[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[Docket No. EERE-2010-BT-TP-0021]

RIN: 1904-AC08r

Energy Conservation Program: Test Procedures for Residential Clothes Washers

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

ACTION: Supplemental notice of proposed rulemaking.

SUMMARY: In this supplemental notice of proposed rulemaking (SNOPR), the U.S. Department of Energy (DOE) proposes to revise its test procedure for residential clothes washers established under the Energy Policy and Conservation Act (EPCA). DOE proposes to amend the definition of the energy test cycle to provide further clarity to ensure that the test procedure is representative of consumer behavior and repeatable among different test laboratories. This proposal incorporates suggestions received from interested parties in response to the September 21, 2010 notice of proposed rulemaking (NOPR) and the August 9, 2011 SNOPR.

DATES: DOE will accept comments, data, and information regarding this SNOPR no later than **[INSERT DATE 30 DAYS AFTER FEDERAL REGISTER PUBLICATION]**. See section V, "Public Participation," for details.

ADDRESSES: Any comments submitted must identify the SNOPR for Test Procedures for residential clothes washers (energy test cycle), and provide docket number EERE-2011–BT–TP–0021 and/or regulatory information number (RIN) number 1904-AC08. Comments may be submitted using any of the following methods:

1. Federal eRulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.
2. E-mail: RES-CW-2010-TP-0021@ee.doe.gov. Include the docket number and/or RIN 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. If possible, please submit all items on a CD. It is not necessary to include printed copies.
4. Hand Delivery/Courier: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC, 20024. Telephone: (202) 586-2945. If possible, please submit all items on a CD. It is not necessary to include printed copies.

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

Docket: The docket is available for review at www.regulations.gov/#!docketDetail;D=EERE-2010-BT-TP-0021, including Federal Register notices, framework documents, public meeting attendee lists and transcripts, comments, and other supporting documents/materials. All documents in the docket are listed in the regulations.gov index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure. The regulations.gov web page contains instructions on how to access all documents, including public comments, in the docket. See section V for information on how to submit comments through regulations.gov.

For further information on how to submit a comment or review other public comments and the docket, contact Ms. Brenda Edwards at (202) 586-2945 or by email: Brenda.Edwards@ee.doe.gov.

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: Stephen.Witkowski@ee.doe.gov.

Ms. Elizabeth Kohl, U.S. Department of Energy, Office of the General Counsel, GC-71, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 586-7796. E-mail: Elizabeth.Kohl@hq.doe.gov.

SUPPLEMENTARY INFORMATION:

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I. Authority and Background

The statutory authority and background for this SNOPR are the same as that published in: (1) DOE's notice of proposed rulemaking (NOPR) to amend the test procedure for residential clothes washers, published in September 2010 (75 FR 57556, Sept. 21, 2010) (September 2010 NOPR); and (2) DOE's recent SNOPR to address the incorporation of certain provisions of IEC 62301 (Second Edition) into the test procedure (76 FR 49238, Aug. 9, 2011) (August 2011 SNOPR). Please see the September 2010 NOPR and August 2011 SNOPR for further details.

II. Summary of the Supplemental Notice of Proposed Rulemaking

The revised clothes washer test procedure amendments DOE is proposing in today's SNOPR would update the definition of the energy test cycle. The proposed definition would apply to the revised test procedure to be published at appendix J2 at 10 CFR 430 subpart B. At the end of this SNOPR, DOE sets forth the proposed regulatory text from DOE's proposed test procedure amendments in the September 2010 NOPR, as amended by the August 2011 SNOPR and today's proposals.

Today's SNOPR covers only the energy test cycle definition. DOE will discuss all other aspects of the proposed test procedure revisions, and respond to comments received from interested parties on those aspects of the proposed revisions, in the final rule.

III. Discussion

A. Today's Proposed Revision for Part (B) of the Energy Test Cycle

Based on the discussion of comments in the following sections, DOE proposes in today's SNOPR to modify the definition of the energy test cycle as follows:

> Energy test cycle for a basic model means:
>
> (A) The cycle setting recommended by the manufacturer for washing cotton or linen clothes, and includes all wash/rinse temperature selections offered in that cycle setting, and

(B) if the cycle setting described in (A) does not include all wash/rinse temperature combinations available on the clothes washer, the energy test cycle shall also include the alternate cycle setting(s) offering these wash/rinse temperature combination(s), tested at the wash/rinse temperature combinations not available on the cycle setting described in (A).

Where multiple alternate cycle settings offer a wash/rinse temperature combination that is not available on the cycle setting recommended by the manufacturer for washing cotton or linen clothes, the cycle setting certified by the manufacturer to have the highest energy consumption, as measured according to section 2.13, shall be included in the energy test cycle.

(C) All cycle settings included under part (A) and part (B) shall be tested using each appropriate load size as defined in section 2.8 and Table 5.1.

(D) For any cycle setting tested under (A) or (B), the manufacturer default settings shall be used, except for the temperature selection, if necessary. This includes wash conditions such as agitation/tumble operation, soil level, spin speed(s), wash times, rinse times, and all other wash parameters or optional features applicable to that cycle, including water heating time for water heating clothes washers. Each wash cycle included as part of the energy test cycle shall comprise the entire active washing mode and exclude any delay start or cycle finished modes.

DOE also proposes to add a new section 2.13 to the revised test procedure as follows:

2.13 Energy consumption for the purpose of certifying the cycle setting(s) to be included in part (B) of the energy test cycle definition.

Where multiple alternate cycle settings offer a wash/rinse temperature combination not available on the cycle setting recommended by the manufacturer for washing cotton or linen clothes, the cycle setting with the highest energy consumption, as measured according to this section, shall be included in the energy test cycle.

To determine which cycle setting has the highest energy consumption, establish the testing conditions set forth in section 2 of this test procedure. Select the applicable cycle setting and temperature combination. Use the manufacturer default settings for agitation/tumble operation, soil level, spin speed(s), wash times, rinse times, and all other wash parameters or optional features applicable to that cycle, including water heating time for water heating clothes washers. Each wash cycle tested under this section shall comprise the entire active washing mode and exclude any delay start or cycle finished modes.

To identify the cycle setting with the highest energy consumption, use the clothes washer's maximum test load size, determined from Table 5.1. For clothes washers with a manual water fill control system, user-adjustable adaptive water fill control system, or adaptive water fill control system with alternate manual water fill control system, use the water fill selector setting resulting in the maximum water level available for each cycle setting.

Measure each cycle setting's electrical energy consumption (E_B) and hot water consumption (H_B). Calculate the total energy consumption for each cycle setting (E_{TB}), as follows:

$E_{TB} = E_B + (H_B \times T \times K)$

where:

E_B is the electrical energy consumption, expressed in kilowatt-hours per cycle.

H_B is the hot water consumption, expressed in gallons per cycle.

T = temperature rise = 75 °F (41.7 °C)

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

The provisions proposed in today's rule would be set forth in appendix J2 and would become effective 30 days after the date of publication in the Federal Register of the final rule in this test procedure rulemaking. DOE would clarify in the published amended test procedures, however, that manufacturers would be required to use amended appendix J1 until the compliance date of any final rule establishing amended energy conservation standards that addresses standby and off mode power consumption for these products. 42 USC 6295(gg)(2)(C). At such time, manufacturers would begin using the test procedures in appendix J2. DOE notes that until use of appendix J2 is required, DOE's guidance on warm rinse and capacity measurement, available at http://www1.eere.energy.gov/buildings/appliance_standards/residential/clothes_washers.html, is still applicable.

B. Discussion of Energy Test Cycle Definition

The following sections summarize DOE's previous proposals regarding the energy test cycle definition as well as comments received from interested parties. Section III.B.1 provides background on the definition of the energy test cycle. Section III.B.2 summarizes DOE's proposal published in the September 2010 NOPR and the comments received from interested parties on the energy test cycle definition. Section III.B.3 summarizes DOE's proposal published

in the August 2011 SNOPR and the comments received from interested parties on the energy test cycle definition. Section III.B.4 provides DOE's responses to all comments received from both the September 2010 NOPR and August 2011 SNOPR that resulted in the proposal stated in section III.A.

1.Background

The "energy test cycle" comprises all the wash/rinse temperature selections currently used in determining the modified energy factor (MEF) and water factor (WF) for a clothes washer, and proposed to be used for determining integrated modified energy factor (IMEF) and integrated water consumption factor (IWF). The energy test cycle is defined in section 1.7 of the current clothes washer test procedure as follows:

> 1.7 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) 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 Part 430, Subpart B, Appendix J1.

The cycle setting recommended for washing cotton or linen clothes is commonly referred to as the "Normal" setting. DOE has observed that on clothes washers with electronic control panels, certain wash/rinse temperature combinations are commonly "locked out" of the Normal setting. In such cases, these wash/rinse temperatures can be accessed only by switching the control panel selection dial to one of the other settings (e.g. "Whites", "Heavy Duty", "Casual", "Permanent Press", etc.). DOE has observed that the extra-hot wash/cold rinse and/or warm wash/warm rinse temperature combinations are locked out of the Normal setting on some clothes washer models that offer such selections.

In cases where certain wash/rinse combinations are locked out of the Normal setting, manufacturers may test only the temperature selections available on the Normal setting, despite being able to access other wash/rinse temperature selections on other settings. Testing only the wash temperature selections available in the Normal setting may neglect part (B) of the energy test cycle definition, which requires manufacturers to switch out of the Normal setting to a different setting that allows the other temperature combinations to be selected and tested, if such testing "will contribute to an accurate representation of energy consumption as used by consumers." Because the temperature selections typically locked out of the Normal setting are those that use greater quantities of hot water and thus have higher water heating energy consumption, excluding them from the energy test cycle could increase a clothes washer's MEF, while not accurately representing the energy consumption of a particular machine as used by the consumer.

2.September 2010 NOPR Proposal and Comments Received

In the September 2010 NOPR, DOE noted that the specific language requiring manufacturers to test different temperature selections if such testing "contribute[s] to an accurate representation of energy consumption as used by consumers" has caused some confusion and differences in interpretation among manufacturers and independent test laboratories. DOE believes the energy test cycle definition must be clear, uniformly understood, and able to be interpreted consistently by manufacturers, competitors, and independent test laboratories without subjective judgment or reliance on proprietary data.

In the September 2010 NOPR, DOE proposed to amend part (B) of the energy test cycle definition to provide clarity in determining whether to test temperature selections that are available on the clothes washer but locked out of the Normal setting. Specifically, DOE proposed modifying part (B) as follows:

> "...(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." 75 FR 57556, 57575–76 (Sept. 21, 2010).

The Association of Home Appliance Manufacturers (AHAM) commented that DOE's proposal in the September 2010 NOPR to amend part (B) of the energy test cycle definition was vague, undefined, and included a significant amount of variability. AHAM noted that variability in a test procedure has substantial consequences for manufacturers, and that the test procedure must be clear and be uniformly understood to avoid significant variations in testing across laboratories or technicians. (AHAM, No. 14 at p. 15)[1]

Alliance Laundry Systems (ALS) commented that DOE's proposal is vague and the proposal would require applying consumer usage factors to all available settings other than the Normal setting. ALS believes that different certification test laboratories could not apply part (B) in any meaningful and consistent manner. Further, ALS believes the burden on manufacturers and test laboratories to try to utilize part (B) would be significant and likely unbearable. (ALS, No. 10 at p. 5)

Whirlpool Corporation (Whirlpool) commented that the term "largely comparable" in the proposed part (B) definition is not clear and is open to the same type of interpretation and confusion that currently exists, and strongly urged DOE to revise its proposed definition. (Whirlpool, No. 13 at p. 13)

BSH Home Appliances (BSH) commented that, while it generally agrees with the proposal to measure a complete warm wash/warm rinse cycle, the problems suggested by DOE

[1] A notation in the form ''AHAM, No. 14 at p. 5'' identifies a written comment made by AHAM; recorded in document number 14 that is filed in the docket of the clothes washer test procedure rulemaking (Docket No. EERE-2010-BT-TP-0021); that appears on page 5 of document number 14.

that prompted the proposed revision of part (B) would return with the proposed wording of the energy test cycle definition. BSH stated that numerous portions of cycles without defined start and end points would need to be incorporated into energy data depending on the interpretation of the words "largely comparable." According to BSH, assembling portions of cycles to test under part (B) would not represent a cycle setting that a consumer could ever select, and thus would not be representative of actual consumer usage. (BSH, No. 20 at p. 4; BSH, Public Meeting Transcript, No. 20 at pp. 188–189) BSH further stated that it opposes the proposed definition of the energy test cycle for the following reasons: (1) the proposed definition would lead to questions about which of the "largely comparable" cycle settings is the "worst case" (e.g., the cycle setting with the highest energy consumption but not the highest water consumption, the cycle setting with the highest water consumption but not the highest energy consumption, etcetera); (2) the uncertainty in interpreting the phrase "contributes to an accurate representation of the energy consumption" would be replaced with similar uncertainty in interpreting the phrase "largely comparable." Accordingly, BSH questioned what threshold criteria would be used to determine whether a setting is close enough to the Normal setting to be considered comparable. BSH believes that the proposed definition could lead to every cycle setting having to be measured, with "largely comparable" being interpreted differently by manufacturers, certification bodies, and verification bodies. (BSH, No. 13 at p. 5; BSH, Public Meeting Transcript. No. 20 at pp. 188, 190, 193)

GE Appliances & Lighting (GE) agreed with AHAM's comments and offered an alternative definition for the energy test cycle, as follows:

> 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 selections available on the clothes washer, and these selections are required for testing as described in this test procedure, then the energy test cycle shall include the other cycles available on the clothes washer tested only at the wash/rinse temperature selections which are not available on the cycle described in (A). If a wash/rinse temperature selection not available in the cycle described in (A) is available on multiple other cycles provided on the clothes washer, then each cycle with that wash/rinse temperature selection must be tested and the cycle resulting in the most energy usage will be included in the energy test cycle." (GE, No. 15 at pp. 1–2)

GE expressed concern that the proposed definition supplied in the September 2010 NOPR may result in different interpretations of what should be included in the energy test cycle. Specifically, GE commented that the interpretation of what would be considered "largely comparable to a cottons or linens cycle" could be variable and affect the results of an energy test. GE stated that its proposed definition would clarify the definition and remove as much interpretation as possible. (GE, No. 15 at pp. 1–2)

Springboard Engineering (Springboard) interpreted the proposed definition in part (B) as requiring the warm wash/warm rinse temperature combination to be tested, but questioned

whether the proposed definition provides enough direction such that different test laboratories would select similar cycle settings on the same clothes washer. Springboard noted, for example, that some clothes washers have three or more warm wash/warm rinse settings to choose among, and different laboratories might use different criteria to select which setting to include in the energy test cycle. Springboard stated that it would choose the cycle setting similar in time and agitation to the Normal setting; however, Springboard noted that the possibility that one laboratory could select the "Colors" setting, for example, while another might select the "Permanent Press" setting, which could produce different measured performance. According to Springboard, different settings may not have the same wash and rinse temperatures or spin speeds, but such information would not be known without first testing each setting on the clothes washer and comparing the hot water usage. Springboard believes that these tests could increase the test burden. (Springboard, No. 11 at pp. 1–2) Springboard also noted that the different warm wash/warm rinse settings on a clothes washer may have different spin speeds, which will affect the remaining moisture content (RMC) and MEF calculation. Id. Furthermore, Springboard commented that some laboratories may interpret that a "Sanitize" setting with extra-hot wash would not have to be tested because it is not comparable to the Normal setting. Springboard questioned whether the intention of part (B) is to test the extra-hot wash temperature combination, even if it has to be selected with a different setting such as the "Sanitize" setting. (Springboard, No. 11 at p. 2)

The Northwest Energy Efficiency Alliance (NEEA) supports DOE's proposal to account for temperature options available outside the "Normal" setting. NEEA believes DOE clarified

this provision in the proposed language change for part (B) of the energy test cycle. (NEEA, No. 12 at p. 14)

3.August 2011 SNOPR Proposal and Comments Received

In testing conducted since the September 2010 NOPR, DOE observed that some clothes washers retain in memory the most recent options selected for a cycle setting the next time that cycle is run. To ensure repeatability of test results, particularly for cycles under part (B) of the energy test cycle definition, DOE proposed in the August 2011 SNOPR to further clarify that the manufacturer default conditions for each cycle setting shall be used, except for the temperature selection, if necessary. For example, if the extra-hot temperature selection was only available on the "Whites" setting, the manufacturer would use the Whites setting to test that temperature option. If the default wash temperature for the Whites setting was warm or hot, however, the manufacturer would have to manually adjust the temperature to obtain the extra-hot wash temperature. For certification testing in this illustrative case, the manufacturer would use the default settings on the Whites setting for all options except the temperature selection, which would be manually adjusted to achieve the desired temperature.

In addition, DOE proposed in the August 2011 SNOPR to delete the phrase, "and required for testing as described in this test procedure" from part (B) as redundant and unnecessary.

In response to the revised proposal in the August 2011 SNOPR, AHAM stated that it opposes including the phrase, "the manufacturer default settings for each cycle setting shall be

used, except for the temperature selection" in the energy test cycle definition. AHAM believes the proposed clarification is vague because it is open to interpretation by manufacturers. (AHAM, No. 24 at p. 5) AHAM further stated generally that the proposed clarification to the energy test cycle definition, as well as the existing part (B) of the definition, represent significant test burden with no corresponding benefit because the results are not representative of actual consumer use. (AHAM, No. 24 at p. 5)

ALS opposed the proposed clarification to part (B) of the energy test cycle definition, stating that the phrase "largely comparable" is vague and open to interpretation. (ALS, No. 22 at p. 2) ALS proposed eliminating part (B) of the energy test cycle definition entirely, due to the test burden associated with measuring energy use in every possible cycle option. ALS proposed implementing only part (A) of the energy test cycle definition, which is "the cycle recommended by the manufacturer for washing cotton or linen clothes, and includes all the wash/rinse temperature selections and water levels offered in that cycle". (ALS, No. 22 at p. 2) ALS supports DOE's proposal to clarify that the manufacturer's default settings be utilized in the energy test cycle definition. (ALS, No. 22 at p. 2)

Whirlpool disagreed with part (B) of the energy test cycle definition as proposed in the August 2011 SNOPR. Whirlpool stated that part (B) would require including temperature/water level options not recommended by the manufacturer for washing cotton and linen clothing because they may lead to clothing damage such as shrinkage, dye transfer, puckering, or other outcomes unacceptable to the consumer. (Whirlpool, No. 27 at p. 2) Whirlpool stated that it possesses proprietary consumer data suggesting that steam and Sanitize cycle settings are used

infrequently, warranting their exclusion from the energy test cycle definition. (Whirlpool, No. 27 at p. 2) Whirlpool proposes the following definition for the energy test cycle:

> "Energy test cycle for a basic model means 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. If a particular wash/rinse temperature selection or water level is available on the basic model, but is not available for selection in the cycle recommended by the manufacturer for washing cotton or linen clothes (i.e., is locked out of the cycle), then that temperature selection and/or water level shall not be included in the energy test cycle." (Whirlpool, No. 27 at p. 2)

Whirlpool, ALS, and GE (hereafter referred to as the "Joint Manufacturers") submitted a joint comment on the August 2011 SNOPR. The Joint Manufacturers agree with AHAM that DOE's proposed amendment to part (B) in the August 2011 SNOPR is vague because it is open to a significant amount of interpretation by manufacturers. (Joint Manufacturers, No. 28 at p. 1) The Joint Manufacturers further agree with AHAM that the cycle setting recommended for washing cotton or linen clothes is the cycle setting that is most representative of consumer use, and if the consumer cannot select a temperature for that cycle setting, then it is not representative to arbitrarily select other settings that have that temperature option. The Joint Manufacturers stated that requiring arbitrary selection of temperatures adds ambiguity to the test procedure, which results in variability. The Joint Manufacturers urged DOE to eliminate part (B) from the proposed definition of the energy test cycle. Id.

The Joint Manufacturers further stated that if DOE nevertheless decides to retain part (B) of the energy test cycle definition, the following revised language should be used for part (B):

> "…(B) if the cycle described in (A) does not include a water heating option and the clothes washer has a water heating temperature selection or cycle available, the cycle and temperature selection recommended by the manufacturer for sanitization, disinfection or similar must be included in the energy test cycle. In the case of multiple such cycles, the cycle using the most energy at the manufacturer default setting must be chosen. If the clothes washer has a water heating option and the manufacturer does not recommend a cycle for sanitization, disinfection, or similar, the energy test cycle shall include the water heating cycle and temperature selection with the manufacturer's default cycle time. Again, in the case of multiple such cycles the cycle using the most energy at the manufacturer default setting must be chosen. Any cycle under (A) or (B) shall include the manufacturer's default agitation/tumble operation, soil level, spin speeds, wash times, and rinse times applicable to that cycle, including water heating time for water heating clothes washers." (Joint Manufacturers, No. 28 at pp. 1–2; Whirlpool, No. 27 at pp. 2–3)

NEEA agrees with DOE's proposed changes to the energy test cycle definition. However, NEEA believes that the point at which the test cycle starts and ends is not defined in the clothes washer test procedure. (NEEA, No. 26 at p. 4) NEEA questioned whether the beginning of the energy test cycle could be defined as the beginning of the delayed wash cycle, if any; and whether the end of the energy test cycle could be defined as the beginning of the "inactive"

mode. (NEEA, No. 26 at p. 4) NEEA stated that defining the energy test cycle as starting with the activation of the "delay start" mode, if any (with the duration specified) and ending with the beginning of the inactive mode (with the duration of the "cycle finished" mode, if any, specified, either in minutes or number of cycles, or both), would simplify and clarify the test procedure. NEEA believes that while this could lengthen the energy test cycle itself, a greater amount of testing time could be saved by not having to set up and measure the "delay start" and "cycle finished" modes separately. (NEEA, No. 26 at p. 4)

4.DOE Response to All Comments

As outlined in the previous sections, the comments DOE received from interested parties collectively identify seven concerns related to its proposed energy test cycle definition:

(1) Vague language. The proposed definition is vague and would lead to significant variability in interpretation; particularly the phrase "largely comparable."

(2) Elimination of part (B). Including part (B) may not provide benefit to the public interest and should be eliminated entirely.

(3) Representativeness. The cycles required to be tested under the proposed part (B) are not representative of typical consumer usage patterns.

(4) Test burden. Third party laboratories could be required to test numerous alternate cycle settings to determine which cycles are largely comparable to the normal cycle, which could significantly increase test burden.

(5) Manufacturer default settings. The energy test cycle definition should clearly specify whether the manufacturer default settings should be used, and if so, should clarify which default settings to use.

(6) Suggested alternative definitions. Interested parties suggested several alternatives for defining the energy test cycle.

(7) Definition of the start and end of each cycle. The energy test cycle definition should clearly define what constitutes the start and end of each active wash cycle.

The following sections provide DOE's responses to each of these issues.

a. Vague Language

Interested parties generally commented that DOE's proposed change to part (B) of the energy test cycle definition would create just as much confusion as the current definition. Specifically, interested parties believe that the proposed definition does not provide clear enough guidance on how to determine whether a cycle setting is "largely comparable" to the Normal setting, which would lead to significant variability in interpretation and test results.

DOE intended the proposed definition to specify that the determination of whether to include a cycle setting under part (B) of the energy test cycle should be made by comparing the agitation/tumble operation, spin speeds, wash times, and rinse times to those of the Normal setting. DOE acknowledges, however, that the proposed definition does not clearly define the boundaries of term "largely comparable," leaving this determination to the subjective judgment of the test laboratory.

As stated earlier, DOE believes the energy test cycle definition must be clear, uniformly understood, and able to be interpreted consistently by manufacturers, competitors, and

independent test laboratories without subjective judgment or reliance on proprietary data. DOE notes that under the alternative definitions proposed by the Joint Manufacturers, the determination of which cycle settings to include under part (B) would be based on an objective numerical criterion readily determined by any test laboratory: the cycle setting using the most energy.

DOE recognizes that there are other possible numerical criteria for determining whether a cycle setting should be included in the energy test cycle under part (B) of the definition, including the cycle setting using the least energy, the cycle setting with energy consumption most similar to that of the Normal setting, or cycle settings above or below a certain energy consumption threshold.

DOE proposes, however, that including the cycle setting that uses the most energy would be the most appropriate, objective criterion for determining which cycle setting should be included under part (B) of the energy test cycle. This approach would ensure that clothes washers requiring testing under part (B) of the energy test cycle meet the applicable energy conservation standard when the maximum energy consumption representative of average consumer use is tested. This approach would also provide clarity by requiring only a single variable to be considered to make the determination. Therefore, DOE proposes in today's SNOPR that for each wash/rinse temperature combination not available under the Normal setting, the alternate cycle setting that uses the most energy must be chosen in the case where multiple alternate cycle settings offer that wash/rinse temperature combination.

DOE notes that this criterion requires a clear definition of which components of energy consumption should be included in the measurement of each cycle setting's energy consumption—e.g. electrical energy, hot water energy, energy required for moisture removal (i.e., dryer energy), or a combination of these three energy components. DOE proposes that the machine electrical energy be included because this is a direct measure of a form of energy consumption by the clothes washer. DOE also proposes that the hot water energy be included for the following reasons: (1) water temperature is the key characteristic that determines the need for testing under part (B) of the energy test cycle definition; (2) water temperature is often one of the primary parameters that consumers consider when selecting a wash/rinse cycle; (3) water heating energy represents a significant portion of a cycle's total energy consumption; (4) the test procedure already requires measuring hot water consumption for each tested cycle; and (5) a simple equation can be used to translate hot water quantity into hot water heating energy.

DOE does not propose to include the drying energy in the determination of which cycle settings should be tested under part (B) of the energy test cycle. DOE lacks information on whether an RMC value that would be measured in alternate cycle settings would be comparable or analogous to the current RMC metric from which drying energy is calculated. Currently, RMC is determined for a clothes washer based on the results of only the cold wash/cold rinse cycle and the warm wash/warm rinse cycle (if available), at minimum and maximum spin speeds (if available), using the maximum load size. Depending on the clothes washer, this corresponds to between one and four dedicated RMC tests and could significantly increase the test burden if required to be performed for each alternate cycle setting. The weighted-average value obtained from these RMC tests is calculated and considered to be the average RMC value for the clothes

washer, across all cycles. Requiring the measurement of RMC for the individual cycles comprising the energy test cycle would be inconsistent with this methodology. Determining the energy required for moisture removal would require weighing the test cloth before and after each cycle to determine its remaining moisture content, which would also impose additional test burden. DOE further believes that in many circumstances, consumers may not be aware of variations in spin speed if that information is not displayed on the front panel of the clothes washer.

For these reasons, DOE does not believe that the drying energy should be included in determining whether a cycle setting should be tested under part (B) of the energy test cycle. Therefore, DOE proposes in today's SNOPR to include the machine electrical energy consumption and hot water energy consumption when determining each cycle setting's total energy consumption, in the identification of the cycle setting that uses the most energy for each wash/rinse temperature combination to be tested under part (B) of the energy test cycle.

Further, DOE notes that in sections 4.1.3 and 4.1.6 of the current test procedure, machine electrical energy and hot water energy are calculated as the weighted averages of each tested load size. Requiring the testing of multiple load sizes for the purpose of determining which cycle setting to select for part (B) of the energy test cycle, however, would unduly increase the test burden. Therefore, DOE proposes in today's SNOPR to require testing only the clothes washer's maximum load size, determined from Table 5.1, for the purpose of comparing the energy consumption of the alternate cycle settings considered under part (B) of the energy test cycle.

Using the maximum load size will produce the most consistent, repeatable, and conservative results.

In addition, DOE notes inconsistent usage of the word "cycle" in the energy test cycle definition. In some instances, the word "cycle" refers to the labeled program setting on the clothes washer (e.g. "Normal", "Whites", "Colors", etc.). In other instances, the word "cycle" refers to an individual wash/rinse cycle performed during active wash mode (e.g. a cold wash/cold rinse cycle). To help reduce this ambiguity, DOE proposes in today's SNOPR to modify the nomenclature by using the term "cycle setting" to indicate the labeled program setting on the clothes washer, and the term "cycle" to indicate an individual wash/rinse cycle.

b. Elimination of Part (B)

As described in previous sections, manufacturers and AHAM commented that DOE should eliminate part (B) of the energy test cycle definition, while NEEA supports keeping part (B) to account for temperature options available outside the Normal setting.

Wash/rinse temperature combinations locked out of the Normal setting should also be included in the energy test cycle, and doing so is representative of average consumer use according to the temperature use factors (TUFs) in the test procedure. DOE is unaware of any publicly available data indicating the frequency with which consumers select the Normal setting versus other cycle settings. However, DOE notes that the TUFs in the test procedure were developed to represent consumer selection of different temperature options available on a clothes washer. Each TUF represents the frequency with which consumers select a particular

temperature option on machines offering that temperature option. The TUFs do not represent the frequency with which consumers select a particular temperature option among all clothes washers on the market. For example, if a particular clothes washer offers a warm rinse option, the warm rinse TUF indicates that the typical consumer using that clothes washer will select the warm rinse option for 27 percent of all wash loads. DOE believes that the energy test cycle proposed in section III.A, which requires use of part (B) of the definition if part (A) does not include all wash/rinse temperature combinations available on the machine, should include any temperature combination for which a TUF has been developed.

If part (B) of the energy test cycle were to be eliminated, only the temperature options available in the Normal setting would be required for testing. Under this scenario, if one clothes washer offered all available temperature options in the Normal setting, while a second clothes washer offered the same temperature options but with a subset of those temperatures locked out of the Normal setting, the locked out temperature options on the second clothes washer would not be factored into its energy efficiency rating. This would imply that consumer behavior would differ for these two clothes washers; i.e., that consumers would select the locked out temperature combinations less frequently on the second machine. DOE is not aware of any data that quantifies how consumers may adjust their behavior based on the cycle setting for which a particular temperature option is available (e.g. "Normal", "Whites", "Colors", etc.) rather than on the desired temperature option itself.

In addition, if DOE eliminated part (B) from the energy test cycle definition, manufacturers could arbitrarily exclude temperatures from the Normal setting, thus excluding

them from being tested under the DOE test procedure. In the most extreme case, a manufacturer could create a Normal setting that offers only cold water temperatures, and move all heated water cycles to alternate cycle settings on the machine. In this case, consumers would likely select the alternate cycle settings for a significant portion of wash cycles, yet only the cold cycle would be required for testing under the DOE test procedure.

In summary, DOE believes that if a temperature combination is "locked out" of the Normal cycle setting but exists on at least one alternate cycle setting, it should be included in the energy test cycle under the assumption that a consumer will switch to one of the alternate cycles to obtain that wash/rinse temperature combination. For the reasons stated above, DOE proposes in today's SNOPR to keep part (B) of the energy test cycle definition, and to require testing of all temperature combinations available on the machine, including any temperature options locked out of the Normal setting.

c. Representativeness

Manufacturers and AHAM expressed concern that the wash cycles, or portions of wash cycles, required to be tested under part (B) are not representative of consumer usage patterns. As described in the previous section, DOE does not have data to verify how consumers may adjust their behavior based on the particular cycle setting for which a temperature option is available, rather than the desired temperature option itself.

DOE acknowledges that the wording of part (B) in the current test procedure and DOE's proposals in the September 2010 NOPR and August 2011 SNOPR include language referring to

"portion(s) of other cycle(s) with that temperature selection or water level…" that may be interpreted in different ways. DOE does not believe that the energy test cycle should include portions of individual wash cycles. DOE concurs with BSH that assembling portions of cycles to test under part (B) (i.e. testing the wash portion of one cycle in combination with the rinse portion of another cycle) would not represent a cycle that a consumer could select, and thus would not be representative of actual consumer usage. As a result, the energy test cycle should include only complete wash/rinse cycles as programmed on the clothes washer. Accordingly, DOE proposes in today's SNOPR to remove the phrase "portion(s) of other cycles" from the definition of energy test cycle.

d. Test Burden

DOE acknowledges that the language it proposed in the September 2010 NOPR and August 2011 SNOPR for part (B) of the energy test cycle could significantly increase test burden if a laboratory is required to test numerous alternate cycle settings to determine which cycles are largely comparable to the normal cycle. Under today's proposal, manufacturers would test all wash/rinse temperature combinations not available under part (A) of the energy test cycle definition. Where multiple cycle settings offer these wash/rinse temperature combinations, DOE proposes a clear, objective way for manufacturers to determine of which cycle(s) to include in the energy test cycle. DOE proposes that for each of these wash/rinse temperature combinations, manufacturers include the cycle setting that uses the most energy in the energy test cycle. DOE further proposes to require manufacturers to certify to DOE the specific cycle settings comprising the energy test cycle for each basic model of its clothes washer. This list of cycle settings would be provided to DOE and any test laboratory used by the manufacturer or DOE, so

that neither DOE nor the test laboratory would be required to independently determine which cycles should be included. DOE believes that this proposal would eliminate a major source of ambiguity and inconsistency of test results among various laboratories.

This proposal would require a manufacturer to provide to DOE as part of its certification the cycle settings that a manufacturer used to determine each clothes washer's energy efficiency rating. Under DOE's certification, compliance, and enforcement program in 10 CFR 429, Subpart C, DOE can conduct assessment or enforcement testing to determine whether the manufacturer's declared energy test cycles are those cycles for a particular wash/rinse temperature combination that use the most energy.

e. Manufacturer Default Settings

A typical clothes washer may allow the consumer to adjust certain parameters of a given cycle setting, such as wash/rinse temperature, water fill levels, soil level, agitation/tumble operation, spin speed, wash time, rinse time, and other optional features such as delay start, cycle-finished activity, steam injection, chemical dispensers, and signal sounds. For any active wash mode cycle included in the energy test cycle, the default manufacturer settings should be used for any parameter not explicitly specified by the test procedure because DOE is not aware of any data quantifying how often consumers select these optional features or deviate from the default manufacturer cycle settings. The test procedure specifies wash/rinse temperatures and water fill levels for all test cycles, and spin speeds for the RMC test cycles. DOE proposes in today's SNOPR to clarify in the definition of the energy test cycle that for any cycle setting

tested under part (A) or (B), the manufacturer default parameters shall be used, except for the temperature selection, if necessary.

f. Suggested Alternative Definitions

Several manufacturers suggested alternate definitions for the energy test cycle, including specific suggestions for part (B), as described previously in sections III.B.2 and III.B.3. In response to the August 2011 SNOPR, the Joint Manufacturers proposed language for part (B) that would require testing the extra-hot cycle on water heating clothes washers. The proposal suggested that in the case of multiple such cycles, the cycle using the most energy at the manufacturer default setting must be chosen.

As described in the previous sections, DOE proposes that a cycle setting's energy consumption be used to determine whether that setting should be included under part (B). However, the definition proposed by the Joint Manufacturers would require testing only the extra-hot temperature setting under part (B). Under this proposal, if other wash/rinse temperature combinations such as warm wash/warm rinse or hot wash/cold rinse were also locked out of the Normal setting, they would not be required for testing. In contrast, GE's proposed definition for part (B), submitted in response to the September 2010 NOPR, as discussed previously, would require testing all wash/rinse temperature selections available on the machine and not included in the Normal setting.

DOE's proposed definition of energy test cycle would require testing of all wash/rinse temperature combinations available on the machine, not just the extra-hot temperature setting, to

ensure that the definition is representative of average consumer use. As stated previously, DOE's proposed definition of energy test cycle would include any temperature combination for which a TUF has been developed. As stated above, if a "locked out" temperature combination exists on at least one alternate cycle setting, a setting with that temperature combination should be included in the energy test cycle because the TUFs indicate that a consumer will switch to one of the alternate settings to obtain that wash/rinse temperature combination.

Therefore, DOE proposes in today's SNOPR to use the criteria suggested by the Joint Manufacturers for determining which cycle setting to choose under part (B), and to use language suggested by GE to require testing all wash/rinse temperature combinations available on the machine not included in the Normal setting. DOE's revised proposal for part (B) of the energy test cycle definition is set forth in section III.A.

g. Definition of the Start and End of Each Cycle

As described previously, NEEA commented that the energy test cycle does not clearly define the start and end of each wash cycle tested under the energy test cycle. DOE has observed through its own testing that delay start and cycle finished features are typically available as optional features which are not activated by default. Thus, they would not be activated during the energy test cycle, and the start and finish of each wash cycle would be unambiguous. DOE acknowledges that as delay start and cycle finished features become more prevalent in the market, however, clothes washers could be manufactured that activate some of these features by default during any of the wash cycles comprising the energy test cycle. Therefore, DOE proposes to define the start and end of the energy test cycle more clearly.

In the August 2011 SNOPR, DOE proposed adding definitions for active washing mode, delay start mode, and cycle finished mode. DOE believes that these three definitions can be used to clarify the start and end of the energy test cycle. DOE proposes in today's SNOPR to specify that each cycle included as part of the energy test cycle comprises the entire active washing mode, and excludes any delay start or cycle finished modes.

C. Compliance with Other EPCA Requirements

1. Test Burden

EPCA requires that any test procedures prescribed or amended under this section be reasonably designed to produce test results that measure energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle or period of use. Test procedures must also not be unduly burdensome to conduct." (42 U.S.C. 6293(b)(3))

DOE determined that the proposed test procedure amendments in the September 2010 NOPR and August 2011 SNOPR satisfy these EPCA requirements, as described in those rulemaking documents. The proposals in today's SNOPR also satisfy these requirements, as described in the following paragraphs.

Commenters stated that the proposed definition of energy test cycle in the September 2010 NOPR and August 2011 SNOPR would be vague and could significantly increase the testing burden. Today's proposal is intended to provide a clear, objective definition of energy test

cycle and would require manufacturers to certify to DOE the list of cycle settings comprising the energy test cycle for each basic model of its clothes washers, so that testing laboratories would know which cycles to test. While the proposed definition of the energy test cycle would require testing additional wash cycles under part (B) to determine which cycle setting has the highest energy consumption, the manufacturer already possesses in-depth knowledge about the energy characteristics of each wash/rinse cycle offered on its clothes washers. Other test laboratories would not be required to conduct multiple tests to determine which cycle settings should be included under part (B) of the energy test cycle. Therefore, compared to the current test procedure, DOE expects that today's proposal could reduce the test burden, because it would remove the existing uncertainty as to which cycle settings should be selected.

2. 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) The definition of the energy test cycle proposed in today's SNOPR could affect the measurement of active mode energy use. DOE notes that 42 U.S.C. 6293(e)(3) provides that models of covered products in use before the date on which an amended energy conservation standard (developed using the amended test procedure pursuant to 42 U.S.C. 6293(e)(2)) becomes effective that comply with the energy conservation standard applicable to such covered products on the day before such date are deemed to comply with the amended standard. The same is true of revisions of such models that

come into use after such date and have the same energy efficiency, energy use or water use characteristics.

IV. Procedural Issues and Regulatory Review

The regulatory reviews conducted for this proposed rule are identical to those conducted for the August 2011 SNOPR. An update to the Regulatory Flexibility Act certification is set forth below. Please see the August 2011 SNOPR for further details.

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 (IFRA) for any rule that by law must be proposed for public comment, unless the agency certifies that the 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 DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website: www.gc.doe.gov.

DOE reviewed today's supplemental proposed rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. DOE tentatively concluded that the September 2010 NOPR and August 2011 SNOPR would not have a significant impact on a substantial number of small entities, and today's SNOPR contains no revisions to that proposal that would result in 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 website[2] 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 revising the definition of energy test cycle to more precisely define which cycles are required for testing under part (B) of the definition.

DOE believes these additional requirements would not be expected to impose a significant economic burden on entities subject to the applicable testing requirements. Today's proposal is intended to provide a clear, objective definition of energy test cycle, which is expected to reduce the testing burden. The provisions in today's SNOPR would also require manufacturers to report to DOE the cycle settings comprising the complete energy test cycle for

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

each basic model. Manufacturers already possess in-depth knowledge about the energy characteristics of each wash/rinse cycle offered on their clothes washers, so DOE expects manufacturers to experience little or no additional test burden due to today's proposed revisions.

For these reasons, DOE certifies that if adopted, the September 2010 NOPR, as modified by the August 2011 SNOPR and today's SNOPR, 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 has previously transmitted 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). DOE seeks comment on the updated certification set forth above.

V.Public Participation

A. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting, but no later than the date provided in the DATES section at the beginning of this proposed rule. Interested parties may submit comments using any of the methods described in the ADDRESSES section at the beginning of this notice.

Submitting comments via regulations.gov. The http://www.regulations.gov web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical

difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to regulations.gov information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through regulations.gov cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through regulations.gov before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that regulations.gov provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery, or mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to regulations.gov. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information on a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via mail or hand delivery, please provide all items on a CD, if feasible. It is not necessary to submit printed copies. No facsimiles (faxes) will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, written in English, and are free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. 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 via email, postal mail, or hand delivery two well-marked copies: one copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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 has previously been made available to others without obligation concerning its confidentiality; (5) an explanation of the competitive injury to the submitting person which 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.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure). Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this proposed rule.

List of Subjects in

10 CFR Part 429

Confidential business information, Energy conservation, Household appliances, Imports, Reporting and recordkeeping requirements.

10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Incorporation by reference, Intergovernmental relations, Small businesses.

Issued in Washington, DC, on October 27, 2011.

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Kathleen B. Hogan
Deputy Assistant Secretary of Energy Efficiency
Energy Efficiency and Renewable Energy

For the reasons stated in the preamble, DOE proposes to amend parts 429 and 430 of title 10 of the Code of Federal Regulations, as set forth below:

PART 429 -- CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

1. The authority citation for part 429 continues to read as follows:

Authority: 42 U.S.C. 6291–6317.

2. Section 429.20 is amended by revising paragraphs (a)(2)(i) introductory text, (a)(2)(ii) introductory text, and (b)(2) to read as follows:

§ 429.20 Residential clothes washers.

(a) * * *

(2) * * *

(i) Any represented value of the water factor, integrated water factor, the estimated annual operating cost, the energy or water consumption, or other measure of energy or water consumption of a basic model for which consumers would favor lower values shall be greater than or equal to the higher of:

* * * * *

(ii) Any represented value of the modified energy factor, integrated modified energy factor, or other measure of energy or water consumption of a basic model for which consumers would favor higher values shall be less than or equal to the lower of:

* * * * *

(b) * * *

(2) Pursuant to §429.12(b)(13), a certification report shall include the following public product-specific information: The modified energy factor (MEF) in cubic feet per kilowatt hour per cycle (cu ft/kWh/cycle), and the capacity in cubic feet (cu ft). For standard-size residential clothes washers, a water factor (WF) in gallons per cycle per cubic feet (gal/cycle/cu ft). After the use of appendix J2 becomes mandatory, a list of all cycle settings comprising the complete energy test cycle for each basic model.

PART 430--ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

3. The authority citation for Part 430 continues to read as follows:

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

4. Section 430.3 is amended by:

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

b. Adding new paragraph (c);

c. Revising newly designated paragraph (m)(2).

The additions read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

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

(1) AATCC Test Method 79-2010, Absorbency of Textiles, Revised 2010, IBR approved for appendix J2 to Subpart B.

(2) AATCC Test Method 118-2007, Oil Repellency: Hydrocarbon Resistance Test, Revised 2007, IBR approved for appendix J2 to Subpart B.

(3) AATCC Test Method 135-2010, Dimensional Changes of Fabrics after Home Laundering, Revised 2010, IBR approved for appendix J2 to Subpart B.

* * * * *

(m) * * *

(2) IEC Standard 62301 ("IEC 62301"), Household electrical appliances–Measurement of standby power, Edition 2.0, 2011-01, IBR approved for appendix J2 to Subpart B.

* * * * *

5. 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 must be rounded off to the nearest dollar per year and is defined as follows:

(i) Before use of appendix J2 becomes mandatory,

(A) When electrically heated water is used,

$(N_1 \times E_{TE1} \times C_{KWH})$

Where,

N_1 = the representative average residential clothes washer use of 392 cycles per year according to appendix J1,

E_{TE1} = the total per-cycle energy consumption when electrically heated water is used, in kilowatt-hours per cycle, determined according to section 4.1.7 of appendix J1, and

C_{KWH} = the representative average unit cost, in dollars per kilowatt-hour, as provided by the Secretary.

(B) When gas-heated or oil-heated water is used,

$(N_1 \times ((ME_{T1} \times C_{KWH}) + (HE_{TG1} \times C_{BTU})))$

Where,

N_1 and C_{KWH} are defined in paragraph (j)(1)(i)(A) of this section,

ME_{T1} = the total weighted per-cycle machine electrical energy consumption, in kilowatt-hours per cycle, determined according to section 4.1.6 of appendix J1,

HE_{TG1} = the total per-cycle hot water energy consumption using gas-heated or oil-heated water, in Btu per cycle, determined according to section 4.1.4 of appendix J1, and

C_{BTU} = the representative average unit cost, in dollars per Btu for oil or gas, as appropriate, as provided by the Secretary.

(ii) After use of appendix J2 becomes mandatory (see the note at the beginning of appendix J2),

(A) When electrically heated water is used,

$(N_2 \times (E_{TE2} + E_{TSO}) \times C_{KWH})$

Where,

N_2 = the representative average residential clothes washer use of 295 cycles per year according to appendix J2,

E_{TE2} = the total per-cycle energy consumption when electrically heated water is used, in kilowatt-hours per cycle, determined according to section 4.1.7 of appendix J2,

E_{TSO} = the per-cycle combined low-power mode energy consumption, in kilowatt-hours per cycle, determined according to section 4.4 of appendix J2, and

C_{KWH} is defined in paragraph (j)(1)(i)(A) of this section.

(B) When gas-heated or oil-heated water is used,

$(N_2 \times ((ME_{T2} + E_{TSO}) \times C_{KWH}) + (HE_{TG2} \times C_{BTU}))$

Where,

N_2 and E_{TSO} are defined in (j)(1)(ii)(A) of this section,

ME_{T2} = the total weighted per-cycle machine electrical energy consumption, in kilowatt-hours per cycle, determined according to section 4.1.6 of appendix J2,

C_{KWH} is defined in (j)(1)(i)(A) of this section,

HE_{TG2} = the total per-cycle hot water energy consumption using gas-heated or oil-heated water, in Btu per cycle, determined according to section 4.1.4 of appendix J2,

C_{BTU} is defined in (j)(1)(i)(B) of this section.

(2) (i) The modified energy factor for automatic and semi-automatic clothes washers is determined according to section 4.4 of appendix J1 before appendix J2 becomes mandatory and

section 4.5 of appendix J2 when appendix J2 becomes mandatory. The result shall be rounded off to the nearest 0.01 cubic foot per kilowatt-hour per cycle.

(ii) The integrated modified energy factor for automatic and semi-automatic clothes washers is determined according to section 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-hour per cycle.

(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:

(i) Before appendix J2 becomes mandatory, the representative average-use of 392 cycles per year and the total weighted per-cycle water consumption in gallons per cycle determined according to section 4.2.2 of appendix J1. The water consumption factor can be determined according to section 4.2.3 of appendix J1, with the result rounded off to the nearest 0.1 gallon per cycle per cubic foot. The remaining moisture content can be determined according to section 3.8 of appendix J1, with the result rounded off to the nearest 0.1 percent.

(ii) After appendix J2 becomes mandatory, the representative average-use of 295 cycles per year and the total weighted per-cycle water consumption for all wash cycles, in gallons per cycle, determined according to section 4.2.11 of appendix J2. The water consumption factor can be determined according to section 4.2.12 of appendix J2, with the result rounded off to the nearest 0.1 gallon per cycle per cubic foot. The integrated water consumption factor can be

determined according to section 4.2.13 of appendix J2, with the result rounded off to the nearest 0.1 gallon per cycle per cubic foot. The remaining moisture content can be determined according to section 3.8 of appendix J2, with the result rounded off to the nearest 0.1 percent.

* * * * *

Appendix J to Subpart B of Part 430 –[Removed]

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

Appendix J1 to Subpart B of Part 430 –[Amended]

7. Appendix J1 to subpart B of part 430 is amended by:

a. Revising the introductory text after the appendix heading;

b. Revising section 1.22;

c. Removing sections 2.6.1.1 through 2.6.1.2.4;

d. Revising section 2.6.3.1;

e. Revising section 2.10;

f. Revising section 3.6;

g. Revising section 4.1.4;

h. Revising section 4.2; and

i. Revising section 5.

The revisions 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 that address standby and off mode power consumption for residential clothes washers**.** After this date, all residential clothes washers shall be tested using the provisions of Appendix J2.

* * * * *

1.22 Cold rinse means the coldest rinse temperature available on the machine.

* * * * *

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).

* * * * *

2.10 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, regardless of the labeling of suggested dial locations. If the clothes washer is equipped with an electromechanical dial controlling wash time, reset the dial to the minimum wash time and then turn it in the direction of increasing wash time to reach the appropriate setting. If the appropriate

setting is passed, return the dial to the minimum wash time and then turn in the direction of increasing wash time until the setting is reached.

* * * * *

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 sections 3.6.1 through 3.6.3 of this appendix for the coldest wash temperature selection available. For a clothes washer that offers two or more wash temperature settings labeled as cold, such as "Cold" and "Tap Cold", the setting with the minimum wash temperature shall be considered the cold wash. If any of the other cold wash temperature settings add hot water to raise the wash temperature above the cold water supply temperature, as defined in section 2.3 of this appendix, those setting(s) shall be considered warm wash setting(s), as defined in section 1.18 of this appendix. If none of the cold wash temperature settings add hot water for any of the water fill levels or test load sizes required for the energy test cycle, the wash temperature setting labeled as "Cold" shall be considered the cold wash, and the other wash temperature setting(s) labeled as cold shall not be required for testing.

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4. Calculation of Derived Results From Test Measurements.

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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.

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4.2 Water consumption of clothes washers.

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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
≥ <	≥ <						
0–0.80	0–22.7	3.00	1.36	3.00	1.36	3.00	1.36
0.80–0.90	22.7–25.5	3.00	1.36	3.50	1.59	3.25	1.47
0.90–1.00	25.5–28.3	3.00	1.36	3.90	1.77	3.45	1.56
1.00–1.10	28.3–31.1	3.00	1.36	4.30	1.95	3.65	1.66
1.10–1.20	31.1–34.0	3.00	1.36	4.70	2.13	3.85	1.75
1.20–1.30	34.0–36.8	3.00	1.36	5.10	2.31	4.05	1.84
1.30–1.40	36.8–39.6	3.00	1.36	5.50	2.49	4.25	1.93
1.40–1.50	39.6–42.5	3.00	1.36	5.90	2.68	4.45	2.02
1.50–1.60	42.5–45.3	3.00	1.36	6.40	2.90	4.70	2.13
1.60–1.70	45.3–48.1	3.00	1.36	6.80	3.08	4.90	2.22
1.70–1.80	48.1–51.0	3.00	1.36	7.20	3.27	5.10	2.31
1.80–1.90	51.0–53.8	3.00	1.36	7.60	3.45	5.30	2.40
1.90–2.00	53.8–56.6	3.00	1.36	8.00	3.63	5.50	2.49
2.00–2.10	56.6–59.5	3.00	1.36	8.40	3.81	5.70	2.59
2.10–2.20	59.5–62.3	3.00	1.36	8.80	3.99	5.90	2.68
2.20–2.30	62.3–65.1	3.00	1.36	9.20	4.17	6.10	2.77
2.30–2.40	65.1–68.0	3.00	1.36	9.60	4.35	6.30	2.86
2.40–2.50	68.0–70.8	3.00	1.36	10.00	4.54	6.50	2.95
2.50–2.60	70.8–73.6	3.00	1.36	10.50	4.76	6.75	3.06
2.60–2.70	73.6–76.5	3.00	1.36	10.90	4.94	6.95	3.15
2.70–2.80	76.5–79.3	3.00	1.36	11.30	5.13	7.15	3.24
2.80–2.90	79.3–82.1	3.00	1.36	11.70	5.31	7.35	3.33
2.90–3.00	82.1–85.0	3.00	1.36	12.10	5.49	7.55	3.42
3.00–3.10	85.0–87.8	3.00	1.36	12.50	5.67	7.75	3.52
3.10–3.20	87.8–90.6	3.00	1.36	12.90	5.85	7.95	3.61
3.20–3.30	90.6–93.4	3.00	1.36	13.30	6.03	8.15	3.70
3.30–3.40	93.4–96.3	3.00	1.36	13.70	6.21	8.35	3.79
3.40–3.50	96.3–99.1	3.00	1.36	14.10	6.40	8.55	3.88
3.50–3.60	99.1–101.9	3.00	1.36	14.60	6.62	8.80	3.99
3.60–3.70	101.9–104.8	3.00	1.36	15.00	6.80	9.00	4.08
3.70–3.80	104.8–107.6	3.00	1.36	15.40	6.99	9.20	4.17
3.80-3.90	107.6-110.4	3.00	1.36	15.80	7.16	9.40	4.26
3.90-4.00	110.4-113.3	3.00	1.36	16.20	7.34	9.60	4.35
4.00-4.10	113.3-116.1	3.00	1.36	16.60	7.53	9.80	4.45

Container volume		Minimum load		Maximum load		Average load	
cu. ft.	liter	lb	kg	lb	kg	lb	kg
≥ <	≥ <						
4.10-4.20	116.1-118.9	3.00	1.36	17.00	7.72	10.00	4.54
4.20-4.30	118.9-121.8	3.00	1.36	17.40	7.90	10.20	4.63
4.30-4.40	121.8-124.6	3.00	1.36	17.80	8.09	10.40	4.72
4.40-4.50	124.6-127.4	3.00	1.36	18.20	8.27	10.60	4.82
4.50-4.60	127.4-130.3	3.00	1.36	18.70	8.46	10.85	4.91
4.60-4.70	130.3-133.1	3.00	1.36	19.10	8.65	11.05	5.00
4.70-4.80	133.1-135.9	3.00	1.36	19.50	8.83	11.25	5.10
4.80-4.90	135.9-138.8	3.00	1.36	19.90	9.02	11.45	5.19
4.90-5.00	138.8-141.6	3.00	1.36	20.30	9.20	11.65	5.28
5.00-5.10	141.6-144.4	3.00	1.36	20.70	9.39	11.85	5.38
5.10-5.20	144.4-147.2	3.00	1.36	21.10	9.58	12.05	5.47
5.20-5.30	147.2-150.1	3.00	1.36	21.50	9.76	12.25	5.56
5.30-5.40	150.1-152.9	3.00	1.36	21.90	9.95	12.45	5.65
5.40-5.50	152.9-155.7	3.00	1.36	22.30	10.13	12.65	5.75
5.50-5.60	155.7-158.6	3.00	1.36	22.80	10.32	12.90	5.84
5.60-5.70	158.6-161.4	3.00	1.36	23.20	10.51	13.10	5.93
5.70-5.80	161.4-164.2	3.00	1.36	23.60	10.69	13.30	6.03
5.80-5.90	164.2-167.1	3.00	1.36	24.00	10.88	13.50	6.12
5.90-6.00	167.1-169.9	3.00	1.36	24.40	11.06	13.70	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. 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 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. 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 J2 does not provide a means for determining the energy consumption of a clothes washer with an adaptive control system. A waiver must be obtained pursuant to 10 CFR

430.27 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.

1.8 Combined low-power mode means the aggregate of available modes other than active washing mode and self-clean mode, including inactive mode, off mode, delay start mode, and cycle finished mode.

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

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

1.11 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.

1.12 Delay start mode means an active mode in which activation of active washing mode

is facilitated by a timer.

1.13 Energy test cycle for a basic model means:

(A) The cycle setting recommended by the manufacturer for washing cotton or linen clothes, and includes all wash/rinse temperature selections offered in that cycle setting, and

(B) If the cycle setting described in (A) does not include all wash/rinse temperature combinations available on the clothes washer, the energy test cycle shall also include the alternate cycle setting(s) offering these wash/rinse temperature combination(s), tested at the wash/rinse temperature combinations not available on the cycle setting described in (A).

Where multiple alternate cycle settings offer a wash/rinse temperature combination not available on the cycle setting recommended by the manufacturer for washing cotton or linen clothes, the cycle setting certified by the manufacturer to have the highest energy consumption, as measured according to section 2.13, shall be included in the energy test cycle.

(C) All cycle settings included under part (A) and part (B) shall be tested using each appropriate load size as defined in section 2.8 and Table 5.1..

(D) For any cycle setting tested under (A) or (B), the manufacturer default settings shall be used, except for the temperature selection, if necessary. This includes wash conditions such as agitation/tumble operation, soil level, spin speed(s), wash times, rinse times, and all other wash parameters or optional features applicable to that cycle, including water heating time for water heating clothes washers. Each wash cycle included as part of the energy test cycle shall comprise the entire active washing mode and exclude any delay start or cycle finished modes.

1.14 IEC 62301 means the test standard published by the International Electrotechnical Commission, entitled "Household electrical appliances–Measurement of standby power," Publication 62301, Edition 2.0 2011-01 (incorporated by reference; see § 430.3).

1.15 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.

1.16 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 combined low-power mode energy consumption; and

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

1.17 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.

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

1.19 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.

1.20 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.

1.21 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.

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

1.23 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.

1.24 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.

1.25 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.

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

1.27 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.

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

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

B—Part B of the Energy Test Cycle

C—Capacity

C (with subscripts)—Cold Water Consumption

D—Energy Consumption for Removal of Moisture from Test Load

E—Electrical Energy Consumption

F—Load Usage Factor

H—Hot Water Consumption

HE—Hot Water Energy Consumption

ME—Machine Electrical Energy Consumption

P—Power

Q—Water Consumption

RMC—Remaining Moisture Content

S—Annual Hours

TUF—Temperature Use Factor

V—Temperature-Weighted Hot Water Consumption

W—Mass of Water

WC—Weight of Test Load After Extraction

WI—Initial Weight of Dry Test Load

Subscripts:

a or avg—Average Test Load

c—Cold Wash (minimum wash temp.)

corr—Corrected (RMC values)

h—Hot Wash (maximum wash temp. ≤135 °F (57.2 °C))

ia—Inactive Mode

LP—Combined Low-Power Mode

m—Extra Hot Wash (maximum wash temp. >135 °F (57.2 °C))

n—Minimum Test Load

o—Off Mode

oi—Combined Off and Inactive Modes

T—Total

w—Warm Wash

ww—Warm Wash/Warm Rinse

x—Maximum Test Load

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_{ia}="Power" in "Inactive Mode"

S_o="Annual Hours" in "Off Mode"

1.30 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.

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

1.32 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).

1.33 Warm rinse means the hottest rinse temperature available on the machine.

1.34 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.

1.35 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.

1.36 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. For combined low-power mode testing, the product shall be installed in accordance with Section 5, Paragraph 5.2 of IEC 62301 (incorporated by reference; see §430.3), disregarding the provisions regarding batteries and the determination, classification, and testing of relevant modes.

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 combined low-power mode testing, maintain the electrical supply voltage waveform indicated in Section 4, Paragraph 4.3.2 of IEC 62301. If the power measuring instrument used for testing is unable to measure and record the total harmonic content during the test measurement period, it is acceptable to measure and record the total harmonic content immediately before and after the test measurement period.

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 combined low-power mode power consumption shall comply with the requirements specified in Section 4, Paragraph 4.4 of IEC 62301. If the power measuring instrument used for testing is unable to measure and record the crest factor, power factor, or maximum current ratio during the test measurement period, it is acceptable to measure and record the crest factor, power factor, and maximum current ratio immediately before and after the test measurement period.

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 section 2.6.4 of this appendix, that is 24 ± 1/2 inches by 36 ± 1/2 inches (61.0 ± 1.3 cm by 91.4 ± 1.3 cm) and has been hemmed to 22 ± 1/2 inches by 34 ± 1/2 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 section 2.6.4 of this appendix, and shall consist of pieces of material that are 12 ± 1/4 inches by 12 ± 1/4 inches (30.5 ± 0.6 cm by 30.5 ± 0.6 cm) and have been hemmed to 10 ± 1/4 inches by 10 ± 1/4 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 section 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 x 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 AATCC Test Method 118-2007, (incorporated by reference; see § 430.3), for 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 AATCC Test Method 79-2010, (incorporated by reference; see § 430.3), for 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 section 2.6.5 of this appendix.

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

2.6.4.6.2 An RMC correction curve shall be calculated as specified in section 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 135-2010, (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 section 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 section 2.6.3 of this appendix. The load size shall be 8.4 lbs, consistent with section 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 ºF ± 5ºF (38 ºC ± 3 ºC)

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 section 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 section 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
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 of this appendix 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 section 2.6.6.1 of this appendix:

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

2.6.7.2 Substitute RMC_{corr} values in calculations in section 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 sections 3.1.1 through 3.1.5 of this appendix. 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 of this appendix 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 Min	Max Min	Max Avg Min	As determined by the Clothes Washer.

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

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, regardless of the labeling of suggested dial locations. If the clothes washer is equipped with an electromechanical dial controlling wash time, reset the dial to the minimum wash time and then turn it in the direction of increasing wash time to reach the appropriate setting. If the appropriate setting is passed, return the dial to the minimum wash time and then turn in the direction of increasing wash time until the setting is reached.

2.11 Test room temperature.

2.11.1 Non-water-heating clothes washer. For combined low-power 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 75ºF ± 5ºF (23.9ºC ± 2.8ºC). For combined low-power 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 ºF (99 ºC).

2.13 Energy consumption for the purpose of certifying the cycle setting(s) to be included in part (B) of the energy test cycle definition. Where multiple alternate cycle settings offer a wash/rinse temperature combination not available on the cycle setting recommended by the

manufacturer for washing cotton or linen clothes, the cycle setting with the highest energy consumption, as measured according to this section, shall be included in the energy test cycle.

To determine which cycle setting has the highest energy consumption, establish the testing conditions set forth in section 2 of this test procedure. Select the applicable cycle setting and temperature combination. Use the manufacturer default settings for agitation/tumble operation, soil level, spin speed(s), wash times, rinse times, and all other wash parameters or optional features applicable to that cycle, including water heating time for water heating clothes washers. Each wash cycle tested under this section shall comprise the entire active washing mode and exclude any delay start or cycle finished modes.

To identify the cycle setting with the highest energy consumption, use the clothes washer's maximum test load size, determined from Table 5.1. For clothes washers with a manual water fill control system, user-adjustable adaptive water fill control system, or adaptive water fill control system with alternate manual water fill control system, use the water fill selector setting resulting in the maximum water level available for each cycle setting.

Measure each cycle setting's electrical energy consumption (E_B) and hot water consumption (H_B). Calculate the total energy consumption for each cycle setting (E_{TB}), as follows:

$E_{TB} = E_B + (H_B \times T \times K)$

where:

E_B is the electrical energy consumption, expressed in kilowatt-hours per cycle.

H_B is the hot water consumption, expressed in gallons per cycle.

T = temperature rise = 75 °F (41.7 °C)

K = Water specific heat in kilowatt-hours per gallon per degree F = 0.00240 (0.00114 kWh/L-°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 ºF±5 ºF (15.6 ºC±2.8 ºC) or 100 ºF±10 ºF (37.8 ºC±5.5 ºC) 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:

$$Tw(\,^{\circ}F)=((Hw\times 135\,^{\circ}F)+(Cw\times 60\,^{\circ}F))/(Hw+Cw)$$

or

$$Tw(\,^{\circ}C)=((Hw\times 57.2\,^{\circ}C)+(Cw\times 15.6\,^{\circ}C))/(Hw+Cw)$$

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 of this appendix. Then the average of the two values (one from each mode, adaptive and manual) for each variable shall be used in section 4 of this appendix 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 ºF (57.2 ºC)**			**>135 ºF (57.2 ºC)****	
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 ºF (57.2 ºC)
†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 sections 3.3.1 through 3.3.3 of this appendix 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 sections 3.4.1 through 3.4.3 of this appendix 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 sections 3.5.1 through 3.5.2.3 of this appendix 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 sections 3.6.1 through 3.6.3 of this appendix for the coldest wash temperature selection available. For a clothes washer that offers two or more wash temperature settings labeled as cold, such as "Cold" and "Tap Cold", the setting with the minimum wash temperature shall be considered the cold wash. If any of the other cold wash temperature settings add hot water to raise the wash temperature above the cold water supply temperature, as defined in section 2.3 of this appendix, those setting(s) shall be considered warm wash setting(s), as defined in section 1.34 of this appendix. If none of the cold wash temperature settings add hot water for any of the water fill levels or test load sizes required for the energy test cycle, the wash temperature setting labeled as "Cold" shall be considered the cold wash, and the other wash temperature setting(s) labeled as cold shall not be required for testing.

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 sections 3.7.2.1 through 3.7.2.3 of this appendix for the applicable warm wash temperature selection as described in section 3.7.1 or 3.7.2 of this appendix 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 (≤135ºF (57.2ºC)) 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 (≤135ºF (57.2ºC)) 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 and section 3.1 of this appendix 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 sections 3.8.2.1 through 3.8.2.4 of this appendix 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 sections 3.8.2.1 through 3.8.2.4 of this appendix 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 section 3.8.2 or 3.8.3 of this appendix. 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 of this appendix 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 sections 3.9.1 through 3.9.3 of this appendix 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 Combined low-power mode power. Connect the clothes washer to a watt meter as specified in section 2.5.3 of this appendix. Establish the testing conditions set forth in sections 2.1, 2.2 and 2.11 of this appendix. For clothes washers that take some time to enter a stable state from a higher 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 for the sampling method specified in Section 5, Paragraph 5.3.2 of IEC 62301 for testing in each possible mode as described in sections 3.11.1 and 3.11.2 of this appendix.

3.11.1 If a clothes washer has an inactive mode as defined in section 1.15 of this appendix, measure and record the average inactive mode power of the clothes washer, P_{ia}, in watts.

3.11.2 If a clothes washer has an off mode as defined in section 1.23 of this appendix, measure and record its average off mode power, P_o, in watts.

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 of this appendix.

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 of this appendix.

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 of this appendix.

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 of this appendix.

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 of this appendix.

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 of this appendix.

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 ºF**	**≤135 ºF**	**≤135 ºF**	**>135 ºF**	**>135 ºF**	**Steam**	**Steam**
	(57.2 ºC)	**(**57.2 ºC)	**(**57.2 ºC)	**(**57.2 ºC)	**(**57.2 ºC)		
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 kWh/gal-°F (0.00114 kWh/L-°C).

Vh_x, Vh_a, and Vh_n are as defined in section 4.1.1 of this appendix.

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 section 4.1.2 of this appendix.

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} = ……...	0.72[1]	0.12[2]
F_{avg} = ……	…….	0.74[2]
F_{min} = ……...	0.28[1]	0.14[2]

[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 section 4.1.3 of this appendix.

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 section 4.1.5 of this appendix.

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 section 4.1.6 of this appendix.

HE_T=As defined in section 4.1.3 of this appendix.

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

$$HE_{sc} = [H_{sc} \times T \times K] \times 12/295$$

where:

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

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).

12 = Representative average number of clothes washer self-clean cycles in a year.

295 = Representative average number of clothes washer cycles in a year.

4.1.9 Per-cycle self-clean hot water energy consumption using gas-heated or oil-heated water. Calculate the per-cycle self-clean hot water energy consumption, HE_{SCG}, using gas-heated or oil-heated water, expressed in Btu per cycle (or megajoules per cycle) and defined as:

$$HE_{SCG}=[HE_{SC}\times 1/e\times 3412\ Btu/kWh]\times 12/295 \text{ or } HE_{SCG}=[HE_{T}\times 1/e\times 3.6\ MJ/kWh]\times 12/295$$

where:

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

HE_{sc}=As defined in section 4.1.8 of this appendix.

12 = Representative average number of clothes washer self-clean cycles in a year.

295 = Representative average number of clothes washer cycles in a year.

4.1.10 Per-cycle self-clean machine electrical energy consumption. Calculate the per-cycle self-clean machine electrical energy consumption, ME_{sc}, expressed in kilowatt-hours per cycle, and defined as:

$$ME_{sc} = E_{sc}\times 12/295$$

where:

E_{sc} = Reported electrical energy consumption value, in gallons per-cycle, for the self-clean cycle as defined in section 3.10 of this appendix.

12 = Representative average number of clothes washer self-clean cycles in a year.

295 = Representative average number of clothes washer cycles in a year.

4.2 Water consumption of clothes washers.

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 section 3.9 of this appendix.

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 section 3.3 of this appendix.

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 section 3.4 of this appendix.

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 section 3.5 of this appendix.

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 section 3.7 of this appendix.

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 section 3.6 of this appendix.

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 section 4.2.1 of this appendix.

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 section 4.2.2 of this appendix.

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 section 4.2.3 of this appendix.

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 section 4.2.4 of this appendix.

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, Qw_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 section 4.2.5 of this appendix.

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 section 4.2.6 of this appendix.

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 sections 4.2.7 through 4.2.12 of this appendix.

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:

$$Q_{sc} = [H_{sc}+C_{sc}] \times 12/295$$

where:

H_{sc}= As defined in section 3.10 of this appendix.

C_{sc}= As defined in 3.10 of this appendix.

12 = Representative average number of clothes washer self-clean cycles in a year.

295 = Representative average number of clothes washer cycles in a year.

4.2.15 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 section 4.2.12 of this appendix.

C=As defined in section 3.1.5 of this appendix.

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 section 4.2.13 of this appendix.

Q_{sc}= As defined in section 4.2.14 of this appendix.

C= As defined in section 3.1.5 of this appendix.

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=[(F_{max}×Maximum test load weight)+(F_{avg}×Average test load weight)+(F_{min}×Minimum test load weight)]×(RMC–4%)×(DEF)×(DUF)

where:

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

Maximum, average, and minimum test load weights are as defined in Table 5.1 of this appendix.

RMC=As defined in section 3.8.2.5, 3.8.3.3, or 3.8.4 of this appendix.

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 combined low-power mode energy consumption. Calculate the clothes washer combined low-power mode energy consumption per cycle, E_{TLP}, expressed in kilowatt-hours per cycle and defined as:

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

where:

P_{ia}= Washer inactive mode power, in watts, as defined in section 3.11.1 of this appendix for clothes washers capable of operating in inactive mode; otherwise, P_{ia}=0.

P_o = Washer off mode power, in watts, as defined in section 3.11.2 of this appendix for clothes washers capable of operating in off mode; otherwise, P_o=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.

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.

S_{oi}= Combined annual hours for off and inactive mode=8,465.

K_p= Conversion factor of watt-hours to kilowatt-hours=0.001.

295 = Representative average number of clothes washer cycles in a year.

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:

$$E_{TSC} = HE_{sc}+ME_{sc}$$

where:

HE_{sc}= As defined in section 4.1.8 of this appendix.

ME_{sc}= As defined in section 4.1.10 of this appendix.

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 section 3.1.5 of this appendix.

E_{TE}=As defined in section 4.1.7 of this appendix.

D_E=As defined in section 4.3 of this appendix.

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:

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

where:

C=As defined in section 3.1.5 of this appendix.

E_{TE}=As defined in section 4.1.7 of this appendix.

D_E=As defined in section 4.3 of this appendix.

E_{TLP}=As defined in section 4.4 of this appendix.

E_{TSC}=As defined in section 4.5 of this appendix.

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	3.00	1.36	3.00	1.36	3.00	1.36
0.80–0.90	22.7–25.5	3.00	1.36	3.50	1.59	3.25	1.47
0.90–1.00	25.5–28.3	3.00	1.36	3.90	1.77	3.45	1.56
1.00–1.10	28.3–31.1	3.00	1.36	4.30	1.95	3.65	1.66
1.10–1.20	31.1–34.0	3.00	1.36	4.70	2.13	3.85	1.75
1.20–1.30	34.0–36.8	3.00	1.36	5.10	2.31	4.05	1.84
1.30–1.40	36.8–39.6	3.00	1.36	5.50	2.49	4.25	1.93
1.40–1.50	39.6–42.5	3.00	1.36	5.90	2.68	4.45	2.02
1.50–1.60	42.5–45.3	3.00	1.36	6.40	2.90	4.70	2.13
1.60–1.70	45.3–48.1	3.00	1.36	6.80	3.08	4.90	2.22
1.70–1.80	48.1–51.0	3.00	1.36	7.20	3.27	5.10	2.31
1.80–1.90	51.0–53.8	3.00	1.36	7.60	3.45	5.30	2.4
1.90–2.00	53.8–56.6	3.00	1.36	8.00	3.63	5.50	2.49
2.00–2.10	56.6–59.5	3.00	1.36	8.40	3.81	5.70	2.59
2.10–2.20	59.5–62.3	3.00	1.36	8.80	3.99	5.90	2.68
2.20–2.30	62.3–65.1	3.00	1.36	9.20	4.17	6.10	2.77
2.30–2.40	65.1–68.0	3.00	1.36	9.60	4.35	6.30	2.86
2.40–2.50	68.0–70.8	3.00	1.36	10.00	4.54	6.50	2.95
2.50–2.60	70.8–73.6	3.00	1.36	10.50	4.76	6.75	3.06
2.60–2.70	73.6–76.5	3.00	1.36	10.90	4.94	6.95	3.15
2.70–2.80	76.5–79.3	3.00	1.36	11.30	5.13	7.15	3.24
2.80–2.90	79.3–82.1	3.00	1.36	11.70	5.31	7.35	3.33
2.90–3.00	82.1–85.0	3.00	1.36	12.10	5.49	7.55	3.42
3.00–3.10	85.0–87.8	3.00	1.36	12.50	5.67	7.75	3.52
3.10–3.20	87.8–90.6	3.00	1.36	12.90	5.85	7.95	3.61
3.20–3.30	90.6–93.4	3.00	1.36	13.30	6.03	8.15	3.7
3.30–3.40	93.4–96.3	3.00	1.36	13.70	6.21	8.35	3.79
3.40–3.50	96.3–99.1	3.00	1.36	14.10	6.40	8.55	3.88
3.50–3.60	99.1–101.9	3.00	1.36	14.60	6.62	8.80	3.99
3.60–3.70	101.9–104.8	3.00	1.36	15.00	6.80	9.00	4.08
3.70–3.80	104.8–107.6	3.00	1.36	15.40	6.99	9.20	4.17
3.80-3.90	107.6-110.4	3.00	1.36	15.80	7.16	9.40	4.26
3.90-4.00	110.4-113.3	3.00	1.36	16.20	7.34	9.60	4.35
4.00-4.10	113.3-116.1	3.00	1.36	16.60	7.53	9.80	4.45
4.10-4.20	116.1-118.9	3.00	1.36	17.00	7.72	10.00	4.54
4.20-4.30	118.9-121.8	3.00	1.36	17.40	7.90	10.20	4.63

Container volume		Minimum load		Maximum load		Average load	
cu. ft.	liter	lb	kg	Lb	kg	lb	Kg
≥ <	≥ <						
4.30-4.40	121.8-124.6	3.00	1.36	17.80	8.09	10.40	4.72
4.40-4.50	124.6-127.4	3.00	1.36	18.20	8.27	10.60	4.82
4.50-4.60	127.4-130.3	3.00	1.36	18.70	8.46	10.85	4.91
4.60-4.70	130.3-133.1	3.00	1.36	19.10	8.65	11.05	5.00
4.70-4.80	133.1-135.9	3.00	1.36	19.50	8.83	11.25	5.10
4.80-4.90	135.9-138.8	3.00	1.36	19.90	9.02	11.45	5.19
4.90-5.00	138.8-141.6	3.00	1.36	20.30	9.20	11.65	5.28
5.00-5.10	141.6-144.4	3.00	1.36	20.70	9.39	11.85	5.38
5.10-5.20	144.4-147.2	3.00	1.36	21.10	9.58	12.05	5.47
5.20-5.30	147.2-150.1	3.00	1.36	21.50	9.76	12.25	5.56
5.30-5.40	150.1-152.9	3.00	1.36	21.90	9.95	12.45	5.65
5.40-5.50	152.9-155.7	3.00	1.36	22.30	10.13	12.65	5.75
5.50-5.60	155.7-158.6	3.00	1.36	22.80	10.32	12.90	5.84
5.60-5.70	158.6-161.4	3.00	1.36	23.20	10.51	13.10	5.93
5.70-5.80	161.4-164.2	3.00	1.36	23.60	10.69	13.30	6.03
5.80-5.90	164.2-167.1	3.00	1.36	24.00	10.88	13.50	6.12
5.90-6.00	167.1-169.9	3.00	1.36	24.40	11.06	13.70	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 Nonconventional 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 if the washer cannot be tested pursuant to the DOE test procedure or the DOE test procedure yields results that are so unrepresentative of the clothes washer's true energy consumption characteristics as to provide materially inaccurate comparative data. In such cases, 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 of this appendix 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×(D/B)=G kWh per year

6.3 Adaptive water fill control system field test. Section 3.2.3.1 of this appendix 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 of this appendix 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 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 this appendix 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 manual control selection)

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

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