clothes washers with cold rinse only:*

3.8.2.1 Record the actual "bone dry" weight of the test load (WI_{max}), then place the test load in the clothes washer.

3.8.2.2 Set water level selector to maximum fill.

3.8.2.3 Run the energy test cycle.

3.8.2.4 Record the weight of the test load immediately after completion of the energy test cycle (WC_{max}).

3.8.2.5 Calculate the remaining moisture content of the maximum test load, RMC_{max}, expressed as a percentage and defined as:

$$RMC_{max} = ((WC_{max} - WI_{max})/WI_{max}) \times 100\%$$

3.8.3 *For clothes washers with cold and warm rinse options:*

3.8.3.1 Complete steps 3.8.2.1 through 3.8.2.4 for cold rinse. Calculate the remaining moisture content of the maximum test load for cold rinse, RMC_{COLD}, expressed as a percentage and defined as:

$$RMC_{COLD} = ((WC_{max} - WI_{max})/WI_{max}) \times 100\%$$

3.8.3.2 Complete steps 3.8.2.1 through 3.8.2.4 for warm rinse. Calculate the remaining moisture content of the maximum test load for warm rinse, RMC_{WARM}, expressed as a percentage and defined as:

$$RMC_{WARM} = ((WC_{max} - WI_{max})/WI_{max}) \times 100\%$$

3.8.3.3 Calculate the remaining moisture content of the maximum test load, RMC_{max}, expressed as a percentage and defined as:

$$RMC_{max} = RMC_{COLD} \times (1 - TUF_r) + RMC_{WARM} \times (TUF_r)$$

Where:

TUF_r is the temperature use factor for warm rinse as defined in Table 4.1.1 of this appendix.

3.8.4 Clothes washers that have options such as multiple selections of spin speeds or spin times that result in different RMC values and that are available in the energy test cycle, shall be tested at the maximum and minimum extremes of the available options, excluding any "no spin" (zero spin speed) settings, in accordance with requirements in 3.8.2 or 3.8.3. The calculated $RMC_{max,max\ extraction}$ and $RMC_{max,min\ extraction}$ at the maximum and minimum settings, respectively, shall be combined as follows and the final RMC to be used in section 4.3 shall be:

$$RMC = 0.75 \times RMC_{max,max\ extraction} + 0.25 \times RMC_{max,min\ extraction}$$

3.9 "*Steam Wash*" *for clothes washers equipped with a steam cycle.* Water and electrical energy consumption shall be measured for each water fill level and/or test load size as specified in 3.9.1 through 3.9.3 for the hottest wash setting available with steam.

3.9.1 *Maximum test load and water fill.* Hot water consumption (Hs_x), cold water consumption (Cs_x), and electrical energy consumption (Es_x) shall be measured for a steam energy test cycle, with the controls set for the maximum water fill level. The maximum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.9.2 *Minimum test load and water fill.* Hot water consumption (Hs_n), cold water consumption (Cs_n), and electrical energy consumption (Es_n) shall be measured for a steam energy test cycle, with the controls set for the minimum water fill level. The minimum test load size is to be used and shall be determined per Table 5.1 of this appendix.

3.9.3 *Average test load and water fill.* For clothes washers with an adaptive water fill control system, measure the values for hot water consumption (Hs_a), cold water consumption (Cs_a), and electrical energy consumption (Es_a) for a steam energy test cycle using an average test load size as determined per Table 5.1 of this appendix.

3.10 *Self-clean.* Set the controls to obtain the self-clean cycle. Hot water consumption (H_{sc}), cold water consumption (C_{sc}), and electric energy consumption (E_{sc}) shall be measured for the self-clean cycle. Do not use a test load.

3.11 *Standby mode, off mode, delay start mode, and cycle finished mode power.* Establish the testing conditions set forth in sections 2.2 and 2.11. For clothes washers that drop from a higher power state to a lower power state as discussed in section 5, paragraph 5.1, note 1 of IEC 62301, (incorporated by reference; see § 430.3), allow sufficient time for the clothes washer to reach the lower power state before proceeding with the test measurement. Follow the test procedure specified in section 5, paragraph 5.3 of IEC 62301 for testing in each possible mode as described in 3.11.1 through 3.11.4. For units in which power varies over a cycle, as described in section 5, paragraph 5.3.2 of IEC 62301, use the average power approach described in Paragraph 5.3.2(a) of IEC 62301.

3.11.1 If a clothes washer has a cycle finished mode as defined in section 1.9, measure and record its average cycle finished mode power, P_{cf}, in watts, allowing the product to stabilize for at least 30 minutes and using a measurement period in which the energy use is not less than 10 minutes.

3.11.2 If a clothes washer has a delay start mode as defined in section 1.11, measure and record its average delay start mode power, P_{ds}, in watts by setting it to a delay start time of 5 hours, allowing at least 5 minutes for the power input to stabilize. Then measure and record the average delay start mode power of the clothes washer, P_{ds}, in watts, for the following 60 minutes.

3.11.3 If a clothes washer has an inactive mode as defined in section 1.14, measure and record the average inactive mode power of the clothes washer, P_{ia}, in watts, allowing the product to stabilize for at least 30 minutes and using a measurement period of not less than 10 minutes.

3.11.4 If a clothes washer has an off mode as defined in section 1.22, measure and record its average off mode power, P_o, in watts, allowing the product to stabilize for at least 30 minutes and using a measurement period of not less than 10 minutes.

4. Calculation of Derived Results From Test Measurements

4.1 *Hot water and machine electrical energy consumption of clothes washers.*

4.1.1 *Per-cycle temperature-weighted hot water consumption for maximum, average, and minimum water fill levels using each appropriate load size as defined in section 2.8 and Table 5.1* of this appendix. Calculate for the cycle under test the per-cycle temperature weighted hot water consumption for the maximum water fill level, Vh_x, the average water fill level, Vh_a, and the minimum water fill level, Vh_n, expressed in gallons per cycle (or liters per cycle) and defined as:

(a) $Vh_x = [Hs_x \times TUF_s] + [Hm_x \times TUF_m] + [Hh_x \times TUF_h] + [Hw_x \times TUF_w] + [Hww_x \times TUF_{ww}] + [Hc_x \times TUF_c]$

(b) $Vh_a = [Hs_a \times TUF_s] + [Hm_a \times TUF_m] + [Hh_a \times TUF_h] + [Hw_a \times TUF_w] + [Hww_a \times TUF_{ww}] + [Hc_a \times TUF_c]$

(c) $Vh_n = [Hs_n \times TUF_s] + [Hm_n \times TUF_m] + [Hh_n \times TUF_h] + [Hw_n \times TUF_w] + [Hww_n \times TUF_{ww}] + [Hc_n \times TUF_c]$

Where:

Hs_x, Hs_a, and Hs_n, are reported hot water consumption values, in gallons per cycle (or liters per cycle), at maximum, average, and minimum water fill, respectively, for the steam cycle with the appropriate test loads as defined in section 2.8.

Hm_x, Hm_a, and Hm_n, are reported hot water consumption values, in gallons per-cycle (or liters per cycle), at maximum, average, and minimum water fill, respectively, for the extra hot wash cycle with the appropriate test loads as defined in section 2.8.

Hh_x, Hh_a, and Hh_n, are reported hot water consumption values, in gallons per-cycle (or liters per cycle), at maximum, average, and minimum water fill, respectively, for the hot wash cycle with the appropriate test loads as defined in section 2.8.

Hw_x, Hw_a, and Hw_n, are reported hot water consumption values, in gallons per-cycle (or liters per cycle), at maximum, average, and minimum water fill, respectively, for the warm wash cycle with the appropriate test loads as defined in section 2.8.

Hww_x, Hww_a, and Hww_n, are reported hot water consumption values, in gallons per-cycle (or liters per cycle), at maximum, average, and minimum water fill, respectively, for the warm wash/warm rinse cycle with the appropriate test loads as defined in section 2.8.

Hc_x, Hc_a, and Hc_n, are reported hot water consumption values, in gallons per-cycle (or liters per cycle), at maximum, average, and minimum water fill, respectively, for the cold wash cycle with the appropriate test loads as defined in section 2.8.

TUF_s, TUF_m, TUF_h, TUF_w, TUF_{ww}, and TUF_c are temperature use factors for steam wash, extra hot wash, hot wash, warm wash, warm wash/warm rinse, and cold wash temperature selections, respectively, and are as defined in Table 4.1.1 of this appendix.

TABLE 4.1.1—TEMPERATURE USE FACTORS

Max Wash Temp Available	≤135 °F (57.2 °C)	≤135 °F (57.2 °C)	≤135 °F (57.2 °C)	>135 °F (57.2 °C)	>135 °F (57.2 °C)	Steam	Steam
No. Wash Temp Selections	Single	2 Temps	>2 Temps	3 Temps	>3 Temps	3 Temps	>3 Temps
TUF_s (steam)	NA	NA	NA	NA	NA	0.02	0.02
TUF_m (extra hot)	NA	NA	NA	0.14	0.05	0.12	0.03
TUF_h (hot)	NA	0.63	0.14	NA	0.09	NA	0.09
TUF_{ww} (warm/warm)	NA	NA	0.27*	0.27*	0.27*	0.27*	0.27*
TUF_w (warm)	NA	NA	0.22	0.22	0.22	0.22	0.22
TUF_c (cold)	1.00	0.37	0.37	0.37	0.37	0.37	0.37

*Only applicable to machines offering a warm/warm cycle. For machines with no warm/warm cycle, this value should be zero and TUF_w (warm) should be 0.49.

4.1.2 *Total per-cycle hot water energy consumption for all maximum, average, and minimum water fill levels tested.* Calculate the total per-cycle hot water energy consumption for the maximum water fill level, HE_{max}, the minimum water fill level, HE_{min}, and the average water fill level, HE_{avg}, expressed in kilowatt-hours per cycle and defined as:

(a) $HE_{max} = [Vh_x \times T \times K]$ = Total energy when a maximum load is tested.

(b) $HE_{avg} = [Vh_a \times T \times K]$ = Total energy when an average load is tested.

(c) $HE_{min} = [Vh_n \times T \times K]$ = Total energy when a minimum load is tested.

Where:

T = Temperature rise = 75 °F (41.7 °C).

K = Water specific heat in kilowatt-hours per gallon degree F = 0.00240 (0.00114 kWh/L − °C).

Vh_x, Vh_a, and Vh_n are as defined in 4.1.1.

4.1.3 *Total weighted per-cycle hot water energy consumption.* Calculate the total weighted per-cycle hot water energy consumption, HE_T, expressed in kilowatt-hours per cycle and defined as:

$HE_T = [HE_{max} \times F_{max}] + [HE_{avg} \times F_{avg}] + [HE_{min} \times F_{min}]$

Where:

HE_{max}, HE_{avg}, and HE_{min} are as defined in 4.1.2.

F_{max}, F_{avg}, and F_{min} are the load usage factors for the maximum, average, and minimum test loads based on the size and type of the control system on the washer being tested. The values are as shown in Table 4.1.3 of this appendix.

TABLE 4.1.3—LOAD USAGE FACTORS

Water fill control system	Manual	Adaptive
F_{max} =	[1]0.72	[2]0.12
F_{avg} =	.....	[2]0.74
F_{min} =	[1]0.28	[2]0.14

[1] Reference 3.2.3.3.
[2] Reference 3.2.3.2.

4.1.4 *Total per-cycle hot water energy consumption using gas-heated or oil-heated water.* Calculate for the energy test cycle the per-cycle hot water consumption, HE_{TG}, using gas-heated or oil-heated water, expressed in Btu per cycle (or megajoules per cycle) and defined as:

$HE_{TG} = HE_T \times 1/e \times 3412$ Btu/kWh or $HE_{TG} = HE_T \times 1/e \times 3.6$ MJ/kWh

Where:

e = Nominal gas or oil water heater efficiency = 0.75.

HE_T = As defined in 4.1.3.

4.1.5 *Per-cycle machine electrical energy consumption for all maximum, average, and minimum test load sizes.* Calculate the total per-cycle machine electrical energy consumption for the maximum water fill level, ME_{max}, the average water fill level, ME_{avg}, and the minimum water fill level, ME_{min}, expressed in kilowatt-hours per cycle and defined as:

(a)

$ME_{max} = [Es_x \times TUF_s] + [Em_x \times TUF_m] + [Eh_x \times TUF_h] + [Ew_x \times TUF_w] + [Eww_x \times TUF_{ww}] + [Ec_x \times TUF_c]$

(b)

$ME_{avg} = [Es_a \times TUF_s] + [Em_a \times TUF_m] + [Eh_a \times TUF_h] + [Ew_a \times TUF_w] + [Eww_a \times TUF_{ww}] + [Ec_a \times TUF_c]$

(c)

$ME_{min} = [Es_n \times TUF_s] + [Em_n \times TUF_m] + [Eh_n \times TUF_h] + [Ew_n \times TUF_w] + [Eww_n \times TUF_{ww}] + [Ec_n \times TUF_c]$

Where:

Es_x, Es_a, and Es_n, are reported electrical energy consumption values, in kilowatt-hours per cycle, at maximum, average, and minimum test loads, respectively, for the steam cycle.

Em_x, Em_a, and Em_n, are reported electrical energy consumption values, in kilowatt-hours per cycle, at maximum, average, and minimum test loads, respectively, for the extra hot wash cycle.

Eh_x, Eh_a, and Eh_n, are reported electrical energy consumption values, in kilowatt-hours per cycle, at maximum, average, and minimum test loads, respectively, for the hot wash cycle.

Ew_x, Ew_a, and Ew_n, are reported electrical energy consumption values, in kilowatt-hours per cycle, at maximum, average, and minimum test loads, respectively, for the warm wash cycle.

Eww_x, Eww_a, and Eww_n, are reported electrical energy consumption values, in kilowatt-hours per cycle, at maximum, average, and minimum test loads, respectively, for the warm wash/warm rinse cycle.

Ec_x, Ec_a, and Ec_n, are reported electrical energy consumption values, in kilowatt-hours per cycle, at maximum, average, and minimum test loads, respectively, for the cold wash cycle.

TUF_s, TUF_m, TUF_h, TUF_w, TUF_{ww}, and TUF_c are as defined in Table 4.1.1 of this appendix.

4.1.6 *Total weighted per-cycle machine electrical energy consumption.* Calculate the total per-cycle load size weighted energy consumption, ME_T, expressed in kilowatt-hours per cycle and defined as:

$ME_T = [ME_{max} \times F_{max}] + [ME_{avg} \times F_{avg}] + [ME_{min} \times F_{min}]$

Where:

ME_{max}, ME_{avg}, and ME_{min} are as defined in 4.1.5.

F_{max}, F_{avg}, and F_{min} are as defined in Table 4.1.3 of this appendix.

4.1.7 *Total per-cycle energy consumption when electrically heated water is used.* Calculate for the energy test cycle the total per-cycle energy consumption, E_{TE}, using electrically heated water, expressed in kilowatt-hours per cycle and defined as:

$E_{TE} = HE_T + ME_T$

Where:

ME_T = As defined in 4.1.6.

HE_T = As defined in 4.1.3.

4.1.8 *Per-cycle self-clean hot water energy consumption.* Calculate the per-cycle self-clean hot water energy consumption, HE_{sc}, expressed in kilowatt-hours per cycle, and defined as:

$HE_{sc} = [H_{sc} \times T \times K]$

Where:

H_{sc} = reported hot water consumption value, in gallons per-cycle, for the self-clean cycle as defined in section 3.10.

T = Temperature rise = 75 °F (41.7 °C).

K = Water specific heat in kilowatt-hours per gallon degree F = 0.00240 (0.00114 kWh/L − °C).

4.2 *Water consumption of clothes washers.* (The calculations in this Section need not be performed to determine compliance with the energy conservation standards for clothes washers manufactured before January 1, 2011.)

4.2.1 *Per-cycle water consumption for steam wash.* Calculate the maximum, average, and minimum total water consumption, expressed in gallons per cycle (or liters per cycle), for the steam cycle and defined as:

$Qs_{max} = [Hs_x + Cs_x]$
$Qs_{avg} = [Hs_a + Cs_a]$
$Qs_{min} = [Hs_n + Cs_n]$

Where:

Hs_x, Cs_x, Hs_a, Cs_a, Hs_n, and Cs_n are defined in 3.9.

4.2.2 *Per-cycle water consumption for extra hot wash.* Calculate the maximum, average, and minimum total water consumption, expressed in gallons per cycle (or liters per cycle), for the extra hot wash cycle and defined as:

$Qm_{max} = [Hm_x + Cm_x]$
$Qm_{avg} = [Hm_a + Cm_a]$
$Qm_{min} = [Hm_n + Cm_n]$

Where:

Hm_x, Cm_x, Hm_a, Cm_a, Hm_n, and Cm_n are defined in 3.3.

4.2.3 *Per-cycle water consumption for hot wash.* Calculate the maximum, average, and minimum total water consumption, expressed in gallons per cycle (or liters per cycle), for the hot wash cycle and defined as:

$Qh_{max} = [Hh_x + Ch_x]$
$Qh_{avg} = [Hh_a + Ch_a]$
$Qh_{min} = [Hh_n + Ch_n]$

Where:

Hh_x, Ch_x, Hh_a, Ch_a, Hh_n, and Ch_n are defined in 3.4.

4.2.4 *Per-cycle water consumption for warm wash with cold rinse.* Calculate the maximum, average, and minimum total water consumption, expressed in gallons per cycle (or liters per cycle), for the warm wash cold rinse cycle and defined as:

$Qw_{max} = [Hw_x + Cw_x]$
$Qw_{avg} = [Hw_a + Cw_a]$
$Qw_{min} = [Hw_n + Cw_n]$

Where:

Hw_x, Cw_x, Hw_a, Cw_a, Hw_n, and Cw_n are defined in 3.5.

4.2.5 *Per-cycle water consumption for warm wash with warm rinse.* Calculate the maximum, average, and minimum total water consumption, expressed in gallons per cycle (or liters per cycle), for the warm wash/warm rinse cycle and defined as:

$Qww_{max} = [Hww_x + Cww_x]$
$Qww_{avg} = [Hww_a + Cww_a]$
$Qww_{min} = [Hww_n + Cww_n]$

Where:

Hww_x, Cww_x, Hww_a, Cww_a, Hww_n, and Cww_n are defined in 3.7.

4.2.6 *Per-cycle water consumption for cold wash.* Calculate the maximum, average, and minimum total water consumption, expressed in gallons per cycle (or liters per cycle), for the cold wash cycle and defined as:

$Qc_{max} = [Hc_x + Cc_x]$
$Qc_{avg} = [Hc_a + Cc_a]$
$Qc_{min} = [Hc_n + Cc_n]$

Where:

Hc_x, Cc_x, Hc_a, Cc_a, Hc_n, and Cc_n are defined in 3.6.

4.2.7 *Total weighted per-cycle water consumption for steam wash.* Calculate the total weighted per cycle consumption, Qs_T, expressed in gallons per cycle (or liters per cycle) and defined as:

$Qs_T = [Qs_{max} \times F_{max}] + [Qs_{avg} \times F_{avg}] + [Qs_{min} \times F_{min}]$

Where:

Qs_{max}, Qs_{avg}, Qs_{min} are defined in 4.2.1.
F_{max}, F_{avg}, F_{min} are defined in Table 4.1.3 of this appendix.

4.2.8 *Total weighted per-cycle water consumption for extra hot wash.* Calculate the total weighted per cycle consumption, Qm_T, expressed in gallons per cycle (or liters per cycle) and defined as:

$Qm_T = [Qm_{max} \times F_{max}] + [Qm_{avg} \times F_{avg}] + [Qm_{min} \times F_{min}]$

Where:

Qm_{max}, Qm_{avg}, Qm_{min} are defined in 4.2.2.
F_{max}, F_{avg}, F_{min} are defined in Table 4.1.3 of this appendix.

4.2.9 *Total weighted per-cycle water consumption for hot wash.* Calculate the total weighted per cycle consumption, Qh_T, expressed in gallons per cycle (or liters per cycle) and defined as:

$Qh_T = [Qh_{max} \times F_{max}] + [Qh_{avg} \times F_{avg}] + [Qh_{min} \times F_{min}]$

Where:

Qh_{max}, Qh_{avg}, Qh_{min} are defined in 4.2.3.
F_{max}, F_{avg}, F_{min} are defined in Table 4.1.3 of this appendix.

4.2.10 *Total weighted per-cycle water consumption for warm wash with cold rinse.* Calculate the total weighted per cycle consumption, Qw_T, expressed in gallons per cycle (or liters per cycle) and defined as:

$Qw_T = [Qw_{max} \times F_{max}] + [Qw_{avg} \times F_{avg}] + [Qw_{min} \times F_{min}]$

Where:

Qw_{max}, Qw_{avg}, Qw_{min} are defined in 4.2.4.
F_{max}, F_{avg}, F_{min} are defined in Table 4.1.3 of this appendix.

4.2.11 *Total weighted per-cycle water consumption for warm wash with warm rinse.* Calculate the total weighted per cycle consumption, Qww_T, expressed in gallons per cycle (or liters per cycle) and defined as:

$Qww_T = [Qww_{max} \times F_{max}] + [Qww_{avg} \times F_{avg}] + [Qww_{min} \times F_{min}]$

Where:

Qww_{max}, Qww_{avg}, Qww_{min} are defined in 4.2.5.
F_{max}, F_{avg}, F_{min} are defined in Table 4.1.3 of this appendix.

4.2.12 *Total weighted per-cycle water consumption for cold wash.* Calculate the total weighted per cycle consumption, Qc_T, expressed in gallons per cycle (or liters per cycle) and defined as:

$Qc_T = [Qc_{max} \times F_{max}] + [Qc_{avg} \times F_{avg}] + [Qc_{min} \times F_{min}]$

Where:

Qc_{max}, Qc_{avg}, Qc_{min} are defined in 4.2.6.
F_{max}, F_{avg}, F_{min} are defined in Table 4.1.3 of this appendix.

4.2.13 *Total weighted per-cycle water consumption for all wash cycles.* Calculate the total weighted per cycle consumption, Q_T, expressed in gallons per cycle (or liters per cycle) and defined as:

$Q_T = [Qs_T \times TUF_s] + [Qm_T \times TUF_m] + [Qh_T \times TUF_h] + [Qw_T \times TUF_w] + [Qww_T \times TUF_{ww}] + [Qc_T \times TUF_c]$

Where:

Qs_T, Qm_T, Qh_T, Qw_T, Qww_T, and Qc_T are defined in 4.2.7 through 4.2.12.
TUF_s, TUF_m, TUF_h, TUF_w, TUF_{ww}, and TUF_c are defined in Table 4.1.1 of this appendix.

4.2.14 *Per-cycle self-clean water consumption.* Calculate the total per-cycle self-clean water consumption, Q_{sc}, in gallons per cycle (or liters per cycle) and defined as:

$Q_{sc} = [H_{sc} + C_{sc}]$

Where:

H_{sc} = As defined in 3.10.
C_{sc} = As defined in 3.10.

4.2.15 *Water consumption factor.* Calculate the water consumption factor, WCF, expressed in gallons per cycle per cubic feet (or liter per cycle per liter), as:

$WCF = Qc_T/C$

Where:

Qc_T = As defined in 4.2.12.
C = As defined in 3.1.5.

4.2.16 *Integrated water consumption factor.* Calculate the integrated water consumption factor, IWF, expressed in gallons per cycle per cubic feet (or liter per cycle per liter), as:

$IWF = [Q_T + Q_{sc}]/C$

Where:

Q_T = As defined in 4.2.13.
Q_{sc} = As defined in 4.2.14.
C = As defined in 3.1.5.

4.3 *Per-cycle energy consumption for removal of moisture from test load.* Calculate the per-cycle energy required to remove the moisture of the test load, D_E, expressed in kilowatt-hours per cycle and defined as:

$D_E = (LAF) \times (Maximum\ test\ load\ weight) \times (RMC–4\%) \times (DEF) \times (DUF)$

Where:

LAF = Load adjustment factor = 0.52.
Test load weight=As required in 3.8.1, expressed in lbs/cycle.
RMC = As defined in 3.8.2.5, 3.8.3.3, or 3.8.4.
DEF = Nominal energy required for a clothes dryer to remove moisture from clothes = 0.5 kWh/lb (1.1 kWh/kg).
DUF = Dryer usage factor, percentage of washer loads dried in a clothes dryer = 0.91.

4.4 *Per-cycle standby mode, off mode, delay start mode, and cycle finished mode energy consumption.* Calculate the clothes washer combined standby mode, off mode, delay start mode, and cycle finished energy consumption per cycle, E_{TSO}, expressed in kilowatt-hours per cycle and defined as:

$E_{TSO} = [(P_{cf} \times S_{cf}) + (P_{ds} \times S_{ds}) + (P_{ia} \times S_{ia}) + (P_o \times S_o)] \times K_p/295$

Where:

P_{cf} = Washer cycle finished mode power, in watts, as defined in 3.11.1 for clothes washers capable of operating in cycle finished mode; otherwise, $P_{cf} = 0$.
P_{ds} = Washer delay start mode power, in watts, as defined in 3.11.2 for clothes washers capable of operating in delay start mode; otherwise, $P_{ds} = 0$.
P_{ia} = Washer inactive mode power, in watts, as defined in 3.11.3 for clothes washers capable of operating in inactive mode; otherwise, $P_{ia} = 0$.
P_o = Washer off mode power, in watts, as defined in 3.11.4 for clothes washers capable of operating in off mode; otherwise, $P_o = 0$.
S_{cf} = 15 annual hours in cycle finished mode for clothes washers capable of operating in inactive mode; otherwise, $S_{cf} = 0$.
S_{ds} = 25 annual hours in delay start mode for clothes washers capable of operating in inactive mode; otherwise, $S_{ds} = 0$.
S_{ia} = Annual hours in inactive mode as defined as S_{oi} if no off mode is possible, $[S_{oi}/2]$ if both inactive mode and off mode are possible, and 0 if no inactive mode is possible, where S_{oi} is the combined annual hours for off and inactive mode as defined in Table 4.4.1 of this appendix.
S_o = Annual hours in off mode as defined as S_{oi} if no inactive mode is possible, $[S_{oi}/2]$ if both inactive mode and off mode are possible, and 0 if no off mode is possible, where S_{oi} is the combined annual hours for off and inactive mode as defined in Table 4.4.1 of this appendix.
K_p = Conversion factor of watt-hours to kilowatt-hours = 0.001.
295 = Representative average number of clothes washer cycles in a year.

TABLE 4.4.1—ANNUAL OFF AND INACTIVE MODE HOURS

	All modes possible	No delay start mode	No cycle finished mode	No delay start or cycle finished modes
No Self-Clean Cycle:				
S_{oi}	8,425	8,450	8,440	8,465
Self-Clean Cycle Possible:				

TABLE 4.4.1—ANNUAL OFF AND INACTIVE MODE HOURS—Continued

	All modes possible	No delay start mode	No cycle finished mode	No delay start or cycle finished modes
S_{oi}	8,409	8,434	8,424	8,449

4.5 *Per-cycle self-clean energy consumption.* Calculate the clothes washer self-clean energy per cycle, E_{TSC}, expressed in kilowatt-hours per cycle and defined as:

$E_{TSC} = [HE_{sc} + E_{sc}] \times 12/295$

Where:

HE_{sc} = As defined in 4.1.8.
E_{sc} = Reported electrical energy consumption value, in kilowatt hours per cycle, for the self-clean cycle as defined in 3.10.
12 = Representative average number of clothes washer self-clean cycles in a year.
295 = Representative average number of clothes washer cycles in a year.

4.6 *Modified energy factor.* Calculate the modified energy factor, MEF, expressed in cubic feet per kilowatt-hour per cycle (or liters per kilowatt-hour per cycle) and defined as:

$MEF = C/(E_{TE} + D_E)$

Where:

C = As defined in 3.1.5.
E_{TE} = As defined in 4.1.7.
D_E = As defined in 4.3.

4.7 *Integrated modified energy factor.* Calculate the integrated modified energy factor, IMEF, expressed in cubic feet per kilowatt-hour per cycle (or liters per kilowatt-hour per cycle) and defined as:

$IMEF = C/(E_{TE} + D_E + E_{TSO} + E_{TSC})$

Where:

C = As defined in 3.1.5.
E_{TE} = As defined in 4.1.7.
D_E = As defined in 4.3.
E_{TSO} = As defined in 4.4.
E_{TSC} = As defined in 4.5.

5. Test Loads

TABLE 5.1—TEST LOAD SIZES

Container volume		Minimum load		Maximum load		Average load	
cu. ft.	liter	lb	kg	lb	kg	lb	kg
<	<						
0–0.8	0–22.7	3	1.36	3.00	1.36	3	1.36
0.80–0.90	22.7–25.5	3	1.36	3.50	1.59	3.25	1.47
0.90–1.00	25.5–28.3	3	1.36	3.90	1.77	3.45	1.56
1.00–1.10	28.3–31.1	3	1.36	4.30	1.95	3.65	1.66
1.10–1.20	31.1–34.0	3	1.36	4.70	2.13	3.85	1.75
1.20–1.30	34.0–36.8	3	1.36	5.10	2.31	4.05	1.84
1.30–1.40	36.8–39.6	3	1.36	5.50	2.49	4.25	1.93
1.40–1.50	39.6–42.5	3	1.36	5.90	2.68	4.45	2.02
1.50–1.60	42.5–45.3	3	1.36	6.40	2.9	4.7	2.13
1.60–1.70	45.3–48.1	3	1.36	6.80	3.08	4.9	2.22
1.70–1.80	48.1–51.0	3	1.36	7.20	3.27	5.1	2.31
1.80–1.90	51.0–53.8	3	1.36	7.60	3.45	5.3	2.4
1.90–2.00	53.8–56.6	3	1.36	8.00	3.63	5.5	2.49
2.00–2.10	56.6–59.5	3	1.36	8.40	3.81	5.7	2.59
2.10–2.20	59.5–62.3	3	1.36	8.80	3.99	5.9	2.68
2.20–2.30	62.3–65.1	3	1.36	9.20	4.17	6.1	2.77
2.30–2.40	65.1–68.0	3	1.36	9.60	4.35	6.3	2.86
2.40–2.50	68.0–70.8	3	1.36	10.00	4.54	6.5	2.95
2.50–2.60	70.8–73.6	3	1.36	10.50	4.76	6.75	3.06
2.60–2.70	73.6–76.5	3	1.36	10.90	4.94	6.95	3.15
2.70–2.80	76.5–79.3	3	1.36	11.30	5.13	7.15	3.24
2.80–2.90	79.3–82.1	3	1.36	11.70	5.31	7.35	3.33
2.90–3.00	82.1–85.0	3	1.36	12.10	5.49	7.55	3.42
3.00–3.10	85.0–87.8	3	1.36	12.50	5.67	7.75	3.52
3.10–3.20	87.8–90.6	3	1.36	12.90	5.85	7.95	3.61
3.20–3.30	90.6–93.4	3	1.36	13.30	6.03	8.15	3.7
3.30–3.40	93.4–96.3	3	1.36	13.70	6.21	8.35	3.79
3.40–3.50	96.3–99.1	3	1.36	14.10	6.4	8.55	3.88
3.50–3.60	99.1–101.9	3	1.36	14.60	6.62	8.8	3.99
3.60–3.70	101.9–104.8	3	1.36	15.00	6.8	9	4.08
3.70–3.80	104.8–107.6	3	1.36	15.40	6.99	9.2	4.17
3.80–3.90	107.6–110.4	3	1.36	15.80	7.16	9.4	4.26
3.90–4.00	110.4–113.3	3	1.36	16.20	7.34	9.6	4.35
4.00–4.10	113.3–116.1	3	1.36	16.60	7.53	9.8	4.45
4.10–4.20	116.1–118.9	3	1.36	17.00	7.72	10.0	4.54
4.20–4.30	118.9–121.8	3	1.36	17.40	7.90	10.2	4.63
4.30–4.40	121.8–124.6	3	1.36	17.80	8.09	10.4	4.72
4.40–4.50	124.6–127.4	3	1.36	18.20	8.27	10.6	4.82
4.50–4.60	127.4–130.3	3	1.36	18.70	8.46	10.8	4.91
4.60–4.70	130.3–133.1	3	1.36	19.10	8.65	11.0	5.00
4.70–4.80	133.1–135.9	3	1.36	19.50	8.83	11.2	5.10
4.80–4.90	135.9–138.8	3	1.36	19.90	9.02	11.4	5.19
4.90–5.00	138.8–141.6	3	1.36	20.30	9.20	11.6	5.28

TABLE 5.1—TEST LOAD SIZES—Continued

Container volume		Minimum load		Maximum load		Average load	
cu. ft.	liter	lb	kg	lb	kg	lb	kg
<	<						
5.00–5.10	141.6–144.4	3	1.36	20.70	9.39	11.9	5.38
5.10–5.20	144.4–147.2	3	1.36	21.10	9.58	12.1	5.47
5.20–5.30	147.2–150.1	3	1.36	21.50	9.76	12.3	5.56
5.30–5.40	150.1–152.9	3	1.36	21.90	9.95	12.5	5.65
5.40–5.50	152.9–155.7	3	1.36	22.30	10.13	12.7	5.75
5.50–5.60	155.7–158.6	3	1.36	22.80	10.32	12.9	5.84
5.60–5.70	158.6–161.4	3	1.36	23.20	10.51	13.1	5.93
5.70–5.80	161.4–164.2	3	1.36	23.60	10.69	13.3	6.03
5.80–5.90	164.2–167.1	3	1.36	24.00	10.88	13.5	6.12
5.90–6.00	167.1–169.9	3	1.36	24.40	11.06	13.7	6.21

Notes: (1) All test load weights are bone dry weights.
(2) Allowable tolerance on the test load weights are ±0.10 lbs (0.05 kg).

6. Waivers and Field Testing

6.1 *Waivers and Field Testing for Non-conventional Clothes Washers.* Manufacturers of nonconventional clothes washers, such as clothes washers with adaptive control systems, must submit a petition for waiver pursuant to 10 CFR 430.27 to establish an acceptable test procedure for that clothes washer. For these and other clothes washers that have controls or systems such that the DOE test procedures yield results that are so unrepresentative of the clothes washer's true energy consumption characteristics as to provide materially inaccurate comparative data, field testing may be appropriate for establishing an acceptable test procedure. The following are guidelines for field testing which may be used by manufacturers in support of petitions for waiver. These guidelines are not mandatory and the Department may determine that they do not apply to a particular model. Depending upon a manufacturer's approach for conducting field testing, additional data may be required. Manufacturers are encouraged to communicate with the Department prior to the commencement of field tests which may be used to support a petition for waiver. Section 6.3 provides an example of field testing for a clothes washer with an adaptive water fill control system. Other features, such as the use of various spin speed selections, could be the subject of field tests.

6.2 *Nonconventional Wash System Energy Consumption Test.* The field test may consist of a minimum of 10 of the nonconventional clothes washers ("test clothes washers") and 10 clothes washers already being distributed in commerce ("base clothes washers"). The tests should include a minimum of 50 energy test cycles per clothes washer. The test clothes washers and base clothes washers should be identical in construction except for the controls or systems being tested. Equal numbers of both the test clothes washer and the base clothes washer should be tested simultaneously in comparable settings to minimize seasonal or consumer laundering conditions or variations. The clothes washers should be monitored in such a way as to accurately record the total energy consumption per cycle. At a minimum, the following should be measured and recorded throughout the test period for each clothes washer: Hot water usage in gallons (or liters), electrical energy usage in kilowatt-hours, and the cycles of usage.

The field test results would be used to determine the best method to correlate the rating of the test clothes washer to the rating of the base clothes washer. If the base clothes washer is rated at A kWh per year, but field tests at B kWh per year, and the test clothes washer field tests at D kWh per year, the test unit would be rated as follows:

$A \times (D/B) = G$ kWh per year

6.3 *Adaptive water fill control system field test.* Section 3.2.3.1 defines the test method for measuring energy consumption for clothes washers which incorporate control systems having both adaptive and alternate cycle selections. Energy consumption calculated by the method defined in section 3.2.3.1 assumes the adaptive cycle will be used 50 percent of the time. This section can be used to develop field test data in support of a petition for waiver when it is believed that the adaptive cycle will be used more than 50 percent of the time. The field test sample size should be a minimum of 10 test clothes washers. The test clothes washers should be totally representative of the design, construction, and control system that will be placed in commerce. The duration of field testing in the user's house should be a minimum of 50 energy test cycles, for each unit. No special instructions as to cycle selection or product usage should be given to the field test participants, other than inclusion of the product literature pack which would be shipped with all units, and instructions regarding filling out data collection forms, use of data collection equipment, or basic procedural methods. Prior to the test clothes washers being installed in the field test locations, baseline data should be developed for all field test units by conducting laboratory tests as defined by section 1 through section 5 of these test procedures to determine the energy consumption, water consumption, and remaining moisture content values. The following data should be measured and recorded for each wash load during the test period: wash cycle selected, the mode of the clothes washer (adaptive or manual), clothes load dry weight (measured after the clothes washer and clothes dryer cycles are completed) in pounds, and type of articles in the clothes load (*e.g.,* cottons, linens, permanent press). The wash loads used in calculating the in-home percentage split between adaptive and manual cycle usage should be only those wash loads which conform to the definition of the energy test cycle.

Calculate:

T = The total number of energy test cycles run during the field test.

T_a = The total number of adaptive control energy test cycles.

T_m = The total number of manual control energy test cycles.

The percentage weighting factors:

$P_a = (T_a/T) \times 100$ (the percentage weighting for adaptive control selection)

$P_m = (T_m/T) \times 100$ (the percentage weighting for manualcontrol selection)

Energy consumption (HE_T, ME_T, and D_E) and water consumption (Q_T), values calculated in section 4 for the manual and adaptive modes, should be combined using P_a and P_m as the weighting factors.

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