DEPARTMENT OF ENERGY

10 CFR Parts 429, 430 and 431

[EERE–2016–BT–TP–0011]

RIN 1904–AD95

Energy Conservation Program: Test Procedures for Residential and Commercial Clothes Washers

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

ACTION: Notice of proposed rulemaking, request for comment, and announcement of webinar.

SUMMARY: The U.S. Department of Energy (''DOE'') proposes to amend the test procedures for residential and commercial clothes washers to specify test conditions, instrument specifications, and test settings; address large clothes container capacities; add product-specific enforcement provisions; delete obsolete provisions; and consolidate all test cloth-related provisions and codify additional test cloth material verification procedures used by industry. DOE also proposes to create a new test procedure for residential and commercial clothes washers with additional modifications for certain test conditions, measurement of average cycle time, required test cycles, tested load sizes, semi-automatic clothes washer provisions, new performance metrics, and updated usage factors. The proposed new test procedure would be used for the evaluation and issuance of updated efficiency standards, as well as to determine compliance with the updated standards. As part of this proposal, DOE is announcing a webinar to collect comments and data on this proposal. DOE is seeking comment from interested parties on the proposal.

DATES: DOE will accept comments, data, and information regarding this proposal no later than November 1, 2021. See section V, ''Public Participation,'' for details. DOE will hold a webinar on Tuesday, September 14, 2021, from 10:00 a.m. to 3:00 p.m. See section V, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov.* Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, by email to the following address: *ResClothesWasher2016TP0011@ee.doe.gov.* Include ''Energy Conservation Program: Test Procedures for Residential and Commercial Clothes Washers'' and docket number EERE–2016–BT–TP–0011 and/or RIN number 1904–AD95 in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including postal mail and hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing corona virus 2019 (''COVID–19'') pandemic. DOE is currently accepting only electronic submissions at this time. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586–1445 to discuss the need for alternative arrangements. Once the COVID–19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

No telefacsimilies (''faxes'') will be accepted. For detailed instructions on submitting comments and additional information on the rulemaking process, see section V of this document.

Docket: The docket, which includes **Federal Register** notices, public meeting attendee lists and transcripts (if a public meeting is held), comments, and other supporting documents/materials, is available for review at *www.regulations.gov.* All documents in the docket are listed in the *www.regulations.gov* index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

The docket web page can be found at *www.regulations.gov/docket/EERE-2016-BT-TP-0011.* The docket 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 *www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT:

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Ms. Kathryn McIntosh, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–2002. Email: *Kathryn.McIntosh@hq.doe.gov.*

For further information on how to submit a comment, review other public comments and the docket, or participate in the webinar, contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

SUPPLEMENTARY INFORMATION: DOE proposes to incorporate by reference the following standards into part 430.

American Association of Textile Chemists and Colorists (''AATCC'') Test Method 79–2010, ''Absorbency of Textiles,'' Revised 2010.

AATCC Test Method 118–2007, ''Oil Repellency: Hydrocarbon Resistance Test,'' Revised 2007.

AATCC Test Method 135–2010, ''Dimensional Changes of Fabrics after Home Laundering,'' Revised 2010.

Copies of AATCC test methods can be obtained from AATC, P.O. Box 12215, Research Triangle Park, NC 27709, (919) 549–3526, or by going to *www.aatcc.org.*

International Electrotechnical Commission (''IEC'') 62301, ''Household electrical appliances—Measurement of standby power,'' (Edition 2.0, 2011–01).

Copies of IEC 62301 are available from the American National Standards Institute, 25 W 43rd Street, 4th Floor, New York, NY 10036, (212) 642–4900, or by going to *webstore.ansi.org.*

For a further discussion of these standards, see section IV.M of this document.

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I. Authority and Background

Consumer (residential) clothes washers (''RCWs'') are included in the list of ''covered products'' for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6292(a)(7)) DOE's energy conservation standards and test procedures for RCWs are currently prescribed at title 10 of the Code of Federal Regulations (''CFR''), part 430 section 23(j), and subpart B appendices J1 (''Appendix J1'') and J2 (''Appendix J2''). DOE also prescribes a test method for measuring the moisture absorption and retention characteristics of new lots of energy test cloth, which is used in testing clothes washers, at appendix J3 to subpart B (''Appendix J3''). Commercial clothes washers (''CCWs'') are included in the list of ''covered equipment'' for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6311(1)(H)) The test procedures for CCWs must be the same as those established for RCWs. (42 U.S.C. 6314(a)(8)) The following sections discuss DOE's authority to establish test procedures for RCWs and CCWs and relevant background information regarding DOE's consideration of test procedures for these products and equipment.

A. Authority

The Energy Policy and Conservation Act, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B[2] of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles, which sets forth a variety of provisions designed to improve energy efficiency. These products include RCWs. (42 U.S.C. 6292(a)(7)) Title III, Part C[3] of EPCA, added by Public Law 95–619, Title IV, section 441(a), established the Energy Conservation Program for Certain Industrial Equipment. This equipment includes CCWs. (42 U.S.C. 6311(1)(H)) Both RCWs and CCWs are the subject of this document.

The energy conservation program under EPCA consists essentially of four parts: (1) Testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291; 42 U.S.C. 6311), test procedures (42 U.S.C. 6293; 42 U.S.C. 6314), labeling provisions (42 U.S.C. 6294; 42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6295; 42 U.S.C. 6313), and the authority to require information and reports from manufacturers (42 U.S.C. 6296; 42 U.S.C. 6316).

The Federal testing requirements consist of test procedures that manufacturers of covered products must use as the basis for: (1) Certifying to DOE that their products comply with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6295(s); 42 U.S.C. 6316(a)), and (2) making representations about the efficiency of those consumer products (42 U.S.C. 6293(c); 42 U.S.C. 6314(d)). Similarly, DOE must use these test procedures to determine whether the products and equipment comply with relevant standards promulgated under EPCA. (42 U.S.C. 6295(s); 42 U.S.C. 6316(a))

Federal energy efficiency requirements for covered products and equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297; 42 U.S.C. 6316(a) and (b)) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6297(d); 42 U.S.C. 6316(b)(2)(D))

Under 42 U.S.C. 6293 and 42 U.S.C. 6314, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered products and equipment, respectively. EPCA requires that any test procedures prescribed or amended under this section be reasonably designed to produce test results which measure energy efficiency, energy use or estimated annual operating cost of a covered product or equipment during a representative average use cycle or period of use and not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3); 42 U.S.C. 6314(a)(2))

In addition, EPCA requires that DOE amend its test procedures for all covered products to integrate measures of standby mode and off mode energy consumption. (42 U.S.C. 6295(gg)(2)(A))

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020).

[2] For editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.

[3] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A–1.

Standby mode and off mode energy consumption must be incorporated into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product unless the current test procedures already account for and incorporate standby and off mode energy consumption or such integration is technically infeasible. If an integrated test procedure is technically infeasible, DOE must prescribe a separate standby mode and off mode energy use test procedure for the covered product, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)(ii)) [4] Any such amendment must consider the most current versions of the IEC Standard 62301 [5] and IEC Standard 62087 [6] as applicable. (42 U.S.C. 6295(gg)(2)(A))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered product, including RCWs, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(1)(A))

If the Secretary determines, on his own behalf or in response to a petition by any interested person, that a test procedure should be prescribed or amended, the Secretary shall promptly publish in the **Federal Register** proposed test procedures and afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such procedures. (42 U.S.C. 6293(b)(2)) The comment period on a proposed rule to amend a test procedure shall be at least 60 days and may not exceed 270 days.[7] *Id.* In prescribing or amending a test procedure, the Secretary shall take into account such information as the Secretary determines relevant to such procedure, including technological developments relating to energy use or energy efficiency of the type (or class) of covered products involved. *Id.* If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures.

EPCA requires the test procedures for CCWs to be the same as the test procedures established for RCWs. (42 U.S.C. 6314(a)(8)) As with the test procedures for RCWs, EPCA requires that DOE evaluate, at least once every 7 years, the test procedures for CCWs to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle. (42 U.S.C. 6314(a)(1))

DOE is publishing this notice of proposed rulemaking (''NOPR'') in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6293(b)(1)(A); 42 U.S.C.6314(a)(1))

B. Background

As discussed, DOE's existing test procedures for clothes washers appear in Appendix J1, Appendix J2, and Appendix J3.

DOE originally established its clothes washer test procedure, codified at 10 CFR part 430, subpart B, appendix J (''Appendix J''),[8] in a final rule published Sept. 28, 1977. 42 FR 49802 (''September 1977 Final Rule''). Since that time, the test procedure has undergone several amendments that are relevant to this rulemaking, summarized as follows and described in additional detail in a request for information (''RFI'') that DOE published on May 22, 2020. 85 FR 31065 (''May 2020 RFI'').

DOE amended Appendix J in August 1997 (62 FR 45484 (Aug. 27, 1997); ''August 1997 Final Rule'') and January 2001 (66 FR 3313 (Jan. 12, 2001); ''January 2001 Final Rule''). The August 1997 Final Rule also established an Appendix J1. 62 FR 45484. DOE amended Appendix J1 in the January 2001 Final Rule (66 FR 3313) and in March 2012. 77 FR 13887 (Mar. 7, 2012) (''March 2012 Final Rule''). The March 2012 Final Rule also established a new test procedure at Appendix J2 and removed the obsolete Appendix J–2001. *Id.*[9]

DOE most recently amended both Appendix J1 and Appendix J2 in a final rule published on August 5, 2015. 80 FR 46729 (''August 2015 Final Rule''). The August 2015 Final Rule also moved the test cloth qualification procedures from Appendix J1 and Appendix J2 to the newly created Appendix J3. 80 FR 46729, 46735.

The current version of the test procedure at Appendix J2 includes provisions for determining modified energy factor (''MEF'') and integrated modified energy factor (''IMEF'') in cubic feet per kilowatt-hour per cycle (''ft^3/kWh/cycle''); and water factor (''WF'') and integrated water factor (''IWF'') in gallons per cycle per cubic feet (''gal/cycle/ft^3''). RCWs manufactured on or after January 1, 2018, must meet current energy conservation standards, which are based on IMEF and IWF, determined using Appendix J2. 10 CFR 430.32(g)(4); 10 CFR 430.23(j)(2)(ii) and (4)(ii). CCWs manufactured after January 1, 2018 must meet current energy conservation standards, which are based on MEF and IWF, determined using Appendix J2. 10 CFR 431.154 and 10 CFR 431.156(b).

DOE published the May 2020 RFI to initiate an effort to determine whether to amend the current test procedures for clothes washers. 85 FR 31065. DOE requested comment on specific aspects of the current test procedure, including product definitions and configurations, testing conditions and instrumentation,

[4] EPCA does not contain an analogous provision for commercial equipment.

[5] IEC 62301, *Household electrical appliances—Measurement of standby power* (Edition 2.0, 2011–01).

[6] IEC 62087, *Methods of measurement for the power consumption of audio, video, and related equipment* (Edition 3.0, 2011–04).

[7] DOE has historically provided a 75-day comment period for test procedure NOPRs, consistent with the comment period requirement for technical regulations in the North American Free Trade Agreement, U.S.-Canada-Mexico (''NAFTA''), Dec. 17, 1992, 32 I.L.M. 289 (1993); the North American Free Trade Agreement Implementation Act, Public Law 103–182, 107 Stat. 2057 (1993) (codified as amended at 10 U.S.C.A. § 2576) (1993) (''NAFTA Implementation Act''); and Executive Order 12889, ''Implementation of the North American Free Trade Agreement,'' 58 FR 69681 (Dec. 30, 1993). However, Congress repealed the NAFTA Implementation Act and has replaced NAFTA with the Agreement between the United States of America, the United Mexican States, and the United Canadian States (''USMCA''), Nov. 30, 2018, 134 Stat. 11, thereby rendering E.O. 12889 inoperable. Consequently, since the USMCA is consistent with EPCA's public comment period requirements and normally requires only a minimum comment period of 60 days for technical regulations, DOE now provides a 60-day public comment period for test procedure NOPRs.

[8] In this NOPR, to distinguish different versions of each test method, DOE uses the following nomenclature: Appendix [letter]-[year of amendment]. For example, the original version of Appendix J is referred to as Appendix J–1977. The version as amended by the August 1997 Final Rule is referred to as Appendix J–1997, and so forth.

[9] In that rulemaking, DOE also adopted procedures to measure standby mode and off mode energy consumption into the energy efficiency metrics in the then-newly created Appendix J2. Manufacturers were not required to incorporate those changes until the compliance date of an amended standard. 77 FR 13887, 13932. Amended standards were then adopted through a direct final rule that required the use of Appendix J2 for RCWs manufactured on or after the 2015 compliance date. 77 FR 32308, 32313 (May 31, 2012). The newly proposed Appendix J in this NOPR follows a similar approach because manufacturers would not be required to incorporate the amendments proposed in Appendix J until the compliance date of an amended standard.

measurement methods, representative usage and efficiency factors, and metric definitions. 85 FR 31065, 31067–31082 (May 22, 2020). In response to stakeholder requests, DOE re-opened the comment period for the May 2020 RFI. 85 FR 38106 (June 25, 2020).

On December 16, 2020, DOE established separate product classes for top-loading RCWs with a cycle time of less than 30 minutes and for front-loading RCWs with a cycle time of less than 45 minutes. 85 FR 81359 (''December 2020 Final Rule''). DOE is re-evaluating the new short-cycle product classes in response to Executive Order 13900, ''Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis.'' 86 FR 7037 (Jan. 25, 2021). In addition, stakeholders and interested parties filed multiple lawsuits challenging the December 2020 Final Rule, and DOE has received several petitions for reconsideration of the December 2020 Final Rule.

DOE received comments in response to the May 2020 RFI from the interested parties listed in Table I.1.

TABLE I.1—WRITTEN COMMENTS RECEIVED IN RESPONSE TO MAY 2020 RFI

Commenter(s)	Reference in this NOPR	Commenter type
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Consumer Federation of America, National Consumer Law Center, Natural Resources Defense Council.	Joint Commenters	Efficiency Organizations.
Association of Home Appliance Manufacturers	AHAM	Trade Association.
Electrolux Home Products	Electrolux	Manufacturer.
GE Appliances	GEA	Manufacturer.
Northwest Energy Efficiency Alliance	NEEA	Efficiency Organization.
Pacific Gas and Electric Company, Southern California Edison, San Diego Gas & Electric Company.	California Investor-Owned Utilities (''CA IOUs'').	Utilities.
Samsung Electronics America	Samsung	Manufacturer.
Underwriters Laboratories	UL	Third-Party Test Laboratory.
Whirlpool Corporation	Whirlpool	Manufacturer.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[10]

II. Synopsis of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to update Appendix J2 as follows:

(1) Further specify supply water temperature test conditions and water meter resolution requirements;

(2) Add specifications for measuring wash water temperature using submersible data loggers;

(3) Expand the load size table to accommodate clothes container capacities up to 8.0 cubic feet (''ft^3'');

(4) Define ''user-adjustable automatic water fill control;''

(5) Specify the applicability of the wash time setting for clothes washers with a range of wash time settings;

(6) Specify how the energy test cycle flow charts apply to clothes washers that internally generate hot water;

(7) Specify that the energy test cycle flow charts are to be evaluated using the Maximum load size;

(8) Specify that testing is to be conducted with any network settings disabled if instructions are available to the user to disable these functions;

(9) Further specify the conditions under which data from a test cycle would be discarded;

(10) Add product-specific enforcement provisions to accommodate the potential for test cloth lot-to-lot variation in remaining moisture content (''RMC'');

(11) Delete obsolete definitions, metrics, and the clothes washer-specific waiver section; and

(12) Move additional test cloth related specifications to Appendix J3.

In this NOPR, DOE is also proposing to update 10 CFR part 430, subpart B, appendix J3, ''Uniform Test Method for Measuring the Moisture Absorption and Retention Characteristics,'' as follows:

(1) Consolidate all test cloth-related provisions, including those proposed to be moved from Appendix J2;

(2) Reorganize sections for improved readability; and

(3) Codify the test cloth material verification procedure as used by industry.

In this NOPR, DOE is also proposing to create a new appendix J to 10 CFR part 430, subpart B, ''Uniform Test Method for Measuring the Energy Consumption of Automatic and Semi-Automatic Clothes Washers,'' which would be used for the evaluation and issuance of any updated efficiency standards, as well as to determine compliance with the updated standards, should DOE determine that amended standards are warranted based on the criteria established by EPCA.[11] The proposed new Appendix J would include the following additional provisions beyond those proposed as amendments to Appendix J2:

(1) Modify the hot water supply target temperature and clothes washer pre-conditioning requirements;

(2) Modify the Extra-Hot Wash threshold temperature;

(3) Add measurement and calculation of average cycle time;

(4) Reduce the number of required test cycles by requiring the use of no more than two Warm Wash/Cold Rinse cycles, and no more than two Warm Wash/Warm Rinse cycles;

(5) Reduce the number of required test cycles by removing the need for one or more cycles used for measuring RMC;

(6) Reduce the number of load sizes from three to two for units with automatic water fill controls;

(7) Modify the load size definitions consistent with two, rather than three, load sizes;

(8) Update the water fill levels to be used for testing to reflect the modified load size definitions;

(9) Specify the installation of single-inlet clothes washers, and simplify the test procedure for semi-automatic clothes washers;

(10) Define new performance metrics that are functions of the weighted-average load size rather than clothes

[10] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for clothes washers. (Docket No. EERE–2016–BT–TP–0011, which is maintained at *www.regulations.gov/docket/EERE-2016-BT-TP-0011*). The references are arranged as follows: (Commenter name, comment docket ID number, page of that document).

[11] Information regarding the ongoing RCW and CCW energy conservation standards rulemakings can be found at docket numbers EERE–2017–BT–STD–0014 and EERE–2019–BT–STD–0044, respectively.

container capacity: ''energy efficiency ratio,'' ''active-mode energy efficiency ratio,'' and ''water efficiency ratio;''

(11) Update the number of annual clothes washer cycles from 295 to 234; and

(12) Update the number of hours assigned to low-power mode to be based on the clothes washer's measured cycle time rather than an assumed fixed value.

Finally, in this NOPR, DOE is proposing to remove Appendix J1 and to update the relevant sections of 10 CFR parts 429, 430 and 431 in accordance with the edits discussed previously, and to modify the product-specific enforcement provisions regarding the determination of RMC.

DOE's proposed actions are summarized in Table II.1 compared to the current test procedures as well as the reason for the proposed change.

TABLE II.1—SUMMARY OF CHANGES IN PROPOSED TEST PROCEDURES RELATIVE TO CURRENT TEST PROCEDURES

Current DOE test procedure	Proposed test procedure	Attribution
Specifies a water meter resolution of no larger than 0.1 gallons.	Requires a water meter with a resolution no larger than 0.01 gallons if the hot water use is less than 0.1 gallons, in Appendices J and J2.	Improve representativeness of test results.
Does not specify how to install clothes washers with a single inlet.	Specifies installing clothes washers with a single inlet to the cold water inlet, in Appendix J.	Provide further direction for unaddressed feature.
Specifies a hot water supply temperature of 130–135 °F.	Specifies a hot water supply temperature of 120–125 °F, in Appendix J.	Improve representativeness of test results.
Defines the Extra-Hot Wash threshold as 135 °F	Specifies an Extra-Hot Wash threshold of 140 °F, in Appendix J.	Improve representativeness of test results.
Specifies a target water supply temperature at the high end of the water supply temperature range.	Removes the target water temperature specification, in Appendices J and J2.	Reduce test burden.
Specifically allows the use of temperature indicating labels for measuring wash water temperature.	Adds specification for using a submersible temperature logger to measure wash water temperature, in Appendices J and J2.	Reduce test burden.
Specifies different pre-conditioning requirements for water-heating and non-water-heating clothes washers.	Requires the same pre-conditioning requirements for all clothes washers, in Appendix J.	Improve reproducibility of test results.
Specifies the test load sizes for clothes container capacities up to 6.0 ft^3.	Specifies the test load sizes for clothes container capacities up to 8.0 ft^3, in Appendices J and J2.	Response to waiver.
Requires 3 tested load sizes on clothes washers with automatic water fill control systems.	Reduces the number of load sizes to test to 2, and specifies new load sizes, in Appendix J.	Reduce test burden.
Defines load sizes for each 0.1 ft^3 increment in clothes container capacity.	Redefines load sizes for each increment in clothes container capacity, consistent with reduction from 3 to 2 load sizes, in Appendix J.	Maintain representativeness.
Defines water fill levels to use with each tested load sizes on clothes washers with manual water fill control systems.	Changes the water fill levels consistent with the updated load sizes, in Appendix J.	Maintain representativeness.
Requires testing up to 3 Warm Wash temperature selections.	Requires testing a maximum of 2 Warm Wash temperature selections, in Appendix J.	Reduce test burden.
Specifies that the RMC is to be measured on separate cycle(s) from the energy test cycle.	Specifies that the RMC is to be measured on all energy test cycles, in Appendix J.	Reduce test burden, improve representativeness of test results.
Provides product-specific enforcement provisions to address anomalous RMC results that are not representative of a basic model's performance.	Provides additional product-specific enforcement provisions to accommodate differences in RMC values that may result from DOE using a different test cloth lot than was used by the manufacturer for testing and certifying the basic model, for Appendices J and J2.	Accommodate potential source of variation in enforcement testing.
Specifies that the starting weight of the test cloth may be up to 104 percent of bone-dry.	Requires that the test cloth be bone-dry at the start of every test cycle, in Appendix J.	Improve reproducibility of test results.
Does not specify a measure of cycle time	Specifies provisions for measuring cycle time, in Appendix J.	Improve representativeness of test results.
Specifies discarding data from a wash cycle that provides a visual or audio indicator to alert the user that an out-of-balance condition has been detected, or that terminates prematurely if an out-of-balance condition is detected.	Specifies discarding the test data if during a wash cycle the clothes washer signals the user by means of a visual or audio alert that an out-of-balance condition has been detected or terminates prematurely, in Appendices J and J2.	Response to test laboratory question.
Does not explicitly state how to test semi-automatic clothes washers.	Provides explicit test provisions for testing semi-automatic clothes washers, in Appendix J.	Provide further direction for unaddressed feature.
Does not explicitly address the required configuration for network-connected functionality.	Specifies that clothes washers with connected functionality shall be tested with the network-connected functions disabled if such settings can be disabled by the end-user, and the product's user manual provides instructions on how to do so, in Appendices J and J2.	Improve reproducibility of test results.
Defines metrics that are dependent on capacity (IMEF, MEF, IWF).	Specifies new metrics that are dependent on the weighted-average load size, in Appendix J.	Improve representativeness of test results.
Estimates the number of annual use cycles for clothes washers as 295, based on the 2005 Residential Energy Consumption Survey (''RECS'') data.	Updates the estimate to 234 cycles per year, based on the latest available 2015 RECS data, in Appendix J.	Update with more recent consumer usage data.

TABLE II.1—SUMMARY OF CHANGES IN PROPOSED TEST PROCEDURES RELATIVE TO CURRENT TEST PROCEDURES—Continued

Current DOE test procedure	Proposed test procedure	Attribution
Estimates the number of hours spent in low-power mode as 8,465, based on 295 cycles per year and an assumed 1-hour cycle time.	Calculates the number of hours spent in low-power mode for each clothes washer based on 234 cycles per year and measured cycle time, in Appendix J.	Improve representativeness of test results.
Does not specify how to test a clothes washer that does not provide water inlet hoses.	Specifies using a water inlet hose length of no more than 72 inches, in Appendix J.	Response to test laboratory question.
Does not provide an explicit definition for ''user-adjustable automatic water fill controls'' or ''wash time''.	Provides a definition for ''user-adjustable automatic water fill controls,'' in Appendix J and for ''wash time,'' in Appendices J and J2.	Improve readability.
Specifies that user-adjustable automatic clothes washers must be tested with the water fill setting in the most or least energy-intensive setting without defining energy-intensive.	Changes the wording to specify selecting the setting based on the most, or least, amount of water used, in Appendices J and J2.	Response to test laboratory question.
Does not specify on which load size to evaluate the energy test cycle flow charts.	Specifies evaluating the flow charts using the maximum load size for Appendix J2 and the large load size for Appendix J.	Response to test laboratory question, improve reproducibility of test results.
Does not explicitly address how to evaluate the Cold/Cold energy test cycle flow chart for clothes washers that internally generate hot water.	Explicitly addresses clothes washers that internally generate hot water, in Appendices J and J2.	Response to test laboratory question.
Does not provide direction for all control panel styles on clothes washers that offer a range of wash time settings.	Clarifies how to test cycles with a range of wash time settings, in Appendices J and J2.	Improve readability.
Includes test cloth verification specifications in Appendix J2.	Moves all test cloth related provisions to Appendix J3.	Improve readability.
Does not include all aspects of test cloth verification procedures performed by industry.	Codifies additional test cloth verification procedures performed by industry, in Appendix J3.	Codify industry practice.
Contains obsolete provisions	Updates or deletes obsolete provisions, including Appendix J1 in its entirety.	Improve readability.

DOE has tentatively determined that the proposed amendments to Appendix J2 and Appendix J3 described in section III of this document would not alter the measured efficiency of clothes washers, and that the proposed test procedures would not be unduly burdensome to conduct.

DOE has tentatively determined that the proposed amendments in the new Appendix J would alter the measured efficiency of clothes washers, in part because the amended test procedures would adopt a different energy efficiency metric and water efficiency metric than in the current test procedure. Because the proposed new Appendix J would be used for the evaluation and issuance of updated efficiency standards, DOE is proposing that use of new Appendix J, if finalized, would not be required until the compliance date of any updated standards. Discussion of DOE's proposed actions are addressed in detail in section III of this document.

III. Discussion

In the following sections, DOE describes the proposed amendments to the test procedures for residential and commercial clothes washers. This NOPR includes issues identified in previous rulemakings and discusses additional issues that DOE has become aware of since the completion of the August 2015 Final Rule. DOE seeks input from the public to assist with its consideration of the proposed amendments presented in this document. In addition, DOE welcomes comments on other relevant issues that may not specifically be identified in this document.

A. General Comments

DOE received a number of general comments from stakeholders, as summarized below.

AHAM commented generally that no test can be considered ''reasonably designed'' under EPCA if the test is not accurate, repeatable, and reproducible. AHAM stated that test procedures with significant variation do not allow consumers to make informed purchase decisions based on energy use/efficiency and do not adequately serve the purpose of demonstrating compliance with energy conservation standards. (AHAM, No. 5 at p. 2) AHAM also claimed that as energy conservation standards become more stringent, minimizing variation in test procedure results becomes more important because of the need for manufacturers to conservatively rate their products. AHAM asserted that lack of uniform test results requires manufacturers to rate more conservatively, which effectively makes the standard more stringent in practice. *Id.*

AHAM commented that the clothes washer test procedure is one of the most burdensome DOE test procedures for consumer appliances. AHAM provided an example that a full-featured clothes washer (one that includes manual and user-adjustable automatic water fill control systems (''WFCS''), a heater, four warm wash temperatures, warm rinse, and selectable spin speeds) could require more than 70 test cycles per unit under Appendix J2. (AHAM, No. 5 at pp. 4–5) GEA similarly commented that DOE should work to reduce test burden for full-featured clothes washers, stating that requiring 70 individual cycles for a single test of certain clothes washers demonstrates that the clothes washer test procedure has become overly complicated and fails to fulfill the representativeness requirement under the EPCA. (GEA, No. 13 at p. 2)

AHAM requested that if DOE implements any changes that will significantly impact measured energy, DOE should require compliance with the revised test procedure on the same date as the next amended energy conservation standards for clothes washers. (AHAM, No. 5 at p. 16)

Electrolux, GEA, and Whirlpool support AHAM's comments to the RFI. (Electrolux, No. 11 at p. 1; GEA, No. 13 at p. 1; Whirlpool, No. 7 at p. 1) GEA incorporates them into its own comments by reference. (GEA, No. 13 at

p. 1) Whirlpool further supports a reasonable balancing of the DOE test procedure, considering repeatability, reproducibility, representativeness, and testing burden. (Whirlpool, No. 7 at p. 1)

As stated, EPCA requires that any test procedures be reasonably designed to produce test results which measure energy efficiency, energy use or estimated annual operating cost of a covered product or equipment during a representative average use cycle or period of use and not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3); 42 U.S.C. 6314(a)(2)) As described in this NOPR, DOE is proposing a number of changes to be implemented in a proposed new Appendix J that DOE has tentatively concluded would significantly reduce test burden while maintaining or improving the representativeness of test results. In addition, both the amendments to Appendix J2 and the proposed new Appendix J are intended to further improve the repeatability and reproducibility of test results, as described in the relevant sections of this document.

DOE is proposing to establish a new test procedure at a new Appendix J at 10 CFR part 430 subpart B. Any changes to the test procedure that would impact measured efficiency would be provided in this proposed new Appendix J, which DOE would use for the evaluation and issuance of updated efficiency standards. Therefore, DOE is proposing that use of new Appendix J would not be required until the compliance date of any updated standards that are based on new Appendix J. (42 U.S.C. 6295(gg)(2)(C)). DOE also proposes to state in the introductory text to both Appendix J2 and the proposed new Appendix J that Appendix J2 is required to determine compliance with energy conservation standards until any such amended standards are adopted.

B. Scope of Coverage

This NOPR covers those consumer products that meet the definition of ''clothes washer,'' as codified at 10 CFR 430.2.

EPCA does not define the term ''clothes washer.'' DOE has defined a ''clothes washer'' as a consumer product designed to clean clothes, utilizing a water solution of soap and/or detergent and mechanical agitation or other movement, that must be one of the following classes: Automatic clothes washers, semi-automatic clothes washers, and other clothes washers. 10 CFR 430.2.

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

A ''semi-automatic clothes washer'' is a class of clothes washer that is the same as an automatic clothes washer except that user intervention is required to regulate the water temperature by adjusting the external water faucet valves. *Id.*

''Other clothes washer'' means a class of clothes washer that is not an automatic or semi-automatic clothes washer. *Id.*

This NOPR also covers commercial equipment that meets the definition of ''commercial clothes washer.'' ''Commercial clothes washer'' is defined as a soft-mount front-loading or soft-mount top-loading clothes washer that—

(A) Has a clothes container compartment that—

(i) For horizontal-axis clothes washers, is not more than 3.5 cubic feet; and

(ii) For vertical-axis clothes washers, is not more than 4.0 cubic feet; and

(B) Is designed for use in—

(i) Applications in which the occupants of more than one household will be using the clothes washer, such as multi-family housing common areas and coin laundries; or

(ii) Other commercial applications.

(42 U.S.C. 6311(21); 10 CFR 431.452)

DOE is not proposing any changes to the scope of products and equipment covered by its clothes washer test procedures, or to the relevant definitions.

C. Testing Conditions and Instrumentation

1. Water Meter Resolution

Section 2.5.5 of Appendix J2 requires the use of water meters (in the hot and cold water lines) with a resolution no larger than 0.1 gallons and a maximum error no greater than 2 percent of the measured flow rate. DOE has observed that some clothes washers use very small amounts of hot water on some temperature selections, on the order of 0.1 gallons or less. 85 FR 31065, 31069. For example, some clothes washers have both Cold and Tap Cold temperature selections, and the Cold selection may use a fraction of a gallon of hot water. 85 FR 31065, 31070. DOE believes that Appendix J2 may not provide the necessary resolution to accurately and precisely measure the hot water usage of such temperature selections. *Id.* In the May 2020 RFI, DOE requested input on whether to amend section 2.5.5 of Appendix J2 to require that water meters must have a resolution more precise than 0.1 gallons. *Id.*

The Joint Commenters encouraged DOE to require a water meter with greater precision than that of the current specification to ensure that the test procedures are accurately representing energy use. (Joint Commenters, No. 10 at p. 3)

AHAM commented that requiring more precise water meters could provide a benefit by increasing the accuracy of the measurements but could also increase the burden due to the cost of obtaining these meters that could become overly burdensome. (AHAM, No. 5 at p. 7)

GEA supported moving to a 0.01-gallon resolution for water meters. GEA stated that it uses water meters with this resolution and has encountered reproducibility issues when using a water meter with only 0.1-gallon resolution. (GEA, No. 13 at p. 2)

Whirlpool commented that requiring a more precise water meter is not justified. Whirlpool estimates that a manufacturer without these meters installed could face a cost of over $100,000 to purchase and install them, and cautioned that the need for a more precise water meter needs to be balanced with the cost burden. (Whirlpool, No. 7 at p. 1)

DOE has identified clothes washers on the market that use less than 0.1 gallons of hot water on certain temperature selections or load sizes required for testing. In DOE's experience with such clothes washers, the maximum load size typically uses more than 0.1 gallons of hot water on each of the available temperature selections (providing indication of which temperature selections use hot water), whereas the average and minimum load sizes may use a quantity less than 0.1 gallons. For these clothes washers, the existing water meter resolution of 0.1 gallons is insufficient to provide an accurate measurement of hot water consumption, *i.e.,* the volume of hot water measured is less than the resolution of the water meter. To improve the representativeness of the water measurement, DOE is proposing a requirement to use a water meter with greater precision for clothes washers that use less than 0.1 gallons of hot water. DOE's testing suggests that

clothes washers that use such low volumes of heated water represent a minority of units on the market. Requiring greater water meter precision for all clothes washers would represent an undue burden for those clothes washer models for which water meters with the currently required level of precision provide representative results. DOE is therefore proposing that the hot water meter must have a resolution no larger than 0.01 gallons only for clothes washers with hot water usage less than 0.1 gallons in any of the individual cycles within the energy test cycle. All other clothes washers may continue to be tested using a water meter with a resolution no larger than 0.1 gallons. As noted by GEA's comment, some manufacturers may already be using water meters with this greater resolution, and DOE's experience working with third-party laboratories indicates that at least some third-party laboratories already use water meters with this greater resolution.

DOE is proposing to include in section 2.5.5 of both the proposed new Appendix J and Appendix J2 the following specification: ''If the volume of hot water for any individual cycle within the energy test cycle is less than 0.1 gallons (0.4 liters), the hot water meter must have a resolution no larger than 0.01 gallons (0.04 liters).''

DOE requests comment on its proposal to require a hot water meter resolution no larger than 0.01 gallons for clothes washers that use less than 0.1 gallons in any of the individual cycles within the energy test cycle. DOE requests comment on the extent to which manufacturers and test laboratories already use water meters with this greater resolution. DOE also requests comment on whether proposing this requirement for Appendix J2 would require manufacturers to retest any basic models that have already been certified under the existing water meter resolution requirements.

2. Installation of Single-Inlet Machines

Section 2.10 of Appendix J2 provides specifications for installing a clothes washer, referencing both the hot water and cold water inlets. Additionally, section 2.5.5 of Appendix J2 specifies that a water meter must be installed in both the hot and cold water lines. DOE is aware of RCWs on the market that have a single water inlet rather than separate hot and cold water inlets. 85 FR 31065, 31070. DOE has observed two types of single-inlet RCWs: (1) Semi-automatic clothes washers, which are generally intended to be connected to a kitchen or bathroom faucet and which require user intervention to regulate the water temperature by adjusting the external water faucet valves; and (2) automatic clothes washers intended to be connected only to a cold water inlet, and which regulate the water temperature through the use of an internal heating element to generate any hot water used during the cycle. *Id.*

DOE stated in the May 2020 RFI that it understood that a ''Y''-shaped hose or other similar device may be provided by the manufacturer on some automatic models to allow separate cold and hot water supply lines to be connected to the single inlet on the unit; however, other models may not include such a connector. *Id.* In the May 2020 RFI, DOE inadvertently attributed the use of a Y-shaped hose to *automatic* single-inlet clothes washers (*emphasis added*)—rather, DOE intended to describe that *semi-automatic* single-inlet clothes washers may provide or accommodate the use of a Y-shaped hose, based on its experience with testing semi-automatic clothes washers.

For single-inlet semi-automatic clothes washers (*i.e.,* the first example described previously), DOE has observed that these clothes washers are most often designed to be connected to a kitchen or bathroom faucet, with a single hose connecting the faucet to the single inlet on the clothes washer (*i.e.,* both cold and hot water are supplied to the clothes washer through a single hose).[12] The user regulates the water temperature externally by adjusting the faucet(s) to provide cold, warm, or hot water temperatures for the wash and rinse portions of the cycle.

Section 3.2.3.2 of Appendix J2 provides setup instructions for semi-automatic clothes washers regarding the configuration of both cold and hot water faucets during testing. Specifically, the test procedure specifies that to obtain a hot inlet water temperature, open the hot water faucet completely and close the cold water faucet; for a warm inlet water temperature, open both hot and cold water faucets completely; and for a cold inlet water temperature, close the hot water faucet and open the cold water faucet completely. In the laboratory setup defined by section 2.2 of Appendix J2, the cold and hot water supplies are provided as separate hookups, in contrast to most faucets in residential settings, in which the cold and hot water supply lines combine internally within the faucet into a single output. Thus, the instructions in section 3.2.3.2 of Appendix J2 can be conducted only for either a semi-automatic clothes washer with both hot and cold water inlets (of which no such models are currently on the market, according to DOE research), or a single-inlet semi-automatic clothes washer installed with a Y-shaped hose or other similar device that combines the cold and hot water supply lines to connect to the single inlet on the unit (simulating most residential faucets, which combine the cold and hot water supply lines internally, as described). Appendix J2 does not, however, explicitly prescribe the use of a Y-shaped hose.

As described in the May 2020 RFI, without the use of a Y-shaped hose, connecting a single-inlet semi-automatic clothes washer to only a single water supply would limit the available water temperature to either 60 degrees Fahrenheit (''°F'') (provided by the cold water supply) or 135 °F (provided by the hot water supply), based on the supply water specifications currently provided in section 2.2 of Appendix J2. 85 FR 31065, 31070. In effect, only Cold Wash/Cold Rinse or Hot Wash/Hot Rinse could be tested with a single-hose installation. *Id.* As noted, Appendix J2 does not provide explicit direction on how to connect a single-inlet semi-automatic clothes washer to enable testing at other wash/rinse temperatures. *Id.* Therefore, DOE requested information on whether and how consumers using this type of clothes washer adjust their water temperature for the wash and rinse portions of the cycle and requested comments, data, and information on the typical connection and representative average use of single-inlet semi-automatic clothes washers. Additionally, DOE requested information on how manufacturers are currently testing single-inlet semi-automatic clothes washers under Appendix J2. *Id.*

No comments were received regarding installation or testing of single-inlet semi-automatic clothes washers.

Based on the previous discussion, DOE maintains that additional direction in the test procedure is warranted for single-inlet semi-automatic clothes washers to produce test results that reflect representative consumer usage of cold, warm, and hot wash/rinse temperatures. DOE considered three potential changes to address the installation of single-inlet semi-automatic clothes washers: (1) Require the use of a Y-shaped hose, which would be used to connect the single inlet of the clothes washer to both the cold and hot water supply connections; (2) connect the single inlet of the clothes washer to a single water supply

[12] As noted, some models may provide or accommodate a Y-shaped hose to connect the separate cold and hot water faucets or supply lines.

connection with a non-fixed temperature output that can be nominally set to 60 °F (for cold), 97.5 °F (for warm), or 135 °F (for hot), for example; or (3) require connection to only the cold water supply, enabling testing of only the Cold/Cold wash/rinse temperature, and calculate the energy and water performance at other wash/rinse temperatures formulaically from the Cold/Cold cycle data. As discussed in detail in the following paragraphs, DOE is proposing to adopt option 3 in this NOPR.

Regarding option 1, requiring the use of a Y-shaped hose would provide a simple and low-cost approach for testing of cold, warm, and hot wash/rinse temperatures on single-inlet semi-automatic clothes washers. The Y-shaped hose would mimic the functionality provided by most residential faucets, and thus would provide a representative installation setup. However, by connecting the cold and hot lines to each other, differences in water pressure [13] between the two sides can result in unequal and unrepeatable water flow rates through the cold and hot sides.

Regarding option 2, (requiring a non-fixed temperature supply line that can be set to the specified cold, warm, or hot temperature), DOE tentatively concludes that such a requirement could present undue test burden on laboratories that do not currently implement variable-temperature supply water controls and instrumentation, given the relatively low number of single-inlet semi-automatic models on the market that would be tested each year. In addition, because temperature sensors are typically calibrated around the target temperature being measured, varying the temperature of the supply line between 60 °F and 120 °F could result in less accurate inlet water temperature measurements.

Regarding option 3, (connecting to the cold water inlet only, testing only on the Cold/Cold cycle, and determining performance at other temperatures numerically), as discussed further in section III.D.8.b of this document, energy and water performance at temperatures other than Cold Wash/Cold Rinse can be calculated numerically using test data from the Cold/Cold cycle because the measured characteristics [14] of a semi-automatic clothes washer cycle do not depend on the inlet water temperature. Therefore, DOE tentatively concludes that representative test results can be obtained with a minimal number of test cycles using this approach, which DOE proposes to incorporate into the proposed new Appendix J.

DOE is proposing in this NOPR to make this change only in the proposed new Appendix J because connecting to only the cold water inlet may differ from how such units are currently being tested by manufacturers and laboratories under Appendix J2. DOE seeks information about implementing this change to Appendix J2 as well, specifically regarding how single-inlet semi-automatic clothes washers are being tested and any potential impact on the measured energy use of these clothes washers on the market.

See section III.D.8 of this document for a full discussion of other proposed edits to testing provisions for semi-automatic clothes washers and a list of related issues on which DOE seeks comment.

For a single-inlet *automatic* clothes washer, DOE discussed in the May 2020 RFI the use of a Y-shaped hose to allow both cold and hot water supply lines to be connected to the single inlet on the unit. 85 FR 31065, 31070 (*emphasis added*). DOE requested comments or information on how single-inlet automatic clothes washers are typically installed by consumers. *Id.*

AHAM commented that it is not aware of a Y-shaped hose connecter being used for typical installation of single-inlet automatic clothes washers. (AHAM, No. 5 at p. 7)

As described previously, DOE inadvertently attributed the use of a Y-shaped hose to *automatic,* rather than *semi-automatic,* single-inlet clothes washers. DOE is not aware of any single-inlet automatic clothes washers that require the use of a Y-shaped hose connector because such clothes washers internally generate any hot water needed for the cycle. Based on a review of models currently certified in DOE's compliance certification database, DOE is aware of three models of single-inlet automatic clothes washers currently available on the market.[15] DOE's examination of user manuals for each of these single-inlet automatic clothes washers indicates that the instructions accompanying these products direct that they be connected to the cold water supply.

Therefore, DOE is proposing in this NOPR to specify that all single-inlet automatic clothes washers be installed to the cold water supply only. As discussed above, DOE is proposing to include this provision in the proposed new Appendix J only. The proposed edit would specify in section 2.10.1 of the proposed new Appendix J that if the clothes washer has only one water inlet, connect the inlet to the cold water supply in accordance with the manufacturer's instructions.

DOE requests comment on its proposal to require all single-inlet clothes washers to be installed to the cold water supply only. DOE also requests comment on whether this requirement should be included in only the proposed new Appendix J, or whether, if adopted, it should be included as an amendment to Appendix J2.

3. Water Supply Temperatures

a. Hot Water Supply Temperature

Section 2.2 of Appendix J2 requires maintaining the hot water supply temperature between 130 °F (54.4 degrees Celsius (''°C'')) and 135 °F (57.2 °C), using 135 °F as the target temperature.

DOE has revised the hot water supply temperature requirements several times throughout the history of the clothes washer test procedures to remain representative of household water temperatures at the time of each analysis. When establishing the original clothes washer test procedure at Appendix J in 1977, DOE specified a hot water supply temperature of 140 °F ± 5 °F for clothes washers equipped with thermostatically controlled inlet water valves. 42 FR 49802, 49808. In the August 1997 Final Rule, DOE specified in Appendix J1 that for clothes washers in which electrical energy consumption or water energy consumption is affected by the inlet water temperatures,[16] the hot water supply temperature cannot exceed 135 °F (57.2 °C); and for other clothes washers, the hot water supply temperature is to be maintained at 135 °F ±5 °F (57.2 °C ± 2.8 °C). 62 FR 45484, 45497. DOE maintained these same requirements in the original version of Appendix J2. In the August 2015 Final Rule, DOE adjusted the allowable tolerance of the hot water

[13] Section 2.3 of Appendix J2 specifies maintaining water pressure of 35 pounds per square inch gauge (''psig'') ± 2.5 psig on both the cold and hot water supply lines. These tolerances could result in a pressure difference of up to 5 psig between the two lines.

[14] Measured characteristics of a semi-automatic clothes washer cycle include total water consumption, electrical energy consumption, cycle time, and bone-dry and cycle complete load weights. See section III.D.8.b of this document for more details.

[15] DOE's certification compliance database is available at *www.regulations.doe.gov/certification-data/CCMS-4-Clothes_Washers.html.* DOE identified the following single-inlet automatic models: WFW3090J**, WFW5090J**, WFC8090G**. Analysis conducted in March 2021.

[16] For example, water-heating clothes washers or clothes washers with thermostatically controlled water valves.

supply temperature in section 2.2 of Appendix J2 to between 130 °F (54.4 °C) and 135 °F (57.2 °C) for all clothes washers, but maintained 135 °F as the target temperature. 80 FR 46729, 46734–46735.

DOE analyzed household water temperatures as part of the test procedure final rule for residential and commercial water heaters published July 11, 2014. 79 FR 40541 (''July 2014 Water Heater Final Rule''). In the July 2014 Water Heater Final Rule, DOE revised the hot water delivery temperature from 135 °F to 125 °F based on an analysis of data showing that the average set point temperature for consumer water heaters in the field is 124.2 °F (51.2 °C), which was rounded to the nearest 5 °F, resulting in a test set point temperature of 125 °F. 79 FR 40541, 40554. Additionally, a 2011 compilation of field data across the United States and southern Ontario by Lawrence Berkeley National Laboratory (''LBNL'') [17] found a median daily outlet water temperature of 122.7 °F (50.4 °C). *Id.* Further, DOE noted in the July 2014 Water Heater Final Rule that water heaters are commonly set with temperatures in the range of 120 °F to 125 °F. *Id.*

Additionally, DOE's consumer dishwasher test procedure, codified at 10 CFR part 430 subpart B, appendix C1 (''Appendix C1''), specifies a hot water supply temperature of 120 °F ± 2 °F for water-heating dishwashers designed for heating water with a nominal inlet temperature of 120 °F, which includes nearly all consumer dishwashers currently on the U.S. market. Section 2.3.2 of Appendix C1. This water supply temperature is intended to be representative of household hot water temperatures.

Table III.1 summarizes the various hot water temperature data considered for the present rulemaking.

TABLE III.1—SUMMARY OF FIELD SURVEYS OF WATER HEATER TEMPERATURE

Source	Description	Temperature (°F)
May 2011 LBNL Report	Median daily outlet water temperature	122.7
July 2014 Water Heater Final Rule	Average set point temperature for consumer water heaters in the field	124.2
July 2014 Water Heater Final Rule	Common water heater setpoints	120–125
Appendix C1	Dishwasher test procedure supply temperature	120

In the May 2020 RFI, DOE requested comments on whether DOE should consider updating the hot water supply temperature specification for the clothes washer test procedures to be within the range of 120 °F to 125 °F, providing better consistency with DOE's test procedures for dishwashers and consumer water heaters. 85 FR 31065, 31069.

AHAM suggested that product design changes may be required if DOE amends the clothes washer test procedures to harmonize the hot water supply temperature with the dishwasher test procedure. AHAM stated that changing the hot water supply temperature specification would impact measured efficiency, and DOE would thus need to address that change in the accompanying standards rulemaking. (AHAM, No. 5 at p. 6)

GEA stated that there is little benefit to consumers by moving the target temperature to 120 °F. If DOE does change the target temperature, GEA is concerned about the change in measured hot water energy usage. (GEA, No. 13 at p. 2)

The CA IOUs recommended keeping the target temperature at 135 °F to prevent the growth of *Legionella* bacteria. The CA IOUs referenced the American Society of Sanitary Engineering (''ASSE'') Scald Awareness Task Group and Unified Plumbing Code (''UPC'') recommendations that hot water temperature should be 130–140 °F to eliminate the risk of *Legionella* growth. (CA IOUs, No. 8 at pp. 14–15)

The Joint Commenters stated that DOE should consider changing the target temperature to 120 °F, because 120 °F is the hot water supply temperature for the consumer dishwasher test procedure and is a common water heater set point. (Joint Commenters, No. 10 at p. 3) However, the Joint Commenters also stated that the 135 °F target temperature may be appropriate to maintain as average set points increase in the field due to *Legionella* concerns. The Joint Commenters encouraged DOE to investigate which hot water supply temperature would be most representative. *Id.*

UL supports specifying the hot water supply temperature to be consistent with hot water heater outlet temperatures, as supported by field data. (UL, No. 9 at p. 1)

Samsung recommended that DOE specify a hot water supply temperature of 120 ± 2 °F, consistent with the temperature specified in the consumer dishwasher test procedure. Samsung also commented that the U.S. Consumer Product Safety Commission recommends this temperature to consumers as the safest set point for water heaters to avoid scalds. (Samsung, No. 6 at p. 3)

NEEA encouraged DOE to investigate the hot water supply temperature that would be most representative of field use. NEEA added that water heater set points may increase closer to the Appendix J2-specified 135 °F in the future, due to concerns about *Legionella* bacteria growth. (NEEA, No. 12 at p. 26) NEEA also recommended that DOE consider heat losses in the pipes and static water in the supply line in the field, which are likely to lower clothes washer inlet hot temperatures relative to water heater set points. *Id.*

Based on the analysis of recent water temperature data summarized in Table III.1, DOE is proposing to update the hot water supply temperature in the proposed new Appendix J from 130–135 °F to 120–125 °F. DOE preliminarily concludes that an inlet temperature of 120–125 °F is more representative of consumer hot water temperatures than the range of 130–135 °F currently specified in Appendix J2.

In addition, section 4.1.2 of Appendix J2 calculates the hot water energy consumption for each tested load size, by multiplying the hot water consumption for each tested load size, by ''T,'' the temperature rise, and by ''K,'' the specific heat of water. In Appendix J2, T is defined as 75 °F, which represents the nominal difference between the hot and cold water inlet temperatures. In this NOPR, DOE is proposing to use a value for T of 65 °F in the proposed new Appendix J, consistent with the differential between the nominal values for the proposed hot

[17] Lutz, JD, Renaldi, Lekov A, Qin Y, and Melody M, ''Hot Water Draw Patterns in Single Family Houses: Findings from Field Studies,'' LBNL Report number LBNL–4830E (May 2011). Available at *www.escholarship.org/uc/item/2k24v1kj.*

water supply temperature (120–125 °F) and the cold water supply temperature (55–60 °F).

DOE agrees with AHAM and GEA that changing the hot water supply temperature would likely impact measured efficiency because hot water energy consumption is a significant component in the calculation of the IMEF metric. As a result, DOE is proposing to update the hot water supply temperature only in the proposed new Appendix J and not in existing Appendix J2. Therefore, DOE's proposal would not affect the measured efficiency of clothes washers currently tested using Appendix J2. The ongoing RCW and CCW energy conservation standards rulemakings would consider the impact of this proposed modification to the hot water supply temperature on measured efficiency.

DOE requests comment on its proposal to update the hot water supply temperature for the proposed new Appendix J from 130–135 °F to 120–125 °F. DOE seeks more recent data on hot water supply temperatures in consumer clothes washer installations. DOE also requests comment on any potential impact to testing costs that may occur by harmonizing temperatures between the clothes washer and dishwasher test procedures, and the impacts on manufacturer burden associated with any changes to the hot water supply temperature.

In the NOPR preceding the July 2014 Water Heater Final Rule, DOE cited a comment from Applied Energy Technology,[18] which stated that water temperatures in the range of 120 °F are adequate to prevent *Legionella* growth as long as the water is maintained at a temperature ''high enough, long enough, and often enough.'' 78 FR 66202, 66219 (Nov. 4, 2013). In that NOPR, DOE also cited the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (''ASHRAE'') guideline[19] which states that hot water should be stored above 140 °F only for high-risk applications (such as health-care facilities and nursing homes). 78 FR 66202, 66218 (Nov. 4, 2013). Moreover, the specification of hot water supply temperature in the clothes washer test procedure is intended to be representative of consumer clothes washer installations, as supported by the data described previously. The target temperature defined in the clothes washer test procedure does not and would not introduce any regulatory requirement on water heater manufacturers, installers, or consumers regarding the set point temperature that can be chosen for any individual water heater installation.

b. Extra-Hot Wash Determination

Clothes washers are tested using an energy test cycle that is comprised of certain cycles taking into consideration all cycle settings available to the end user. Section 2.12 of Appendix J2. Figure 2.12.5 of Appendix J2 specifies that for the energy test cycle to include an Extra-Hot Wash/Cold Rinse, the clothes washer must have an internal heater and the Normal cycle[20] must, in part, contain a wash/rinse temperature selection that has a wash temperature greater than 135 °F. The 135 °F threshold matches the current hot water inlet target temperature, as specified in section 2.2 of Appendix J2.

DOE has revised the Extra-Hot wash temperature parameters previously. In the August 1997 Final Rule, DOE changed the minimum hot water supply temperature from 140 °F in Appendix J–1977 to 135 °F in Appendix J1–1997, and also revised the threshold temperature for Extra-Hot Wash from 140 °F to 135 °F accordingly. 62 FR 45484, 45497. As noted, Appendix J2 retains this threshold temperature of 135 °F for Extra-Hot Wash.

As described previously, DOE is proposing to update the hot water inlet temperature from 135 °F to 125 °F (see section III.C.3.a of this document). This proposed change to the hot water inlet temperature prompted DOE to reassess the threshold temperature for the Extra-Hot wash temperature. Because the inclusion of an Extra-Hot Wash/Cold Rinse in the energy test cycle requires the clothes washer to have an internal heater, the threshold temperature is not limited to the input temperature.

DOE testing of a broad range of clothes washers[21] indicates that over 70 percent of Extra-Hot cycles have a wash water temperature that exceeds 140 °F, despite the threshold temperature for Extra-Hot Wash changing to 135 °F in the August 1997 Final Rule. Furthermore, DOE research indicates that 140 °F is widely cited as a threshold for achieving sanitization by organizations including the World Health Organization and the United Kingdom's National Health Service.[22] [23] Based on DOE's data indicating that a majority of existing Extra-Hot cycles have wash water temperatures that exceed 140 °F, and based on the cited reports finding that washing textiles at 140 °F is an accepted sanitation threshold, DOE proposes specifying the Extra-Hot Wash threshold as 140 °F. Based on the research described above, DOE preliminarily concludes that a temperature threshold of 140 °F would align with 140 °F as an accepted temperature threshold for sanitization, and therefore may be more representative of consumer expectations and usage of the Extra-Hot Wash cycle, than the current 135 °F threshold.

In addition to improving representativeness, changing the Extra-Hot Wash temperature threshold to 140 °F could potentially reduce test burden. As discussed more fully in section III.C.4 of this document, a threshold of 140 °F would enable easier confirmation that an Extra-Hot temperature has been achieved when measuring wash temperature with non-reversible temperature indicator labels, as permitted by section 3.3 of Appendix J2. Temperature indicator labels are widely available with a 140 °F indicator, whereas DOE is not aware of any commercially available temperature indicator labels that provide a 135 °F indicator.

In summary, DOE is proposing to specify in the proposed new Appendix J that the minimum temperature threshold for the Extra-Hot Wash/Cold Rinse is 140 °F. This change would be reflected in the proposed Extra Hot Wash/Cold Rinse flowchart in section 2.12 of the proposed new Appendix J as well as any references to this temperature threshold elsewhere

[18] See comment number 22 in Docket number EERE–2011–BT–TP–0042. Available at *www.regulations.gov/docket/EERE–2011–BT–TP–0042.*

[19] ASHRAE Guideline 12, ''Minimizing the Risk of Legionellosis Associated with Building Water Systems,'' states that the temperature range most favorable for amplification of legionellae bacteria is 77 – 108 °F (25 – 42 °C) and recommends that when practical, hot water should be stored at temperatures of 120 °F (49 °C) or above. The guideline states that hot water should be stored above 140 °F (60 °C) for high-risk settings such as in health care facilities and nursing homes. For more information visit: *www.ashrae.org.*

[20] Section 1.25 of Appendix J2 defines the Normal cycle as the cycle recommended by the manufacturer (considering manufacturer instructions, control panel labeling, and other markings on the clothes washer) for normal, regular, or typical use for washing up to a full load of normally-soiled cotton clothing. For machines where multiple cycle settings are recommended by the manufacturer for normal, regular, or typical use for washing up to a full load of normally-soiled cotton clothing, then the Normal cycle is the cycle selection that results in the lowest IMEF or MEF value.

[21] DOE analyzed test data from 2 top-loading and 15 front-loading models representing 7 different manufacturers and 9 different brands.

[22] World Health Organization. ''Boil Water.'' Available at: *www.who.int/water_sanitation_health/dwq/Boiling_water_01_15.pdf.*

[23] National Health Service. ''Can clothes and towels spread germs?'' Available at: *www.nhs.uk/common-health-questions/infections/can-clothes-and-towels-spread-germs/.*

throughout the proposed new Appendix J.

DOE recognizes that for the 30 percent of units with Extra-Hot Wash temperatures that do not exceed 140 °F, DOE's proposal to change the Extra-Hot Wash definition may impact measured efficiency. Therefore, in this NOPR, DOE is proposing to include the amended Extra-Hot Wash temperature parameter only in the proposed new Appendix J and not in existing Appendix J2. The ongoing RCW and CCW energy conservation standards rulemakings would consider the impact of any modifications to the Extra-Hot Wash definition on measured efficiency.

DOE requests comment on its proposal to specify in the proposed new Appendix J that the Extra-Hot Wash/Cold Rinse designation would apply to a wash temperature greater than or equal to 140 °F. DOE requests any additional data on the wash temperature of cycles that meet the Appendix J2 definition of Extra-Hot Wash/Cold Rinse. DOE is also interested in data and information on any potential impact to testing costs that may occur by changing the Extra-Hot Wash temperature threshold, and the impacts on manufacturer burden associated with any changes to the Extra-Hot Wash/Cold Rinse definition.

c. Target Water Supply Temperature

Section 2.2 of Appendix J2 specifies that the hot water supply temperature must be maintained between 130 °F (54.4 °C) and 135 °F (57.2 °C), using 135 °F as the target temperature. Based on experience working with third-party test laboratories, as well as its own testing experience, DOE recognizes that maintaining 135 °F as the target temperature for the hot water supply may be difficult given that the target temperature of 135 °F lies at the edge, rather than the midpoint, of the allowable temperature range of 130 °F to 135 °F. 85 FR 31065, 31069. On electronic temperature-mixing valves commonly used by test laboratories, the output water temperature is maintained within an approximately two-degree tolerance above or below a target temperature programmed by the user (*e.g.,* if the target temperature is set at 135 °F, the controller may provide water temperatures ranging from 133 °F to 137 °F). *Id.* To ensure that the hot water inlet temperature remains within the allowable range of 130 °F to 135 °F, such a temperature controller would need to be set to around the midpoint of the range, which conflicts with the test procedure requirement to use 135 °F as the target temperature. *Id.* An analogous difficulty exists for the cold water supply temperature. Section 2.2 of Appendix J2 specifies maintaining a cold water temperature between 55 °F and 60 °F, using 60 °F as the target.

In the May 2020 NOPR, DOE requested comments on whether it should consider changes to the target temperature or allowable range of temperature specified for the hot and cold water inlets, and if so, what alternate specifications should be considered. *Id.*

UL commented that it supports the change to an equal sided tolerance for the hot and cold water inlet temperature requirements. (UL, No. 9 at p. 1)

AHAM also supported DOE updating the target water temperature to have a tolerance and nominal value (rather than any temperature within the range) specified as the target, *i.e.,* X ± Y, with nominal (X) as the target. (AHAM, No. 5 at p. 6)

The CA IOUs supported a change in the water supply temperature tolerance to ± 2.5 °F around the target temperature, claiming that it may create a more repeatable test procedure and decrease the number of failed test runs. (CA IOUs, No. 8 at p. 15)

GEA supported a hot water target temperature adjustment to 132.5 ± 2.5 °F, stating that doing so would align the test procedure with engineering best practices. (GEA, No. 13 at p. 2)

DOE recognizes the widespread support for defining a temperature range centered around a target midpoint of the range. Although this would appear to reflect current test laboratory practice, DOE is concerned that specifying a cold water target temperature of 57.5 °F in Appendix J2 and the proposed new Appendix J, or specifying a hot water target temperature of 132.5 °F for Appendix J2 or 122.5 °F for the proposed new Appendix J, could imply that the test procedure requires a precision of 0.5 °F in temperature control, which could create undue test burden. Furthermore, DOE is concerned that defining a ''target'' temperature, whether as currently defined or defined as the midpoint of the range, could unintentionally imply that a test would be invalid if the water temperature remains within the allowable range, but not centered exactly around the target.

For these reasons, DOE is proposing to remove the ''target'' temperature associated with each water supply temperature range, and to instead define only the allowable temperature range. Specifically, the cold water supply temperature range would be defined as 55 °F to 60 °F in both Appendix J2 and the proposed new Appendix J; the hot water supply temperature range in Appendix J2 would be defined as 130 °F to 135 °F; and the hot water supply temperature range in the proposed new Appendix J would be defined as 120 °F to 125 °F. Defining allowable water supply temperature ranges instead of specific target temperatures at the upper end of the allowable ranges would reduce the difficulty of maintaining water supply temperatures within the desired ranges.

DOE requests comment on its proposal to remove the target temperatures and instead specify water supply temperature ranges as 55 °F to 60 °F for cold water in both Appendix J2 and the proposed new Appendix J, 130 °F to 135 °F for hot water in Appendix J2, and 120 °F to 125 °F for hot water in the proposed new Appendix J.

4. Wash Water Temperature Measurement

In the August 2015 Final Rule, DOE amended section 3.3 of Appendix J2, ''Extra-Hot Wash/Cold Rinse,'' to allow the use of non-reversible temperature indicator labels to confirm that a wash temperature greater than 135 °F had been achieved. 80 FR 46729, 46753. Since the publication of the August 2015 Final Rule, DOE has become aware that some third-party laboratories measure wash temperature using self-contained temperature sensors in a waterproof capsule placed inside the clothes washer drum during testing. 85 FR 31065, 31069. In the May 2020 RFI, DOE requested comments on manufacturers' or test laboratories' experience with these or any other methods for determining the temperature during a wash cycle that may reduce manufacturer burden, including the reliability and accuracy of those methods. *Id.*

UL commented that it has not found any temperature labels that read exactly 135 °F, but rather only labels that provide 10 °F increments between 130 °F and 140 °F. (UL, No 9 at p. 2) UL added that if a label does not change at 140 °F but does change at 130 °F, there is no way of knowing if the water temperature reached 135 °F without running an additional test run with a data logger. *Id.* UL also commented that if DOE requires temperature loggers for measuring the internal water temperature, DOE should prescribe a specific method, for increased lab-to-lab reproducibility. *Id.*

AHAM similarly commented that the non-reversible temperature indicator labels currently specified in the test procedure do not work well because the labels available on the market do not easily identify when 135 °F is reached, as they typically provide 10 °F

increments, and none are available in increments of 125 °F to 135 °F. (AHAM, No. 5 at pp. 6–7) According to AHAM, testers must estimate when 135 °F is reached on labels that are currently available. Thus, AHAM suggests that DOE consider permitting the use of submersible temperature loggers. *Id.*

As discussed by UL and AHAM, DOE is aware that none of the temperature indicator labels available on the market provide an indicator at 135 °F, the current Extra-Hot Wash water temperature threshold. Because of this, temperature indicator labels can be used to confirm that the water temperature reached 135 °F only if the water temperature exceeds 140 °F. The temperature indicator labels are unable to identify an Extra-Hot Wash/Cold Rinse cycle if the temperature of the cycle is greater than 135 °F but less than 140 °F. DOE recognizes the potential benefit of other methods of measurement to supplement or replace the temperature indicator labels.

DOE investigated submersible temperature loggers as suggested by AHAM. DOE found submersible temperature loggers available for less than $175 and available with a resolution of 0.5 °C (0.9 °F) or better and an accuracy of ±0.5 °C (0.9 °F) for water temperatures between –10 °C (14 °F) and +65 °C (149 °F).[24] In testing with such temperature loggers, DOE found them small enough in size to be able to embed within the test load during testing. However, DOE testing indicated a 5 to 10-minute time lag in measuring dynamically changing temperatures, which is likely due to the thermal mass of the waterproof capsule. As a result of this time lag, if a clothes washer's wash water temperature were to reach 135 °F only briefly, then a submersible temperature logger may not record that 135 °F had been reached. DOE concludes that, similar to temperature indicator labels, a submersible temperature logger indicating a temperature higher than 135 °F can provide confirmation that the water temperature reached 135 °F, but failure to record a temperature of 135 °F does not necessarily determine that the temperature threshold for the Extra-Hot Wash cycle has not been achieved. For clothes washers with sustained water temperatures greater than 135 °F but less than 140 °F, submersible temperature loggers may provide potentially reduced test burden, compared to using temperature indicator labels.

For Appendix J2, DOE is proposing to allow the use of a submersible temperature logger as an additional temperature measurement option to confirm that an Extra-Hot Wash temperature greater than 135 °F has been achieved during the wash cycle. DOE is proposing that the submersible temperature logger must have a time resolution of at least 1 data point every 5 seconds and a temperature measurement accuracy of ±1 °F. As described currently for temperature indicator labels, DOE would include a note that failure to measure a temperature of 135 °F would not necessarily indicate of the lack of an Extra-Hot Wash temperature. However, such a result would not be conclusive due to the lack of verification of that the required water temperature was achieved, in which case an alternative method must be used to confirm that an extra-hot wash temperature greater than 135 °F has been achieved during the wash cycle.

Because DOE is proposing to change the Extra-Hot Wash water temperature threshold to 140 °F for the proposed new Appendix J, commercially available temperature indicator labels with indications at 140 °F would be able to be used more readily to determine whether the water temperature reached the Extra-Hot Wash temperature threshold. DOE is also proposing to allow the usage of a submersible temperature logger in the proposed new Appendix J as an option to confirm that an Extra-Hot Wash temperature greater than 140 °F has been achieved during the wash cycle. Like the temperature threshold of 135 °F in Appendix J2, failure to measure a temperature of 140 °F would not necessarily indicate the lack of an Extra-Hot Wash temperature. However, such a result would not be conclusive due to the lack of verification of that the required water temperature was achieved, in which case an alternative method must be used to confirm that an extra-hot wash temperature greater than 140 °F has been achieved during the wash cycle.

Lastly, DOE is proposing to move the description of allowable temperature measuring devices from section 3.3 of Appendix J2 to section 2.5.4 of both Appendix J2 and the proposed new Appendix J (''Water and air temperature measuring devices''), specifying the use of non-reversible temperature indicator labels in new section 2.5.4.1, and adding specifications for the use of submersible temperature loggers to new section 2.5.4.2 of both Appendix J2 and the proposed new Appendix J.

DOE requests comment on its proposal to allow the use of a submersible temperature logger in Appendix J2 and the proposed new Appendix J as an option to confirm that an Extra-Hot Wash temperature greater than the Extra-Hot Wash threshold has been achieved during the wash cycle. DOE requests data and information confirming (or disputing) DOE's discussion of the benefits and limitations of using a submersible temperature logger, including DOE's determination that a submersible logger's failure to measure a temperature greater than the Extra-Hot Wash threshold does not necessarily indicate that the cycle under test does not meet the definition of an Extra-Hot Wash/Cold Rinse cycle.

5. Pre-Conditioning Requirements

Section 2.11 of Appendix J2 specifies the procedure for clothes washer pre-conditioning. The current pre-conditioning procedure requires that any clothes washer that has not been filled with water in the preceding 96 hours, or any water-heating clothes washer that has not been in the test room at the specified ambient conditions for 8 hours, must be pre-conditioned by running it through a Cold Rinse cycle and then draining it to ensure that the hose, pump, and sump are filled with water. The purpose of pre-conditioning is to promote repeatability and reproducibility of test results by ensuring a consistent starting state for each test, as well as to promote the representativeness of test results by ensuring that the clothes washer is operated consistent with the defined ambient conditions. In particular, the additional specification for water-heating clothes washers was first suggested in a supplemental NOPR published on April 22, 1996, (''April 1996 SNOPR''), in which DOE expressed concern about the testing of water-heating clothes washers that may have been stored at a temperature outside of the specified ambient temperature range (75 °F ± 5 °F) prior to testing. 61 FR 17589, 17594–17595. DOE stated that the energy consumed in a water-heating clothes washer may be affected by the ambient temperature. *Id.* Thus, if the ambient temperature prior to and during testing is relatively hot, then less energy will be consumed than under typical operating conditions, *i.e.,* the test will understate the clothes washer's energy consumption. *Id.* Conversely, if the ambient temperature prior to and during the test is relatively cold, then the energy consumption will be overstated. *Id.* In the subsequent August 1997 Final Rule, DOE added the

[24] See *e.g., www.maximintegrated.com/en/products/ibutton-one-wire/data-loggers/DS1923.html/product-details/tabs-3, www.maximintegrated.com/en/products/ibutton-one-wire/ibutton/DS9107.html,* and *www.maximintegrated.com/en/products/interface/universal-serial-bus/DS9490.html.*

pre-conditioning requirement for water-heating clothes washers, which requires water-heating units to be pre-conditioned if they had not been in the test room at ambient conditions for 8 hours. 62 FR 45484, 45002, 45009, 45010.

DOE is concerned that the energy use of non-water-heating clothes washers could also be affected by the starting temperature of the clothes washer, particularly those that implement temperature control by measuring internal water temperatures during the wash cycle. For example, if the ambient temperature prior to testing is relatively hot, causing the internal components of the clothes washer to be at a higher temperature than the specified ambient temperature range, less hot water may be consumed during the test than otherwise would be if the starting temperature of the clothes washer is within the specified ambient temperature range. Noting that third-party test laboratories cannot necessarily identify whether a unit is a water-heating clothes washer or not, DOE is proposing to require the same pre-conditioning procedure for both water-heating and non-water-heating clothes washers, which would minimize the influence of ambient temperature on energy use and alleviate the need for third-party test laboratories to determine whether a clothes washer is water-heating or not. If adopted, this proposed change may impact the measured energy use of non-water-heating clothes washers that implement temperature control by measuring internal water temperatures during the wash cycle. Due to the potential impact on the measured energy use, DOE is proposing this change only for the proposed new Appendix J, which would be used for the evaluation and issuance of updated efficiency standards, and to determine compliance with those standards. DOE is therefore proposing that use of the proposed new Appendix J, if finalized, would not be required until the compliance date of any updated standards.

In addition, the proposed amendments to the pre-conditioning requirements would eliminate the differentiation between ''water-heating clothes washer'' and ''non-water heating clothes washer,'' which are defined terms in the test procedure. Therefore, DOE is also proposing to remove the definitions of ''water-heating clothes washer'' and ''non-water-heating clothes washer'' from section 1 of the proposed new Appendix J.

DOE requests comment on its proposal to specify the same pre-conditioning requirements for all clothes washers and to remove the ''water-heating clothes washer'' and ''non-water-heating clothes washer'' definitions in the proposed new Appendix J. DOE also requests information regarding whether test laboratories typically pre-condition water-heating and non-water-heating clothes washers using the same procedure.

D. Cycle Selection and Test Conduct

1. Tested Load Sizes

Table 5.1 of Appendix J2 provides the minimum, average, and maximum load sizes to be used for testing based on the measured capacity of the clothes washer. The table defines capacity ''bins'' in 0.1 ft^3 increments. The load sizes for each capacity bin are determined as follows:

☐ Minimum load is 3 pounds (''lb'') for all capacity bins;

☐ Maximum load (in lb) is equal to 4.1 times the mean clothes washer capacity of each capacity bin (in ft3); and

☐ Average load is the arithmetic mean of the minimum load and maximum load.

These three load sizes are used for testing clothes washers with automatic WFCS. Clothes washers with manual WFCS are tested with only the minimum and maximum load sizes.

a. Expanding the Load Size Table

DOE originally introduced the load size table in Appendix J1–1997, which accommodated clothes container capacities up to 3.8 ft^3. 62 FR 45484, 45513. In the March 2012 Final Rule, DOE expanded Table 5.1 in both Appendix J1 and Appendix J2 to accommodate clothes container capacities up to 6.0 ft^3. 77 FR 13887, 13910. DOE extrapolated the load sizes to 6.0 ft^3 using the same equations to define the maximum and average load sizes as described above.

On May 2, 2016 and April 10, 2017, DOE granted waivers to Whirlpool and Samsung, respectively, for testing RCWs [25] with capacities between 6.0 and 8.0 ft^3, by further extrapolating Table 5.1 using the same equations to define the maximum and average load sizes as described. 81 FR 26215; 82 FR 17229. DOE's regulations in 10 CFR 430.27 contain provisions allowing any interested person to seek a waiver from the test procedure requirements if certain conditions are met. A waiver allows manufacturers to use an alternate test procedure in situations where the DOE test procedure cannot be used to test the product or equipment, or where use of the DOE test procedure would generate unrepresentative results. 10 CFR 430.27(a)(1) DOE's regulations at 10 CFR 430.27(l) require that as soon as practicable after the granting of any waiver, DOE will publish in the **Federal Register** a NOPR to amend its regulations so as to eliminate any need for the continuation of such waiver. As soon thereafter as practicable, DOE will publish in the **Federal Register** a final rule. 10 CFR 430.27(l).

In the May 2020 RFI, DOE requested comment on whether to extrapolate Table 5.1 of Appendix J2 to accommodate RCW capacities up to 8.0 ft^3, and if so, appropriate methods for extrapolation. 85 FR 31065, 31077. DOE received comments from multiple interested parties regarding the definition of load sizes more generally, which DOE addresses in section III.D.1.b of this document. DOE received no comments regarding the expansion of the load size table itself.

In this NOPR, DOE is proposing to expand Table 5.1 in both Appendix J2 and the proposed new Appendix J to accommodate clothes washers with capacities up to 8.0 ft^3. In Appendix J2, DOE proposes to expand Table 5.1 using the same equations as the current table, as described above, and consistent with the load size tables provided in the two granted waivers. For the proposed new Appendix J, DOE proposes a revised methodology for defining the load sizes in each capacity bin in Table 5.1, as further discussed in section III.D.1.b of this document.

DOE requests comment on its proposal to expand the load size table in both Appendix J2 and the proposed new Appendix J to accommodate RCWs with capacities up to 8.0 ft^3.

b. Defining New Load Sizes

As discussed in the previous section, Appendix J2 currently defines three load sizes for automatic clothes washers (minimum, average, and maximum) for each capacity bin in Table 5.1 of the appendix. In this NOPR, DOE is proposing for the proposed new Appendix J to define two load sizes for automatic clothes washers (small and large) for each capacity bin, which are intended to represent the same load size distribution underlying the existing three load sizes. DOE has tentatively concluded that this would substantially reduce test burden while maintaining or improving representativeness. The following paragraphs describe the development of the current load size definitions to provide context and

[25] As noted, CCWs are limited under the statutory definition to a maximum capacity of 3.5 cubic feet for horizontal-axis CCWs and 4.0 cubic feet for vertical-axis CCWs. (42 U.S.C. 6311(21))

justification for DOE's proposed changes.

The current load size definitions (*i.e.,* the defining of three load sizes, and the equations used to determine each of the three load sizes) are based on consumer usage data analyzed during the test procedure rulemaking that culminated in the August 1997 Final Rule. As part of that rulemaking, AHAM presented to DOE data from the Procter & Gamble Company (''P&G'') showing the distribution of consumer load sizes for 2.4 ft^3 and 2.8 ft^3 clothes washers, which represented typical clothes washer capacities at the time (1995).[26] The 1995 P&G data indicated that the distribution of consumer load sizes followed an approximate normal distribution slightly skewed towards the lower end of the size range. Figure III.1 shows the summarized data presented by AHAM.

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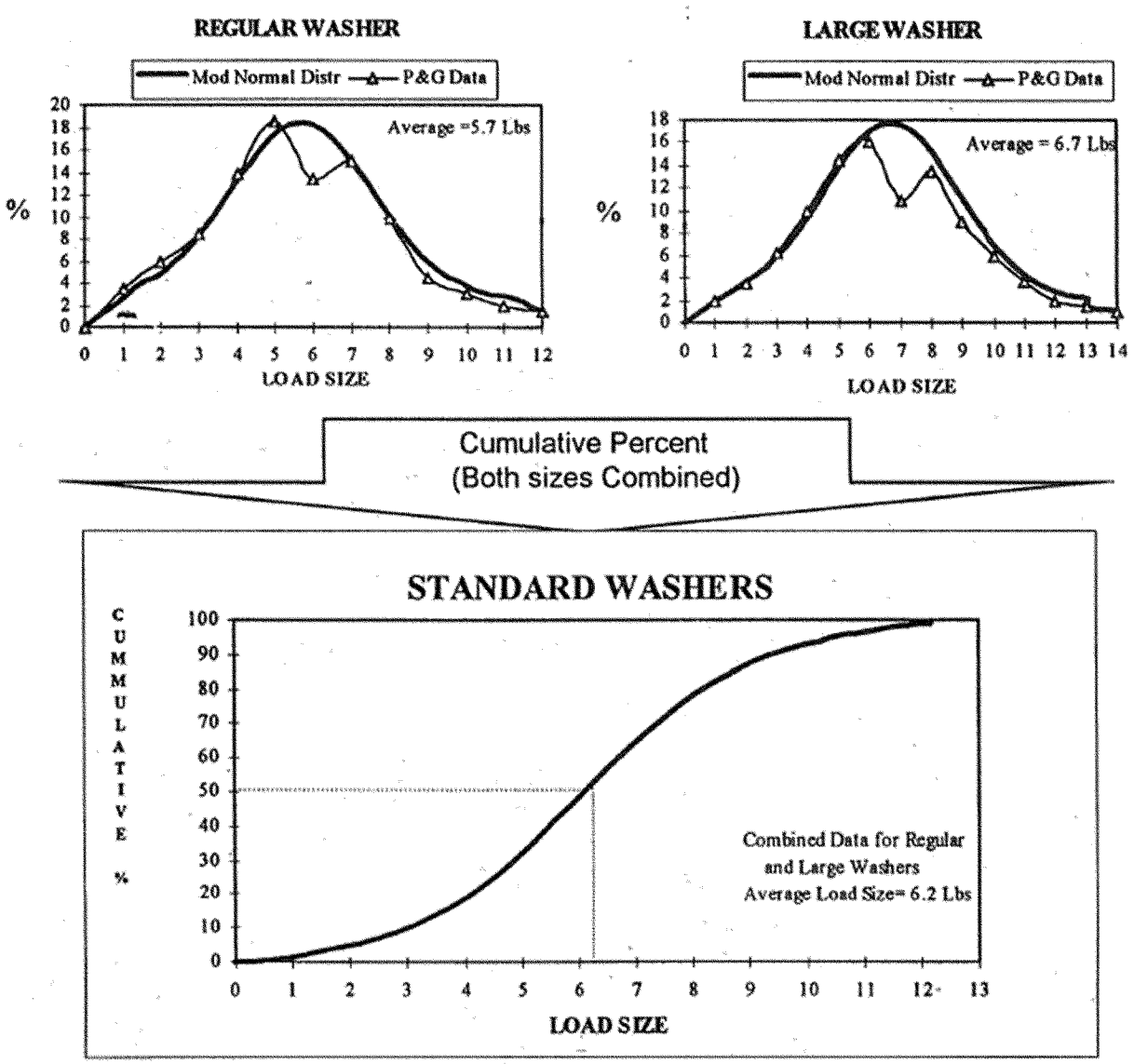

Figure III.1 1995 Procter & Gamble Consumer Load Size Distributions as Provided by AHAM

In the August 1997 Final Rule, DOE defined three load sizes—minimum, average, and maximum—to represent this normal distribution. 62 FR 45484, 45490. The minimum load size represented approximately the 14th percentile of the distribution (*i.e.,* the lower 14 percent of the cumulative distribution); the average load size represented approximately the 14th through 88th percentile (*i.e.,* the middle 74 percent of the cumulative distribution); and the maximum load size represented approximately the 88th through 100th percentile (*i.e.,* the upper 12 percent of the cumulative distribution).[27] Figure III.2 illustrates the boundaries representing the three defined load sizes overlaid with the P&G load distribution data.

[26] The full data set presented by AHAM is available at *www.regulations.gov/document/EERE-2006-TP-0065-0027.*

[27] See the table titled ''Relationship of Water Fill Factors to Cumulative Load Size Distribution'' on page 22 of the data presented by AHAM as part of the rulemaking that culminated in the August 1997 Final Rule, available at *www.regulations.gov/document/EERE-2006-TP-0065-0027.*

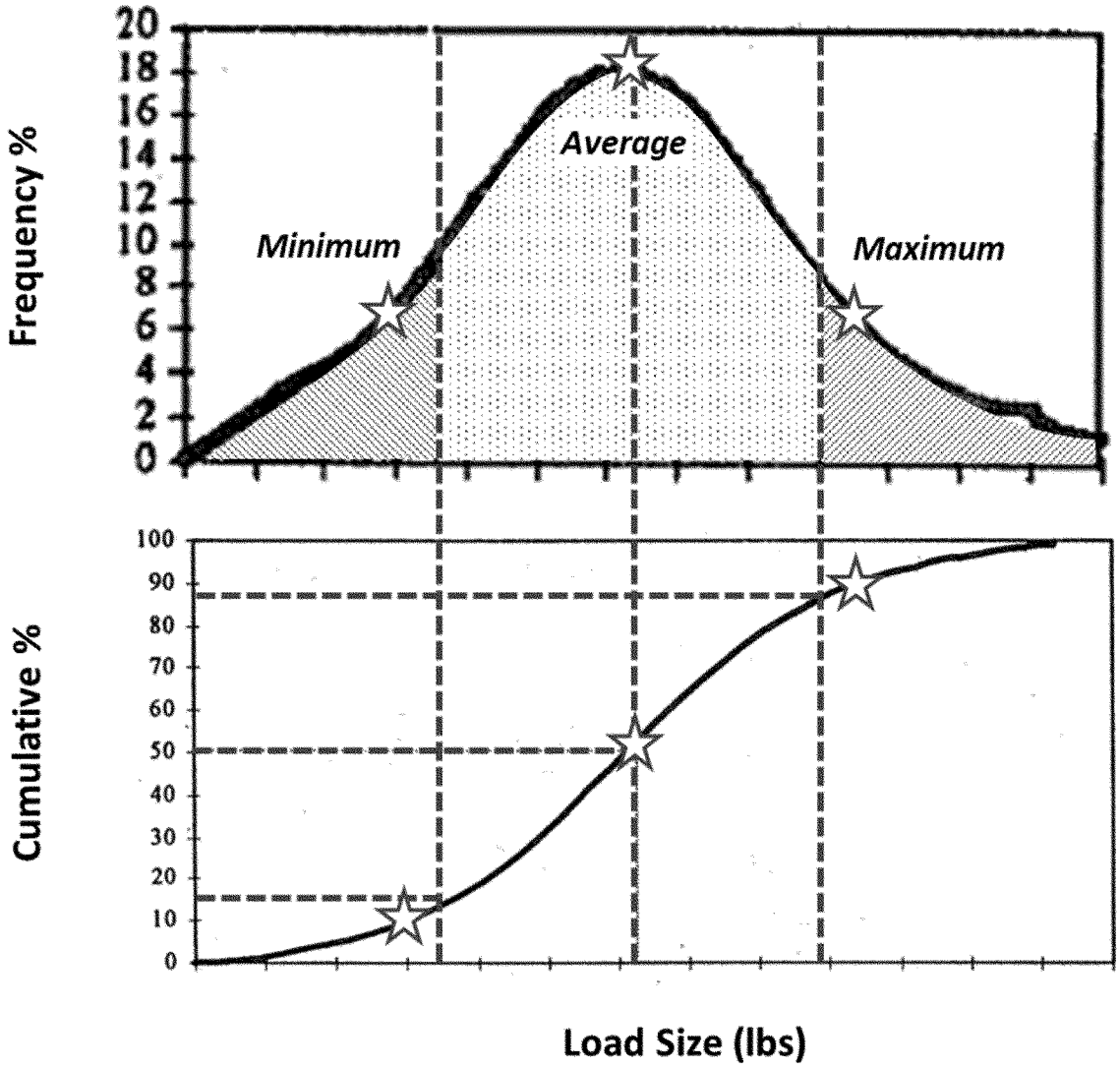

Figure III.2 Illustrative Depiction of the Three Load Sizes Representing the Normal Distribution of Consumer Loads from the 1995 Procter & Gamble Data

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In the August 1997 Final Rule, these load size relationships were scaled across the range of 0.8 ft^3 to 3.8 ft^3 capacities [28] using the equations described above: Minimum load size fixed at 3 lb for all capacity bins; maximum load size calculated as 4.1 times the mean clothes washer capacity of each capacity bin; and average load size calculated as the mean of the minimum and maximum load sizes. 62 FR 45484, 45504, 45513. Within each capacity bin, the three defined load sizes were intended to approximate a normal distribution of consumer load sizes. As noted, the load size table in Appendix J1–1997 was extrapolated to 6.0 ft^3 in the March 2012 Final Rule, applicable to both Appendix J1 and Appendix J2.

In the May 2020 RFI, DOE requested data and information on whether the minimum, average, and maximum load size definitions in Table 5.1 are representative of the range of load sizes used by consumers for each capacity bin in the table, particularly for larger-capacity RCWs. 85 FR 31065, 31078.

UL commented that in order to make load sizes more equitable for the widening range of clothes washer capacities, all three load sizes should be proportional to capacity, similar to the current definition of maximum load. UL suggested that minimum and average load sizes could be proportional to the maximum load size (*e.g.,* minimum and average load sizes could be 25 percent and 50 percent of maximum load size, respectively). (UL, No. 9 at p. 4)

Fixing the minimum load size at 3 lb represents the need for consumers to wash a small load of laundry (for example, a single outfit of clothing) regardless of the capacity of the clothes washer. The ''average'' load size as constructed in Appendix J2 represents the middle of the range of load sizes [29] washed by consumers (*i.e.,* the approximate peak of the roughly normal distribution of load sizes). As described below, DOE is proposing in the proposed new Appendix J to define two, rather than three, load sizes, and each of the two load sizes would be defined as a function of capacity.

The CA IOUs recommended that DOE amend the average and maximum load sizes in Table 5.1 of Appendix J2 to use

[28] For capacities in the range of 0.0 to 0.8 ft^3, a fixed load size of 3 lb was defined for all three test load sizes.

[29] In effect, the ''average'' load size is intended to represent the median load size washed by consumers.

a logarithmic relationship between capacity and load size. (CA IOUs, No. 8 at pp. 1–4) The CA IOUs presented data from a 2016 Pacific Gas and Electric Company (''PG&E'') field survey (''2016 PG&E survey'') that recorded load size and capacity data, and showed a logarithmic relationship between load size and capacity for clothes washers with capacities from 2–5 ft^3. In the range of 2 ft^3 to approximately 5 ft^3 capacity, the 2016 PG&E survey showed slightly higher average consumer load sizes than would be defined by Table 5.1 in Appendix J2 for a clothes washer of the same capacity. The CA IOUs commented that extrapolating this relationship to smaller and larger-capacity clothes washers, however, would result in a smaller consumer load sizes than would be defined by Table 5.1 of the current Appendix J2. *Id.* The CA IOUs also commented that a similar logarithmic trend was found in an Australian clothes dryer study.[30] Although the Australian study relates to residential clothes dryers, the CA IOUs asserted that the operation of clothes washers and clothes dryers are closely linked. *Id.* The CA IOUs commented that the 2016 PG&E survey excludes households outside of the ''hot-dry'' Southwestern region of the United States, as well as households that rely on CCWs to wash their clothes, and requested that DOE conduct a larger national survey or study existing surveys to explore the relationship between capacity and average load size before making any changes to Table 5.1 of Appendix J2 to ensure that the test procedure produces results that most represent an average use cycle. *Id.*

DOE appreciates the CA IOUs providing consumer usage data from the 2016 PG&E field survey. While the conclusions from this data may be instructive as a point of comparison, these data are limited in that they represent usage in a single season (summer), in a single state (California), and only around three wash cycles per participating household.[31] Notwithstanding these limitations, the results indicate that within the range of 2 to approximately 5 ft^3, which encompasses the large majority of units on the market, the load sizes defined by Appendix J2 are reasonably close to the load sizes observed in the 2016 PG&E field study. Regarding the Australian clothes dryer study, while these data provide a point of comparison, usage patterns of Australian consumers do not necessarily represent the usage patterns of U.S. consumers. DOE is not aware of, and the CA IOUs have not provided, any data or information that would suggest that Australian usage patterns are the same as U.S. usage patterns. Further, clothes dryer load sizes may differ from clothes washer loads for reasons which may depend on region or localized customs (for example, line drying clothing may be more common in hot, dry climates). DOE is not aware of, nor have the CA IOUs provided, any data to suggest how Australian dryer load sizes relate to Australian clothes washer load sizes. DOE also observes that a logarithmic trend may not represent the best characterization of the Australian data.

NEEA recommended that, if DOE were to adopt an efficiency metric that is a function of capacity, DOE should eliminate the current average load calculation method and replace it with a fixed 7.6 lb load, which it believes would be more representative. NEEA cited its 2014 laundry field study that found an average clothes washer load size of 7.6 lb, which NEEA characterized as being close to the average load size of 8.5 lb that corresponds with the 2010 market-weighted average capacity of 3.5 ft^3. NEEA stated, however, that the market-weighted average capacity as of 2019 has increased to 4.4 ft^3, for which Appendix J2 defines an average load size of 10.4 lb.[32] (NEEA, No. 12 at pp. 22–24) NEEA compared this 10.4 lb average load size to three Australian field studies that found an average load size of approximately 6.6 lb. NEEA further referenced another Australian research study conducted by Choice [33] in which consumers were instructed to fully fill the clothes container. The resulting average load size measured during the study was 8 lb, which NEEA described as significantly less than an amount that the clothes container could hold. *Id.* NEEA asserted that using a fixed average load size of 7.6 lb would increase representativeness, stating that the growing inconsistency between field-measured average load size and Appendix J2-calculated average load size indicates that average load size is independent of clothes washer capacity and is relatively small. *Id.* NEEA also stated that using a fixed average load size would reduce test burden, since less work would be required by the laboratory to build an inventory of custom Appendix J2-defined average loads for each clothes washer capacity. NEEA recommended that if DOE were to determine a field average load size for the United States, DOE could conduct a study similar to the referenced Choice study but with a representative group of consumers in the United States. *Id.*

DOE appreciates NEEA providing the consumer usage data from the 2014 laundry study. DOE does not agree with NEEA's conclusion that the 2014 laundry study confirms that the field average load size is independent of clothes container size and is relatively small. In support of its assertion, NEEA presented data indicating that current (2019) average capacity has increased to 4.4 ft^3, for which Appendix J2 defines an average load size of 10.4 lb. However, NEEA did not present any field data demonstrating average consumer load sizes for a sample of clothes washers with an average capacity of 4.4 ft^3. Therefore, no conclusions can be drawn from the 2014 laundry study regarding how consumer load sizes may have changed as average clothes washer capacity has increased from around 3.5 ft^3 in 2010 to 4.4 ft^3 in 2019. Regarding NEEA's summary of the three Australian field studies, DOE reiterates that the usage patterns of Australian consumers do not necessarily represent the usage patterns of U.S. consumers. DOE notes that the summaries of the Electrolux and Fisher & Paykel surveys provided by NEEA do not identify the average capacity of the clothes washers in the survey samples. Therefore, no conclusions can be drawn regarding how the average consumer load size of 6.6 lb from the surveys compares to the load size that Appendix J2 would prescribe for a U.S. clothes washer of the same size. While DOE agrees that using a fixed average load size could decrease test burden by avoiding the need to inventory different average load sizes for each possible capacity, for the reasons described above, DOE preliminarily concludes that the data provided by NEEA do not justify using a fixed average load size across all clothes container capacities.

The Joint Commenters also encouraged DOE to consider specifying an average load size that is a constant value independent of capacity. (Joint

[30] Lloyd Harrington of Energy Efficient Strategies, Australia. Supporting data and corresponding presentations: *eedal2017.uci.edu/wp-content/uploads/Thursday-17-Harrington.pdf.*

[31] According to CA IOUs, the data represent 310 wash cycles across 105 California households. (CA IOUs, No. 8 at p. 7)

[32] NEEA's estimate of 4.4 ft^3 average capacity in 2019 is based on NEEA's 2019 ENERGY STAR Retail Products Platform data.

[33] ''Washing machine user habits: A report on wash temperature and load size habits among CHOICE Members.'' 2011. Prepared for the Australian Department of Climate Change and Energy. Not publicly published, but can be made available upon request to Simon Newman, Residential Energy Efficiency Branch, Energy Security and Efficiency Division, Department of Industry, Science, Energy and Resources, PO Box 2013, Canberra, ACT 2601. 39 Personal Communication. Lloyd Harington, Energy Efficient Strategies. 17 June 2020.

Commenters, No. 10 at pp. 4–5) According to the Joint Commenters, the introduction of large-capacity clothes washers to the market, combined with the structure of Table 5.1 in Appendix J2, has led to the weighted-average load size for the largest clothes washers being significantly greater than that for small clothes washers. For example, the Joint Commenters stated that the weighted-average load size for a 6.0 ft^3 clothes washer (13.68 lb) is around 60 percent larger than the weighted-average load size for a 3.5 ft^3 clothes washer (8.68 lb). *Id.* The Joint Commenters also referenced NEEA's laundry field study, which the Joint Commenters characterized as finding no clear correlation between clothes washer capacity and load size. The Joint Commenters expressed concern that the current test procedure may not be representative of an average cycle use for large-capacity clothes washers. *Id.*

As noted previously, DOE preliminary concludes that the data provided by NEEA, as referenced by the Joint Commenters, do not demonstrate that using a fixed average load size would be representative of U.S. consumer usage. DOE also notes that the assertion made by NEEA and the Joint Commenters—that consumer average load sizes are *smaller* than DOE's Appendix J2 load sizes—conflicts with the data summarized above from the CA IOUs, which suggest consumer average load sizes for clothes washers in the range of 2 to 5 ft^3 capacity that are *larger* than the Appendix J2 load sizes. These conflicting conclusions, combined with the noted limitations of each data set, do not provide justification for DOE to change the average load sizes in Table 5.1 of Appendix J2.

As noted, DOE is proposing to replace the minimum, maximum, and average load sizes with two new load sizes in the proposed new Appendix J, designated as ''small'' and ''large.'' In the paragraphs that follow, DOE explains its rationale for (1) reducing the number of load sizes from three to two, and (2) defining the two load sizes for each capacity bin.

As discussed in section III.A of this document, AHAM and GEA commented on the current test burden associated with conducting the Appendix J2 test procedure. While DOE acknowledges the theoretical possibility of Appendix J2 requiring up to 70 test cycles, DOE is not aware of any products currently or historically on the market that would require this maximum number of test cycles. In DOE's experience, in practice the number of test cycles is around 6 cycles for clothes washers with very few and basic features; around 15–20 cycles for the most typical configurations on the market; and around 35 cycles for the most feature-rich models that would trigger the greatest number of required test cycles in Appendix J2. Nevertheless, DOE seeks to find opportunities for reducing the test burden associated with its test procedures, while maintaining representative, repeatable, and reproducible test results.

One of the key contributors to the total number of required cycles is the requirement to test three load sizes for each wash/rinse temperature selection required for testing on clothes washers with automatic WFCS (which represent the majority of the market). As described previously, the three load sizes were devised to approximate a normal distribution of consumer load sizes. At the time of the August 1997 Final Rule, clothes washer control panels were not as feature-rich as current models available on the market, and DOE had not contemplated that future clothes washer models could require testing up to 35 cycles.

Given the increasing prevalence of more feature-rich clothes washer models that require a higher number of test cycles under Appendix J2, DOE is proposing to reduce test burden by reducing the number of defined load sizes for the proposed new Appendix J from three to two for clothes washers with automatic WFCS. The following paragraphs discuss how DOE proposes to define the two load sizes for each capacity bin.

The new proposed small and large load sizes would continue to represent the same roughly normal distribution presented in the 1995 P&G data described above. The weighted-average load size using the proposed small and large load sizes would match the weighted-average load size using the current minimum, average, and maximum load sizes. As proposed, the small and large load sizes would have equal load usage factors (''LUFs'') [34] of 0.5. The small and large load sizes would represent approximately the 25th and 75th percentiles of the normal distribution, respectively. Each of these points is discussed in greater detail in the paragraphs that follow.

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Figure III.3 illustrates how the proposed new small and large load sizes would overlay with the P&G load distribution data.

[34] LUFs are weighting factors that represent the percentage of wash cycles that consumers run with a given load size.

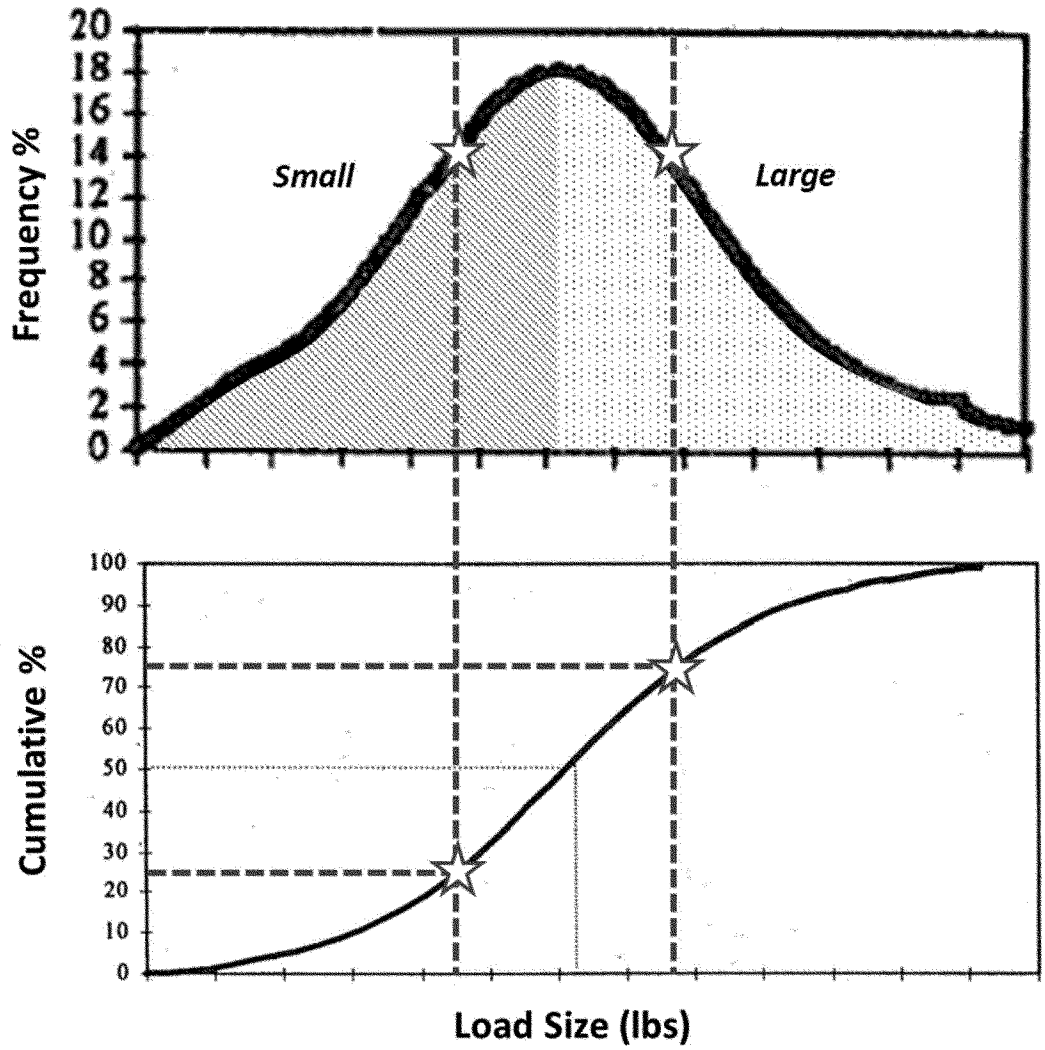

Figure III.3 Illustrative Depiction of the Two Load Sizes Representing the Normal Distribution of Consumer Loads from the 1995 Procter & Gamble Data

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As noted, DOE defined the proposed new load sizes and LUFs such that the weighted-average load size equals the weighted-average load size of the current minimum, average, and maximum load definitions for clothes washers with automatic WFCS, and thus will produce test results with equivalent representativeness. As noted in DOE's responses to comments above, DOE is not aware of any more recent, nationally representative field data indicating that the consumer load size distribution in relation to clothes washer capacity has changed since the introduction of the three load sizes in the August 1997 Final Rule.

Further, defining the small and large loads to represent approximately the 25th and 75th percentiles of the normal distribution balances the need to capture as large of a load size range as possible while remaining representative of the ''peak'' of the load distribution curve, which represents the most frequently used load sizes.

Specifically, DOE is proposing that the small and large load sizes be calculated using Equation III.1 and Equation III.2, respectively.

Small load size [*lb*] = 0.90 × Capacity [ft^3] + 2.34

Equation III.1 Proposed Determination of the Small Test Load Size

Large load size [*lb*] = 3.12 × Capacity [ft^3] + 0.72

Equation III.2 Proposed Determination of the Large Test Load Size

As noted, clothes washers with manual WFCS are tested only with the minimum and maximum load sizes, in contrast to clothes washers with automatic WFCS, which are tested with all three load sizes. Given DOE's proposal to define only two load sizes in the proposed new Appendix J, the same two load sizes could be used for all clothes washers, regardless of whether a clothes washer's WFCS is automatic or manual.

DOE's proposal would reduce test burden under the proposed new Appendix J by requiring only two load sizes to be tested instead of three for clothes washers with automatic WFCS. Specifically, the number of cycles tested would be reduced by 33 percent for clothes washers with automatic WFCS, which represent a large majority of clothes washers on the market.

DOE's proposed water fill selections corresponding to the new small and large load sizes are further discussed in section III.D.2 of this document.

DOE requests comment on its proposal to replace the minimum, maximum, and average load sizes with the small and large load sizes in the proposed new Appendix J. DOE seeks comment on how reducing the number of load sizes tested would impact the

representativeness of test results. DOE also requests data and information to quantify the reduction in test burden that would result from reducing the number of load sizes from three to two for clothes washers with automatic WFCS.

2. Water Fill Setting Selections for the Proposed Load Sizes

Section 3.2.6 of Appendix J2 prescribes the water fill setting selections to use with each load size based on the type of WFCS on the clothes washer. As discussed in section III.D.1.b of this document, DOE is proposing that the proposed new Appendix J test newly-defined small and large load sizes, rather than the minimum, maximum, and average load sizes used in Appendix J2. To test clothes washers using these new small and large load sizes, the appropriate water fill setting selections would also need to be provided in the proposed new Appendix J for each load size for each type of WFCS.

Appendix J2 defines two main types of WFCS: manual WFCS, which ''requires the user to determine or select the water fill level,'' and automatic WFCS, which ''does not allow or require the user to determine or select the water fill level, and includes adaptive WFCS and fixed WFCS.'' Sections 1.22 and 1.5 of Appendix J2, respectively. Section 3.2.6.2 of Appendix J2 further distinguishes between user-adjustable and not-user-adjustable automatic WFCS. Additionally, section 3.2.6.3 of Appendix J2 accommodates clothes washers that have both an automatic WFCS and an alternate manual WFCS. Proposed amendments to the definitions of fixed WFCS and user-adjustable automatic WFCS are further discussed in section III.H.3.a of this document.

Section 3.2.6.1 of the current Appendix J2 specifies that clothes washers with a manual WFCS are set to the maximum water level available for the wash cycle under test for the maximum test load size and the minimum water level available for the wash cycle under test for the minimum test load size.

Section 3.2.6.2.1 of Appendix J2 specifies that clothes washers with non-user-adjustable automatic WFCS are tested using the specified maximum, minimum, and average test load sizes, and that the maximum, minimum, and average water levels are selected by the control system when the respective test loads are used (*i.e.,* no selection of water fill level is required by the user).

Section 3.2.6.2.2 of Appendix J2 specifies that clothes washers with user-adjustable automatic WFCS undergo four tests. The first test is conducted using the maximum test load and with the automatic WFCS set in the setting that will give the most energy intensive result. The second test is conducted with the minimum test load and with the automatic WFCS set in the setting that will give the least energy intensive result. The third test is conducted with the average test load and with the automatic WFCS set in the setting that will give the most energy intensive result for the given test load. The fourth test is conducted with the average test load and with the automatic WFCS 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 are calculated as the average of the third and fourth tests.

As discussed in section III.D.1.b of this document, DOE is proposing that the proposed new Appendix J test newly-defined small and large load sizes, rather than the minimum, maximum, and average load sizes used in Appendix J2. To test clothes washers using these new small and large load sizes, the appropriate water fill setting selections would also need to be provided in the proposed new Appendix J for each load size for each type of WFCS.

For manual WFCS clothes washers, DOE first considered maintaining the current water fill level settings as specified in Appendix J2 (*i.e.,* testing the proposed small load with the minimum water level setting available and testing the proposed large load with the maximum water level setting available). However, the proposed small load is larger than the current minimum load, and using the minimum water fill setting for the larger-sized ''small'' load may not be representative of consumer use. In other words, while the minimum water fill level setting may provide an appropriate amount of water for washing the ''minimum'' load size, it may not provide sufficient water for washing the ''small'' load size as proposed. Further, the 1995 P&G data showed that when using a clothes washer with manual WFCS, consumers tend to select more water than is minimally necessary for the size of the load being washed.[35]

Based on these considerations, DOE is instead proposing to specify the use of the second-lowest water fill level setting for the proposed small load size. Although DOE is not aware of any clothes washers with manual WFCS currently on the market with only two water fill level settings available, DOE proposes to accommodate such a design by specifying that if the water fill level selector has two settings available for the wash cycle under test, the minimum water fill level setting would be selected for the small load size, consistent with the current specification in Appendix J2. In all cases, the water fill level selector would be set for the large load size to the maximum water fill level setting available for the wash cycle under test, consistent with the current specification in Appendix J2 for testing the maximum load size.

For clothes washers with non-user-adjustable automatic WFCS, no changes would be required because the water fill levels are determined automatically by the WFCS.

As discussed, section 3.2.6.2.2 of Appendix J2 specifies that clothes washers with user-adjustable automatic WFCS require four test cycles: one test at the most energy-intensive setting[36] using the maximum load size, one test at the least energy-intensive setting using the minimum load size, one test at the least energy-intensive setting using the average load size, and one test at the most energy-intensive setting using the average load size. As described in section III.D.1.b of this document, DOE's proposal would reduce the number of test load sizes from three to two, which would necessitate a change to these instructions for clothes washers with user-adjustable WFCS. To accommodate the proposed ''small'' and ''large'' load sizes in the proposed new Appendix J, DOE is proposing to require testing clothes washers with user-adjustable WFCS using the large test load size at the setting that provides the most energy-intensive result, and the small test load size at the setting that provides the least energy-intensive result. This proposal would capture the same range of water fill performance as the current test procedure (*i.e.,* capturing the range of least-intensive to most-intensive results). Additional tests could be considered, for example: Testing the small test load size at the setting that provides the most energy-intensive result and the large test load size at the setting that provides the least energy-intensive result. However, DOE has tentatively concluded that requiring

[35] See p. 20 of the AHAM document at *www.regulations.gov/document/EERE–2006–TP–0065–0027;* specifically, the conclusions that ''consumers are not good judges of clothes load size'' and ''consumers overuse maximum fill level.''

[36] As described in section III.H.3.b of this document, DOE is proposing to update the phrase ''the setting that will give the most energy-intensive result'' to ''the setting that uses the most water'' (and likewise for the setting that will give the least energy-intensive result) to reflect the original intent of this provision.

these two additional cycles beyond the two proposed cycles would create additional test burden with little, if any, improvement to representativeness compared to the proposal.

In summary, DOE tentatively concludes that the proposed changes to the water fill level settings, in conjunction with the proposed changes to the load sizes and the applicable LUFs, would continue to produce representative test results for each type of WFCS. Collectively, this combination of amendments would continue to approximate the same consumer usage patterns that provide the foundation for the current Appendix J2 test procedure.

DOE recognizes that for some models, these proposed amendments could change the measured efficiency. As noted, DOE is proposing to include the changes to the water fill level specifications only in the proposed new Appendix J, which DOE would use for the evaluation and issuance of updated efficiency standards. Thus, DOE is proposing that use of the proposed new Appendix J, if finalized, would not be required until such time as the energy conservation standards are amended using the measured efficiency as determined under Appendix J.

DOE requests comment on its proposal to change the water fill level selections in the proposed new Appendix J for clothes washers with manual and user-adjustable automatic WFCS to reflect the proposed small and large test load sizes. DOE seeks data and information on how the proposed changes to the water fill level selection for clothes washers with manual and user-adjustable automatic WFCS would impact test procedure representativeness.

3. Determination of Warm Wash Tested Settings

Section 3.5 of Appendix J2 states that if a clothes washer has four or more Warm Wash/Cold Rinse temperature selections, either all discrete selections shall be tested, or the clothes washer shall be tested at the 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, the next warmer temperature selection shall be used. DOE refers to the latter provision as the ''25/50/75 test.'' Section 3.6 of Appendix J2 states that the 25/50/75 test provision also applies to the Warm Wash/Warm Rinse temperature selection.

DOE first established the 25/50/75 test in Appendix J1–1997 to address the test burden for clothes washers that offer a large number of warm wash temperature selections, if the test procedure were to require testing all warm temperature selections. 62 FR 45484, 45497. DOE had originally proposed a similar method [37] in the April 1996 SNOPR for clothes washers having infinite warm wash selections that are nonuniformly distributed. 61 FR 17589, 17599. In the August 1997 Final Rule, DOE considered clothes washers with more than three warm wash temperatures to be clothes washers with infinite warm wash temperature selections, therefore allowing them to also use the 25/50/75 test. 62 FR 45484, 45498. DOE concluded at that time that testing at the various test points of the temperature range, with a requirement to test to the next higher selection if a temperature selection is not available at a specified test point, would provide data representative of the warm wash temperature selection offerings. *Id.*

DOE notes that the 25/50/75 test was adopted before the widespread use of electronic controls, which now allow for the assignment of wash water temperatures that may not reflect the physical spacing between temperature selections on the control panel. For example, with electronic controls, the 25-percent, 50-percent, and 75-percent positions on the dial may not necessarily correspond to 25-percent, 50-percent, and 75-percent temperature differences between the hottest and coldest selections. DOE is aware of clothes washers on the market with four or more warm wash temperature selections, in which the temperature selections located at the 25, 50, and 75-percent positions are low-temperature cycles that have wash temperatures only a few degrees higher than the coldest wash temperature; whereas the temperature selection labeled ''Warm'' is located beyond the 75-percent position on the temperature selection dial and is therefore not included for testing under the 25/50/75 test. 85 FR 31065, 31073.

In the May 2020 RFI, DOE requested feedback on the representativeness of using the 25/50/75 test on clothes washers with electronic controls, particularly for clothes washers in which the 25-percent, 50-percent, and 75-percent positions on the dial do not correspond to 25-percent, 50-percent, and 75-percent temperature increments between the hottest and coldest selections. *Id.* DOE also requested comment on whether there is a less burdensome means for the test procedure to be reasonably designed to measure energy use or efficiency of the clothes washer during a representative average use cycle.

AHAM opposed any changes to the 25/50/75 test for clothes washers with four or more warm/cold temperature selections, stating that changes are not necessary. AHAM asserted that introducing any change could lead to increased test burden with no evident benefit to consumers or energy savings. (AHAM, No. 5 at p. 13)

The CA IOUs supported DOE amending the 25/50/75 test to define positions along the temperature range instead of positions along the temperature selection device. The CA IOUs expressed concern that the current 25/50/75 test significantly underestimates energy usage of clothes washers in situations where positions along the temperature selection device do not match positions along the temperature range. (CA IOUs, No. 8 at p. 16)

The Joint Commenters expressed concern that the 25/50/75 test for clothes washers with four or more Warm Wash/Cold Rinse temperature selections is not representative because, for some clothes washers, the 25-percent, 50-percent, and 75-percent positions on the temperature dial may not accurately represent the 25-percent, 50-percent, and 75-percent temperature differences between the coldest and hottest selections. The Joint Commenters encouraged DOE to amend the 25/50/75 test so that it adequately represents the energy use of all clothes washers' Warm Wash/Cold Rinse temperature selections. (Joint Commenters, No. 10 at p. 3)

NEEA recommended that DOE characterize the Warm Wash/Cold Rinse temperature selections using a single test run on the wash temperature setting labeled ''Warm'' in order to increase representativeness of real-world use. NEEA expressed concern that the current test procedure likely underestimates hot water use and adds unnecessary test burden. (NEEA, No. 12 at pp. 18–20) NEEA added that its recommended change would eliminate up to six test runs from the test procedure (three load sizes at two wash/rinse temperatures). NEEA expects that this benefit would affect a sizeable percentage of the market, given NEEA's estimate that more than 75 percent of clothes washers sold in the Northwest have three or more discrete Warm Wash/Cold Rinse temperature selections. *Id.*

[37] The originally proposed test would have required testing at the 20/40/60/80 percent positions.

DOE is proposing to require testing of both the hottest Warm Wash/Cold Rinse setting and the coldest Warm Wash/Cold Rinse setting for all clothes washers in the proposed new Appendix J instead of the 25/50/75 test. Water consumption, electrical energy consumption, and all other measured values [38] would be averaged between the two tested cycles to represent the Warm Wash/Cold Rinse cycle. DOE is proposing to make the same changes to the Warm Wash/Warm Rinse cycle in the proposed new Appendix J.

DOE's proposal would decrease the test burden under the proposed new Appendix J for clothes washers that offer more than two Warm Wash/Cold Rinse or Warm Wash/Warm Rinse temperature settings, which DOE estimates represent around half of the market, by reducing the number of Warm Wash/Cold Rinse and Warm Wash/Warm Rinse tested cycles from three to two. Because this proposed approach may, however, change the measured energy use of clothes washers that offer more than two Warm Wash/Cold Rinse or Warm Wash/Warm Rinse settings, the proposed edits would not apply to Appendix J2 and therefore would not affect the measured efficiency of existing clothes washers. The ongoing RCW and CCW energy conservation standards rulemakings would consider the impact of any modifications to the measured efficiency using the proposed new Appendix J.

DOE tentatively concludes that the proposed approach in the proposed new Appendix J would maintain representativeness by continuing to capture the complete range of Warm Wash temperatures available for selection (*i.e.,* by relying on an average of the hottest Warm Wash/Cold Rinse setting and the coldest Warm Wash/Cold Rinse setting). For models that are currently tested using the 25/50/75 test and for which certain ''Warm'' settings are located beyond the 75-percent position on the temperature selection dial and therefore not included for testing, DOE's proposal would capture entire range of available Warm Wash temperatures available to the consumer, and therefore would improve representativeness.

DOE acknowledges that NEEA's suggestion to characterize the Warm Wash/Cold Rinse temperature selections using a single test run on the wash temperature setting labeled ''Warm'' would reduce test burden even further by requiring just a single test cycle. However, DOE tentatively concludes that testing a single Warm Wash temperature on a clothes washer that offers multiple Warm Wash selections to the user may not provide as accurate a representation of consumer usage as DOE's proposal, which captures the full range of available Warm Wash temperatures. In addition, DOE is concerned that defining the tested temperature as the setting labeled ''Warm'' would create ambiguity for clothes washers that offer multiple Warm Wash temperatures but for which no setting is expressly labeled ''Warm.'' For example, DOE is aware of clothes washers that use descriptors such as ''Colors,'' ''Brights,'' and ''Whites'' to describe the different wash temperature selections available to the user.

DOE requests comment on the proposal to require in the proposed new Appendix J testing only the hottest and the coldest Warm Wash/Cold Rinse settings. DOE seeks data and information on how this proposed change to the Warm Wash temperature settings required for testing would impact representativeness, testing costs, and manufacturer burden.

As noted, based on its market research, DOE estimates that roughly half of all clothes washer models on the U.S. market offer more than two Warm Wash/Cold Rinse temperature settings. For these units, DOE's proposal to simplify the Warm Wash/Cold Rinse settings required for testing may impact measured efficiency. Therefore, in this NOPR, DOE is proposing to change the Warm Wash tested settings only in the proposed new Appendix J and not in the existing Appendix J2. The ongoing RCW and CCW energy conservation standards rulemakings would consider the impact of these modifications to the Warm Wash/Cold Rinse tested cycles on measured efficiency.

4. Remaining Moisture Content

Section 3.8.4 of Appendix J2 requires that for clothes washers that have multiple spin settings [39] available within the energy test cycle that result in different RMC values, the maximum and minimum extremes of the available spin settings must be tested with the maximum load size on the Cold/Cold temperature selection.[40] The final RMC is the weighted average of the maximum and minimum spin settings, with the maximum spin setting weighted at 75 percent and the minimum spin setting weighted at 25 percent. The RMC measurement is used to calculate the drying energy component of IMEF. On most clothes washers, the drying energy component represents the largest portion of energy captured in the MEF and IMEF metric.

DOE is aware of clothes washers on the market that offer multiple spin settings, but which offer only the maximum spin setting on the Cold/Cold temperature selection. 85 FR 31065, 31073. This results in the lower spin setting not being factored into the RMC calculation, despite being available at other temperature selections in the energy test cycle. As defined in the Temperature Use Factor (''TUF'') [41] Table 4.1.1 in Appendix J2, the Cold/Cold temperature selection represents 37 percent of consumer temperature selections, whereas the other available temperature selections, for which the lower spin settings would be available on such a unit, represent a combined 63 percent of consumer temperature selections. *Id.* DOE has tentatively concluded that the existing RMC measurement procedure may not provide representative test results on certain clothes washer models.

a. Revised Calculation

In the May 2020 RFI, DOE requested comment on testing clothes washers that offer only the maximum spin setting on the Cold/Cold temperature selection but provide lower spin settings on other temperature selections. *Id.* DOE suggested that, RMC could be measured at the default spin setting for each temperature selection and averaged using the TUFs. *Id.*

AHAM stated that it is not necessary to address clothes washers with spin settings that are only available on certain temperature selections because the current method of RMC calculation is representative of an average use cycle. (AHAM, No. 5 at p. 13)

Samsung commented that clothes washers with spin settings that are available only on certain temperature selections make the current test procedure unrepresentative of real world use, since customers can select an

[38] As discussed in sections III.D.4.a and III.D.5 of this document, DOE is proposing to require measurements of RMC and cycle time for each tested cycle.

[39] The term ''spin settings'' refers to spin times or spin speeds. The maximum spin setting results in a lower (better) RMC.

[40] On clothes washers that provide a Warm Rinse option, RMC must be measured on both Cold Rinse and Warm Rinse, with the final RMC calculated as a weighted average using TUFs of 73 percent for Cold Rinse and 27 percent for Warm Rinse. DOE has observed very few clothes washer models on the market that offer Warm Rinse. For simplicity throughout this discussion, DOE references the testing requirements for clothes washers that offer Cold Rinse only.

[41] As described in more detail in section III.G.4 of this document, TUFs are weighting factors that represent the percentage of time that consumers choose a particular wash/rinse temperature selection for the wash cycle.

un-tested, and potentially more energy-intensive mode, in order to access the spin speed they intend to use. Samsung suggested that for such units, DOE consider requiring an additional test at another temperature setting where the spin speed is selectable. (Samsung, No. 6 at pp. 2–3)

NEEA commented that it was not aware of any units with spin speeds that are available only on certain temperature selections, but asserted that Appendix J2's current RMC test does not represent the range of RMCs expected in the field, even when maximum and minimum speeds are tested as specified in Appendix J2. NEEA presented RMC data from its testing of three top-selling clothes washer models, which demonstrated a difference in RMC of 0.3–1.1 percentage points between maximum and minimum speed.[42] (NEEA, No. 12 at p. 5) NEEA described laboratory testing it conducted to isolate and measure variables that affect RMC: testing was performed on 12 top-selling RCW models (including six front-loading and five top-loading), representing over five manufacturers, and spanning the range of efficiencies available on the market; two CCWs were tested as well. (NEEA at No. 12, pp. 2–13) NEEA stated its testing was performed according to the DOE Appendix J2 procedure, except that the RMC was calculated for all test runs performed; an encoder non-invasively measured revolutions per minute during test runs; and some tests were performed at different load sizes or using different cycle selections. Based on its data, NEEA stated that the current Appendix J2 RMC test does not represent the RMC of an average clothes washer cycle. NEEA asserted that the RMC test procedure prescribed in Appendix J2 represents a ''best-case'' scenario for RMC conditions—every other test that NEEA performed at alternate temperatures, load sizes, and cycle types increased the RMC value relative to the Appendix J2-tested value. *Id.* NEEA commented that, according to its testing, the primary difference in RMC for a given clothes washer was due to programmed spin differences such as spin time, and not differences in load size. *Id.* NEEA's stated that its test data show that among all the clothes washers tested, spin time was, on average, 7 minutes longer using the Cold Wash/Cold Rinse temperature selection with the maximum spin selection than when using the Warm Wash/Cold Rinse temperature selection with the default spin selection. These differences resulted in an RMC difference of an average of 10 percentage points. *Id.* NEEA recommended that DOE measure RMC at the default spin setting for each temperature selection and load size, and average those RMC values using TUFs and LUFs. NEEA stated that this approach will reduce test burden by removing the need for a separate test run exclusively for measuring RMC, increase representativeness by capturing RMC for all load sizes and water temperatures, and potentially result in significant energy savings for clothes dryers in the future. *Id.*

The Joint Commenters and CA IOUs supported NEEA's comments and urged DOE to amend the test procedure to measure RMC for all load sizes and temperature selections, and to weight the measurements using LUFs and TUFs because doing so would improve the representativeness of the test procedure. (Joint Commenters, No. 10 at pp. 1–2; CA IOUs, No. 8 at pp. 6–7) The Joint Commenters stated that the current test procedure is likely significantly underestimating drying energy use and is leading to inaccurate efficiency ratings. (Joint Commenters, No. 10 at p. 1)

DOE is proposing an amended method for measuring RMC in the proposed new Appendix J that would require measuring RMC on each of the energy test cycles using the default spin settings, and determining the final RMC by weighting the individual RMC measurements using the same TUFs and LUFs that apply to the water and energy measurements. DOE notes that this proposal is largely consistent with the approach recommended by NEEA and supported by the Joint Commenters and CA IOUs.

DOE tentatively concludes (based on its test observations as described above and the test results presented by NEEA) that the current method of measuring RMC may no longer produce test results that measure energy and water use during a representative average use cycle or period of use, particularly as the prevalence of clothes washers with complex electronic controls continues to increase in the market. On a clothes washer with basic controls (*e.g.,* in which the available spin settings are the same regardless of what wash/rinse temperature is selected), measuring RMC using only the Cold/Cold cycle would be expected to provide RMC results that are equally representative of the other available wash/rinse temperatures, which as noted comprise the majority of consumer cycle selections. However, on a clothes washers in which the selection of wash/rinse temperature affects which spin settings are available to be selected, measuring RMC using only the Cold/Cold cycle may not necessarily provide results that measure energy and water use during a representative average use cycle or period of use (*i.e.,* across the range of wash/rinse temperature options selected by consumers, as represented by the temperature use factors).

The data presented by NEEA illustrates how, on average, the spin portion of the cycle on the setting used to measure RMC (*i.e.,* the maximum spin setting on the Cold Wash/Cold Rinse temperature setting) may not be representative of the spin characteristics and resulting RMC measurement of other temperature selections comprising the energy test cycle. Specifically, the data presented by NEEA suggest that the specific cycle configuration from which RMC is measured is programed with a longer spin time than other temperature settings available to the consumer, resulting in a significantly better RMC measurement than would be experienced by the consumer on the majority of wash cycles performed.

The proposed update to the RMC measurement would provide a more representative measure of RMC than the current test procedures because RMC would be measured on all of the energy test cycles rather than only the Cold Wash/Cold Rinse cycles, which represent only 37 percent of consumer cycles and may not share the same RMC performance as the other 63 percent of consumer cycles.[43]

Regarding Samsung's suggestion to require an additional RMC test at a different temperature setting that would provide the spin speed that is unavailable on the Cold setting, DOE tentatively concludes that its proposed approach would provide a more representative measure of RMC by capturing RMC across all the temperature settings within the energy test cycle.

Because RMC directly affects drying energy, which is a large component in the calculation of IMEF, it is important that the RMC value be representative of all test cycles. DOE's proposal would make the RMC calculation consistent with how hot water energy, electrical energy, and water usage are calculated, *i.e.,* by testing multiple load sizes and temperatures and averaging these values using LUFs and TUFs.

[42] DOE notes that in NEEA's comment, this range was cited as 0.3–0.9, but the data in the table presented by NEEA displayed a range of 0.3–1.1 percentage points between the RMCs at maximum and minimum speed.

[43] 37% is the TUF for the Cold Wash/Cold Rinse temperature selection as specified in Table 4.1.1 of Appendix J2.

DOE tentatively concludes that this proposal would reduce overall test burden. The proposal would require weighing the cloth before and after each test cycle, but would avoid the need to perform extra cycles for capturing both the maximum and minimum spin settings available on the clothes washer if such spin settings are not activated by default as part of the energy test cycle. In DOE's experience, a majority of clothes washers offer multiple spin settings, thus requiring between one and eight RMC cycles, depending on the specific options available on the clothes washer. Appendix J2 currently requires measuring the test load weight before each cycle in order to verify that the load is bone-dry.[44] To DOE's knowledge, many laboratories already measure and record the test load weight after each test cycle as a means for identifying potential cycle anomalies or to provide additional data that can be used to verify quality control retrospectively. In cases where a laboratory currently does not measure the weight after completion of the cycle, DOE's proposal would incur a *de minimis* amount of additional time to weigh the load after the cycle, which can be performed using the same scale used to weigh the load at the beginning of the cycle. For these reasons DOE does not expect the additional collection of data to result in additional test burden.

This proposal would likely impact the measured RMC value and thus would impact a clothes washer's IMEF value. Therefore, in this NOPR, DOE is proposing the revised RMC procedure only in the proposed new Appendix J and not in existing Appendix J2. The ongoing RCW and CCW energy conservation standards rulemakings would consider the impact of any modifications to the RMC calculation on measured efficiency.

DOE requests comment on its proposal to revise the RMC procedure so that RMC would be measured at the default spin setting for each temperature selection and load size, and the individual RMC values would be averaged using TUFs and LUFs to calculate the final RMC. DOE seeks data and information regarding how this change to the RMC calculation would impact testing costs and manufacturer test burden.

DOE further requests comment on whether DOE should implement any changes to the RMC calculation in Appendix J2 to address clothes washers with spin settings that are available only on certain temperature selections.

[44] See section III.D.4.b of this document for the definition of the term ''bone-dry.''

b. Definition of Bone-Dry

In section 1.6 of Appendix J2, the term ''bone-dry'' is defined as a condition of a load of test cloth that 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. The bone-dry definition was first established in the September 1977 Final Rule. 42 FR 49801, 49807–49808. In the March 2012 Final Rule, DOE added a specification to section 2.6 of Appendix J2 requiring that the dryer used for drying the cloth to bone-dry must heat the test cloth (and stuffer cloths) above 210 °F (99 °C). 77 FR 13888, 13924.

In response to the May 2020 RFI, NEEA recommended that DOE update its procedure for achieving bone-dry test cloth to harmonize with Annex G of IEC Standard 60456, ''Clothes washing machines for household use—Methods for measuring the performance'' Edition 5.0 (''IEC 60456''). (NEEA, No. 12 at p. 26) In particular, NEEA recommended that DOE consider the tumble dryer specifications in Section G.2 of IEC 60456, the dryer inlet temperature measurement method, and the requirement that the weight of the bone-dry load change be no more than 1 percent or 0.044 lb (whichever is smaller) between 10-minute drying periods (Section G.3 of IEC 60456). *Id.*

DOE is not aware of any problems with the current bone-dry definition that would justify changing the bone-dry definition as NEEA has suggested. DOE has tentatively concluded that specifying a weight change of no more than 1 percent or 0.044 lb (whichever is smaller) would increase the test burden because for a majority of tested loads, the 0.044 lb requirement would apply, which would be more stringent than the existing 1 percent requirement. DOE has not identified, and commenters have not suggested, any problems with the current approach. In the absence of data indicating any problems with the current procedure, DOE is not proposing any changes to the bone-dry definition or associated dryer temperature measurement method in this NOPR.

DOE requests comment on its tentative conclusion not to propose changes to the bone-dry definition and associated dryer temperature measurement method.

c. Starting Moisture Content

Section 2.9.1 of Appendix J2 requires the test load for energy and water consumption measurements to be bone-dry prior to the first cycle of the test, and allows the test load to be dried to a maximum of 104 percent of the bone-dry weight for subsequent testing. This allowance effectively allows for an increase to the starting moisture content of the load from 1 percent moisture (as implied in the definition of ''bone-dry'' in section 1 of Appendix J2) to 4 percent moisture, which creates two concerns.

First, for the largest clothes washers on the market, which use the largest test load sizes, a 4 percent tolerance can represent up to 1 lb of additional water weight in a starting test load. DOE is concerned that the range of starting water weights that this provision allows could reduce the repeatability and reproducibility of test results, particularly for larger clothes washers.

Second, as described in section III.D.4.a of this document, DOE is proposing to require the measurement of RMC for all tested cycles in the proposed new Appendix J. The RMC of each tested cycle would be calculated based on the bone-dry weight at the start of the cycle. Allowing the bone-dry weight to vary within a range of 1 percent to 4 percent moisture at the beginning of each tested cycle would introduce variability into the RMC calculation.

Therefore, to improve repeatability and reproducibility of test results, DOE is proposing in new Appendix J to remove the provision that allows for a starting test load weight of 104 percent of the bone-dry weight, and instead require that each test cycle use a bone-dry test load. DOE is not proposing to make any changes to section 2.9.1 of Appendix J2, recognizing that such a change could impact measured energy efficiency.

In DOE's experience, most test laboratories use the bone-dry weight as the starting weight of each test load rather than a starting weight up to 104 percent of bone-dry, as allowed by section 2.9.1 of Appendix J2. If a test laboratory does make use of this provision in section 2.9.1 of Appendix J2, the requirement to use the bone-dry weight would add no more than 10 minutes of drying time per cycle to ensure that the test load has reached the bone-dry requirement. In DOE's experience, most test laboratories dry the load from the previous test cycle while the next cycle is being tested on the clothes washer, such that a minor increase in drying time would not affect the overall time required to conduct the test procedure.

DOE requests comment on its proposal to require that each test cycle use a bone-dry test load in the proposed new Appendix J. DOE requests comment on whether test laboratories

start test cycles with the test load at bone-dry or at up to 104 percent of the bone-dry weight. DOE further requests feedback on its assessment that this change would not affect test burden.

5. Cycle Time Measurement

The current test procedure does not specify a measurement for average cycle time. In this NOPR, DOE is proposing to base the allocation of annual combined low-power mode hours on the measured average cycle time rather than a fixed value of 8,465 hours, for the proposed new Appendix J (see section III.G.3 of this document). DOE is therefore proposing to require the measurement of average cycle time for the proposed new Appendix J. Calculating the annual standby mode and off mode hours using the measured average cycle time would provide a more representative basis for determining the energy consumption in the combined low-power modes for the specific clothes washer under test.

DOE is proposing to define the overall average cycle time of a clothes washer model as the weighted average of the individual cycle times for each wash cycle configuration conducted as part of the test procedure, using the TUFs and LUFs for the weighting. Using the weighted-average approach would align the average cycle time calculation with the calculations for determining weighted-average energy and water use. These proposed changes would apply only to the proposed new Appendix J.

DOE does not expect the measurement of cycle time to increase test burden. To DOE's knowledge, test laboratories are either already measuring cycle time for all tested cycles or using data acquisition systems to record electronic logs of each cycle, from which determining the cycle time would require minimal additional work.

DOE requests comment on its proposal to add cycle time measurements and to calculate average cycle time using the weighted-average method in the proposed new Appendix J. DOE also requests comment on its assertion that adding cycle time measurements and a calculation of a weighted-average cycle time would not increase testing costs or overall test burden.

6. Capacity Measurement

Section 3.1 of Appendix J2 provides the procedure for measuring the clothes container capacity, which represents the maximum usable volume for washing clothes. The clothes container capacity is measured by filling the clothes container with water and using the weight of the water to determine the volume of the clothes container. For front-loading clothes washers, this procedure requires positioning the clothes washer on its back surface such that the door opening of the clothes container faces upwards and is leveled horizontally.

a. Computer-Aided Design

DOE is aware that for some front-loading clothes washers, positioning the clothes washer on its back surface may be impractical or unsafe, particularly for very large or heavy clothes washers or those with internal components that could be damaged by the procedures specified in section 3.1 of Appendix J2. 85 FR 31065, 31072. On other clothes washers, filling the clothes container volume as described could be difficult or impractical, particularly for clothes washers with concave or otherwise complex door geometries. *Id.*

Recognizing these challenges, in the May 2020 RFI, DOE considered whether to allow manufacturers to determine the clothes container capacity by performing a calculation of the volume based upon computer-aided design (''CAD'') models of the basic model in lieu of physical measurements of a production unit of the basic model. 85 FR 31065, 31072. DOE allows a CAD-based approach for consumer refrigerators, refrigerator-freezers, and freezers, as specified at 10 CFR 429.72(c).[45] In the May 2020 RFI, DOE requested comments on whether to allow CAD-based determination of clothes container capacity for clothes washers in lieu of physical measurements of a production unit of the basic model. *Id.* DOE also requested comments on the impacts on manufacturer burden associated with any such change to the capacity measurement procedure. *Id.*

AHAM stated that the current volume measurement procedure works well as written, and AHAM does not believe it is necessary to allow for CAD-based determination of volume, stating that it would add unnecessary complexity to the test procedure. (AHAM, No. 5 at p. 10)

UL commented that while manufacturers could easily use CAD models of their clothes washer containers in order to measure capacity, third-party laboratories would still need to use the water-filling method. UL suggested that in order to eliminate the necessity of the water-filling method, manufacturers could submit CAD drawings to DOE as part of the certification process. (UL, No. 9 at p. 3)

NEEA commented that DOE should not allow manufacturers to declare capacities that cannot be verified by a third party (such as manufacturer-reported CAD-based determinations). (NEEA, No. 12 at pp. 26–27)

No information is available at this time to determine how a capacity rating based on a CAD model would compare to the measured capacity using the procedure defined in Appendix J2. DOE is not proposing to allow CAD-based capacity measurement at this time.

b. Alternative Measurements

In test procedures established in certain other jurisdictions (*e.g.,* Europe, the United Arab Emirates, Australia, and New Zealand), clothes washer capacity is represented in terms of the weight of clothing (*e.g.,* kilograms or pounds) that may be washed, rather than the physical volume of the clothes container. Furthermore, some of these test procedures allow for the clothes washer capacity to be declared by the manufacturer, representing the maximum weight of clothing that the clothes washer is designed to successfully clean. 85 FR 31065, 31072.

Some of the alternate representations of clothes washer capacity that DOE could consider include:

- A weight-based capacity, such as pounds of clothing, which could be derived from the measured volume of the clothes container in a similar manner to the way that the maximum test load is currently specified in Table 5.1 of Appendix J2 based on the measured clothes container volume.
- A clothes container capacity that is declared by the manufacturer using an industry-standard methodology. For example, IEC 60456 provides two optional methodologies for determining clothes container capacity, using either table tennis balls or water.[46]

In the May 2020 RFI, DOE requested comment on whether to consider any changes to the representation of clothes washer capacity, including, but not limited to, a weight-based capacity or manufacturer-declared capacity based on industry-standard methodology. 85 FR 31065, 31072. Specifically, DOE

[45] Under this approach, any value of total refrigerated volume of a basic model reported to DOE in a certification of compliance in accordance with § 429.14(b)(2) must be calculated using the CAD-derived volume(s) and the applicable provisions in the test procedures in 10 CFR part 430 for measuring volume, and must be within 2 percent, or 0.5 ft^3 (0.2 ft^3 for compact products), whichever is greater, of the volume of a production unit of the basic model measured in accordance with the applicable test procedure in 10 CFR part 430. (*See* 10 CFR 429.72(c).)

[46] For the table tennis ball approach, the clothes container is filled with specified table tennis balls, and an empirically determined equation is provided to convert the number of balls into a capacity value. The water approach is similar to the approach provided in section 3.1 of Appendix J2.

requested comment on whether the two methodologies provided in IEC 60456 provide capacity measurements that result in a test method that measures the energy use of the clothes washer during a representative average use cycle or period of use. *Id.*

AHAM supported the continued use of the current DOE clothes washer volume measurement, stating that it is accurate, repeatable, and reproducible. AHAM opposed any changes of the representation of clothes washer volume to a weight-based measurement or other manufacturer-declared capacity because, to AHAM's knowledge, there is not a repeatable, reproducible way to do so. (AHAM, No. 5 at pp. 10–12) AHAM described work it has performed over the past decade to develop a test procedure to evaluate capacity in terms of the weight of clothes that can be effectively washed and rinsed, similar to various international approaches. *Id.* As part of its investigation, AHAM tested cleaning, rinsing, and gentleness on nine randomly selected units to develop a baseline performance. AHAM stated that the results of this testing showed that the variation of the performance scores was too high to yield repeatable or reproducible results. *Id.* AHAM stated that any DOE effort to formulate a similar procedure would likely meet similar challenges. *Id.*

Electrolux supported AHAM's position that alternative capacity measurement methods should not be considered. Electrolux stated that the water volume-based method in use today is easy for third-party laboratories to use, and provides the best and most accurate data for the DOE test method. Electrolux stated that the water method is neither too restrictive nor too burdensome. (Electrolux, No. 11 at p. 1)

NEEA commented that DOE should maintain a single method of measurement of volumetric capacity, as it does currently in Appendix J2. (NEEA, No. 12 at pp. 26–27) NEEA stated that DOE should not allow multiple methods of capacity measurement under the test method, stating that this can lead to inconsistency and inequitable application of the test procedure that includes a maximum load size based on basket capacity. *Id.* NEEA also commented that DOE should not allow manufacturer declarations of capacity that cannot be verified by a third party (such as manufacturer reported CAD-based determinations). *Id.* NEEA cited the potentially high burden that would be associated with including washing performance testing that would be required for a manufacturer-reported weight capacity. *Id.*

DOE appreciates details and insights from stakeholders and industry regarding efforts to investigate this issue. DOE is not proposing to specify any alternatives to the current capacity measurement procedure at this time.

c. Modifications to the Existing Capacity Method

Section 3.1 of Appendix J2 provides the methodology for determining clothes container capacity. In the March 2012 Final Rule, DOE revised the clothes container capacity measurement to better reflect the actual usable capacity compared to the previous measurement procedures. 77 FR 13887, 13917. In the August 2015 Final Rule, DOE further added to the capacity measurement procedure a revised description of the maximum fill volume for front-loading clothes washers, as well as illustrations of the boundaries defining the uppermost edge of the clothes container for top-loading vertical-axis clothes washers and the maximum fill volume for horizontal-axis clothes washers. 80 FR 46729, 46733.

For top-loading vertical-axis clothes washers, DOE defined the uppermost edge of the clothes container as the uppermost edge of the rotating portion of the wash basket. 77 FR 13887, 13917–13918. DOE also concluded that the uppermost edge is the highest horizontal plane that a dry clothes load could occupy in a top-loading vertical-axis clothes washer that would allow clothing to interact with the water and detergent properly. *Id.*

Samsung recommended that DOE reconsider the capacity measurement guideline for top-loading clothes washers. Samsung stated that volume should be measured up to the manufacturer-recommended fill line, instead of measuring up to the top of the rotating portion of the clothes container. Samsung added that the discrepancy between measured volume and manufacturer-recommended fill line may overstate the energy and water efficiency in the test method compared to real-world use. (Samsung, No. 6 at p. 2)

DOE discussed its justification for the current fill level definition for top-loading clothes washers as part of the March 2012 Final Rule. 77 FR 13888, 13917–13920. The fill level recommended by Samsung corresponds to ''Fill Level 1'' as described in the March 2012 Final Rule, while the current definition as the uppermost edge of the rotating portion of the wash basket corresponds to ''Fill Level 2'' as described in the March 2012 Final Rule. As DOE explained in the March 2012 Final Rule, by respecting manufacturer recommendations, Fill Level 1 would best ensure wash performance is maintained, and thus is the most consumer-relevant fill level. However, should clothing occupy the space between Fill Level 1 and Fill Level 2 during a wash cycle, the clothing could be cleaned sufficiently because water can still be contained within that volume. Clothing above Fill Level 2, however, is not likely to be cleaned sufficiently because it would be outside the wash basket during the wash cycle and risks being damaged if it becomes entangled on stationary fixtures such as the tub cover or other mechanical components of the clothes washer during the wash cycle. *Id.* For these reasons, DOE adopted Fill Level 2 for determining the capacity of top-loading clothes washers.

DOE is not aware of any changes to product designs since the March 2012 Final Rule that would cause DOE to reevaluate its conclusions about the most appropriate capacity fill level. In DOE's experience since the March 2012 Final Rule, the existing capacity fill definition is implemented consistently by test laboratories and results in repeatable and reproducible measurements of capacity. DOE is therefore not proposing any changes to the existing capacity measurement method.

DOE requests comment on its tentative determination to maintain the current capacity measurement method.

7. Anomalous Cycles

Section 3.2.9 of Appendix J2 specifies discarding the data from a wash cycle that ''provides a visual or audio indicator to alert the user that an out-of-balance condition has been detected, or that terminates prematurely if an out-of-balance condition is detected, and thus does not include the agitation/tumble operation, spin speed(s), wash times, and rinse times applicable to the wash cycle under test.'' In the May 2020 RFI, DOE sought input on whether the test procedure should, in addition to out-of-balance conditions, also require discarding data for wash cycles in which any other anomalous behavior may be observed. 85 FR 31065, 31070. DOE also requested information on whether the test procedure should explicitly require that any wash cycle for which data was discarded due to anomalous behavior must also be repeated to obtain data without the anomalous behavior to be included in the energy test cycle. *Id.*

NEEA requested more specific guidance on when test cycle data should be considered anomalous to ensure test

procedure consistency, specifically whether a ''visual or audio'' indicator includes tub cabinet hits, a paused spin cycle, anomalous revolutions per minute (''rpm''), an ''unbalanced'' indication on the control panel, or any other type of signal. NEEA stated that inconsistencies among test laboratory interpretations of this provision could lead to repeatability and reproducibility issues. (NEEA, No. 12 at p. 17)

UL commented that DOE should consider amending section 3.2.9 of Appendix J2 to specify whether the term ''audio indicator'' includes only electronic tones from the clothes washer (*e.g.,* beeps), or if it also includes mechanical noises from the machinery itself (*e.g.,* the cabinet hitting due to an unbalanced load). UL added that unbalanced visual indicators (such as a machine control panel displaying ''ul'' for unbalanced load) may last for only a few seconds and could be easily missed. (UL, No. 9 at p. 2) UL also suggested that wash water use data be discarded if consumption and/or cycle time differ vastly from other cycles run on the machine, since cycle time may be altered if a clothes washer adds an extra rinse to redistribute an unbalanced load. *Id.*

AHAM commented that sometimes a cycle may not terminate due to an out-of-balance or other anomalous behavior, and that some models do not provide audio or visual indicators to notify the consumer that an anomalous condition was detected and fixed by the machine. (AHAM, No. 5 at pp. 7–8) According to AHAM, these actions benefit the consumer—instead of requiring consumer interaction during the cycle, the clothes washer addresses the anomalous behavior and finishes the cycle. AHAM added that this also often saves energy and water by finishing the cycle with some incrementally increased water or energy usage instead of requiring a cycle to be canceled and completely re-run. *Id.* AHAM stated that it is unlikely that these anomalous conditions happen frequently when consumers use the clothes washer and that test runs exhibiting these conditions should be considered invalid. *Id.* In response to DOE's question about how anomalous behavior can be detected without an indicator and during the test of only one unit, AHAM commented that a spot check verification test would be the only means for doing so. AHAM added that should anomalous behavior occur during a single test, more units will almost always be tested as part of DOE's enforcement procedures or ENERGY STAR verification procedures, and that at that time, anomalous behavior would become evident and would be a signal to the laboratory that the outlier test run should be discarded. *Id.* According to AHAM, a trained technician—whether at a manufacturer laboratory or a third-party laboratory—should similarly be able to tell that there was a power interruption at some point in the duration of the cycle due to software detecting an issue, stopping the cycle, and taking action to fix it (*e.g.,* redistributing the load). *Id.*

AHAM recommended that DOE add language to the test procedure specifying that if there is a visual or audio indicator that would alert the user about anomalous behavior, or if there are other indicators that suggest anomalous behavior, the test be stopped and the results discarded. *Id.* According to AHAM, without this change, manufacturers may need to redesign products to terminate at any indication of anomalous behavior rather than automatically resolve the issue for the consumer. AHAM added that the ability of a clothes washer to correct itself without terminating the cycle is an important consumer utility. *Id.* To address possible circumvention concerns (*e.g.,* that a product would be designed to perform this way), AHAM proposed that DOE consider a similar approach to IEC 60456 (Section 8.2.5 and the accompanying note which references Section 9.1), which limits the number of additional test runs and requires reporting the reason for the rejection of a test run. *Id.*

Electrolux supported the suggestion that energy data obtained from a cycle that may be acting erratically or abnormally in any way should be discarded. Electrolux recommended that DOE consider a possible manufacturer-supplied cycle status code that would be available to any test agency following completion of a cycle, which would monitor the cycle for anomalous behavior and provide an error code indicating not to use that cycle data. Electrolux additionally supported AHAM's comments on this issue. (Electrolux, No. 11 at p. 3)

DOE acknowledges that as clothes washer technology has improved, certain clothes washers are designed to self-correct out-of-balance loads or make other adjustments to the operation of the unit to complete the cycle without alerting the consumer or requiring user intervention. DOE also recognizes the benefit of objective and observable criteria to determine when an anomalous cycle has occurred, based on a single test, such that the data from that anomalous cycle should be discarded.

To provide more objective and observable criteria, DOE proposes that data from a wash cycle would be discarded if either: The washing machine signals to the user by means of an audio or visual alert that an off-balance condition has occurred; or the wash cycle terminates prematurely and thus does not include the agitation/tumble operation, spin speed(s), wash times, and rinse times applicable to the wash cycle under test. The proposed reference to an audio or visual alert refers to a warning sound initiated by the clothes washer, or visual cue such as a flashing light or persistent error code, that is provided to the user to actively inform the user that a problem has occurred; as opposed to a more passive indication such as the cabinet hitting the side or a change in the projected cycle duration, which could go unnoticed by the user or which itself may not be an indication of an out-of-balance load that warrants discarding the data for a test cycle. To emphasize this intent, DOE is proposing to change the current phrase ''provides a visual or audio indicator to alert the user'' to ''signals to the user by means of a visual or audio alert'' in both section 3.2.9 of Appendix J2 and section 3.2.6 of the proposed new Appendix J.

DOE is also proposing to change the current phrase ''terminates prematurely if an out-of-balance condition is detected'' to simply ''terminates prematurely,'' in recognition that other factors beyond an out-of-balance condition could also cause a wash cycle to terminate prematurely (*e.g.,* a clogged filter, mechanical malfunction, *etc.*), and that for any such reason, the data from that wash cycle would be discarded.

DOE is further proposing non-substantive wording changes to section 3.2.9 of Appendix J2 and section 3.2.6 of the proposed new Appendix J to make explicit that if data are discarded for the reasons described in these sections, the wash cycle is repeated.

DOE requests comment on the proposed criteria for determining whether test data are to be discarded. Specifically, DOE requests comment on the proposal that test data are discarded if a washing machine either signals to the user by means of a visual or audio alert that an out-of-balance condition has occurred or terminates prematurely. DOE requests comment on whether additional or alternate criteria would provide objective and observable indication during a single test that test data are to be discarded.

8. Semi-Automatic Clothes Washers

Section III.C.2 of this document discussed the installation of semi-automatic clothes washers for testing.

This section discusses the wash/rinse temperature selections and TUFs applicable to semi-automatic clothes washers. As noted, semi-automatic clothes washers are defined at 10 CFR 430.2 as a class of clothes washer that is the same as an automatic clothes washer except that user intervention is required to regulate the water temperature by adjusting the external water faucet valves. DOE's test procedure requirements at 10 CFR 430.23(j)(2)(ii) state that the use of Appendix J2 is required to determine IMEF for both automatic and semi-automatic clothes washers.

Semi-automatic clothes washers inherently do not provide wash/rinse temperature selections on the control panel, as any combination of cold, warm, and hot wash temperatures and rinse temperatures are provided by the user's adjustment of the external water faucet valves. The following discussion provides relevant historical context on this issue.

Section 6.1 of Appendix J–1977 and Appendix J–1997 provided separate TUFs explicitly for semi-automatic clothes washers for the following wash/rinse temperature combinations: Hot/Hot, Hot/Warm, Hot/Cold, Warm/Warm, Warm/Cold, and Cold/Cold. The specification of these TUFs indicated that these six wash/rinse temperature combinations were required for testing. Section 3.2.2.6 of Appendix J–1977 and Appendix J–1997 and section 3.2.3.1.6 of Appendix J1–1997 and Appendix J1–2001 provided a table indicating the following external water faucet valve positions required to achieve each wash and rinse temperature selection:

- Hot: Hot valve completely open, cold valve closed;
- Warm: Hot valve completely open, cold valve completely open; and
- Cold: Hot valve closed, cold valve completely open.

Inherently, testing the Hot/Hot, Warm/Warm, and Cold/Cold temperature combinations require no changes to the water faucet valve positions between the wash and rinse portions of the cycle. However, testing the Hot/Warm, Hot/Cold, and Warm/Cold temperature combinations requires the test administrator to manually regulate the water temperature between the wash and rinse portions of the cycle by adjusting the external water faucet valves. As reflected in DOE's definition of semi-automatic clothes washer, user intervention is required to regulate the water temperature of all semi-automatic clothes washers (*i.e.,* user regulation of water temperature is the distinguishing characteristic of a semi-automatic clothes washer). *See* 10 CFR 430.2.

When it established Appendix J1–1997, DOE combined all of the TUF tables—for both automatic and semi-automatic clothes washers—that were provided in section 5 and section 6 of Appendix J–1997 into a single condensed table in Table 4.1.1 of Appendix J1–1997. 62 FR 45484, 45512. In contrast to Appendix J–1997, which provided separate TUF tables for every possible set of available wash/rinse temperature selections, the simplified table in Appendix J1–1997 was organized into columns based on the number of wash temperature selections available on a clothes washer. Warm rinse was considered separately within each column of the table. *Id.* In the current version of Appendix J2, Table 4.1.1 remains a single simplified table, although in the August 2015 Final Rule, DOE clarified the column headings by listing the wash/rinse temperature selections applicable to each column. 80 FR 46729, 46782.

The simplified Table 4.1.1 in Appendix J2 does not state which column(s) of the table are applicable to semi-automatic clothes washers. In the May 2012 Direct Final Rule, DOE stated that it was not aware of any semi-automatic clothes washers on the market. 77 FR 32307, 32317. However, DOE is currently aware of several semi-automatic clothes washer models available in the U.S. market.

In the May 2020 RFI, DOE requested input on whether to amend the test procedure with regard to the specificity of wash/rinse test combinations for semiautomatic clothes washers in Appendix J2, and whether those updates would provide test results that measure energy efficiency and water use during a representative average use cycle or period of use, and whether they would be unduly burdensome to conduct. 85 FR 31065, 31077.

No comments were received regarding these aspects of the test procedure for semi-automatic clothes washers. The following sections describe DOE's proposals for specifying how to test semi-automatic clothes washers.

a. Temperature Selections and Usage Factors

DOE is proposing to specify how to test semi-automatic clothes washers in the proposed new Appendix J. In this section, DOE describes its proposals to specify which temperatures to test and which TUFs to apply to the measured results.

As described above, Appendix J–1977 required testing six wash/rinse temperature combinations: Hot/Hot, Hot/Warm, Hot/Cold, Warm/Warm, Warm/Cold and Cold/Cold. The TUFs in Table 6.1 of Appendix J–1977 used the same general usage factors for semi-automatic clothes washers as for automatic clothes washers. 42 FR 49802, 49810. For example, the Cold/Cold TUF of 0.15 was the same for both types, and the sum of Hot/Hot, Hot/Warm and Hot/Cold (with a total TUF of 0.30) for semi-automatic clothes washers was the same as the TUF for Hot/Cold on an automatic clothes washer with only three temperature selections.

DOE updated the TUFs in the August 1997 Final Rule, based on P&G data provided by AHAM. 62 FR 45484, 45491. Currently, Table 4.1.1 of Appendix J2 does not include TUFs for all six of the temperatures required for testing in Appendix J–1977.

DOE considered requiring that semi-automatic clothes washers be tested with the same six temperature settings as in Appendix J–1977. Table III.2 lists potential TUF values that could be used if DOE were to require testing all six possible temperature combinations. These values follow the same pattern that was used in Table 6.1 of Appendix J–1977, such that the sum of all temperature selections with a Hot Wash add up to 0.14 and the sum of all temperature selections with a Warm Wash add up to 0.49,[47] consistent with the current TUFs for Hot/Cold and Warm/Cold as defined in Table 4.1.1 of Appendix J2.

TABLE III.2—POTENTIAL TEMPERATURE USAGE FACTORS FOR SEMI-AUTOMATIC CLOTHES WASHERS REFLECTING SIX REQUIRED TEMPERATURE COMBINATIONS

Wash/rinse temperature selection	Potential TUF values
Hot/Hot	0.07
Hot/Warm	0.05
Hot/Cold	0.02
Warm/Warm	0.38
Warm/Cold	0.11
Cold/Cold	0.37

By including all six possible temperature combinations, Table 6.1 of Appendix J–1977 included wash/rinse temperature settings that require the water temperature to be changed between the wash portion and the rinse portion of the cycle (*i.e.,* Hot/Warm, Hot/Cold, and Warm/Cold), and wash/rinse temperature settings that do not require any water temperature change

[47] DOE notes that the apportionment between Warm/Warm and Warm/Cold was different for automatic clothes washers and semi-automatic clothes washers in Appendix J–1977. DOE is proposing a TUF apportionment between Warm/Warm and Warm/Cold that is proportional to the apportionment in Table 6.1 of Appendix J–1977.

(*i.e.,* Hot/Hot, Warm/Warm, and Cold/Cold). In Table 6.1 of Appendix J–1977, temperature settings that do not require a water temperature change had higher usage factors than temperatures settings that do require a water temperature change, reflecting that consumers are more likely to use a single temperature for the entire duration of the cycle than to change the temperature between the wash and rinse portions of the cycle.

In implementing specific provisions for testing semi-automatic clothes washers in the proposed new Appendix J, DOE is proposing to require testing only those temperature settings that do not require a water temperature change (*i.e.,* Hot/Hot, Warm/Warm, and Cold/Cold). As indicated, by the TUFs from Appendix J–1977 and Appendix J–1997, consumers are more likely to use a single temperature for the entire duration of the cycle than to change the temperature between the wash and rinse portions of the cycle. Changing the temperature between the wash and rinse portions of the cycle would require the consumer to monitor the operation of the clothes washer and adjust the temperature at the appropriate time. It is expected that consumers are more likely not to interact with the operation of the clothes washer during operation of the unit, once it has been started. Not requiring testing of temperature combinations that would require the user to change the temperature between wash and rinse would reduce test burden significantly, while producing results that are representative of consumer usage. DOE tentatively concludes that requiring testing all six possible temperature combinations would present undue burden compared to testing only those temperature combinations that do not require a water temperature change.

DOE requests comment on its proposal for testing semi-automatic clothes washers in the proposed new Appendix J that would require testing only the wash/rinse temperature combinations that do not require a wash temperature change between the wash and rinse portions of the cycle (*i.e.,* Hot/Hot, Warm/Warm, and Cold/Cold).

To define the TUFs for these three temperature combinations, DOE proposes to use the TUFs from the existing column of Table 4.1.1 of Appendix J2 specified for testing clothes washers with Hot/Cold, Warm/Cold, and Cold/Cold temperature selections, and presented in Table III.3. To further simplify the test procedure, since DOE is proposing to require testing only those temperature selections that do not require a change in the water temperature, DOE is proposing to label these selections ''Hot,'' ''Warm,'' and ''Cold,'' respectively (as opposed to ''Hot/Hot'', ''Warm/Warm'', and ''Cold/Cold'').

TABLE III.3—POTENTIAL TEMPERATURE USAGE FACTORS FOR SEMI-AUTOMATIC CLOTHES WASHERS REFLECTING THREE REQUIRED TEMPERATURE COMBINATIONS

Temperature selection	Potential TUF values
Hot	0.14
Warm	0.49
Cold	0.37

DOE requests feedback on its proposal to test semi-automatic clothes washers using TUF values of 0.14 for Hot, 0.49 for Warm, and 0.37 for Cold.

DOE further requests comment on whether the temperature selections and TUFs that DOE has proposed for semi-automatic clothes washers would be representative of consumer use; and if not, which temperature selections and TUF values would better reflect consumer use.

DOE recognizes that these proposed specifications for testing semi-automatic clothes washers may differ from how manufacturers are currently testing semi-automatic clothes washers under Appendix J2 (which, as described, does not provide explicit instructions for semi-automatic clothes washers). Therefore, DOE is proposing to include these provisions only in the proposed new Appendix J, which would be used for the evaluation and issuance of updated efficiency standards, and would not be required until the compliance date of any updated standards. However, DOE could consider replicating these changes in Appendix J2 as well, to provide greater clarity on how to test semi-automatic clothes washers using Appendix J2.

DOE requests comment on whether to include explicit instructions for how to test semi-automatic clothes washers in Appendix J2, and if so, whether DOE should implement the same procedures being proposed for the proposed new Appendix J.

DOE requests feedback on how manufacturers of semi-automatic clothes washers are currently testing their products using Appendix J2.

b. Cycles Required for Test

Inherent to semi-automatic clothes washer operation is that the clothes washer provides the same cycle operation for a given load size and cycle setting, regardless of the water temperature that the user provides. As a result, when testing a semi-automatic clothes washer, machine energy consumption, total water consumption, bone-dry weight, cycle-completion weight, and cycle time for a given load size are unaffected by wash/rinse temperature. When testing a given load size, only the relative amount of cold and hot water consumption is based on the water temperature provided by the user. For the Cold cycle as proposed, all of the water used is cold; for the Hot cycle as proposed, all of the water used is hot; and for the Warm cycle as proposed, half of the water used is cold and half is hot.[48] Based on these relationships, for a given load size, once one of the test cycles has been performed and the total water consumption determined, the relative amounts of cold and hot water for the other required cycles can be determined formulaically rather than needing to be determined through testing. Therefore, DOE has tentatively determined that testing all three of the proposed temperature selections would be unnecessary, and that only a single test cycle is required for a given load size. DOE is proposing in the proposed new Appendix J to require testing only the Cold cycle, and to determine the representative values for the Hot and Warm cycles formulaically based on the values measured for the Cold cycle. This approach would reduce the test burden for semi-automatic clothes washers by requiring only two test cycles be conducted (using the small and large test loads with the Cold cycle) as opposed to six cycles (using the small and large test loads with the Cold, Warm, and Hot cycles) and obtaining the other required values through calculation.

DOE requests comment on its proposal to require semi-automatic clothes washers to test only the Cold cycle, and to determine the representative values for the Warm and Hot cycles formulaically, for the proposed new Appendix J.

DOE notes that if it were to require measuring all six temperature options listed in Table III.2 of this document (Hot/Hot, Hot/Warm, Hot/Cold, Warm/Warm, Warm/Cold, and Cold/Cold), the determination of hot and cold water use would be more complicated for temperature selections that require a

[48] These water use determinations are based on the water faucet positions specified in section 3.2.3.2 of Appendix J2, which as described previously, specifies that to obtain a hot inlet water temperature, open the hot water faucet completely and close the cold water faucet; for a warm inlet water temperature, open both hot and cold water faucets completely; and for a cold inlet water temperature, close the hot water faucet and open the cold water faucet completely.

water temperature change. The tester would first need to determine the proportion of wash water to rinse water, in order to be able to apportion the total volume of cold and hot water used between wash and rinse for each of the temperature selections determined formulaically.

DOE requests comment on the test burden associated with determining the apportionment between wash water use and rinse water use on semi-automatic clothes washers.

c. Implementation

To implement the changes described above for semi-automatic clothes washers, DOE is proposing to create a section 3.4 in the proposed new Appendix J (see discussion in section III.H.7 of this document for an explanation of how section 3 of the proposed new Appendix J would be structured) specifying the cycles required for testing semi-automatic clothes washers. Section 3.4.1 would specify the required test measurements for the Cold cycle and would define variables for each measured value. Section 3.4.2 would specify the formulas used to calculate the representative values for the Warm and Hot cycles, based on the measured values from the Cold cycle.

DOE is also proposing to create a section 2.12.2 in the proposed new Appendix J to state that the energy test cycle for semi-automatic clothes washers includes only the Cold Wash/Cold Rinse (''Cold'') test cycle. DOE would also create a section 2.12.1, which would parallel the current section 2.12 in Appendix J2 and would be identified as applying to automatic clothes washers. DOE is further proposing to specify that section 3.2.1 of the proposed new Appendix J (which would mirror section 3.2.4 of Appendix J2) would apply only to automatic clothes washers.

9. Optional Cycle Modifiers

Section 3.2.7 of Appendix J2 states that for clothes washers with electronic control systems, the manufacturer default settings must be used for any cycle selections, except for (1) the temperature selection, (2) the wash water fill levels, or (3) if necessary, the spin speeds on wash cycles used to determine RMC. Specifically, the manufacturer default settings must be used for wash conditions such as agitation/tumble operation, soil level, spin speed on wash cycles used to determine energy and water consumption, wash times, rinse times, optional rinse settings, water heating time for water-heating clothes washers, and all other wash parameters or optional features applicable to that wash cycle. Any optional wash cycle feature or setting (other than wash/rinse temperature, water fill level selection, or spin speed on wash cycles used to determine RMC) that is activated by default on the wash cycle under test must be included for testing unless the manufacturer instructions recommend not selecting this option, or recommend selecting a different option, for washing normally soiled cotton clothing.

DOE has observed a trend towards increased availability of optional cycle modifiers such as ''deep fill,'' and ''extra rinse,'' among others. 85 FR 31065, 31076. These optional settings may significantly impact the water and/or energy consumption of the clothes washer when activated. *Id.* DOE has observed that the default setting of these optional settings on the Normal cycle is most often in the off position; *i.e.,* the least energy- and water-intensive setting. *Id.* The growing presence of such features may, however, be indicative of an increase in consumer demand and/or usage of these features. *Id.*

In the May 2020 RFI, DOE sought comment on whether testing cycle settings other than the manufacturer default settings would measure the energy efficiency and water use of the clothes washer during a representative average use cycle or period of use. *Id.* DOE also sought comment on whether the non-default selections required by the current DOE test procedure meet this requirement. *Id.* DOE additionally requested information regarding how frequently consumers use ''deep fill,'' ''extra rinse,'' or other cycle modifiers, as well as whether (and if so, by how much) such modifiers may increase the energy or water consumption of a wash cycle compared to the default settings on the Normal cycle. *Id.* DOE requested comment on whether testing these features in the default settings would produce test results that measure energy efficiency and water use of clothes washers during a representative average use cycle or period of use, and the burden of such testing on manufacturers. *Id.*

AHAM opposed testing of cycle settings other than the manufacturer default and recommended that DOE should not test every possible clothes washer cycle or combination of options. AHAM stated that it does not believe optional cycle modifiers are used in most cycles—they exist to provide additional choices to the consumer and increase customer satisfaction. (AHAM, No. 5 at pp. 14–15) AHAM, stated that testing these optional cycle modifiers could increase test burden without a corresponding benefit in improving consumer representativeness, and that DOE should only measure cycles that are representative of an average use cycle or period of use, as required by EPCA. *Id.* AHAM commented that any potential future test procedure change or calculation approach must take into account the frequency with which consumers use optional features and the impact such usage has on energy. (AHAM, No. 5 at p. 4)

Electrolux also opposed additional testing for cycle modifiers. Electrolux commented that cycle modifiers are included on clothes washers for special purposes and are not intended for full-time use. According to Electrolux, these modifiers may be unavailable for specific test cycles and are never a default option due to their specific use. Electrolux stated that adding these to an energy calculation would require extensive survey of their use by consumers. Electrolux further commented that the variety and number of cycle modifiers on machines on the market make it difficult to track and understand usage of the modifiers. (Electrolux, No. 11 at p. 3)

The CA IOUs supported the investigation of the usage frequency of cycle modifiers, stating that the increased presence of such modifiers implies that there is a market desire for such features and that clothes washers are being used with these cycle settings at a non-trivial frequency. (CA IOUs, No. 8 at p. 16)

NEEA commented that, since options such as ''extra water'' and/or ''deep fill'' improve clothes washer performance,[49] it is likely that many consumers use these options even if they are not enabled by default. NEEA stated that these alternative settings should therefore be included in the test procedure. (NEEA, No. 12 at p. 21)

The Joint Commenters encouraged DOE to capture the impact of cycle modifiers such as ''deep fill'' and ''extra rinse'' on energy and water use. The Joint Commenters expressed concern that since the default position for these modifiers is most often ''off,'' the test procedure is effectively assigning a value of zero to the energy and water use of these features, which is likely not representative. According to the Joint Commenters, the test procedure may therefore be significantly underestimating energy and/or water use of clothes washers with these

[49] DOE assumes that by clothes washer performance, NEEA means cleaning and rinsing performance.

optional cycle modifiers. (Joint Commenters, No. 10 at p. 4)

Samsung suggested that DOE amend section 2.8 of Appendix J2 to note that at test load sizes ''Max'' and ''Min'' for manual and automatic water control systems, the corresponding water fill setting should require the use of any user-selectable options to change water level in order to reflect real-world minimum and maximum fill levels. (Samsung, No. 6 at p. 3)

DOE is not aware of any consumer usage data concerning the use of optional cycle modifiers, nor did interested parties provide any such data. Although DOE maintains that the growing presence of such features may be indicative of an increase in consumer usage of these features, DOE lacks consumer usage data that would be required to incorporate the testing of such features in the test procedure. Therefore, DOE is not proposing to change the current requirement to use the manufacturer default settings for optional cycle modifiers.

In response to Samsung's comment, DOE notes that in section 3.2.7 of Appendix J2, wash water fill levels are excluded from the list of cycle options for which the manufacturer default settings must be used. Selecting the most (or least) energy intensive water fill setting as required in section 3.2.6.2.2 for clothes washers with user-adjustable automatic WFCS would therefore require changing an optional cycle modifier from its default position if doing so would provide the most (or least) energy intensive result.

Finally, as discussed in section III.D.4 of this document, DOE is proposing in the proposed new Appendix J to require measuring RMC on each tested cycle using the default spin settings for each cycle. Consistent with this proposal, DOE is proposing to remove ''spin speeds on wash cycles used to determine RMC'' from the list of cycle settings that are excluded from the requirement to use the manufacturer default settings in section 3.2.4 (*Manufacturer default settings*) of the proposed new Appendix J.

DOE requests comment on maintaining the current requirement to use the manufacturer default settings for optional cycle modifiers.

10. Clothes Washers With Connected Functionality

DOE is aware of several ''connected'' RCW models currently on the market, from at least four major manufacturers. 85 FR 31065, 31068. These products offer optional wireless network connectivity to enable features such as remote monitoring and control via smartphone, as well as certain demand response features [50] available through partnerships with a small number of local electric utilities. *Id.* In addition, connected features are available via certain external communication modules for CCWs. *Id.* However, DOE is not aware of any CCW models currently on the market that incorporate connected features directly into the unit. *Id.*

As noted previously, section 3.2.7 of Appendix J2 specifies using the manufacturer default settings for any cycle selections except temperature selection, wash water fill level, or spin speed. Furthermore, section 3.9.1 of Appendix J2 specifies performing the combined low-power mode testing without changing any control panel settings used for the active mode wash cycle. With regard to the measurement of network mode energy use specifically, DOE stated in the March 2012 Final Rule that ''DOE cannot thoroughly evaluate these [IEC Standard 62301 (Second Edition)] network mode provisions, as would be required to justify their incorporation into DOE's test procedures at this time.'' 77 FR 13887, 13899. DOE notes that although an individual appliance may consume a relatively small amount of power in network mode, the potential exists for energy-related benefits that more than offset this additional power consumption if the appliance can be controlled by the ''smart grid'' to consume power during non-peak periods. 85 FR 31065, 31068.

If connected features on a clothes washer affect its inactive mode power consumption in the as-shipped configuration (*e.g.,* by energizing a wireless communication chip on the circuit board by default), such impact would be measured by the current test procedure provisions in section 3.9 of Appendix J2 for measuring combined low-power mode power. Whereas, if the inactive mode power consumption is not affected unless the consumer actively enables the connected functionality on the unit, any incremental inactive mode power consumption resulting from the connected features would not be measured by the current test procedure, because the test procedure does not include instructions for activating any such features before performing the low-power mode measurement. Similarly, any incremental energy consumption in active mode, or any other modes of operation impacted by the product's connected features, would not be measured as part of the current DOE test procedure, because the test cycle requirements in section 3.2.7 of Appendix J2 do not include instructions for activating any such features before performing the active mode test cycles.

In the May 2020 RFI, DOE requested feedback on its characterization of connected RCWs, and any CCWs, currently on the market. *Id.* Specifically, DOE requested input on the types of features or functionality enabled by connected clothes washers that exist on the market or that are under development. *Id.* DOE also sought comment on adding a clarifying provision that would require testing to be conducted with any network functionality turned off, or without measuring or reporting the energy use of the clothes washer in network mode. *Id.* DOE also requested data on the percentage of users purchasing connected RCWs who activate the connected capabilities, and, for those users, the percentage of the time when the connected functionality of the RCW is activated and using additional energy. *Id.*

The CA IOUs recommended that network-capable RCWs be tested with connected functions activated to capture the energy use associated with these functions, especially as connected clothes washers become more prevalent. The CA IOUs commented that while network capabilities may use a small amount of power compared to the active washing cycle, these features often operate year-round and could potentially consume a significant amount of energy annually. (CA IOUs, No. 8 at pp. 12–13) The CA IOUs added that capturing the energy consumption associated with connected features should not hinder their continued development. *Id.*

The Joint Commenters recommended that DOE incorporate a measurement of ''network mode'' power consumption to provide consumers with information about any additional energy consumption associated with connected features. The Joint Commenters stated that, although it asserts that DOE is concerned about impeding innovation, the power consumption associated with ''network mode'' may be accounted for in energy conservation standards so as not to hinder the availability of models with connected features. (Joint Commenters, No. 10 at p. 2)

NEEA recommended that DOE develop a method for measuring standby mode energy use of clothes washers with connected functionality,

[50] ''Demand response features'' refers to product functionality that can be controlled by the ''smart grid'' to improve the overall operation of the electrical grid, for example by reducing energy consumption during peak periods and/or shifting power consumption to off-peak periods.

since connected clothes washers are becoming more prevalent and sales of connected RCWs have been increasing. NEEA also commented that Wi-Fi-enabled appliances tend to experience a wide variation of energy use, depending on the circuit design and silicon used, so it will be important to measure individual clothes washer energy use in this context. (NEEA, No. 12 at pp. 20–21)

AHAM commented that there is not yet adequate consumer use data on connected features to justify amending the test procedure. (AHAM, No. 5 at p. 5) AHAM stated that consumer use and understanding of new technologies continues to evolve and inform manufacturers' designs. According to AHAM, some consumers do not even connect their network-enabled appliances to use the available features. *Id.* AHAM stated that DOE should ensure that the clothes washer test procedure does not prematurely address new designs which may not yet have an average use or be in common use, and that doing so could stifle innovation. *Id.*

DOE recognizes the potential benefits that could be provided by connected capability, such as providing energy saving benefits to consumers, enabling peak load shifting on the electrical grid, and other consumer-related benefits. While a number of connected clothes washers are currently on the market with varying implementations of connected features, DOE is not aware of any data available, nor did interested parties provide any such data, regarding the consumer use of connected features. Therefore, DOE is unable to establish a representative test configuration for assessing the energy consumption of connected functionality for clothes washers.

As noted previously, while DOE's current test procedure does not specifically consider energy use of network features, the test procedure may result in the measurement of the energy use of connected features in inactive mode. Specifically, as discussed, any energy use of connected features would be measured in section 3.9 of Appendix J2 for measuring combined low-power mode power if the connected features are enabled in the ''as-shipped'' configuration. If the consumer is required to actively enable the connected functionality, however, such energy consumption would not be measured. Similarly, any incremental energy consumption in active mode, or any other modes of operation impacted by the product's connected features, would not be measured because the test cycle requirements in section 3.2.7 of Appendix J2 do not include instructions for activating any such features before performing the active mode test cycles.

Given the lack of data to establish a test configuration that would be representative of consumer use of connected features on clothes washers, DOE is proposing to amend section 3.2.7 of Appendix J2 and section 3.2.4 of the proposed new Appendix J to specify that network settings (on clothes washers with network capabilities) must be disabled during testing if such settings can be disabled by the end-user, and the product's user manual provides instructions on how to do so.

If, however, connected functionality cannot be disabled by the end-user or the product's user manual does not provide instruction for disabling connected functionality that is enabled by default, then the unit must be tested with the network capability in the factory default setting as specified in the current test procedure. DOE has preliminarily determined that if connected functionality cannot be disabled, or the product's user manual does not provide instruction for disabling the function, it is more representative to include the energy consumption of the clothes washer in the default condition, including the enabled connected function, than to exclude the energy consumption associated with the connected feature. As such, the energy consumption of a connected function that cannot be disabled would continue to be measured, as in the current test procedure. DOE notes that this approach is consistent with the approach proposed in the test procedure supplemental NOPR for microwave ovens published on August 3, 2021. 86 FR 41759.

DOE requests comment on its proposed amendment to Appendix J2 and the proposed new Appendix J to specify that network settings (on clothes washers with network capabilities) must be disabled during testing if such settings can be disabled by the end-user, and the product's user manual provides instructions on how to do so.

DOE seeks the following information regarding connected clothes washers, which could inform future test procedure considerations:

DOE requests feedback on its characterization of connected clothes washers currently on the market. Specifically, DOE requests input on the types of features or functionality enabled by connected clothes washers that exist on the market or that are under development.

DOE requests data on the percentage of users purchasing connected clothes washers, and, for those users, the percentage of the time when the connected functionality of the clothes washer is used.

DOE requests data on the amount of additional or reduced energy use of connected clothes washers.

DOE requests data on the pattern of additional or reduced energy use of connected clothes washers; for example, whether it is constant, periodic, or triggered by the user.

DOE requests information on any existing testing protocols that account for connected features of clothes washers, as well as any testing protocols that may be under development within the industry.

E. Metrics

1. Replacing Capacity With Weighted-Average Load Size

As discussed, the current energy efficiency standards for RCWs are based on the IMEF metric, measured in ft^3/kWh/cycle, as calculated in section 4.6 of Appendix J2. IMEF is calculated as the capacity of the clothes container (in ft^3) divided by the total clothes washer energy consumption (in kWh) per cycle. The total clothes washer energy consumption per cycle is 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; and (d) the combined low-power mode energy consumption.

The current energy efficiency standards for CCWs are based on the MEF_{J2} metric, measured in ft^3/kWh/cycle, as determined in section 4.5 of Appendix J2. The MEF_{J2} metric differs from the IMEF metric by not including the combined low-power mode energy consumption in the total clothes washer energy consumption per cycle.

The current water efficiency standards for both RCWs and CCWs are based on the IWF metric, measured in gal/cycle/ft^3, as calculated in section 4.2.13 of Appendix J2. IWF is calculated as the total weighted per-cycle water consumption (in gallons) for all wash cycles divided by the capacity of the clothes container (in ft^3).

In the May 2020 RFI, DOE requested feedback on whether to consider changing the energy or water efficiency metrics for RCWs or CCWs to maintain consistency with any changes to the capacity metric or for other reasons. 85 FR 31065, 31080. DOE included several examples such as incorporating the weighted-average weight of test cloth test load, which would result in energy efficiency metric expressed in terms of pounds of clothing per kWh per cycle. *Id.*

AHAM stated that DOE does not need to change the energy efficiency or water efficiency metrics. (AHAM, No. 5 at p. 16)

The CA IOUs recommended changing IWF and IMEF to eliminate their relationship to capacity. The CA IOUs stated that by normalizing with the capacity of a clothes washer, the current metrics create a built-in bias towards larger-capacity machines, as the minimum- and average-sized test loads are not purely scaled with the clothes washer's capacity. The CA IOUS stated that this leads to larger-capacity clothes washers washing a smaller fraction of clothing compared to their capacity. The CA IOUs commented that in order to remove this bias, IMEF and IWF should be normalized with the weighted-average load size of clothing washed (*e.g.,* IMEF would be measured in lb/kWh/cycle instead of ft^3/kWh/cycle). (CA IOUs, No. 8 at p. 5) The CA IOUs stated that this amendment would create a more representative performance metric of an average clothes washer use cycle and would also improve alignment with the clothes dryer performance metric. *Id.*

The Joint Commenters encouraged DOE to consider basing efficiency metrics on pounds of clothes washed instead of capacity of the clothes washer. According to the Joint Commenters, basing efficiency metrics on clothes washer capacity creates a bias towards large-capacity clothes washers, since weighted-average load size is much greater for large-capacity clothes washers than it is for small-capacity clothes washers. The Joint Commenters encouraged DOE to instead consider alternative efficiency metrics based on the LUF-weighted-average load size for a given clothes washer capacity. (Joint Commenters, No. 10 at p. 5)

NEEA commented that the current DOE test procedure allows larger-capacity clothes washers to use more energy and water per pound of textiles washed than smaller-capacity clothes washers with the same IMEF ratings. NEEA has also observed that IMEF generally increases with capacity in the most recent models to come into the market. NEEA stated that due to the increase in average clothes washer capacity from 3.5 ft^3 to 4.4 ft^3, this issue is becoming more prevalent. (NEEA, No. 12 at pp. 13–17) NEEA conducted testing under conditions that it characterized as more realistic than DOE test conditions and summarized the results as demonstrating that on a lb/kWh basis, larger-capacity clothes washers perform less efficiently than smaller-capacity clothes washers.[51] Based on these results, NEEA concluded that large-capacity clothes washers may use more energy than small-capacity clothes washers when operating with typical load sizes and wash temperatures. *Id.* NEEA recommended that, to better address the efficiency of the largest-capacity clothes washers in the market, DOE should consider adopting an alternative energy efficiency metric such as pounds of textile per kWh, which would be based on the LUF-weighted load size, and the LUF-weighted and TUF-weighted energy use per cycle. NEEA also recommended that DOE consider developing an energy conservation standard that is a function of capacity, so that larger-capacity clothes washers would need to meet higher IMEF and lower IWF levels than smaller clothes washers. *Id.* NEEA noted that this would be similar to the way standards for refrigerators, room air conditioners, and water heaters are a function of adjusted volume, cooling capacity, and storage volume, respectively. NEEA calculated that making these changes could result in 1–2 quads of energy savings over a 30-year period associated with increased efficiency of large-capacity clothes washers. *Id.*

As noted throughout the discussion previously, under Appendix J2, energy use (the denominator of the IMEF and MEF equations) scales with weighted-average load size, whereas capacity (the numerator of the IMEF and MEF equations) scales with maximum load size. This provides an inherent numerical advantage to large-capacity clothes washers that is disproportionate to the efficiency advantage that can be achieved through ''economies of scale'' associated with washing larger loads. This advantage means that a larger-capacity clothes washer consumes more energy to wash a pound of clothes than a smaller-capacity clothes washer with the same IMEF rating. This relationship applies similarly to water efficiency through the IWF equation. As noted in the comments summarized previously, this disproportionate benefit increases as average clothes washer capacity increases over time. To avoid providing bias for large-capacity clothes washers, DOE is proposing to change the energy and water efficiency metrics in the proposed new Appendix J by replacing the capacity term with the weighted-average load size, in pounds. Under this proposed change, energy and water use would scale proportionally with weighted-average load size in the IMEF, MEF, and IWF formulas and thus eliminate the efficiency bias currently provided to large-capacity clothes washers.

EPCA defines energy efficiency as ''the ratio of the useful output of services from a consumer product to the energy use of such product.'' (42 U.S.C. 6291(5); 42 U.S.C. 6311(3)) In the current efficiency metrics, clothes washer capacity is used to represent the measure of useful output. DOE has tentatively determined that clothing load size (*i.e.,* the weight of clothes cleaned), expressed as the weighted-average load size, may better represent the ''useful output'' of a clothes washer.

Were DOE to finalize the proposed metric change, changes to the energy conservation standards would be addressed in an energy conservation standards rulemaking.

DOE requests comment on its proposal to replace the capacity term with weighted-average load size in the energy efficiency metrics and the water efficiency metric in the proposed new Appendix J.

In addition, DOE is proposing to rename the efficiency metrics to avoid any confusion between the proposed new metrics and the existing metrics. DOE is proposing to designate energy efficiency ratio (''EER'') as the energy efficiency metric for RCWs (replacing IMEF); active-mode energy efficiency ratio (''AEER'') as the energy efficiency metric for CCWs (replacing MEF_{J2}); and water efficiency ratio (''WER'') as the water efficiency metric for both RCWs and CCWs (replacing IWF). As proposed, EER would be calculated as the quotient of the weighted-average load size (in lb) divided by the total clothes washer energy consumption (in kWh) per cycle; and AEER would be calculated as the quotient of the weighted-average load size (in lb) divided by the total clothes washer energy consumption (in kWh) per cycle not including the combined low-power mode energy consumption. Section III.E.2 of this document describes how WER would be calculated.

DOE is also proposing to establish provisions in 10 CFR 430.23(j) to specify the procedure for determining EER and WER for RCWs, and in 10 CFR 431.154 to specify the procedure for determining AEER and WER for CCWs.

DOE requests comment on its proposed names for the proposed new efficiency metrics: Energy efficiency ratio (EER), active-mode energy efficiency ratio (AEER), and water efficiency ratio (WER).

[51] NEEA stated that that it considers these data to be preliminary and that additional testing would provide more clarity.

2. Inverting the Water Metric

As described previously, IWF is calculated in section 4.2.13 of Appendix J2 as the total weighted per-cycle water consumption (in gallons) for all wash cycles divided by the capacity of the clothes container (in ft^3). Unlike the IMEF metric, in which a higher number indicates more efficient performance, a lower IWF value indicates more efficient performance.

In the May 2020 RFI, DOE requested feedback on whether to consider any changes to the water efficiency metric defined in the test procedure to maintain consistency with any changes to the capacity metric or for any other purpose, including those described for the energy efficiency metric, and whether it would be appropriate to invert the existing calculation such that a higher value of IWF would represent more efficient performance. 85 FR 31065, 31080.

The CA IOUs supported inverting the IWF and WF metrics to better align with the IMEF and MEF metrics. (CA IOUs, No. 8 at p. 6) Additionally, the CA IOUs recommended that DOE should consider changing the name of the updated metrics in order to alert customers and relevant stakeholders of the implications of the change. *Id.*

DOE is proposing to invert the water metric, in conjunction with replacing the capacity term with weighted-average load size, as described in the previous section. By inverting the metric, a higher value would represent more efficient performance, consistent with the energy efficiency metrics. In addition, by inverting the metric, the proposed WER metric would represent the ratio of the useful output of services to the water use of the product, consistent with EPCA's definition of energy efficiency as described.

DOE is proposing to define WER in the proposed new Appendix J as the quotient of the weighted-average load size (in lb) divided by the total weighted per-cycle water consumption for all wash cycles (in gallons).

DOE requests comment on its proposal to invert the water efficiency metric and calculate the newly defined WER metric as the quotient of the weighted-average load size divided by the total weighted per-cycle water consumption for all wash cycles.

3. Annual Energy Use

The annual energy consumption of an RCW tested according to Appendix J2 is calculated as part of the estimated annual operating cost calculations at 10 CFR 430.23(j)(1)(ii)(A) and (B).[52] In each equation, annual energy consumption is calculated by multiplying the per-cycle energy consumption [53] by the representative average RCW use of 295 cycles per year.[54] The annual operating cost is provided to the consumer on the Federal Trade Commission (''FTC'') EnergyGuide label for RCWs.

DOE considered whether to make changes to the method for calculating annual energy use so that the calculation more directly reflects annual energy use during a representative average use cycle. DOE also considered whether changes to the overall calculation methodology would improve the usefulness of the information presented to the consumer on the product label.

According to the current calculation methodology, all clothes washers are assumed to be used for 295 cycles per year, while the per-cycle energy reflects a weighted-average load size based on the clothes washer capacity. Therefore, the annual energy calculation reflects an annual volume of laundered clothing that scales with clothes washer capacity. For example, the current annual energy calculation methodology is based on an annual laundry volume of 2,258 pounds for a 3.0-ft^3 RCW and 4,036 pounds for a 6.0-ft^3 RCW. 85 FR 31065, 31081.

Under the current annual energy calculation methodology, the information presented on the product label would indicate that a larger-capacity RCW would use significantly more annual energy than a smaller-capacity model with the same IMEF rating. This is because the larger-capacity RCW's label would be based on a significantly larger amount of annual laundry than the smaller-capacity model, as illustrated above. Whereas, if compared on the basis of an equivalent volume of laundered clothing, both RCWs could be expected to use the same amount of annual energy since they have the same IMEF efficiency rating. This potential disparity may limit the ability of an individual consumer to use the information presented on the product label to compare the differences in expected energy use among RCW models with the same rated energy efficiency but different capacities.

When DOE originally developed the annual energy calculation methodology at 10 CFR 430.23(j)(1)(i), the test procedure accommodated clothes washers with capacities up to 3.8 ft^3.[55] An increasingly wide range of RCW capacities are available on the market, ranging from less than 1.0 ft^3 to greater than 6.0 ft^3. As the range of capacities increases, the effect of capacity on the represented annual energy cost becomes more pronounced.

Given the increasingly wide range of RCW capacities available on the market, and the significant changes over time in estimated annual RCW cycles, DOE considered whether any changes are warranted for the annual energy and annual water calculations to ensure that the results continue to reflect representative average use for all clothes washer sizes, to harmonize with any changes to other metrics within the DOE test procedures, and to continue to provide useful comparative information to consumers. 85 FR 31065, 31081. DOE described two examples in the May 2020 RFI:

- Revising the annual energy and annual water calculation methodology from being based on a fixed number of annual cycles to a fixed number of annual pounds of clothing.
- Varying the annual number of wash cycles based on clothes washer capacity, rather than a fixed number of annual cycles for all clothes washers. *Id.*

In the May 2020 RFI, DOE requested data and information regarding whether and how the annual number of wash cycles varies as a function of clothes washer capacity. *Id.* DOE also requested feedback on whether DOE should consider any changes to the annual energy or annual water calculation methodology and the burden associated with these potential changes. *Id.*

NEEA recommended that DOE change the annual energy metric to use an average number of pounds of textiles washed annually instead of using an average number of cycles per year. NEEA stated that its research found that neither number of cycles nor load size scales with capacity, suggesting that this change would provide a more effective comparison of clothes washers with different capacities. (NEEA, No. 12 at p. 25)

The CA IOUs supported DOE's current method of basing annual energy calculations on a fixed number of wash cycles per year, rather than using a fixed amount of clothing washed per year.

[52] Part (A) provides the calculation when electrically heated water is used. Part (B) provides the calculation when gas-heated or oil-heated water is used.

[53] These equations include the machine electrical energy consumption, hot water energy consumption, and combined low-power mode energy consumption; they exclude the energy consumption for removal of moisture from the test load (*i.e.,* the ''drying energy'').

[54] See section III.G.1 of this document for DOE's proposal to modify the representative average clothes washer use per year.

[55] The maximum capacity in the original load size table in Appendix J1–1997 was 3.8 ft^3.

The CA IOUs commented that annual energy calculations based on a fixed amount of clothing washed would contradict the test procedure that acknowledges that clothes washers of different sizes wash different amounts of clothing, as identified in LUFs and test load sizes. (CA IOUs, No. 8 at pp. 11–12) The CA IOUs further recommended that DOE investigate whether the fixed number of cycles per year should be changed to be more representative of average use in larger households, since larger households tend to have larger-capacity clothes washers, and larger-capacity clothes washers run more cycles per year, as detailed in Table HC3.4 and Figure 3.9 of the 2015 Residential Energy Consumption Survey (''RECS'') data. *Id.*

The CA IOUs also recommended that if DOE changes the annual energy calculation from a fixed number of annual wash cycles to a fixed amount of clothing washed, this change should also be reflected in the rest of the test procedure to capture any operational difference by capacity. (CA IOUs, No. 8 at p. 12)

Notwithstanding the potential limitations of DOE's current approach of calculating annual energy consumption, as described previously, in the absence of any new nationally representative data showing either a constant annual weight of washed laundry, or a correlation between clothes washer capacity and annual weight of washed laundry, DOE is not proposing to change the methodology for calculating annual energy use. DOE could, however, consider such a change should additional data or information become available, as previously described.

DOE requests data on the annual amount of laundry washed by consumers, and whether the annual amount of laundry washed by consumers is correlated with clothes washer capacity.

4. Representation Requirements

Representation requirements for RCWs and CCWs are codified at 10 CFR 429.20(a) and 10 CFR 429.46(a), respectively.

DOE is proposing to specify that the sampling requirements for RCWs specified at 10 CFR 429.20(a)(2)(ii) would also apply to the new proposed EER and WER metrics. DOE is proposing to clarify that the capacity specified in 10 CFR 429.20(a)(3) is the *clothes container* capacity (emphasis added).

DOE is proposing to specify that the sampling requirements specified for CCWs at 10 CFR 429.46(a)(2)(ii) would also apply to the new proposed AEER and WER metrics.

DOE requests comment on its proposed updated representation and sampling requirements for RCWs and CCWs.

F. Cleaning Performance

EPCA requires DOE to consider any lessening of the utility or the performance of the covered products (and certain commercial equipment, including CCWs) likely to result from the imposition of potential new or amended standards. (42 U.S.C. 6295(o)(2)(B)(i)(IV); 42 U.S.C. 6316(a)) EPCA prohibits DOE from prescribing an amended or new standard if the Secretary finds that interested persons have established by a preponderance of the evidence that the standard is likely to result in the unavailability in the United States in any covered product type (or class) of performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as those generally available in the United States at the time of the Secretary's finding. (42 U.S.C. 6295(o)(4)) [56]

EPCA authorizes DOE to design test procedures that measure energy efficiency, energy use, water use (in the case of showerheads, faucets, water closets and urinals), or estimated annual operating cost of a covered product during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(3)) DOE regulates only the energy and water efficiency of clothes washers. Manufacturers may design their products to prioritize any of the other consumer-relevant performance characteristics, including cleaning performance. As such, DOE's clothes washer test procedures do not prescribe a method for testing clothes washer cleaning performance.

Samsung commented that a product should perform at least its basic cleaning function during the energy test cycle so that consumers can purchase products that perform their basic function effectively, while saving energy and water. (Samsung, No. 6 at p. 2) Samsung added that unless clothes washers perform at a minimum level of acceptable functionality on the Normal cycle, consumers may use other energy- or water-intensive modes and unknowingly sacrifice energy efficiency. *Id.* To ensure products perform their basic functionality, Samsung recommended that DOE incorporate by reference the ENERGY STAR ''Test Method for Determining Residential Clothes Washer Cleaning Performance'' [57] as a new appendix to the test procedure. *Id.*

Electrolux encouraged DOE to introduce an independent cleaning and rinsing performance test into the energy test procedure, because Electrolux is concerned that as more cycles become available to consumers, they are less likely to select the more efficient energy test cycle due to performance concerns. (Electrolux, No. 11 at p. 2) Electrolux added that tying performance testing to the energy test cycle could give consumers visibility into the tradeoff between efficiency and cleaning/rinsing performance, and place the energy test cycle as a more prominent cycle that is efficient and has high cleaning performance. *Id.* Electrolux stated that if DOE were to add a new cleaning and rinsing test, it should be developed based on proven industry standards in use, such as IEC 60456, AHAM HLW–1–2013, ''Performance Evaluation Procedures for Household Clothes Washers'' (''AHAM HLW–1–2013''), or AS/NZS 2040.1:2005, ''Performance of household electrical appliances—Clothes washing machines Methods for measuring performance, energy and water consumption'' (''AS/NZS 2040.1:2005''). *Id.* Electrolux stated that these industry cleaning standards do not have the repeatability and reproducibility required for establishing limits or boundaries, but Electrolux supported their use for reporting and comparison purposes. *Id.* According to Electrolux, adding new cleaning and rinsing metrics would not significantly increase testing burden because manufacturers already extensively perform cleaning and rinsing testing on the energy test cycle. *Id.* Electrolux suggested the following specific testing criteria: (1) Incorporate by reference cleaning and rinsing performance test procedures; (2) test the same machines used for energy testing; (3) test the energy test cycle and settings used for the energy testing; (4) test with a load size based on DOE average capacity and using load types defined in the cleaning standard; (5) limit load sizes to one or two; (6) limit wash and rinse temperature combinations to those that differentiate performance the most, such as one cold, one hot, and one warmest warm; (7) weight multiple tests using TUFs from Appendix J2; and (8) average

[56] The unavailability provision is applicable to CCWs under 42 U.S.C. 6316(a).

[57] The ENERGY STAR ''Test Method for Determining Residential Clothes Washer Cleaning Performance'' is available at *www.energystar.gov/sites/default/files/asset/document/Test%20Method%20for%20Determining%20Residential%20Clothes%20Washer%20Cleaning%20Performance%20-%20July%202018_0.pdf.*

machine cleaning and rinsing performance scores. *Id.*

As noted, EPCA authorizes DOE to design test procedures that measure energy efficiency, energy use, water use (in the case of showerheads, faucets, water closets and urinals), or estimated annual operating cost of a covered product during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(3)) Also as noted, in determining whether a new or amended energy conservation standard is economically justified, EPCA requires DOE to consider any lessening of the utility or the performance likely to result from the imposition of a new standard. 42 U.S.C. 6295(o)(2)(B)(i)(IV); 42 U.S.C. 6295(o)(4); 42 U.S.C. 6316(a)). As indicated by comments summarized above, multiple test procedures from industry and international organizations are available for measuring clothes washer cleaning performance (among other attributes). DOE may conduct research and testing that uses these or other established test methods as part of an energy conservation standards rulemaking to evaluate any lessening of the utility or the performance of the covered products likely to result from the imposition of potential new or amended standards, as required by EPCA. For example, in the most recent energy conservation standards final rule for CCWs, published on December 15, 2014 (''December 2014 Final Rule''), DOE conducted performance testing using AHAM's HLW–1–2010 test procedure to quantitatively evaluate potential impacts on cleaning performance, rinsing performance, and solid particle removal as a result of higher standard levels. 79 FR 74492, 74506.

DOE is not, however, proposing to add a cleaning performance test procedure to the proposed new Appendix J or to Appendix J2 in this NOPR.

G. Consumer Usage Assumptions

In the May 2020 RFI, DOE requested information on whether, in accordance with 42 U.S.C. 6293(b)(3), the consumer usage factors incorporated into the test procedure produce test results that measure energy efficiency and water use of clothes washers during a representative average use cycle or period of use. 85 FR 31065, 31077. DOE also sought comment on whether testing cycle configurations with usage factors below a certain percentage would be unduly burdensome to conduct and would not be considered to be reasonably designed to measure energy and water use during a representative average use cycle or period of use because they are rarely used by consumers. *Id.*

AHAM commented generally that it supports updating the test procedure to reflect average use cycles, but commented that any updates must reflect changes observed in national, statistically significant field use studies and must not impact repeatability or reproducibility, or be unduly burdensome to conduct. (AHAM, No. 5 at p. 12) AHAM stated that should it find data that would assist DOE in its rulemaking, it will provide it as soon as possible. (AHAM, No. 5 at p. 15)

Discussion and consideration of consumer usage assumptions are provided in the following paragraphs.

1. Annual Number of Wash Cycles

Section 4.4 of Appendix J2 provides the representative average number of annual clothes washer cycles to translate the annualized inactive and off mode energy consumption measurements into a per-cycle value applied to each active mode wash cycle. Separately, the number of annual wash cycles is also referenced in DOE's test procedure provisions at 10 CFR 430.23(j)(1)(i)(A) and (B), (j)(1)(ii)(A) and (B), and (j)(3)(i) and (ii) to calculate annual operating cost and annual water consumption of a clothes washer.

In the August 1997 Final Rule, DOE estimated the representative number of annual wash cycles per RCW to be 392, which represented the average number of cycles per year from 1986 through 1994, based on P&G survey data provided to DOE as described in a NOPR published on March 23, 1995. 60 FR 15330, 1533; 62 FR 45484, 45501.

In the March 2012 Final Rule, DOE updated the representative number of wash cycles per year to 295 based on an analysis of the 2005 RECS data. 77 FR 13887, 13909. More recently, in the May 2020 RFI, DOE presented an analysis of the 2009 RECS data, which suggests 284 cycles per year, and of the 2015 RECS data (the most recent available) which suggests 234 cycles per year. 85 FR 31065, 31079.

In the May 2020 RFI, DOE requested data and information on whether any further adjustments to the number of annual wash cycles are warranted to reflect current RCW consumer usage patterns, as suggested by RECS data. *Id.*

AHAM supported using 2015 RECS data as a basis for determining annual use cycles. (AHAM, No. 5 at p. 15) AHAM stated that its survey of members found that the average number of annual cycles is 233, which supports DOE's analysis of the 2015 RECS data indicating 234 cycles per year. *Id.*

NEEA supported keeping the current number of wash cycles per year or increasing it slightly. (NEEA, No. 12 at p. 24) NEEA stated that findings from its 2014 laundry study indicate 313 annual use cycles for RCWs. *Id.* NEEA stated that its study was developed to represent the distribution of average household size, which NEEA claims principally determines the number of annual laundry cycles. *Id.* NEEA recommended that DOE not use the RECS methodology, which NEEA stated relies on consumer recollection of typical number of clothes washer loads, and which NEEA asserts is likely to be less accurate. *Id.*

DOE appreciates the submission of data by NEEA but notes that the survey results represent regional usage (the Pacific Northwest) during a 4 to 6-week period in 2012, as described in the referenced report. As such, these findings do not provide a basis for estimated national average usage. In lieu of such data, DOE finds that the 2015 RECS survey is the most reliable source available for nationally representative annual usage data.

Based on the data from the 2015 RECS survey, DOE is proposing to update the number of annual wash cycles to 234 in the proposed new Appendix J. This update would impact the per-cycle low-power mode energy consumption value included in the calculation of IMEF and EER. The per-cycle low-power mode energy consumption would be divided by a smaller number (*i.e.,* 234 instead of 295), and would therefore increase by around 25%. See further discussion of the proposed changes to the calculation of low-power mode energy in section III.G.3 of this document.

DOE is not proposing to change the number of annual wash cycles in Appendix J2 because such a change would impact measured energy efficiency. DOE proposes to make such changes only in the proposed new Appendix J, which would be used for the evaluation and issuance of updated efficiency standards, and for determining compliance with those standards.

In addition to other changes discussed in section III.H.6 of this document, DOE is proposing to update 10 CFR 430.23(j)(1)(i) and (j)(3)(i) such that the annual operating cost and annual water consumption calculation would reflect the new proposed number of annual wash cycles when a clothes washer is tested using the proposed new Appendix J, if finalized.

DOE requests comment on its proposal to update the number of annual wash cycles to 234 in the

proposed new Appendix J and 10 CFR 430.23(j)(1)(i) and (j)(3)(i).

2. Drying Energy Assumptions

Section 4.3 of Appendix J2 provides an equation for calculating total per-cycle energy consumption for removal of moisture from the clothes washer test load in a clothes dryer, *i.e.,* the ''drying energy.'' DOE first introduced the drying energy equation in Appendix J1 as part of the August 1997 Final Rule. The drying energy calculation is based on the following three assumed values: (1) A clothes dryer final moisture content of 4 percent; (2) the nominal energy required for a clothes dryer to remove moisture from a pound of clothes (''DEF'') of 0.5 kWh/lb; and (3) a clothes dryer usage factor (''DUF'') of 0.91, representing the percentage of clothes washer loads dried in a clothes dryer.

a. Dryer Final Moisture Content

DOE's test procedure for clothes dryers, codified at 10 CFR part 430, subpart B, appendix D1 (''Appendix D1''), prescribes a final moisture content between 2.5 and 5.0 percent, which is consistent with the 4-percent final moisture content value in the clothes washer test procedure for determining the drying energy. However, DOE's alternate clothes dryer test procedure, codified at 10 CFR part 430, subpart B, appendix D2 (''Appendix D2''), prescribes a final moisture content between 1 and 2.5 percent for timer dryers, which are clothes dryers that can be preset to carry out at least one operation that is terminated by a timer, but may also be manually controlled without including any automatic termination function. For automatic termination control dryers, which can be preset to carry out at least one sequence of operations to be terminated by means of a system assessing, directly or indirectly, the moisture content of the load, the test cycle is deemed invalid if the clothes dryer terminates the cycle at a final moisture content greater than 2 percent. Section 3.3.2 of Appendix D2. In the final rule establishing Appendix D2, DOE determined a clothes dryer final moisture content of 2 percent using the DOE test load to be more representative in that, generally, consumers would find a final moisture content higher than this level unacceptable. 78 FR 49607, 49625 (Aug. 14, 2013). Timer dryers are allowed a range of final moisture contents during the test because DOE concluded that it would be unduly burdensome to require the tester to dry the test load to an exact final moisture content; however, the measured test cycle energy consumption for timer dryers is normalized to calculate the energy consumption required to dry the test load to 2-percent final moisture content. *Id.* Manufacturers may elect to use Appendix D2 to demonstrate compliance with the January 1, 2015, energy conservation standards; however, the procedures in Appendix D2 need not be performed to determine compliance with energy conservation standards for clothes dryers at this time. See introductory paragraph to Appendix D1. Use of Appendix D2 is, however, required for ENERGY STAR certification.[58]

In the May 2020 RFI, DOE requested information to determine whether to revise the clothes dryer final moisture content in the clothes washer test procedure. 85 FR 31065, 31079.

AHAM opposed changing the final moisture content to align with DOE's clothes dryer test procedure in Appendix D2 because the current value of 4 percent is consistent with Appendix D1, which is still the mandatory test procedure and the one most often used. (AHAM, No. 5 at p. 15)

Samsung supported changing the final moisture content value in the drying energy calculation in Appendix J2 from 4 percent to 2 percent to align with the DOE clothes dryer test procedure in Appendix D2, because automatic termination dryers represent a majority of the clothes dryer market, and Appendix D2 has been recognized by stakeholders as representative of how automatic termination dryers are used by consumers. (Samsung, No. 6 at p. 4) Samsung added that the Appendix D1 test procedure was intended as a stopgap measure to test ''sensor dryers'' using ''non-sensing'' settings, and that the Appendix D1 procedure does not represent how the ''sensor dry'' products are used by consumers as accurately as the Appendix D2 test procedure. *Id.*

The Joint Commenters and CA IOUs supported changing the final moisture content value in the drying energy calculation from 4 percent to 2 percent in order to align with the clothes dryer test procedure in Appendix D2. (Joint Commenters, No. 10 at p. 4; CA IOUs, No. 8 at p. 9)

Although clothes dryer manufacturers may optionally use Appendix D2 to demonstrate compliance with the current energy conservation standards, Appendix D1 provides the basis for the current clothes dryer energy conservation standard levels and, as noted by AHAM, is the test procedure used as the basis for certification for the majority of models on the market. In this NOPR, DOE is not proposing to change the assumed final moisture content of 4 percent in the drying energy calculation, which aligns with Appendix D1. However, DOE could reevaluate updating the assumed final moisture content in the clothes washer test procedure based on future updates to clothes dryer test procedures or standards, among other factors.

DOE requests comment on maintaining the assumed final moisture content of 4 percent in the drying energy equation, or whether it should update the assumed final moisture content to 2 percent to align with DOE's Appendix D2 clothes dryer test procedure.

b. Nominal Dryer Energy

The DEF represents the nominal energy required for a clothes dryer to remove moisture from clothes. The value of 0.5 kWh/lb was first proposed in the March 23, 1995 NOPR. 60 FR 15330, 15336. DOE received no comments on this proposal and introduced this DEF value into Appendix J1 in the August 1997 Final Rule. 62 FR 45484, 45489.

In the May 2020 RFI, DOE requested information to determine whether to revise the DEF value as a result of the 2015 updates to the DOE clothes dryer test procedure and any market changes due to the most recent energy conservation standards for clothes dryers. 85 FR 31065, 31079.

AHAM proposed that DOE should lower DEF because of the existence of more efficient clothes dryers. (AHAM, No. 5 at pp. 15–16). AHAM did not propose an amended DEF value but commented that one would need to be determined based on the efficiency of products in the market. *Id.*

The CA IOUs commented that the current DEF represents a reasonable and conservative estimate for residential clothes dryers based on their analysis of current consumer clothes dryer standards and market share data from the most recent energy conservation standards rulemaking for clothes dryers. (CA IOUs, No. 8 at pp. 9–11)

NEEA recommended that DOE retain the current DEF, or increase it slightly to what NEEA stated would be a more representative value, such as 0.66 kWh/lb, as used by the Northwest Regional Technical Forum. (NEEA, No. 12 at pp. 25–26) NEEA stated that its research showed that residential clothes dryers use more energy in the field than what is predicted by the dryer test procedure.

[58] The ENERGY STAR Specification of Clothes Dryer Requirements Version 1.1 requires the use of Appendix D2 for clothes dryers to obtain ENERGY STAR certification.

Id. NEEA recommended that if DOE retains the current DEF, DOE should revisit this issue once the clothes dryer test procedure has been adjusted to better reflect real-world energy use. *Id.*

As noted by the CA IOUs, the current estimate of 0.5 kWh/lb is consistent with the estimates that DOE developed to reflect the current installed base of clothes dryers as part of the most recent energy conservation standards final rule for clothes dryers.[59] In lieu of any additional data representing national average clothes dryer usage, DOE has tentatively concluded that a DEF of 0.5 kWh/lb remains representative of the nominal energy required for a clothes dryer to remove moisture from clothes.

DOE is, therefore, not proposing to change the value of DEF at this time.

DOE requests comment on maintaining the current DEF value of 0.5 kWh/lb.

c. Dryer Usage Factor

The DUF represents the percentage of clothes washer loads dried in a clothes dryer and is used in section 4.3 of Appendix J2 in the equation for calculating the per-cycle drying energy. In the August 1997 Final Rule, DOE originally established a DUF value of 0.84, which was based in part on data provided by P&G, as described in the April 1996 SNOPR. 61 FR 17589, 17592; 62 FR 45484, 45489. In the March 2012 Final Rule, DOE revised the DUF in Appendix J2 to 0.91 based on updated consumer usage data from 2005 RECS. 77 FR 13887, 13913–13914.

In the May 2020 RFI, DOE requested information to determine whether to revise the DUF value. 85 FR 31065, 31078.

NEEA supported keeping the DUF at 0.91 or raising it to a slightly higher value. (NEEA, No. 12 at p. 25) NEEA calculated a DUF of 0.935, using data from its own study. *Id.*

DOE appreciates the submission of data by NEEA but notes that its survey results represent regional usage (the Pacific Northwest) during a 4 to 6-week period in 2012, as described in its report. As such, NEEA's suggested DUF value of 0.935 does not represent national average usage. DOE is not aware of data or information that would indicate that a value other than 0.91 should be considered and so is not proposing to change the DUF in this NOPR.

DOE requests comment on maintaining the current DUF value of 0.91.

3. Low-Power Mode Assumptions

Section 4.4 of Appendix J2 allocates 8,465 combined annual hours for inactive and off modes. If a clothes washer offers a switch, dial, or button that can be optionally selected by the user to achieve a lower-power inactive/off mode than the default inactive/off mode, section 4.4 of Appendix J2 assigns half of those hours (*i.e.,* 4,232.5 hours) to the default inactive/off mode and the other half to the optional lowest-power inactive/off mode. This allocation is based on an assumption that if a clothes washer offers such a feature, consumers will select the optional lower-power mode half of the time. 77 FR 13887, 13904. The allocation of 8,465 hours to combined inactive and off modes is based on assumptions of 1 hour per cycle and 295 cycles per year, resulting in 295 active mode hours (for a total of 8,760 hours per year for all operating modes). As described in the September 2010 NOPR and confirmed in the March 2012 Final Rule, the estimate of 1 hour per cycle was based on a 2005 report from the U.S. Environmental Protection Agency (''EPA'')[60] that summarized test data from three issues of the *Consumer Reports* magazine, which showed top-loading clothes washers with ''normal'' cycle times of 37–55 minutes and front-loading clothes washers with ''normal'' cycle times of 51–105 minutes.[61]

In the May 2020 RFI, DOE requested input on whether the annual hours allocated to combined inactive and off modes, as well as the assumed 50-percent split between default inactive/off mode and any optional lower-power inactive/off mode, result in a test method that measures the energy efficiency of the clothes washer during a representative average use cycle or period of use and would not be unduly burdensome to conduct. 85 FR 31065, 31079.

No comments were received regarding the assumed 50-percent split between default inactive/off mode and any optional lower-power inactive/off mode. Other issues regarding low-power mode, specifically regarding CCWs, are further discussed in section III.G.7 of this document.

For the proposed new Appendix J, DOE is proposing to update the number of hours spent in low-power mode from a fixed 8,465 total hours to a formula based on the clothes washer's measured cycle time, as discussed in section III.D.5 of this document, and the updated number of annual cycles, as discussed in section III.G.1 of this document. This proposal would allow for a more representative allocation of hours between active mode and low-power mode. DOE is not proposing to make these changes to Appendix J2 because doing so would likely change the measured efficiency, and DOE proposes to make such changes only in the proposed new Appendix J, which would be used for the evaluation and issuance of updated efficiency standards, and for determining compliance with those standards.

DOE requests comment on its proposal to update the number of hours spent in low-power mode from a fixed 8,465 total hours to a formula based on measured cycle time and an assumed number of annual cycles.

4. Temperature Usage Factors

TUFs are weighting factors that represent the percentage of wash cycles for which consumers choose a particular wash/rinse temperature selection. The TUFs in Table 4.1.1 of Appendix J2 are based on the TUFs established in Appendix J1–1997. As described in the April 1996 SNOPR, DOE established the TUFs in Appendix J1–1997 based on an analysis of consumer usage data provided by P&G, AHAM, General Electric Company, and Whirlpool, as well as linear regression analyses performed by P&G and the National Institute of Standards and Technology (''NIST''). 61 FR 17589, 17593.

In the May 2020 RFI, DOE requested comment on current consumer usage frequency of the wash/rinse temperature selections required for testing in Appendix J2. 85 FR 31065, 31077. DOE also requested input on whether requiring the testing of temperature selections with low TUFs (for example, the current Table 4.1.1 lists TUFs including 5, 9, and 14 percent) is consistent with the EPCA requirement that the test procedure be reasonably designed to measure the energy use or efficiency of the clothes washer during a representative average use cycle or period of use, and not be unduly burdensome to conduct. *Id.*

NEEA and the CA IOUs commented that they support the existing TUF values. (NEEA, No. 12 at p. 22; CA IOUs, No. 8 at p. 7) The CA IOUs provided temperature selection data from the 2016 PG&E survey, which found that wash temperature and rinse temperature usage data aligned

[59] April 2011 Clothes Dryers Energy Conservation Standards Final Rule Technical Support Document, Chapter 9. Available at *www.regulations.gov/document/EERE-2007-BT-STD-0010-0053.*

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

[61] These studies appeared in the July 1998, July 1999, and August 2000 issues of Consumer Reports, as cited by EPA.

reasonably well with TUFs from Table 4.1.1 of Appendix J2. (CA IOUs, No. 8 at p. 7–8) As summarized by CA IOUs, the 2016 PG&E survey indicated the following selection frequencies of each wash temperature setting: Cold (45 percent), Warm (46 percent), Hot (7 percent), and Sanitize (1 percent). *Id.* For the rinse temperature setting, 21 percent of cycles used warm rinse, 51 percent used cold rinse, and 28 percent reported no separate rinse temperature. *Id.*

The CA IOUs supported measuring energy and water use of all relevant cycle selections in Table 4.1.1 of Appendix J2, including those with lower TUFs, in order to fully capture energy use in a representative average use cycle or period of use, as required by EPCA. (CA IOUs, No. 8 at p. 7)

As previously mentioned in section III.A of this document, AHAM commented that, in the worst-case scenario of a product with every feature (one that includes manual and user-adjustable automatic WFCS, a heater, four warm wash temperatures, warm rinse, and selectable spin speeds), over half of the test cycles have 1 percent or less overall contribution to the total energy efficiency. (AHAM, No. 5 at p. 4) AHAM emphasized that temperature use factors play a role in the overall burden of the test procedure. *Id.*

DOE appreciates the CA IOUs' data regarding consumer usage of different wash temperatures. As noted previously, the results from the 2016 PG&E survey are instructive as a point of comparison, but limited in geographic and seasonal representation, and represent only a small number of wash cycles per participating household. DOE is not aware of any nationally representative consumer usage data that demonstrate a change in temperature setting usage; therefore, DOE is not proposing any changes to the TUF values at this time.

In response to AHAM's comment regarding the test burden caused by TUFs that represent a relatively smaller percentage of consumer usage, DOE is proposing to implement several other changes to the proposed new Appendix J that would reduce test burden while maintaining representativeness. In particular, DOE is proposing to reduce the number of Warm Wash tested settings, as discussed in section III.D.3 of this document; to reduce the number of tested load sizes, as further discussed in section III.D.1.b of this document; and to measure RMC on the energy test cycle rather than requiring separate additional cycles for measuring RMC, as further discussed in section III.D.4 of this document. Nonetheless, testing the full range of wash temperatures available to consumers on the Normal cycle is necessary to fully capture the energy and water use of a representative use cycle/period of use of a clothes washer.

DOE requests comment on maintaining the current TUF values.

5. Load Usage Factors

As described previously, LUFs are weighting factors that represent the percentage of wash cycles that consumers run with a given load size. Table 4.1.3 of Appendix J2 provides two sets of LUFs based on whether the clothes washer has a manual WFCS or automatic WFCS.

For a clothes washer with a manual WFCS, the two LUFs represent the percentage of wash cycles for which consumers choose the maximum water fill level and minimum water fill level in conjunction with the maximum and minimum load sizes, respectively. For a clothes washer with an automatic WFCS, the three LUFs represent the percentage of cycles for which the consumer washes a minimum-size, average-size, and maximum-size load (for which the clothes washer determines the water fill level). As discussed in section III.D.1.b of this document, the values of these LUFs are intended to approximate a normal distribution that is slightly skewed towards the minimum load size.

In the May 2020 RFI, DOE requested data on current consumer usage as related to the LUFs and whether any updates to the LUFs in Table 4.1.3 of Appendix J2 are warranted to reflect current consumer usage patterns. 85 FR 31065, 31077. DOE specifically requested comment on whether the use of certain LUFs in the test procedure is consistent with the EPCA requirement that the test procedure be reasonably designed to measure energy and water use during a representative average use cycle or period of use without being unduly burdensome to conduct, because certain load sizes may be rarely used by consumers. *Id.*

The CA IOUs provided load size data from the 2016 PG&E survey that showed the following load size usage: Very small (3 percent), small (11 percent), medium (28 percent), large (45 percent), and very large (14 percent).[62] (CA IOUs, No. 8 at pp. 8–9) The CA IOUs stated that international research supports the conclusion that large loads represent a more significant portion of consumer operation than currently represented by Table 4.1.3 of Appendix J2. *Id.* The CA IOUs recommended that DOE consider the results from the 2016 PG&E survey in updating the LUFs. *Id.*

NEEA presented its test data showing that 36 percent of consumer loads are small (less than 6 lb), 52 percent are medium (6 lb to 12 lb), and 11 percent are large (12 lb or more). (NEEA, No. 12 at p. 22) NEEA recommended, based on its testing data, that DOE update the LUFs to place higher weightings on small- and average-sized loads, and less weighting on maximum-sized loads. *Id.*

DOE notes that, as discussed previously in this document, the data presented from both NEEA and the CA IOUs are regional in scope and do not necessarily represent national U.S.-average usage. In addition, DOE notes that the two data sets offer opposing conclusions with regard to load size usage factors.

As previously discussed in section III.D.1.b of this document, DOE is proposing to replace the minimum, maximum, and average load sizes with the small and large load sizes in the proposed new Appendix J. DOE has defined the small and large load sizes such that the small and large load sizes each have an equal (50–50) weighting. As such, DOE is proposing to update the LUFs in the proposed new Appendix J to 0.5 for both the small and the large load size. Because this proposal simplifies the LUF definitions by using the same LUFs regardless of clothes washer WFCS, a separate LUF table is no longer needed. DOE is therefore proposing to remove the LUF Table 4.1.3 and define the LUFs as 0.5 in the equations where the LUFs are first used in section 4.1.3 of the proposed new Appendix J.

DOE requests comment on its proposal to update the LUFs for the small and large load sizes to be equal to 0.5, consistent with the proposed load size definitions in the proposed new Appendix J.

6. Water Heater Assumptions

Section 4.1.2 of Appendix J2 provides equations for calculating total per-cycle hot water energy consumption for all water fill levels tested. The hot water energy consumption is calculated by multiplying the measured volume of hot water by a constant fixed temperature rise of 75 °F and by the specific heat of water, defined as 0.00240 kilowatt-hours per gallon per degree Fahrenheit (''kWh/gal-°F''). No efficiency or loss factor is included in this calculation, which implies an electric water heater efficiency of 100 percent. Similarly, section 4.1.4 of Appendix J2 provides an equation for calculating total per-cycle

[62] The CA IOUs did not define the terms ''very small,'' ''small,'' ''medium,'' ''large,'' or ''very large.''

hot water energy consumption using gas-heated or oil-heated water, for product labeling requirements.[63] This equation includes a multiplication factor ''e,'' representing the nominal gas or oil water heater efficiency, defined as 0.75. These water-heating energy equations estimate the energy required by the household water heater to heat the hot water used by the clothes washer. Per-cycle hot water energy consumption is one of the four energy components in the IMEF metric.

In the May 2020 RFI, DOE requested input on whether any updates were warranted to the water heater efficiency values implied in section 4.1.2 and provided in section 4.1.4 of Appendix J2. 85 FR 31065, 31079.

The CA IOUs recommended that DOE update the gas and oil efficiency factor in section 4.1.4 of Appendix J2, and include a new efficiency factor for electric water heaters in the rest of section 4.1 of Appendix J2, to account for heat losses in the hot water distribution system. (CA IOUs, No. 8 at p. 15)

The CA IOUs did not provide specific recommendations or data that could be used to justify updating the gas and oil efficiency factor, or for a new efficiency factor to account for any heat losses in the hot water distribution system. DOE is unaware of any nationally representative data regarding heat losses in residential water distribution systems.

In the absence of such data, DOE is not proposing any changes to the assumed water heater efficiency factors in the clothes washer test procedure.

DOE requests comment on maintaining the current water heater efficiency assumptions.

7. Commercial Clothes Washer Usage

As mentioned in section I of this document, CCWs are included in the list of ''covered equipment'' for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6311(1)(H)) EPCA requires the test procedures for CCWs to be the same as those established for RCWs. (42 U.S.C. 6314(a)(8))

The CA IOUs recommended that DOE include CCW use patterns when determining the number of average use cycles, annual loads of laundry, and LUF values. (CA IOUs, No. 8 at pp. 8–9, 12–14) The CA IOUs stated that according to Table HC3.4 of the 2015 RECS data, 17.6 percent of respondents rely on CCWs to wash their clothing. The CA IOUs commented that, due to the exclusion of CCW usage data, DOE's analysis undercounts the average annual use cycles. *Id.* The CA IOUs cited an ENERGY STAR case study at an apartment building in Maryland that reported 1,138 cycles per CCW per year, with each CCW servicing more than 19 apartments.[64] According to the CA IOUs, this implies that the RECS annual cycle use analysis provided by DOE in the September 2010 NOPR represents an undercounting of the average annual use cycles due to a lack of representation of CCWs. *Id.*

The CA IOUs also suggested that DOE develop a DEF for CCWs that is different than the DEF for RCWs. (CA IOUs, No. 8 at p. 11) The CA IOUs recommended that DOE calculate this DEF by investigating any changes to market share distribution of consumer clothes dryers since the 2011 clothes dryer standards rulemaking, and by incorporating energy use and market share implications for CCWs. *Id.*

NEEA, the CA IOUs, and the Joint Commenters recommended that DOE require standby/low power mode testing for CCWs, and that low-power mode energy consumption should be incorporated into the energy efficiency metric for CCWs. (NEEA, No. 12 at p. 18; Joint Commenters, No. 10 at p. 2; CA IOUs, No. 8 at p. 13) NEEA reported data from its test program that showed CCWs have an average standby power of 6.4 watts compared to 0.5 watts for RCWs. NEEA stated that although CCWs have more active wash cycles than RCWs, CCWs still spend a significant amount of time in low power mode. According to NEEA, low-power mode energy use in CCWs can be reduced cost-effectively in a variety of ways. (NEEA, No. 12 at p. 18) The CA IOUs further commented that transitioning CCWs' efficiency metric to IMEF could align with the California Energy Commission's Low Power Modes Roadmap.[65] (CA IOUs, No. 8 at p. 13)

NEEA's standby power data for CCWs falls within with the range of test results described by DOE in the December 2014 Final Rule. As part of its market assessment and engineering analysis for the December 2014 Final Rule, DOE performed an in-depth evaluation of the standby and off mode power characteristics of a representative sample of CCWs spanning a wide range of display types, payment systems, and communication features. 79 FR 74492, 74501. DOE observed that manufacturers offer a variety of display and payment functionalities that can be selected independently from the basic model. The standby power associated with these different display and payment functionalities varies from 0.88 to 11.77 watts. *Id.* The lowest standby power levels are associated with models having no vend price display and no coin or card payment options (often referred to as ''push-to-start'' models). These models are typically used in small multi-family housing facilities offering free laundry, or in other commercial applications not requiring fare payment. Such models are not suitable for coin-operated laundry or most other multi-family housing facilities. *Id.* The highest standby power levels are associated with models having a digital vend price display, coin or debit card payment system, and advanced features such as dynamic or cycle-based pricing controls, built-in logging capabilities, and remote auditing features. These models are typically used in coin-operated laundries located in competitive markets. *Id.*

In the December 2014 Final Rule, DOE determined not to include low-power mode energy in the CCW energy efficiency metric. *Id.* DOE determined that promulgating an amended standard that included low-power mode energy could enable backsliding and that the IMEF metric would not provide a useful means for differentiating the active mode characteristics of different CCW models. *Id.* Because of the wide variations in standby power, CCWs with significantly different active mode ratings could have similar IMEF ratings depending on their control panel functionalities, and vice versa. This would diminish the usefulness of the IMEF metric as a means for differentiating the active mode characteristics of different CCW models. *Id.*

Moreover, as noted, EPCA requires the test procedures for CCWs to be the same as those established for RCWs. (42 U.S.C. 6314(a)(8)) Creating load, temperature, or dryer usage factors specific to CCWs within the RCW test procedure would effectively create a separate test procedure for CCWs because the LUF, TUF, DUF, and DEF values are integral to the calculations of per-cycle energy and water use, on which the regulated metrics for RCWs and CCWs are based.

Regarding annual use cycles, DOE notes that in calculating national energy

[63] The Federal Trade Commission's EnergyGuide label for RCWs includes the estimated annual operating cost using natural gas water heating.

[64] The apartment building included 14 clothes washers for 272 apartments. *www.energystar.gov/ia/products/appliances/clotheswash/508_ColesvilleTowers.pdf.*

[65] Additional information can be found at the California Energy Commission's Low-Power Mode docket: *efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=17-AAER-12.*

savings as part of the analysis conducted during CCW energy conservation standards rulemakings, DOE uses CCW-specific usage data for factors such as annual use cycles, the proportion of gas versus electric water heating, and others. This ensures that the analysis of energy savings and national impacts as part of a CCW standards rulemaking accurately reflects CCW usage. Any determination regarding whether to include low-power mode energy use in the energy efficiency metric for CCWs would be made as part of the ongoing energy conservation standards rulemaking for CCWs.

DOE is not proposing any changes to CCW usage factors or to the CCW energy efficiency metric in this NOPR.

H. Clarifications

In this section of the NOPR, DOE is proposing amendments to its test procedures for clothes washers at Appendix J2 that DOE has tentatively determined would not alter the measured efficiency of clothes washers. The proposed amendments either codify guidance on the existing regulations, provide more specificity in the test procedure provisions, provide improved organization of each section, or correct formatting errors in DOE's clothes washer test procedures.

1. Water Inlet Hose Length

DOE has observed an increasing trend of water inlet hoses not being included with the purchase of a new clothes washer. DOE has received questions from test laboratories asking how to install a clothes washer that does not include water inlet hoses among the installation hardware.

Multiple styles of water inlet hoses (different materials, lengths, durability, etc.) are commercially available from appliance and hardware retailers. While most such products intended for consumer use would be appropriate for installing a clothes washer, DOE seeks to provide additional direction to avoid the use of a hose designed for niche purposes (*i.e.,* to ensure representativeness) as well as to ensure reproducible results among different laboratories. Specifically, DOE observes a wide range of hose lengths available on the market, and recognizes that using an excessively long hose could result in the water temperature or pressure at the clothes washer inlet deviating significantly from the temperature and pressure at the test fixture. Based on a review of water inlet hoses available at major retailers, the most common lengths for clothes washer hoses range from 3–6 feet (''ft''). DOE is therefore proposing to specify the use of hoses that do not exceed 72 inches in length (6 ft) in section 2.10.1 of the proposed new Appendix J.

DOE requests comment on its proposal to specify the use of hoses not to exceed 72 inches in length in the proposed new Appendix J. DOE also requests comment on the length of inlet hose typically used for testing.

DOE could also consider this change for Appendix J2, but is not proposing it in this NOPR because of the potential for this change to impact measured energy efficiency. DOE proposes to make such changes only in the proposed new Appendix J, which would be used for the evaluation and issuance of updated efficiency standards, and for determining compliance with those standards.

2. Water Fill Selection Availability

Table 2.8 within section 2.8 of Appendix J2 requires that, for clothes washers with manual WFCS, each temperature selection that is part of the energy test cycle be tested using both the minimum and maximum water fill levels, using the minimum and maximum load sizes, respectively. Section 3.2.6 of Appendix J2 describes these water fill levels as the minimum and maximum water levels available for the wash cycle under test. DOE has observed one RCW model with electronic controls in which the maximum water fill level on the unit cannot be selected with all of the temperature selections required for testing; *i.e.,* on at least one temperature setting, the maximum water fill that can be selected is one of the intermediate fill levels on the unit. In such cases generally, the ''reduced maximum'' water fill level for a particular temperature setting may not be appropriate for use with the maximum load size required for that particular cycle under test. Using a maximum load size with a reduced maximum water fill level may not provide results that measure energy efficiency and water use during a representative average use cycle or period of use, since the unavailability of the ''full maximum'' water fill level for that particular cycle under test would suggest that the particular temperature selection is not intended to be used with a maximum load size.

The RCW model with this characteristic is no longer available on the market, and DOE is not aware of any other clothes washer models currently on the market with this characteristic. As described further in this discussion, DOE is not proposing any amendments in this NOPR to address the potential for the maximum load size required by the test procedure to conflict with the maximum load size intended or able to be washed on such a cycle. Nevertheless, DOE considered comments received from interested parties on this issue and seeks additional comment on several approaches that DOE has considered that could address this issue in the test procedure.

In the May 2020 RFI, DOE requested comment from interested parties on how the test procedure should accommodate clothes washers in which the maximum available water fill level may differ depending on the temperature selection. 85 FR 31065, 31073.

Samsung stated that it believes that because some clothes washers do not offer all water level selections for all temperature options, the current test procedure is unrepresentative of real-world use. According to Samsung, if the energy test cycle cannot be run at all temperature and water fill options, consumers may switch to a non-tested, and potentially more energy-intensive, mode in order to access the water level and temperature they intend to use. Samsung suggested that DOE consider amending the test procedure to require testing of other cycles, in addition to the Normal cycle, for which all water level selections are available. (Samsung, No. 6 at pp. 2–3)

AHAM commented that it is not necessary to amend the test procedure to include directions for testing clothes washers with water fill levels that are only available at certain temperature settings. (AHAM, No. 5 at p. 12) AHAM commented that while consumers have options available for other needs, the Normal cycle remains the most representative of customer use, and there have not been any data to prove otherwise. AHAM emphasized that the purpose of testing is to test the most used, or ''representative,'' cycle and that the Normal cycle has been and remains that cycle. *Id.* Furthermore, AHAM commented that DOE has achieved its objectives by limiting water and energy use and restrictions on options in the most commonly used cycle while also allowing for consumer choice. AHAM stated that it may have more data on this issue at a future time. *Id.*

The suggestion by Samsung to require testing of other cycles for which all water level selections are available would mirror the approached used in the flowcharts in section 2.12 of Appendix J2 for determining the wash/rinse temperatures that comprise energy test cycle. For each wash/rinse temperature selection other than Cold/Cold, the flowcharts require deviating

from the Normal cycle (as that term is defined in section 1.25 of Appendix J2) if the particular wash/rinse temperature combination is not offered on the Normal cycle but is offered on one of the other cycle selections on the clothes washer. DOE could consider amending the flowcharts to incorporate the availability of load sizes in conjunction with the availability of wash/rinse temperature selections, for example.

DOE could also consider other approaches that would maintain the use of the Normal cycle in such cases; for example, specifying the use of a modified load size if the maximum load size defined by the test procedure conflicts with the maximum load size intended or able to be washed on such a cycle.

DOE notes an important distinction between the requirements of EPCA and AHAM's comment regarding the purpose of the test procedure. As discussed, EPCA requires that test procedures produce test results that measure energy efficiency or energy use during a representative average use cycle or period of use (among other considerations). (42 U.S.C. 6293(b)(3); 42 U.S.C. 6314(a)(2)) AHAM's comment suggests that testing other cycles for models with certain characteristics is not necessary because, according to AHAM, the Normal cycle remains the most representative of customer use. However, EPCA does not require that the results of the test procedure be representative of the average use of consumers across all models of clothes washers; rather, EPCA requires that the results of the test procedure be representative of the energy (and water) use of the particular model being tested. Although the Normal cycle may be the most commonly used cycle across all clothes washers on the market, the ''representative average use cycle or period of use'' might differ for a model in which the maximum water fill level on the unit cannot be selected with all of the temperature selections required for testing.

As stated, DOE is not proposing any changes at this time to address the potential for the maximum load size required by the test procedure to conflict with the maximum load size intended or able to be washed using the cycle required for testing. To the extent that models with this characteristic were to be reintroduced the market, more research would be needed to address any potential concerns regarding representative use.

Finally, DOE notes that the amended load sizes proposed for new Appendix J (in which the ''large'' load size is smaller than the ''maximum'' load size currently defined by Appendix J2) would obviate the need for any changes to the test procedure for the one RCW model of concern.

DOE requests comment on whether it should amend the test procedure to accommodate potential future clothes washer models for which the maximum load size required by the test procedure conflicts with the maximum load size intended or able to be washed with the cycle required for testing. If so, DOE seeks additional comment on the approaches it has considered, or on any other approaches that could be considered, that would address this issue in the test procedure.

3. Water Fill Control Systems

a. Definitions

Section 1.5 of Appendix J2 defines ''automatic water fill control system'' as a clothes washer WFCS that does not allow or require the user to determine or select the water fill level, and includes adaptive WFCS and fixed WFCS. Section 1.4 of Appendix J2 defines ''adaptive water fill control system'' as a clothes washer automatic WFCS that is capable of automatically adjusting the water fill level based on the size or weight of the clothes load placed in the clothes container. Section 1.14 of Appendix J2 defines ''fixed water fill control system'' as a clothes washer automatic WFCS that automatically terminates the fill when the water reaches an appropriate level in the clothes container. Section 3.2.6.2.2 of Appendix J2 provides testing instructions for a ''user-adjustable'' automatic WFCS, which is described in that section as an automatic water fill control that affects the relative wash water levels.

In response to the May 2020 RFI, NEEA and the Joint Commenters recommended that DOE develop new definitions for WFCS to address the current variety and sophistication of clothes washer fill options and the range of possible consumer use. NEEA stated that the market has shifted away from the two main types of WFCS currently defined in Appendix J2, and that NEEA has encountered many types of combined WFCS. (NEEA, No. 12 at p. 21; Joint Commenters, No. 10 at pp. 3–4)

To provide additional specificity to both Appendix J2 and the proposed new Appendix J, DOE is proposing revisions to some of the WFCS definitions, as follows.

DOE proposes to amend the definition of ''fixed water fill control system'' to mean ''a clothes washer automatic water fill control system that automatically terminates the fill when the water reaches a pre-defined level that is not based on the size or weight of the clothes load placed in the clothes container, without allowing or requiring the user to determine or select the water fill level.'' This proposed amendment to the definition would specify that the water fill level for this type of WFCS is pre-defined (*i.e.,* fixed) and does not vary based on the size or weight of the load. The proposal would incorporate the same terminology used in the other WFCS definitions so as to more clearly articulate how a fixed WFCS relates to the other defined WFCS. This amended definition would be included in the proposed new Appendix J as well.

To provide greater specificity regarding user-adjustable automatic WFCS, DOE is proposing to add a definition of a ''user-adjustable automatic water fill control system'' to section 1 of both Appendix J2 and the proposed new Appendix J. DOE is proposing to define a user-adjustable automatic WFCS as ''an automatic clothes washer fill control system that allows the user to adjust the amount of water that the machine provides, which is based on the size or weight of the clothes load placed in the clothes container.'' Given DOE's proposal to create a definition of user-adjustable automatic WFCS, DOE proposes to simplify the wording of section 3.2.6.2.2 of Appendix J2 from ''[c]onduct four tests on clothes washers with user adjustable automatic water fill controls that affect the relative wash water levels'' to ''[c]onduct four tests on clothes washers with user-adjustable automatic water fill controls.'' For the proposed new Appendix J, section 3.2.3.2.2 would state ''For the large test load size, set the water fill selector to the setting that uses the most water. For the small test load size, set the water fill selector to the setting that uses the least water.''

DOE requests comment on its proposed changes to the definition of ''fixed water fill control system'' and on its proposal to add a definition for ''user-adjustable automatic water fill control system.''

b. ''Most Energy Intensive'' Wording for User-Adjustable Automatic Water Fill Control Systems

As discussed, section 3.2.6.2.2 of Appendix J2 specifies how to test clothes washers with user-adjustable automatic WFCS. Four tests are required:

☐ A test using the maximum test load size and with the WFCS set in the setting that will give the most energy intensive result;

☐ a test using the minimum test load size and with the WFCS set in the setting that will give the least energy intensive result;

☐ a test using the average test load size and with the WFCS set in the setting that will give the most energy intensive result; and

☐ a test using the average test load size and with the WFCS set in the setting that will give the least energy intensive result.

DOE has received questions from a test laboratory regarding how to determine which setting is the most ''energy intensive'' for the purposes of this provision. Depending on the quantity and temperature of water under consideration—as well as whether the term ''energy intensive'' is intended to include machine electrical energy, hot water heating energy, and/or drying energy—the setting that uses the most (or least) amount of water may not correspond to the most (or least) amount of energy. While the amount of water used in a wash cycle can be readily determined, measuring and calculating the amount of energy consumption requires more time and effort, particularly if energy consumption includes a combination of machine electrical energy, hot water heating energy, and/or drying energy.

The provisions requiring testing the most and least energy intensive settings were initially proposed in response to an interim waiver granted to GEA for a clothes washer with user-adjustable adaptive WFCS. 61 FR 57794, 57795 (Nov. 8, 1996; ''November 1996 NOPR''), referencing interim waiver case no. CW–004, 61 FR 18125 (Apr. 24, 1996; ''April 1996 Interim Waiver''). These testing provisions were adopted in the August 1997 Final Rule 62 FR 45484, 45487.

At the time of the November 1996 NOPR, the applicable energy efficiency metric (*i.e.,* energy factor) did not include the drying energy component, and the energy conservation standards at the time did not regulate the water efficiency of clothes washers. As evident throughout the discussions in the April 1996 Interim Waiver, November 1996 NOPR, and August 1997 Final Rule, absent the consideration of drying energy and water efficiency, DOE used the terms ''most energy intensive'' and ''least energy intensive'' synonymously with discussing the water fill amounts.[66] The terms ''most energy intensive'' and ''least energy intensive'' were originally employed to provide direction of the water fill amounts required for testing of the adaptive WFCS. In no part of any of these three documents did DOE discuss the possibility that the highest (or lowest) water fill amount would not also correspond to the most (or least) energy intensive setting. In the context of the user-adjustable automatic WFCS provisions, the test conditions are to provide instruction as to the required water fill level, and not require a determination of energy intensity.

As the test procedures and energy conservation standards have been amended, the measured energy use accounts for more than just that which correlates to the water fill level. However, use of the energy intensity terminology remained in the user-adjustable automatic WFCS provisions.

Given the evolution of clothes washer control systems and operation since the August 1997 Final Rule, more precise language is needed to avoid an unnecessary determination of whether the highest (or lowest) water fill amount on a user-adjustable automatic WFCS corresponds to the most (or least) energy intensive setting. Therefore, DOE is proposing to change the wording of both section 3.2.6.2.2 of Appendix J2 and section 3.2.3.2.2 of the proposed new Appendix J, to update the phrase ''the setting that will give the most energy intensive result'' to ''the setting that uses the most water'' to reflect the original intent of this provision. Similarly, DOE is proposing to update the phrase ''the setting that will give the least energy intensive result'' to ''the setting that uses the least water.''

DOE requests comment on its proposal to update the wording of section 3.2.6.2.2 of Appendix J2 and section 3.2.3.2.2 of the proposed new Appendix J from ''the setting that will give the most energy intensive result'' to ''the setting that uses the most water;'' and from ''the setting that will give the least energy intensive result'' to ''the setting that uses the least water.''

4. Energy Test Cycle Flowcharts

In the August 2015 Final Rule, DOE implemented a series of flowcharts to determine the wash/rinse temperature selections required for testing in section 2.12 of Appendix J2. 80 FR 46730, 46744.

a. Clarification of Load Size To Be Used for Temperature Comparisons

Figure 2.12.5 of Appendix J2, which is the flow chart used for the determination of the Extra-Hot Wash/Cold Rinse temperature selection, asks if the wash/rinse temperature selection has a wash temperature greater than 135 °F. DOE is aware that for some clothes washer on the market, the answer to that question could differ depending on what load size is used, *i.e.,* the wash temperature may exceed 135 °F only on certain load sizes, meaning that the determination of whether the temperature selection is classified as Hot Wash/Cold Rinse or Extra-Hot Wash/Cold Rinse would depend on the load size used for making the determination. More generally, all of the flowcharts in section 2.12 require comparing wash and rinse water temperatures across different temperature selections, without specifying a load size to be used for making these comparisons.

DOE is proposing to specify using the maximum load size to evaluate the flow chart for clothes washers tested to Appendix J2, and the large load size for the proposed new Appendix J.[67] The maximum/large load size is the load size expected to use the most water (compared to the other load sizes) under each appendix, and in DOE's experience, larger quantities of water (particularly hot water) provide a more reliable determination of the relative differences in water temperature among the various temperature settings. Therefore, the maximum/large load size is likely to provide the most repeatable and reproducible end result for each flowchart.

DOE notes that Figure 2.12.1 of Appendix J2, which is the flow chart used for the determination of the Cold Wash/Cold Rinse temperature selection, provides direction for cases where multiple wash temperature selections in the Normal cycle do not use any hot water for any of the water fill levels or test load sizes required for testing. For Appendix J2, DOE is proposing that the new clarifying language would not apply to the Cold Wash/Cold Rinse temperature settings in order to avoid the potential need for retesting under Appendix J2 if a clothes washer was tested in a manner inconsistent with this proposed change. For the proposed new Appendix J, DOE is proposing to delete from the Cold Wash/Cold Rinse flowchart (Figure 2.12.1) the clause applying it to all tested load sizes, and

[66] For example, in the April 1996 Interim Waiver, DOE stated the following: However, the ''sensitivity'' or relative fill amounts of the automatic water fill mode can be reprogrammed in the secondary programming mode, thus resulting in an increase in energy consumption above the manual mode result. 61 FR 18125, 18127.

[67] See section III.D.1.b of this document for a discussion of the definition of the new ''large'' test load size.

to instead require the use of the large size, consistent with all the other wash/rinse temperature selection flowcharts.

DOE requests comment on its proposal to require that the energy test cycle flow charts be evaluated using the large load size for all wash/rinse temperature settings in the proposed new Appendix J. DOE also requests comment on its proposal to require that the energy test cycle flow charts be evaluated using the maximum load size, except for the Cold/Cold flow chart, in Appendix J2.

b. Clothes Washers That Generate All Hot Water Internally

As described in section III.C.2 of this document, DOE is aware of single-inlet clothes washers on the market that intake only cold water and internally generate all hot water required for a cycle by means of an internal heating element. As observed on the market, these clothes washers offer Cold, Warm, Hot, and/or Extra Hot temperature selections. As part of determining the Cold Wash/Cold Rinse temperature selection, the instruction box in the flowchart in Figure 2.12.1 of Appendix J2 refers to ''. . . multiple wash temperature selections in the Normal cycle [that] do not use any hot water for any of the water fill levels or test load sizes required for testing . . .'' In the May 2020 RFI, DOE considered rephrasing the text in Figure 2.12.1 of Appendix J2 to say ''. . . use *or internally generate* any heated water . . .'' (emphasis added) so that the wording of the Cold Wash/Cold Rinse flowchart in Figure 2.12.1 of Appendix J2 explicitly addresses clothes washers that internally generate hot water. 85 FR 31065, 31074. This change would be consistent with DOE's interpretation of the current Cold Wash/Cold Rinse flowchart and subsequent flowcharts for the Warm Wash and Hot Wash temperature selections for this type of clothes washer. *Id.* DOE requested input on this rephrasing. *Id.*

UL supported changing the wording of Figure 2.12.1 of Appendix J2 to specifically address clothes washers that internally generate heated water. (UL, No. 9 at p. 3)

AHAM stated that it does not oppose rephrasing Figure 2.12.1 of Appendix J2 to specifically address clothes washers that internally generate all hot water used for a cycle by means of internal heating elements, and believes it would be a useful clarification. (AHAM, No. 5 at p. 13)

As suggested in the May 2020 RFI, DOE proposes rephrasing the text in Figure 2.12.1 of both Appendix J2 and the proposed new Appendix J to say ''. . . use *or internally generate* any heated water . . .'' (emphasis added) so that the wording of the Cold Wash/Cold Rinse flowchart in both appendices explicitly addresses clothes washers that internally generate hot water. 85 FR 31065, 31074. In this NOPR, DOE is further proposing to rephrase the description of Warm Wash/Warm Rinse in Figure 2.12.4 of both Appendix J2 and the proposed new Appendix J to state ''. . . rinse temperature selections that add *or internally generate* hot water . . .'' (emphasis added), for the same reasons.

DOE requests comments on its proposal to update the flowcharts for Cold Wash/Cold Rinse and Warm Wash/Warm Rinse in both Appendix J2 and the proposed new Appendix J to explicitly address clothes washers that internally generate hot water.

5. Wash Time Setting

Section 3.2.5 of Appendix J2 defines how to select the wash time setting on a clothes washer. If no one wash time is prescribed for the wash cycle under test, the wash time setting is the higher of either the minimum or 70 percent of the maximum wash time available, regardless of the labeling of suggested dial locations. Hereafter in this document, DOE refers to this provision as the ''70-percent test.''

In the March 2012 Final Rule, DOE added instructions to the wash time section of Appendix J1 and Appendix J2 that specified the direction of rotation of electromechanical dials, and that the 70-percent test applies regardless of the labeling of suggested dial locations. 77 FR 13887, 13927. In the August 2015 Final Rule, DOE specified that, if 70-percent of the maximum wash time is not available on a dial with a discrete number of wash time settings, the next-highest setting greater than 70-percent must be chosen. 80 FR 46729, 46745.

a. Electronic vs. Electromechanical Dials

DOE has observed on the market clothes washers that have an electronic cycle selection dial designed to visually simulate a conventional electromechanical dial.[68] 85 FR 31065, 31075. In particular, DOE has observed clothes washers with an electronic dial that offers multiple Normal cycle selections; for example, ''Normal-Light,'' ''Normal-Medium,'' and ''Normal-Heavy,'' with the descriptor referring to the soil level of the clothing. On such clothes washers, the only difference between the three Normal cycles apparent to consumers when performing each cycle may be the wash time, although other less observable parameters may also differ. Although the electronic dial simulates the visual appearance of an electromechanical dial, the electronic dial is programmed with a preestablished set of wash cycle parameters, including wash time, for each of the discrete cycle selections presented on the machine. *Id.* For this type of cycle selection dial, each of the discrete cycle selection options represents a selectable ''wash cycle'' as referred to in section 3.2.5 of Appendix J2, and a wash time is prescribed for each available wash cycle. Therefore, for clothes washers with this type of electronic dial, the wash cycle selected for testing must correspond to the wash cycle that meets the definition of Normal cycle in section 1.25 of Appendix J2. The wash time setting thus would be the prescribed wash time for the selected wash cycle; *i.e.,* the 70-percent test would not apply to this type of dial. *Id.* In the May 2020 RFI, DOE requested feedback on whether to further clarify section 3.2.5 of Appendix J2 regarding electronic cycle selection dials that visually simulate conventional electromechanical dials. *Id.*

AHAM suggested that section 3.2.5 of Appendix J2 could be clarified by specifying that the instructions pertaining to electromechanical dials (regarding resetting the dial and turning it to reach the appropriate setting) also pertain to timers that control wash time. (AHAM, No. 5 at p. 14)

DOE agrees with AHAM's suggestion and is proposing to amend section 3.2.5.3 of both Appendix J2 and the proposed new Appendix J by adding the words ''or timer'' after the words ''electromechanical dial'' in order to clarify the application of the instructions to electronic cycle selection dials.

DOE is further proposing to revise the wording of section 3.2.5 of Appendix J2 and section 3.2.2 of the proposed new Appendix J[69] by changing the first sentence of the section to read, ''*If the cycle under test offers a range of wash time settings,* the wash time setting shall be the higher of either the minimum 70 percent of the maximum wash time available for the wash cycle under test,

[68] On most electromechanical dials, the rotational position of the dial corresponds to the desired wash time. The user rotates the dial from the initial ''off'' position to the desired wash time position, and after starting the wash cycle, the dial rotates throughout the progression of the wash cycle until it reaches the ''off'' position at the end of the cycle. In contrast, an electronic dial contains a fixed number of selectable positions, and the dial remains in the selected position for the duration of the wash cycle.

[69] See section III.H.7 of this document for a discussion of the structure of section 3 of the proposed new Appendix J.

regardless of the labeling of suggested dial locations'' (emphasis added). DOE is also proposing to separate section 3.2.5 of Appendix J2 and section 3.2.2 of the proposed new Appendix J into two subsections: Section 3.2.5.1 (in Appendix J2) and section 3.2.2.1 (in the proposed new Appendix J), which specifies the wash time setting for a clothes washer cycle with a range of wash time settings; and section 3.2.5.2 (in Appendix J2) and 3.2.2.2 (in the proposed new Appendix J), which specifies the dial rotation procedure for a clothes washer equipped with an electromechanical dial or timer that rotates in both directions.

DOE requests comment on its proposal to clarify the wording of the wash time setting specifications in section 3.2.5 of Appendix J2 and section 3.2.2 of the proposed new Appendix J.

b. Direction of Dial Rotation

Section 3.2.5 of Appendix J2 states that, for clothes washers with electromechanical dials controlling wash time, the dial must be turned in the direction of increasing wash time to reach the appropriate wash time setting. DOE is aware that not all electromechanical dials currently on the market can be turned in the direction of increasing wash time. 85 FR 31065, 31075. On such models, the dial can only be turned in the direction of decreasing wash time. DOE believes that the direction of rotation need only be prescribed on a clothes washer with an electromechanical dial that can rotate in both directions. *Id.* In the May 2020 RFI, DOE requested comment on its understanding of the functioning of dials currently on the market, specifically with regard to the direction(s) of rotation and whether the wording of section 3.2.5 of Appendix J2 warrants revision to specify that the requirement to rotate the dial in the direction of increasing wash time applies only to dials that can rotate in both directions. *Id.*

UL commented that it supports specifying that the requirement to rotate the dial in the direction of increasing wash time applies only to dials that can rotate in both directions, because some dials only rotate in one direction. (UL, No. 9 at p. 3)

AHAM supported amending section 3.2.5 of Appendix J2 to specify that the requirement to rotate the dial in the direction of increasing wash time applies only to dials that can rotate in both directions. (AHAM, No. 5 at p. 14)

DOE notes general support for its suggestion to specify that the requirement to rotate the dial in the direction of increasing wash time applies only to dials that can rotate in both directions. In this NOPR, DOE is proposing to add a clause in section 3.2.5.2 of Appendix J2 and section 3.2.2.2 of the proposed new Appendix J that would specify that the requirement to rotate the dial in the direction of increasing wash time would only apply to dials that can rotate in both directions.

DOE requests comment on its proposal to add a clause in section 3.2.5.2 of Appendix J2 and section 3.2.2.2 of the proposed new Appendix J stating that the requirement to rotate the dial in the direction of increasing wash time would only apply to dials that can rotate in both directions.

c. ''Wash Time'' Definition

The 70-percent test described above does not explicitly define how to calculate ''wash time.'' In the May 2020 RFI, DOE was considering whether to state that the phrase ''wash time'' in section 3.2.5 of Appendix J2 refers to the period of agitation or tumble. 85 FR 31065, 31975. This clarification would be consistent with the historical context of this section of the test procedure. In Appendix J–1997, section 2.10 *Clothes washer setting* refers to ''actual wash time'' as the ''period of agitation.'' In Appendix J–2001, DOE renamed section 2.10 *Wash time (period of agitation or tumble) setting.*[70] 66 FR 3313, 3330. When establishing Appendix J1 in the August 1997 Final Rule, DOE did not include reference to ''period of agitation or tumble'' in section 2.10 of Appendix J1. 62 FR 45484, 45510. DOE did not address this difference from Appendix J–1977 in the preamble of the August 1997 Final Rule or the NOPRs that preceded that final rule, but given the continued reference to ''wash time'' in Appendix J1, did not intend to change the general understanding that wash time refers to the wash portion of the cycle, which includes agitation or tumble time. DOE has since further amended section 2.10 of both Appendix J1 and Appendix J2 as part of the March 2012 Final Rule and August 2015 Final Rule (in which section 2.10 was renumbered as section 3.2.5), with no discussion in these final rules of the statement that remained in Appendix J–2001, where wash time was referred to in the title of section 2.10 as the period of agitation or tumble time. DOE further notes that in current RCW models on the market, agitation or tumble may be periodic or continuous during the wash portion of the cycle.

In the May 2020 RFI, DOE requested feedback on whether DOE should consider reincorporating language into section 3.2.5 of Appendix J2 to state that the term ''wash time'' refers to the wash portion of the cycle, including agitation or tumble time. 85 FR 31065, 31076.

UL suggested that the phrase ''wash time'' include agitation or tumble time, which can be periodic throughout the wash cycle. (UL, No. 9 at p. 3) UL specified in particular that wash time could be defined as starting when the clothes washer starts filling with water, agitating or tumbling, or a combination of both; and as ending when the clothes washer drains the water from the wash portion of the cycle. *Id.*

AHAM agreed with DOE's proposal to state that ''wash time'' refers to the period of agitation or tumble. (AHAM, No. 5 at p. 14)

In order to provide further clarity in evaluating the wash time setting requirements of section 3.2.5 of Appendix J2 and section 3.2.2 of the proposed new Appendix J, DOE is proposing to define the term ''wash time'' in section 1 of both Appendix J2 and the proposed new Appendix J as ''the wash portion of the cycle, which begins when the cycle is initiated and includes the agitation or tumble time, which may be periodic or continuous during the wash portion of the cycle.''

DOE requests comment on its proposal to add a definition of ''wash time'' to section 1 of both Appendix J2 and the proposed new Appendix J.

6. Annual Operating Cost Calculation

DOE provides in 10 CFR 430.23(j)(1)(ii) the method for calculating the estimated annual operating cost for automatic and semi-automatic clothes washers, when using Appendix J2. In the March 2012 Final Rule, DOE assigned the symbol ''E_{TLP}'' to represent combined low-power mode energy consumption. However, in that rule, DOE used a different symbol (''E_{TSO}'') in updating section 10 CFR 430.23(j)(1)(ii) to represent the same value. 77 FR 12888, 13937–13948. DOE is proposing to update the symbol nomenclature in 10 CFR 430.23(j)(1)(ii) to match the symbol nomenclature in Appendix J2.

In addition, to differentiate between values determined using Appendix J2 from values determined using the proposed new Appendix J throughout 10 CFR 430.23(j), DOE is proposing to add a number ''2'' to each of the symbols representing values derived from Appendix J2 (*e.g.,* E_{TLP2}) that are not already designated accordingly.

[70] In this context, ''agitation'' refers to the wash action of a top-loading clothes washer, whereas ''tumble'' refers to the wash action of a front-loading clothes washer.

DOE further notes that the formula for calculating the estimated annual operating cost for automatic and semi-automatic clothes washers when gas-heated or oil-heated water is used, provided in 10 CFR 430.23(j)(1)(ii)(B), is missing a pair of parentheses. The ''N_2'' multiplier is intended to apply to all of the other factors in the equation, but the lack of parentheses around the ''ME_{T2}'' through ''C_{BTU}'' terms erroneously applies it to only the first term of the sum. DOE is proposing to correct this error.

Since DOE is proposing to remove Appendix J1, DOE is also proposing to update 10 CFR 430.23(j)(1)(i), which currently specifies the formulas for calculating the estimated annual operating cost for automatic and semi-automatic clothes washers when using Appendix J1, with the formulas for calculating the estimated annual operating cost for automatic and semi-automatic clothes washers when using the proposed new Appendix J. These proposed formulas are analogous to the formulas in 10 CFR 430.23(j)(1)(ii). As discussed further in section III.H.7 of this document, the proposed new Appendix J does not include a separate calculation for ''E_{TE}'' (the sum of machine electrical energy (''ME_T'') and hot water heating energy (''HE_T''), as currently defined in section 4.1.7 of Appendix J2). Therefore, DOE's proposed revisions to 10 CFR 430.23(j)(1)(i) replace E_{TE} with the individual components $ME_T + HE_T$.

DOE requests comment on its proposed updates to the annual operating cost calculations in 10 CFR 430.23(j)(1).

7. Structure of the Proposed New Appendix J

As part of the creation of the proposed new Appendix J, DOE is proposing several changes to the structure of the test procedure as compared to the current Appendix J2 to improve readability, as follows.

DOE is proposing to better organize section 2.8 of the proposed new Appendix J, as compared to the parallel section in Appendix J2. Currently, section 2.8 of Appendix J2 cross-references the load size table to determine the three load sizes, specifies the allowable composition of energy test cloths and energy stuffer cloths in each load,[71] and provides a table showing required test load sizes and water fill settings for each type of WFCS. In the proposed new Appendix J, section 2.8.1 would contain the specifications for determining the load sizes; section 2.8.2 would contain the specifications describing the allowable composition of energy test cloths and energy stuffer cloths in each load; and the table specifying the required test load sizes and water fill settings for each type of WFCS would not be included. This table would be no longer needed in the proposed new Appendix J because the same two load sizes (small and large) would be used for all WFCS types.

Section 2.9 of Appendix J2 is named ''Use of test loads'' and provides specifications for drying each load to bone-dry prior to use and instructions for loading the test cloth into the clothes washer. DOE is proposing to title section 2.9 of the proposed new Appendix J ''Preparation and loading of test loads'' and to include a statement that the procedures described in section 2.9 to prepare and load each test load are applicable when performing the testing procedures in section 3 of the appendix.

Section 3.2 of Appendix J2 is titled ''Procedure for measuring water and energy consumption values on all automatic and semi-automatic washers'' and specifies conducting testing under the energy test cycle (3.2.1); provides a table that cross-references to each relevant test section in section 3 of the appendix (3.2.2); and provides specifications for: Configuring the hot and cold water faucets (3.2.3); selecting the wash/rinse temperature selection (3.2.4); selecting the wash time setting (3.2.5); selecting water fill levels for each type of WFCS (3.2.6); using manufacturer default settings (3.2.7); testing active washing mode only (3.2.8); and discarding anomalous data (3.2.9). DOE is proposing to title section 3.2 of the proposed new Appendix J as simply ''Cycle settings'' and to organize the section as follows: The contents in section 3.2.1 of Appendix J2 would be instead included within the instructions of a new section 3.3 (as described below); the contents of section 3.2 of Appendix J2, including the table, would not be included as the contents would be redundant with the proposed sections 3.3 and 3.4; the contents of section 3.2.3 of Appendix J2 would not be included, as the hot and cold water faucet instructions would no longer be necessary given the proposed changes described in section III.C.2 of this document regarding the installation of single-inlet clothes washers; and sections 3.2.4 through 3.2.9 of Appendix J2 would be included as sections 3.2.1 through 3.2.6, respectively, and include any relevant edits as discussed throughout this document.

Currently, sections 3.3 through 3.7 of Appendix J2 contain detailed instructions for testing each wash/rinse temperature available in the energy test cycle: Extra Hot/Cold (3.3); Hot/Cold (3.4); Warm/Cold (3.5); Warm/Warm (3.6); and Cold/Cold (3.7). The content and structure of each of these sections is nearly identical, except for two caveats: (1) Describing the use of temperature indicator labels in section 3.3 to verify the presence of an Extra Hot wash; and (2) describing the 25/50/75 test, described in section III.D.3 of this document, for clothes washers that offer four or more Warm/Cold or Warm/Warm selections. To significantly simplify this part of test procedure, and because the use of temperature indicator labels would be moved to section 2.5.4 of the proposed new Appendix J and the 25/50/75 test would no longer be applicable under the proposals outlined in section III.D.3 of this document, DOE is proposing to combine the common language from sections 3.3 through 3.7 in Appendix J2 into a single section 3.3 in the proposed new Appendix J for automatic clothes washers and an analogous section 3.4 for semi-automatic clothes washers. Section 3.3 of the proposed new Appendix J would also provide a table designating the symbol definitions of each required measured value for each wash/rinse temperature selection and load size. As discussed in section III.D.8.c of this document, section 3.4 of the proposed new Appendix J would provide the same information for semi-automatic clothes washes.

Section 3.8 of Appendix J2 specifies the procedure for measuring and calculating RMC. As described in section III.D.4 of this document, DOE is proposing in the proposed new Appendix J to require measuring the RMC of each tested cycle within the energy test cycle, and to calculate final RMC using TUFs and LUFs, consistent with how hot water energy, electrical energy, and water usage are calculated. Under this proposed change, the RMC values would be calculated in section 4 (''Calculation of Derived Results From Test Measurements'') of the proposed new Appendix J. Given these proposed changes, the current specifications in section 3.8 of Appendix J2 would not apply to the proposed new Appendix J. DOE is therefore proposing not to include the RMC provisions from section 3 in Appendix J2 in the proposed new Appendix J.

DOE is proposing to include sections 3.9 and 3.10 of Appendix J2 in the proposed new Appendix J as sections 3.5 and 3.6, respectively, and to provide the appropriate cross-references.

[71] Test loads must consist of energy test cloths and no more than five energy stuffer clothes per load to achieve the proper weight.

Section 3.10 of Appendix J2 (section 3.6 in the proposed new Appendix J) is titled ''Energy consumption for the purpose of determining the cycle selection(s) to be included in the energy test cycle'' and specifies the following: Establishing the test conditions and setting the cycle selections (3.10.1); using the maximum test load size (3.10.2); using the maximum water fill level available (3.10.3); including only the active washing mode (3.10.4); and calculating ''total energy consumption'' using a defined equation (3.10.5). DOE is proposing to simplify section 3.6 in the proposed new Appendix J by condensing the specifications of sections 3.10.1 through 3.10.4 in Appendix J2 into a single statement in section 3.6.1 of the proposed new Appendix J to use the cycle settings as described in section 3.2 of the proposed new Appendix J. Current section 3.10.5 of Appendix J2 would be included in the proposed new Appendix J as section 3.6.2.

Sections 3 and 4 of Appendix J2 assign various different subscripts to each symbol definition to denote load size and wash/rinse temperature selection, among other attributes. Currently, Appendix J2 uses the subscript ''x'' to denote the maximum load size and the subscript ''m'' to denote the Extra Hot/Cold temperature selection. In the proposed new Appendix J, DOE proposes to use new subscripts to represent the large load size (''L'') and the small load size (''S''). Because the maximum load size would no longer apply in the proposed new Appendix J, DOE is proposing to update the subscript for Extra-Hot/Cold temperature selection from ''m'' to ''x'' (since ''x'' is more intuitive in representing ''Extra''). These changes would apply to sections 3.3, 3.4, 3.6 and 4 in the proposed new Appendix J. Additionally, throughout section 4 of Appendix J2, the symbol ''F'' is used to refer to load usage factors. For greater clarity in the proposed new Appendix J, DOE is proposing to use the symbol ''LUF'' throughout section 4 to represent the load usage factors, rather than the symbol ''F.''

Section 4.1.7 of Appendix J2 specifies calculating ''Total per-cycle energy consumption when electrically heated water is used,'' assigned as symbol ''E_{TE},'' as the sum of machine electrical energy and hot water heating energy. E_{TE} was originally defined in section 4.6 of Appendix J–1977 and at the time represented the total measured energy consumption, since the drying energy (''D_E'') and E_{TLP} were not yet included as part of the clothes washer test procedure. Currently, however, the total measured energy consumption would be more accurately represented by the sum of H_{ET}, M_{ET}, D_E, and E_{TLP}. Because the calculation of E_{TE} as an intermediate step is now obsolete, DOE is proposing to not include the definition of E_{TE} from section 4.1.7 of the proposed new Appendix J, as well as all edit cross-references to E_{TE} (within sections 4.5 and 4.6 of the proposed new Appendix J and 10 CFR 430.23(j)(1)(i)(A) as proposed). In these instances, DOE is proposing to replace E_{TE} with its component parts: HE_T and ME_T.

Section 4.2 of Appendix J2 provides the calculation of water consumption and is structured with multiple subsections. Sections 4.2.1 through 4.2.5 of Appendix J2 provide for the calculation of total water consumption for each load size within each wash/rinse temperature selection by summing the measured values of hot water and cold water: Extra Hot/Cold (4.2.1); Hot/Cold (4.2.2); Warm/Cold (4.2.3); Warm/Warm (4.2.4); and Cold/Cold (4.2.5). In sections 4.2.6 through 4.2.10 of Appendix J2, the total weighted water consumption for each wash/rinse temperature selection is calculated by combining the water consumption values for each load size as calculated in 4.2.1 through 4.2.5 using the LUFs. In section 4.2.11 of Appendix J2, the total weighted water consumption for all wash cycles is calculated by combining the values calculated in sections 4.2.6 through 4.2.10 (representing each wash/rinse temperature) using the TUFs. DOE notes that this order of calculations (which combines the measured values from the individual cycles first using LUFs, then combines the resulting values using TUFs) is the reverse order used for the machine electrical and hot water heating energy calculations in section 4.1 of Appendix J2 (which combines the measured values from the individual cycles first using TUFs, then combines the resulting values using LUFs). In the proposed new Appendix J, DOE is proposing to organize section 4.2 to simplify the calculations and to provide consistency between the water consumption calculations and the energy calculations (*i.e.,* to combine the measured values from the individual cycles first using TUFs, then combine the resulting values using LUFs). Accordingly, section 4.2.1 of the proposed new Appendix J would define the per-cycle total water consumption for each large load size tested (summing the hot and cold water consumption for each load size and temperature setting), and 4.2.2 would similarly define the per-cycle total water consumption for each large small size tested. Section 4.2.3 of the proposed new Appendix J would provide for the calculation of the per-cycle total water consumption for all load sizes, using the TUFs to calculate the weighted average of all temperature settings for each load size. Finally, section 4.2.4 of the proposed new Appendix J would calculate the total weighted per-cycle water consumption, using the LUFs to calculate the weighted average over the two load sizes.

DOE requests comment on its proposed structure of the proposed new Appendix J to simplify and improve readability as compared to Appendix J2.

8. Proposed Deletions and Simplifications

DOE proposes to remove Appendix J1 to subpart B of 10 CFR part 430 along with all references to Appendix J1 in 10 CFR parts 429, 430, and 431. Appendix J1 applied only to RCWs manufactured before March 7, 2015 and CCWs manufactured before January 1, 2018 and is therefore not applicable to models manufactured on or after those dates. Use of Appendix J2 to subpart B of 10 CFR part 430 is currently required for any representations of energy or water consumption of both RCWs and CCWs, including demonstrating compliance with the currently applicable energy conservation standards. As discussed, DOE proposes to maintain the current naming of Appendix J2, and to establish a new test procedure at Appendix J, which would be used for the evaluation and issuance of updated efficiency standards, and for determining compliance with those standards.

DOE requests comment on its proposal to remove Appendix J1 to subpart B of 10 CFR part 430 along with all references to Appendix J1 in 10 CFR parts 429, 430, and 431.

Given DOE's proposal to update the energy and water metrics in the proposed new Appendix J, as described in section III.E of this document, DOE proposes to include references to the proposed new metrics EER, AEER, and WER in place of references to the WF, IWF, MEF, and IMEF metrics, as appropriate, in the proposed new Appendix J. Given that the WF metric is no longer the basis for energy conservation standards for either RCWs or CCWs, DOE proposes to remove the calculation of WF in section 4.2.12 of Appendix J2, as well as any references to WF in 10 CFR parts 429, 430, and 431. Similarly, given that MEF is no longer the basis for energy conservation standards for RCWs, DOE proposes to remove references to MEF from 10 CFR 429.20 and 10 CFR 430.23.

DOE requests comment on its proposal to remove obsolete metric definitions.

DOE proposes to delete the following definitions from section 1 of Appendix J2 because they are either no longer used within the appendix currently, or would no longer be used given DOE's proposed amendments in this NOPR: ''adaptive control system,'' ''compact,'' ''manual control system,'' ''standard,'' and ''thermostatically controlled water valves.''

Section 1.13 of Appendix J2 defines the energy test cycle as follows: Energy test cycle means the complete set of wash/rinse temperature selections required for testing, as determined according to section 2.12 [of Appendix J2]. Within the energy test cycle, the following definitions apply:

(a) Cold Wash/Cold Rinse is the wash/rinse temperature selection determined by evaluating the flowchart in Figure 2.12.1 of this appendix.

(b) Hot Wash/Cold Rinse is the wash/rinse temperature selection determined by evaluating the flowchart in Figure 2.12.2 of this appendix.

(c) Warm Wash/Cold Rinse is the wash/rinse temperature selection determined by evaluating the flowchart in Figure 2.12.3 of this appendix.

(d) Warm Wash/Warm Rinse is the wash/rinse temperature selection determined by evaluating the flowchart in Figure 2.12.4 of this appendix.

(e) Extra-Hot Wash/Cold Rinse is the wash/rinse temperature selection determined by evaluating the flowchart in Figure 2.12.5 of this appendix.

Parts (a) through (e) of this definition are redundant with the flowchart definitions provided in section 2.12 of Appendix J2. Therefore, DOE proposes to simplify the definition of energy test cycle in both Appendix J2 and the proposed new Appendix J by keeping only the first sentence of the current definition: Energy test cycle means the complete set of wash/rinse temperature selections required for testing, as determined according to section 2.12.

DOE also proposes to remove section 1.30 of Appendix J2, ''Symbol usage,'' to rename section 1 of Appendix J2 (currently ''Definitions and Symbols'') ''Definitions,'' and name section 1 of the proposed new Appendix J ''Definitions'' accordingly. Throughout the appendices, each symbol is defined at each usage, making this section unnecessary for executing the test procedure. DOE notes that most other test procedures in subpart B to part 430 do not include a symbol usage section.

DOE also proposes to remove the numbering of all definitions in section 1 of Appendix J2, and in section 2 of Appendix J3, and instead list the definitions in alphabetical order. This would simplify cross-references to defined terms and would allow for easier editing in the future by avoiding the need to renumber all the definitions (and associated cross-references) any time a definition is added or deleted.

The proposed new Appendix J reflects these changes as proposed for Appendix J2.

DOE requests comment on its proposal to delete the following definitions from section 1 of Appendix J2: ''adaptive control system,'' ''compact,'' ''manual control system,'' ''standard,'' and ''thermostatically controlled water valves.'' DOE also requests comment on its proposal to simplify the definition of ''energy test cycle.'' DOE also requests comment on its proposal to remove section 1.30 ''Symbol usage'' from Appendix J2. Lastly, DOE requests comment on its proposal to remove the numbering of all definitions in section 1 of Appendix J2 and section 2 of Appendix J3, and to instead list the definitions in alphabetical order.

DOE further proposes to remove section 6, *Waivers and Field Testing,* from Appendix J2 and not include a parallel section in the proposed new Appendix J. The language of section 6 of Appendix J2 was first introduced as section 7 in Appendix J–1997 and has been maintained through successive amendments of the test procedures. DOE notes, however, that none of the waivers sought by manufacturers to date have made use of these provisions. Instead, the provisions of 10 CFR 430.27 (Petitions for waiver and interim waiver) provide comprehensive instructions regarding DOE's waiver process. DOE tentatively concludes that the information presented in section 6 of Appendix J2 is unnecessary given the regulatory language of 10 CFR 430.27.

DOE requests comment on its proposal to remove section 6, *Waivers and Field Testing,* of Appendix J2 and proposal not to include a parallel section in the proposed new Appendix J.

9. Typographical Errors

In an effort to improve the readability of the text in certain sections of 10 CFR 430.23 and Appendix J2, DOE is proposing to make minor typographical corrections and formatting modifications as follows. These minor proposed modifications are not intended to change the substance of the test methods or descriptions provided in these sections. The language of the proposed new Appendix J reflects these corrections.

The test procedure provisions at 10 CFR 430.23(j)(1)(ii)(B) contain a definition for ''C_{KWH},'' which is duplicative with the same definition provided in 10 CFR 430.23(j)(1)(ii)(A). DOE proposes to remove the duplicate definition of C_{KWH} from 10 CFR 430.23(j)(1)(ii)(B).

DOE is proposing to correct two misspellings in section 2.8 of Appendix J2 referring to energy stuffer cloths (currently ''clothes'') and test load sizes (currently ''siszes''). DOE is also proposing to correct the spelling of ''discrete'' in section 3.2.5 of Appendix J2 (currently ''discreet'') and of ''test cycle'' in section 3.6 of Appendix J2 (currently ''testy''). DOE is also proposing to spell out the word ''percent'' in the paragraph in section 3.2.5 of Appendix J2.

Currently in Appendix J2, the drying energy abbreviation is D_E. This notation is inconsistent with the notation used for machine electrical energy and hot water heating energy (ME_T and HE_T, respectively). DOE is proposing to standardize the notation used for drying energy throughout sections 3 and 4 of the proposed new Appendix J, such that it is listed as DE_T. DOE could consider also making this change in Appendix J2, but understands that changing the symbol definition could require test laboratories to update test templates that use the D_E symbol as currently defined in Appendix J2.

DOE is also proposing to rename section 2 in Appendix J2 from ''Testing Conditions'' to ''Testing Conditions and Instrumentation'' to more fully reflect the contents of this section.

In several instances throughout Appendix J2, the qualifier ''of this appendix'' is missing in section cross-references. DOE is proposing to rectify these omissions. DOE is also proposing to clarify references to Appendix J3 in Appendix J2, and *vice-versa,* by using ''to this subpart.'' Finally, DOE proposes to update all cross-references as needed, following the edits proposed in this NOPR.

DOE requests comment on its proposal to make the minor typographical corrections and formatting modifications described in this section.

I. Test Cloth Provisions

Appendix J2 requires using specialized test cloth as the material comprising each tested load. DOE originally developed the energy test cloth specifications as part of the January 2001 Final Rule, based on the results of a detailed investigation of the cloth material used by industry for

testing.[72] In particular, DOE observed that the material properties of the energy test cloth had a significant effect on the RMC measurement,[73] which as discussed was added to Appendix J1–2001 to measure the effectiveness of the final spin cycle in removing moisture from the wash load. As described in the test cloth report, the final specifications for the energy test cloth were developed to be representative of a consumer load: A 50-percent cotton/50-percent polyester blended material was specified to approximate the typical mix of cotton, cotton/polyester blend, and synthetic articles that are machine-washed by consumers. In developing the test cloth specifications, DOE also considered:

□ Manufacturability: A 50/50 cotton-polyester momie weave was specified because at the time, such cloth was produced in high volume, had been produced to a consistent specification for many years, and was expected to be produced on this basis for the foreseeable future. 66 FR 3314, 3331.

□ Consistency in test cloth production: The cloth material properties were specified in detail, including fiber content, thread count, and fabric weight; as well as requirements to verify that water repellent finishes are not applied to the cloth. *Id.*

□ Consistency of the RMC measurement among different lots: A procedure was developed to generate correction factors for each new ''lot'' (*i.e.,* batch) of test cloth to normalize test results and ensure consistent RMC measurements regardless of which lot is used for testing. *Id.*

1. Test Cloth Specification

In the May 2020 RFI, DOE requested comments on manufacturers' and testing laboratories' experience with the current test cloth specifications and whether DOE should consider any changes to the energy test cloth specifications to reduce burden and improve testing results. 85 FR 31065, 31071.

AHAM commented that it would strongly oppose changing from the uniform test cloth to a more varied load. AHAM stated that the clothes washer test procedure requires the use of a uniform test cloth to produce repeatable and reproducible results. (AHAM, No. 5 at p. 3) According to AHAM, the introduction of a ''real-world'' load that includes items with different weights, sizes, and materials could introduce significant variation in the test procedure. AHAM stated that sufficient data have not been provided that would demonstrate acceptable repeatability and reproducibility using a ''real-world'' test load. *Id.*

GEA recommended that DOE not change the current test cloth specifications, noting that significant work has gone into addressing the myriad complexities with test cloth variation. (GEA, No. 13 at p. 2)

DOE is not proposing any changes to the test cloth specification.

2. Consolidation to Appendix J3

Appendix J3 specifies a qualification procedure that must be conducted on all new lots of energy test cloth prior to the use of such test cloths in any clothes washer test procedure. This qualification procedure provides a set of correction factors that correlate the measured RMC values of the new test cloth lot with a set of standard RMC values established as the historical reference point. These correction factors are applied to the RMC test results in section 3.8.2.6 of Appendix J2 to ensure the repeatability and reproducibility of test results performed using different lots of test cloth. The measured RMC of each clothes washer has a significant impact on the final IMEF value.

DOE is proposing several structural changes to Appendix J3 to consolidate all of the test cloth specifications and procedures (some of which are currently located in Appendix J2) that must be evaluated on each new lot of test cloth. Consolidating into a single test procedure will improve the overall logical flow of both test procedures and clarify that the test cloth procedures need not be conducted for each clothes washer under test. As described further, the proposed changes would remove from Appendix J2 specifications and procedures that are not intended to be completed for every clothes washer test. The proposed edits would also formally codify additional qualification procedures that are currently conducted for every new lot of test cloth.

a. Test Cloth Requirements in Appendix J2

Section 2.7 of Appendix J2 (''Test cloths'') contains specifications and procedures regarding the test cloth. Sections 2.7.1 and 2.7.2 specify the unfinished and finished dimensions, maximum lifetime, and marking requirements for energy test cloth and energy stuffer cloths, respectively. These sections also specify that mixed lots of material must not be used for testing. Section 2.7.3 specifies a procedure for preconditioning new test cloth, which requires performing a series of five wash cycles on all new (unused) test cloths before the cloth can be used for clothes washer tests. Section 2.7.4 provides the material specifications (fabric type, fabric weight, thread count, and fiber content) for the energy test cloths and energy stuffer cloths, as well as three industry test methods that must be performed to confirm the absence of any water-repellent finishes and to measure the cloth shrinkage after preconditioning. Section 2.7.5 references Appendix J3 for performing the standard extractor procedure to measure the moisture absorption and retention characteristic of each new lot of cloth.

Several of these provisions within section 2.7 of Appendix J2 are not intended to be conducted as part of each individual clothes washer test performed under Appendix J2. Based on discussions with the AHAM Test Cloth Task Force, DOE is aware that some of the test cloth provisions in section 2.7 of Appendix J2 are performed by a third-party laboratory on each new lot of test cloth, avoiding the need for manufacturers and test laboratories to perform the same procedures for each individual clothes washer test. 85 FR 31065, 31071.

In the May 2020 RFI, DOE requested comments on whether to consolidate into Appendix J3 provisions from section 2.7 of Appendix J2 that relate only to the testing of the test cloth and are not required to be performed for each individual Appendix J2 clothes washer test. *Id.* DOE also sought comment on whether to remove these provisions entirely. *Id.*

AHAM supported the consolidation of section 2.7 of Appendix J2 provisions into Appendix J3, stating that doing so would mitigate testing burden. (AHAM, No. 5 at p. 9)

NEEA supported reorganization of the test procedure to put all test cloth qualification and lot correction information into the separate Appendix J3 test procedure, as this would add clarity and improve ease of use. (NEEA, No. 12 at p. 25)

In this NOPR, DOE is proposing to move most of the specifications from section 2.7 of Appendix J2 to Appendix J3. Section 2.7 of Appendix J2 would retain the following specifications, which are relevant to the conduct of

[72] ''Development of a Standardized Energy Test Cloth for Measuring Remaining Moisture Content in a Residential Clothes Washer.'' U.S. Department of Energy: Buildings, Research and Standards. May 2000. Available online at *www.regulations.gov/document/EERE-2006-STD-0064-0277.*

[73] The RMC measurement is an important aspect of DOE's clothes washer test procedure because the RMC value determines the drying energy, which is the largest contributor to IMEF. Based on the Technical Support Documents from the March 2012 Final Rule, drying energy represents 65 percent of the total energy for a 2015 baseline-efficiency top-loading standard RCW, and 72 percent for a 2015 baseline-efficiency front-loading standard RCW.

individual clothes washer tests: The maximum lifetime specification, marking requirements, and the requirement that mixed lots of material must not be used for testing. All other specifications from section 2.7 of Appendix J2 would be moved to Appendix J3. DOE would add a general statement in section 2.7 of Appendix J2 that the test cloth material and dimensions must conform to the specifications in Appendix J3. These proposed changes are also reflected in the proposed new Appendix J.

DOE requests comment on its proposal to consolidate into Appendix J3 the test cloth specifications and procedures from section 2.7 of Appendix J2 that are not intended to be conducted as part of each individual clothes washer test performed under Appendix J2.

b. Test Cloth Requirements in Appendix J3

Industry has developed a process in which the qualification procedure described above is performed by a third-party laboratory, and the results are reviewed and approved by the AHAM Test Cloth Task Force, after which the new lot of test cloth is made available for purchase by manufacturers and test laboratories. 85 FR 31065, 31071.

DOE has received a request from members of the AHAM Test Cloth Task Force to add to Appendix J3 additional steps to the qualification procedure that have historically been performed on each new lot of test cloth to ensure uniformity of RMC test results on test cloths from the beginning, middle, and end of each new lot. *Id.* Industry practice is to perform this ''uniformity check'' before conducting the procedure to develop the RMC correction factors currently specified in the DOE test procedure, as described previously. *Id.* Specifically, the uniformity check involves performing an RMC measurement on nine bundles of sample cloth representing the beginning, middle, and end locations of the first, middle, and last rolls of cloth in a new lot. *Id.* The coefficient of variation across the nine RMC values must be less than or equal to 1 percent for the test cloth lot to be considered acceptable for use. *Id.*

In the May 2020 RFI, DOE sought comment on whether it is necessary to specify any qualification procedure that must be conducted on all new lots of energy test cloth prior to use of such test cloths, as opposed to simply providing requirements for the test cloth without specifying in DOE's regulations the procedure for achieving those requirements. *Id.* Industry could then continue with its current prequalification process, making changes as it determined necessary to improve that process, without the need to seek permission from DOE and participate in a rulemaking proceeding to make such improvements. *Id.* DOE also requested comments on whether it is necessary to incorporate the aforementioned test cloth uniformity check into Appendix J3, or whether the current regulations, with the existing requirements for test cloth and qualification procedure, are sufficient to ensure the quality of the test cloth. *Id.* DOE requested comment on any burden that results from the current qualification procedure, or would result from incorporating the discussed uniformity check, particularly for small businesses. *Id.*

AHAM commented that the existing cloth uniformity test is effective and does not need to be changed. (AHAM, No. 5 at p. 9) AHAM added that DOE should consider requiring that each load that is used for testing contains a mix of cloth from the beginning, middle, and end of the lot so that it is representative of the entire lot. AHAM further added that more sampling may be necessary if test cloth lot sizes increase. *Id.*

With regards to DOE's consideration of test burden, AHAM commented that the current process works well, and that it is not necessary to develop a particular qualification procedure. *Id.*

NEEA encouraged DOE to adopt an additional test cloth qualification procedure if one is needed to maintain reproducibility, as it would improve transparency. (NEEA, No. 12 at p. 25)

In this NOPR, DOE is proposing to codify in Appendix J3 the ''uniformity check'' described above and to restructure Appendix J3 to improve the overall logical flow of the procedure.

The sections of Appendix J3 are currently structured as follows: (1) Objective; (2) Definitions; (3) Testing Conditions; (4) Test Loads; (5) Test Measurements; (6) Calculation of RMC Correction Curve; and (7) Application of the RMC Correction Curve.

DOE is proposing to update the objectives included in section 1 to specify that Appendix J3 now includes: (1) Specifications for the energy test cloth to be used for testing clothes washers; (2) procedures for verifying that new lots of energy test cloth meet the defined material specifications; and (3) procedures for developing the RMC correction coefficients.

In section 2 of Appendix J3, DOE is proposing to add a definition for the term ''roll,'' which refers to a subset of a lot, and to remove the definition of roll from Appendix J2.

DOE is proposing to create a new section 3, ''Energy Test Cloth Specifications,'' that would specify the test cloth material, dimensions, and use requirements as currently specified in section 2.7 of Appendix J2.

DOE is proposing to change the title of current section 3 of Appendix J3, newly renumbered as section 4, from ''Testing Conditions'' to ''Equipment Specifications.'' This section would contain the specifications for the extractor (currently specified in section 3.2) and the bone-dryer (currently specified in section 3.3). DOE proposes to merge the current specification in section 3.1 of Appendix J3 (which specifies the extractor spin conditions to be used) with the proposed edits to newly renumbered section 8 (''RMC Correction Curve Procedure''), as described below.

DOE is proposing to create a new section 5, ''Pre-Conditioning Instructions,'' in Appendix J3 that would specify the instructions for pre-conditioning test cloth, as currently specified in section 4.1 of Appendix J3, with a clarifying wording change. Currently, the second paragraph of section 4.1 in Appendix J3 specifies ''Perform five complete wash-rinse-spin cycles, the first two with current AHAM Standard detergent Formula 3 and the last three without detergent.'' The last sentence of that paragraph specifies: ''Repeat the cycle with detergent and then repeat the cycle three additional times without detergent, bone drying the load between cycles (for a total of five complete wash-rinse-spin cycles).'' DOE is concerned that the wording of the last sentence could be misconstrued as requiring the repeating of the entire sequence of five wash-rinse-spin cycles specified in the first sentence. To avoid this potential misinterpretation, DOE is proposing to replace the last sentence with the following: ''Dry the load to bone-dry between each of the five wash-rinse-spin cycles.''

DOE is proposing to create a new section 6, ''Extractor Run Instructions,'' in Appendix J3 that would specify the instructions for testing test cloth in the extractor at specific spin speed and time conditions, as currently listed in sections 5.1 through 5.10 of Appendix J3, with some minor organizational changes.

DOE is proposing to create a new section 7, ''Test Cloth Material Verification Procedure,'' in Appendix J3 that codifies the ''uniformity check'' procedure described above.

DOE is proposing to add a new section 8, ''RMC Correction Curve Procedure,'' in Appendix J3 which would consolidate the provisions

currently specified in sections 5 and 6 of Appendix J3.

DOE is proposing to renumber section 7 to section 9 in Appendix J3 and to update any applicable cross references.

Finally, given the broader scope of Appendix J3 as proposed by these amendments, DOE is proposing to rename Appendix J3 from ''Uniform Test Method for Measuring the Moisture Absorption and Retention Characteristics of New Energy Test Cloth Lots'' to ''Energy Test Cloth Specifications and Procedures for Determining Correction Coefficients of New Energy Test Cloth Lots.''

DOE requests comment on its proposed edits to Appendix J3 to codify the ''uniformity check'' procedure and to restructure Appendix J3 to improve the overall logical flow of the procedure.

J. Product-Specific RMC Enforcement Provisions

DOE provides product-specific enforcement provisions for all clothes washers at 10 CFR 429.134(c), which specify provisions for determining RMC. 10 CFR 429.134(c)(1)(i) specifies that the measured RMC value of a tested unit will be considered the tested unit's final RMC value if the measured RMC value is within two RMC percentage points of the certified RMC value of the basic model (expressed as a percentage), or is lower than the certified RMC value. 10 CFR 429.134(c)(1)(ii) specifies that if the measured RMC value of a tested unit is more than two RMC percentage points higher than the certified RMC value of the basic model, DOE will perform two additional replications of the RMC measurement procedure, each pursuant to the provisions of section 3.8.5 of Appendix J2, for a total of three independent RMC measurements of the tested unit. The average of the three RMC measurements will be the tested unit's final RMC value and will be used as the basis for the calculation of per-cycle energy consumption for removal of moisture from the test load for that unit.

As described in sections I.B and III.I of this document, DOE uses the procedures specified in Appendix J3 to evaluate the moisture absorption and retention characteristics of each new lot of test cloth. The results are used to develop a unique correction curve for each new lot of test cloth, which helps ensure that a consistent RMC measurement is obtained for any test cloth lot used during testing. The correction factors developed for each new cloth lot are used to adjust the ''uncorrected'' RMC measurements obtained when performing an Appendix J2 test on an individual clothes washer model.[74] Without the application of correction factors, the uncorrected RMC values for a given spin setting can vary by more than 10 RMC percentage points. The application of correction factors is intended to significantly reduce this lot-to-lot variation in RMC results.

Multiple interested parties have presented confidential data to DOE suggesting that despite the application of correction factors, the ''corrected'' RMC values can vary by up to three RMC percentage points among different test cloth lots. A variation of three RMC percentage points can lead to over a 5-percent variation in IMEF rating.[75] DOE conducted an internal analysis of the confidential data, in which DOE investigated three potential sources of the observed variation in corrected RMC values: (1) Test-to-test variation masking as lot-to-lot variation; (2) spin cycle anomalies masking as lot-to-lot variation; and (3) choice of Lot 3 as the reference lot.[76] Based on DOE's investigations, none of these three hypotheses explained the observed lot-to-lot variation in corrected RMC values in the data presented by the interested parties.

Based on these investigations, DOE preliminarily concludes that although the application of correction factors for each test cloth lot significantly reduces the lot-to-lot variation in RMC (from over 10 percentage points uncorrected), the current methodology may be limited to reducing lot-to-lot variation in corrected RMC to around three RMC percentage points.

Recognizing this potential for lot-to-lot variation of up to three RMC percentage points (corrected), DOE proposes to extend its product-specific enforcement provisions for clothes washers to accommodate up to a 3-percentage point variation in the corrected RMC measurement based on the test cloth lot used for testing. The following paragraphs describe DOE's proposed approach for implementation of these provisions.

DOE proposes to modify the text of 10 CFR 429.134(c)(1) to state that its provisions address anomalous RMC results that are not representative of a basic model's performance, as well as differences in RMC values that may result from DOE using a different test cloth lot than was used by the manufacturer for testing and certifying the basic model.

DOE proposes to specify the enforcement provisions when testing according to the proposed new Appendix J at 10 CFR 429.134(c)(1)(i), and when testing according to Appendix J2 at 10 CFR 429.134(c)(1)(ii).

Under the provisions for Appendix J2, DOE proposes new subsection (ii)(A), which would specify that the procedure for determining RMC will be performed once in its entirety, pursuant to the test requirements of section 3.8 of Appendix J2, for each unit tested (as currently specified at 10 CFR 429.134(c)(1)).

DOE proposes new subsection (ii)(B), which would specify that if the measured RMC value of a tested unit is equal to or lower than the certified RMC value of the basic model (expressed as a percentage), the measured RMC value will be considered the tested unit's final RMC value and will be used as the basis for the calculation of per-cycle energy consumption for removal of moisture from the test load for that unit (consistent with the current specifications at 10 CFR 429.134(c)(1)(i)).

DOE proposes new subsection 10 CFR 429.134(ii)(C), which would specify that if the difference between the measured RMC value and the certified RMC value of the basic model is less than or equal to two RMC percentage points, the measured RMC value of a tested unit will be considered the tested unit's final RMC value unless DOE used a different test cloth lot than was used by the manufacturer for testing and certifying the basic model; in which case, DOE may[77] apply the proposed new paragraph (c)(1)(ii)(E) of the same section if the difference between the measured and certified RMC values would affect the unit's compliance with the applicable standards.

DOE proposes new subsection 10 CFR 429.134 (ii)(D)—which would address anomalous RMC results that are not representative of a basic model's performance—specifying that if the measured RMC value of a tested unit is more than two RMC percentage points

[74] DOE maintains an historical record of the standard extractor test data and final correction curve coefficients for each approved lot of energy test cloth. These are available through DOE's web page for standards and test procedures for residential clothes washers at *www.energy.gov/eere/buildings/downloads/clothes-washer-test-cloth-correction-factor-information.*

[75] See discussion in the August 2015 Final Rule in which DOE described that limiting RMC variation to 2 RMC percentage points would limit the variation in the overall MEF or IMEF calculation to roughly 5 percent. 80 FR 46730, 46756.

[76] The RMC characteristics of historical Lot 3 represent the ''standard RMC values'' defined in Table 6.1 of Appendix J3.

[77] DOE is proposing to use the phrase ''may apply'', as opposed to ''shall apply'', to allow for appropriate discretion by DOE. If ''shall'' were to be used instead, DOE would be required to seek the test cloth lot information from the manufacturer in every such case, since lot number is not a reported value. Alternatively, DOE could require reporting of the lot number used to certify each basic model.

higher than the certified RMC value of the basic model, DOE will perform two replications of the RMC measurement procedure, each pursuant to the provisions of section 3.8.5 of Appendix J2, for a total of three independent RMC measurements of the tested unit; and that average of the three RMC measurements will be calculated (as currently specified at 10 CFR 429.134(c)(1)(ii)). Within this section, a new subsection 10 CFR 429.134 (ii)(D)(1) would specify that if the average of the three RMC measurements is equal to or lower than the certified RMC value of the basic model, the average RMC value will be considered the tested unit's final RMC value. A new subsection 10 CFR 429.134 (ii)(D)(2) would specify that if the average of the three RMC measurements is higher than the certified RMC value of the basic model, the average RMC value will be considered the tested unit's final RMC value unless DOE used a different test cloth lot than was used by the manufacturer for testing and certifying the basic model; in which case, DOE may apply a new proposed paragraph (c)(1)(ii)(E) of the same section if the difference between the average and certified RMC values would affect the unit's compliance with the applicable standards.

The proposed new subsection (ii)(E)—which would address differences in RMC values that may result from DOE using a different test cloth lot—specifies two potential courses of action if DOE uses a different test cloth lot than was used by the manufacturer for testing and certifying the basic model. New subsection 10 CFR 429.134 (ii)(E)(1) would specify that if the difference between the tested unit's measured RMC value (or average RMC value pursuant to the new proposed paragraph (c)(1)(ii)(D) of the same section) and the certified RMC value of the basic model is less than or equal to three RMC percentage points, then the certified RMC value of the basic model may be considered the tested unit's final RMC value. New subsection 10 CFR 429.134 (ii)(E)(2) would specify that if the tested unit's measured RMC value (or average RMC value pursuant to paragraph (c)(1)(ii)(D) of the same section) is more than three RMC percentage points higher than the certified RMC value of the basic model, then a value three RMC percentage points less than the measured RMC value may be considered the tested unit's final RMC value.

For testing conducted according to the proposed new Appendix J, several modifications would be made to the procedures described for Appendix J2 due to the revised methodology for measuring RMC in the proposed new Appendix J, as described in section III.D.4 of this document (specifically, that in the proposed new Appendix J, RMC would be measured for each individual test cycle as opposed to measured using a separate set of additional test cycles, as is required by Appendix J2). The provisions for the proposed new Appendix J would not include the specifications for 10 CFR 429.134 (ii)(A) or 10 CFR 429.134 (ii)(D) as described previously.

DOE requests comment on its proposal to extend its product-specific enforcement provisions for clothes washers to accommodate up to a 3-percentage point variation in the corrected RMC measurement based on the test cloth lot used for testing. DOE also requests comment on alternate enforcement approaches that could be implemented.

K. Test Procedure Costs, Harmonization, and Other Topics

1. Test Procedure Costs and Impact

EPCA requires that test procedures proposed by DOE not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) The following sections discuss DOE's evaluation of estimated costs and savings associated with the amendments proposed in this NOPR.

a. Appendix J2 and Appendix J3 Proposed Amendments

In this NOPR, DOE proposes to amend the existing test procedures for clothes washers by:

(1) Further specifying supply water temperature test conditions and water meter resolution requirements;

(2) Adding specifications for measuring wash water temperature using submersible data loggers;

(3) Expanding the load size table to accommodate clothes container capacities up to 8.0 ft^3;

(4) Defining user-adjustable automatic WFCS;

(5) Specifying the applicability of the wash time setting for clothes washers with a range of wash time settings;

(6) Specifying how the energy test cycle flow charts apply to clothes washers that internally generate hot water;

(7) Specifying that the energy test cycle flow charts be evaluated using the Maximum load size;

(8) Specifying that testing is to be conducted with any network settings disabled if instructions are available to the user to disable these functions;

(9) Further specifying the conditions under which data from a test cycle would be discarded;

(10) Adding a product-specific enforcement provision to accommodate the potential for test cloth lot-to-lot variation in RMC;

(11) Deleting obsolete definitions, metrics, and the clothes washer-specific waiver section;

(12) Consolidating all test cloth-related specifications in Appendix J3;

(13) Reorganizing sections of Appendix J3 for improved readability; and

(14) Codifying the test cloth material verification procedure as used by industry.

DOE has tentatively determined that these proposed amendments to Appendix J2 and Appendix J3 would not be unduly burdensome for manufacturers to conduct and would not result in the need for any re-testing.

The proposal to remove the target inlet water temperatures from the specified range of temperatures would allow test laboratories to select the optimal water temperature target for their water supply system within the prescribed range (*e.g.,* choosing the midpoint of the range as the target). This could reduce test burden by reducing the potential for invalid cycles to occur due to a deviation in water temperatures outside the specified range.

The proposal to require more precise hot water meters for clothes washers with hot water usage less than 0.1 gallons in any of the energy test cycles would require additional cost to upgrade existing water meters if a manufacturer or test laboratory expects to test such clothes washers but does not already have a water meter with the proposed more precise resolution. Based on a market survey of water meters, the cost of a water meter that provides the proposed resolution, including associated hardware, is around $600 for each device. DOE recognizes that laboratories may have multiple test stands, and that each test stand would likely be upgraded with the more precise hot water meter (if such an upgrade is required). As an example, for a laboratory with 10 test stands, the material cost associated with installing a more precise hot water meter would total approximately $6,000. However, as discussed, at least one manufacturer already uses water meters with the proposed more precise resolution, and DOE's experience working with third-party laboratories indicates that most, if not all, third-party laboratories already use water meters with this resolution. DOE has not included the potential costs associated with this proposal based on stakeholder comment and DOE's knowledge of third-party laboratory capabilities that suggest that

laboratories that test clothes washers with hot water usage less than 0.1 gallons already use water meters with the proposed more precise resolution.

The proposal to explicitly allow for the use of submersible temperature loggers would specify an additional means for determining wash water temperatures to confirm whether a wash temperature greater than 135 °F (defined as an Extra Hot Wash) has been achieved during the wash cycle. As discussed, other methods for measuring wash water temperatures may provide inconclusive results, thus requiring re-testing of cycles or additional ''exploratory'' testing to accurately determine the wash water temperature. Explicitly providing for the use of submersible temperature loggers may avoid the need for such additional testing. Based on a market survey of submersible data loggers, the cost of a submersible data logger is around $230 for each device. As discussed, laboratories may have multiple test stands, and DOE expects that a laboratory would purchase a separate data logger for each test stand. As an example, for a laboratory with 10 test stands, the material cost associated with purchasing submersible data loggers for each test stand would total around $2,300. DOE expects that the recurring cost savings enabled by the use of submersible temperature loggers (due to reducing the need for re-testing certain cycles or performing additional exploratory testing) would substantially outweigh the one-time purchase cost associated with each device and therefore has not included this cost in its summary of costs associated with this NOPR.

DOE requests comment, specifically from manufacturers and third-party test laboratories, on whether costs would be incurred for each laboratory as a result of the proposals in this NOPR to specify more precise hot water meters and to explicitly allow the use of submersible temperature loggers; and if so, the total incurred cost associated with outfitting each test stand with the specified instrumentation. DOE also requests comment on the potential cost savings to be expected from enabling the use of submersible temperature loggers.

The proposal to extend the load size table would apply only to clothes washers with capacities exceeding 6.0 ft^3. Any such clothes washers currently on the market have already been granted a test procedure waiver from DOE, which specifies the same extended capacity table.

The proposal to more explicitly define user-adjustable automatic WFCS would provide greater specification of DOE's existing definitions and could potentially alleviate test burden resulting from an incorrect application of the existing language. The proposals specifying updated language regarding cycle selection for clothes washers with a range of wash time settings would improve repeatability and reproducibility without imposing any additional test burden. The proposal to specify how the energy test cycle flow charts apply to clothes washers that internally generate hot water reflects DOE's interpretation of the current Cold Wash/Cold Rinse flowchart and subsequent flowcharts for the Warm Rinse temperature selections for this type of clothes washer; in addition, comments from interested parties suggest that this interpretation is generally consistent with that of manufacturers and third-party laboratories. The proposal to specify that the energy test cycle flow charts be evaluated using the Maximum load size would improve repeatability and reproducibility without imposing any additional test burden.

The proposal to specify that network settings must be disabled for testing under Appendix J2 would impact only clothes washers with network settings that are enabled by default. DOE is not aware of any clothes washers currently on the market that meet these characteristics, and as such DOE does not expect this proposal to change how any current models are tested.

The proposal to add product-specific enforcement provisions to accommodate the potential for lot-to-lot variation in RMC would extend current product-specific enforcement provisions for clothes washers to accommodate up to a 3-percentage point variation in the corrected RMC measurement based on the test cloth lot used for testing, and would not impact manufacturers' testing costs.

The proposal to delete obsolete definitions, metrics, and the waiver section would not impact manufacturers' testing costs because these sections of the test procedure are no longer in use.

The proposal to move all test cloth-related sections of the test procedures into Appendix J3 would simplify Appendix J2 without any changes to the test conduct or cost to manufacturers. The proposal to add additional test cloth qualification procedures to Appendix J3 would not affect manufacturer cost because the proposal would codify existing industry-standard practices.

DOE requests comment on its characterization of the expected costs of the proposed amendments to Appendix J2 and Appendix J3 and on DOE's preliminary determination that the proposed amendments would not be unduly burdensome.

b. Appendix J Proposed Test Procedure

In this NOPR, DOE is also proposing a new Appendix J that would include, in addition to the amendments discussed previously for Appendix J2, significant additional changes that would affect the measured efficiency of a clothes washer. Because DOE would use the new Appendix J for the evaluation and issuance of any updated efficiency standards, and for determining compliance with those standards, the use of the proposed new Appendix J would not be required until such a time as compliance with any amended energy conservation standards that are developed with consideration of new Appendix J are required. The ongoing energy conservation standards rulemakings for RCWs and CCWs would consider the impact of such changes to manufacturers. The differences between Appendix J2 (as proposed in this NOPR) and the proposed Appendix J are the following:

(1) Modifying the hot water supply temperature range;

(2) Modifying the clothes washer pre-conditioning requirements;

(3) Modifying the Extra-Hot Wash threshold temperature;

(4) Adding a measurement and calculation of average cycle time;

(5) Requiring the testing of no more than two Warm Wash/Cold Rinse cycles, and no more than two Warm Wash/Warm Rinse cycles;

(6) Measuring RMC on each cycle within the energy test cycle, rather than on cycles specifically dedicated to measuring RMC;

(7) Reducing the number of load sizes from three to two for units with automatic WFCS;

(8) Modifying the load size definitions consistent with two, rather than three, load sizes;

(9) Updating the water fill levels to be used for testing to reflect the modified load size definitions;

(10) Specifying the installation of single-inlet clothes washers, and simplifying the test procedure for semi-automatic clothes washers;

(11) Defining new performance metrics that are functions of the weighted-average load size rather than clothes container capacity;

(12) Updating the number of annual clothes washer cycles from 295 to 234; and

(13) Updating the number of hours assigned to low-power mode to be based on the clothes washer's average

measured cycle time rather than an assumed fixed value.

The proposal to require the measurement of cycle time could result in an increase in test burden if a laboratory is not currently measuring cycle time. However, although cycle time is not currently required to be measured, it is DOE's understanding that test laboratories already measure cycle time or use a data acquisition system to record electronic logs of each test cycle, from which average cycle time can be readily determined such that any increase in test burden would be *de minimis*. Therefore, DOE preliminarily concludes that the proposal to require measurement of cycle time is unlikely to result in an increase in test burden. Furthermore, none of the other proposed changes for Appendix J would result in an increase in test burden. As described in the paragraphs that follow, DOE has tentatively determined that several of the proposed changes would result in a substantial decrease in test burden.

To determine the potential savings to manufacturers, DOE first estimated the number of RCW and CCW models that are currently certified, using data from DOE's publicly available Compliance Certification Database (''CCMS'').[78] DOE identified approximately 25 manufacturers selling an estimated 702 basic models of RCWs and 67 basic models of CCWs.

To enable an estimate of cost savings associated with specific features, as described in the paragraphs that follow, DOE developed representative market samples consisting of 100 basic models of RCWs and 10 basic models of CCWs (representing approximately 15 percent of the total basic models for each) that capture the range of available functionalities and options available to consumers. To develop these market samples, DOE selected a sample of basic models for which detailed product features could be determined from product brochures and other marketing materials, representing all major manufacturers and product designs currently on the market, and spanning all available efficiency levels.

The proposal to reduce the number of load sizes from three to two for units with an automatic WFCS would reduce test burden for all clothes washers with an automatic WFCS. DOE's representative market sample suggests that 11 percent of RCWs have a manual WFCS and therefore would experience no change in test burden as a result of this proposal. Whereas, 89 percent of RCWs on the market would experience a reduction in test burden as follows: 20 percent of RCWs would experience a reduction in test burden of 2 to 4 cycles; 54 percent of RCWs would experience a reduction in test burden of 5 to 8 cycles; and 15 percent of RCWs would experience a reduction in test burden of more than 9 cycles. DOE's representative mark sample suggests that all CCWs have an automatic WFCS and therefore DOE estimates that 70 percent of CCWs would experience a reduction in test burden of 3 or 4 cycles and that 30 percent of CCWs would experience a reduction in test burden of 5 cycles. Based on these estimates, DOE estimates a weighted-average test burden reduction of 5.1 cycles per RCW, and 3.7 cycles per CCW.

The proposal to reduce the number of required test cycles by requiring the use of no more than two Warm Wash/Cold Rinse cycles, and no more than two Warm Wash/Warm Rinse cycles, would reduce the number of tested cycles for any clothes washer offering more than two Warm Wash temperatures. Based on DOE's representative market sample, DOE estimates that 49 percent of RCWs offer two or fewer Warm Wash temperature options and therefore would experience no change; 44 percent of RCWs would experience a reduction in test burden of 2 cycles; and 7 percent of RCWs would experience a reduction in test burden of 4 cycles. DOE estimates that 70 percent of CCWs would experience no change and that 30 percent of CCWs would experience a reduction in test burden of 4 cycles. Based on these estimates, DOE estimates a weighted-average additional test burden reduction of 1.2 cycles per RCW, and 0.6 cycles per CCW.[79]

The proposal to reduce the number of required test cycles by measuring RMC on each tested cycle instead of measuring it on dedicated RMC cycles would remove the need for one or more cycles used for measuring RMC for any clothes washer offering more than one spin speed selectable on the Normal cycle. Based on DOE's representative market sample, DOE estimates that 45 percent of RCWs would experience no change; 27 percent of RCWs would experience a reduction in test burden of 1 cycle; 27 percent of RCWs would experience a reduction in test burden of 2 cycles; and 1 percent of RCWs would experience a reduction in test burden of 4 cycles. DOE estimates that no CCWs would experience a reduction in test burden from this change. Based on these estimates, DOE estimates a weighted-average additional test burden reduction of 0.9 cycles per RCW.[80]

The proposal to simplify the test procedure for semi-automatic clothes washers would reduce test burden for all semi-automatic clothes washers by 10 cycles. DOE has determined that approximately 2 percent of RCW basic models in CCMS are semi-automatic and is not aware of any semi-automatic CCWs. DOE therefore estimates a weighted-average additional test burden reduction of 0.2 cycles per RCW.

To estimate the cost savings associated with the amendments that are expected to reduce the number of cycles required for testing, DOE estimated each RCW cycle to have a duration of 1 hour, and each CCW cycle to have a duration of 45 minutes. Based on data from the Bureau of Labor Statistics' (''BLS's'') Occupational Employment and Wage Statistics, the mean hourly wage for mechanical engineering technologists and technicians is $29.27.[81] Additionally, DOE used data from BLS's Employer Costs for Employee Compensation to estimate the percent that wages comprise the total compensation for an employee. DOE estimates that wages make up 70.3 percent of the total compensation for private industry employees.[82] Therefore, DOE estimated that the total hourly compensation (including all fringe benefits) of a technician performing the testing is $41.64.[83]

Based on a July 2021 price list from the test cloth manufacturer, the cost of the test cloth required for performing testing is $7.47 per cloth.[84] Based on an average RCW capacity of 4.14 ft^3,[85] the load sizes associated with testing an

[78] *www.regulations.doe.gov/certification-data.* Last accessed on June 24, 2021.

[79] These savings assume the savings from reducing the number of load sizes have already been implemented.

[80] These savings assume the savings from reducing the number of load sizes and from reducing the number of Warm Wash temperature selections under test have already been implemented.

[81] DOE used the mean hourly wage of the ''17–3027 Mechanical Engineering Technologists and Technicians'' from the most recent BLS Occupational Employment and Wage Statistics (May 2020) to estimate the hourly wage rate of a technician assumed to perform this testing. See *www.bls.gov/oes/current/oes173027.htm.* Last accessed on May 26, 2021.

[82] DOE used the December 2020 ''Employer Costs for Employee Compensation'' to estimate that for ''Private Industry Workers,'' ''Wages and Salaries'' are 70.3 percent of the total employee compensation. See *www.bls.gov/news.release/archives/ecec_03182021.pdf.* Last accessed on May 26, 2021.

[83] $29.27 ÷ 0.703 = $41.64.

[84] *testgewebe.de/en/products/ballast-loads-base-load-textiles/doe-energy-test-cloth/.* Last accessed and converted to U.S. dollars on July 8, 2021.

[85] AHAM Trends in Energy Efficiency, 2018.

average-capacity RCW,[86] and the maximum allowable usage of 60 test cycles per cloth,[87] DOE estimates a total material cost of $5.35 per wash cycle on average across all RCWs on the market. Using these material costs, labor rates and time estimates, DOE estimates that the reduction in burden of a single test cycle on an RCW would provide $46.99 in costs savings [88] for tests conducted at an in-house test facility. Based on discussions with manufacturers over the course of multiple rulemakings, DOE understands that the majority of manufacturer testing is conducted at in-house test facilities.

Based on an average CCW capacity of 3.17 ft^3,[89] the load sizes associated with testing an average-capacity CCW,[90] and the maximum allowable usage of 60 test cycles per cloth, DOE estimates a total material cost of $4.36 per wash cycle on average across all CCWs on the market. Using these material costs, labor rates and time estimates, DOE estimates that the reduction in burden of a single test cycle on a CCW would provide $35.59 in costs savings [91] for tests conducted at an in-house test facility.

Based on these estimates, DOE has tentatively determined that the use of proposed new Appendix J would result in a total burden reduction of 7.4 cycles per RCW on average, which results in an average saving of $348 per basic model of RCW.[92] For CCWs, use of proposed new Appendix J would result in a total burden reduction of 4.3 cycles per CCW on average, which results in an average saving of $153 per basic model of CCW.[93]

Based on these estimates, DOE has tentatively determined that the proposed new test procedure at Appendix J would not be unduly burdensome for manufacturers to conduct.

DOE requests comment on any aspect of the estimated testing costs and savings associated with DOE's proposed test procedures.

2. Harmonization With Industry Standards

DOE's established practice is to adopt relevant industry standards as DOE test procedures unless such methodology would be unduly burdensome to conduct or would not produce test results that reflect the energy efficiency, energy use, water use (as specified in EPCA) or estimated operating costs of that product during a representative average use cycle or period of use. Section 8(c) of Appendix A of 10 CFR part 430 subpart C; 10 CFR 431.4. In cases where the industry standard does not meet EPCA statutory criteria for test procedures, DOE will make modifications through the rulemaking process to these standards as the DOE test procedures.

The test procedures for clothes washers at the proposed new Appendix J and Appendix J2 and Appendix J3 incorporate by reference certain provisions of IEC Standard 62301 that provide test conditions, testing equipment, and methods for measuring standby mode and off mode power consumption. These appendices also reference AATCC test methods for qualifying new batches of test cloth, and AHAM Standard Test Detergent Formula 3 for preconditioning new test cloths. DOE is not aware of any existing industry test procedures for clothes washers that measure energy and water efficiency.

AHAM commented on the May 2020 RFI that it is about to begin development of its own clothes washer energy test procedure based on Appendix J2, which will address many of the issues DOE raised in the May 2020 RFI. (AHAM, No. 5 at p. 5) For example, AHAM stated that it plans to investigate methods of reducing test burden, including through review of relevant customer usage data. (AHAM, No. 5 at p. 4) AHAM suggested that DOE eventually incorporate AHAM's test procedure by reference. (AHAM, No. 5 at p. 5) AHAM invited DOE, as well as other entities that are able to contribute technical resources to the effort, to participate in the task force. *Id.*

The CA IOUs opposed the adoption of industry test procedures without modification without DOE conducting an independent assessment of representativeness in a public rulemaking to allow adequate stakeholder discussion and review. (CA IOUs, No. 8 at p. 16)

DOE is aware of two clothes washer test procedures established by industry: AHAM HLW–1–2013 and IEC 60456. AHAM's existing clothes washer procedure, AHAM HLW–1–2013, does not include a procedure for measuring energy and water. IEC 60456 includes tests for water and energy use, water extraction (*i.e.,* RMC), washing performance, rinsing performance, and wool shrinkage. DOE notes several key differences between IEC 60456 and DOE's test procedure, including:

(1) IEC 60456 uses manufacturer-declared capacity or, in the absence of a declared capacity, specifies two alternative capacity measurement procedures: A table tennis ball method (in which the drum is filled with table tennis balls) and a water fill method, which more closely resembles DOE's capacity measurement method. However, the water fill method for top-loading clothes washers corresponds to ''Fill Level 1,'' as discussed in section III.D.6.c of this document, in contrast to DOE's currently specified ''Fill Level 2.''

(2) IEC 60456 defines two types of load materials that can be used: A 100-percent cotton load, consisting of sheets, pillowcases, and towels; or a synthetics/blends load (65-percent polyester, 35-percent cotton), consistent of men's shirt and pillowcases. IEC 60456 requires a distribution in age (*i.e.,* number of cycles that have been performed) for each different item type comprising the load.

(3) The procedure for determining water and energy consumption (section 8.6 of IEC 60456) specifies that the test load shall be subjected to ''performance'' testing, which requires operating a reference clothes washer in parallel with the unit under test; using a test load that includes stain strips used to evaluate cleaning performance; and using detergent as specified.

(4) IEC 60456 does not define the ''Normal'' cycle or energy test cycle; rather, the procedures in IEC 60456 are generic and can be applied to any wash program or cycle selections defined by the tester.

DOE tentatively concludes that IEC 60456 does not meet EPCA statutory criteria, in that IEC 60456 would be unduly burdensome to conduct and would not produce test results that reflect the energy efficiency, energy use, water use, or estimated operating costs of a clothes washer during a representative average use cycle or period of use for a U.S. consumer.

[86] The load sizes associated with a 4.14 ft^3 clothes washer are 3.0 lb (minimum), 10.0 lb (average), and 17.0 lb (maximum) under Appendix J2; and 6.1 lb (small) and 13.65 lb (large) under proposed Appendix J, resulting in an average load size of 10.0 lb under Appendix J2 or 9.9 lb under Appendix J. For the purpose of the calculations in this analysis, DOE used 10.0 lb to represent the average load size.

[87] Section 2.7.1 of Appendix J2 specifies that each energy test cloth must not be used for more than 60 test runs (after preconditioning).

[88] $1 \times \$41.64 + \$5.35 = \$46.99$.

[89] DOE calculated the average CCW capacity based on the average capacity of the representative sample of CCWs presented in chapter 5 of the technical support document accompanying the December 2014 Final Rule. Available at *www.regulations.gov/document/EERE-2012-BT-STD-0020-0036.*

[90] The load sizes associated with a 3.17 ft^3 clothes washer are 3.0 lb (minimum), 7.95 lb (average), and 12.9 lb (maximum) under Appendix J2; and 5.2 lb (small) and 10.55 lb (large) under proposed Appendix J, resulting in an average load size of 7.95 lb under Appendix J2 or 7.9 lb under Appendix J. For the purpose of the calculations in this analysis, DOE used 7.95 lb to represent the average load size.

[91] $0.75 \times \$41.64 + \$4.36 = \$35.59$.

[92] $7.4 \times \$46.99 = \$348$.

[93] $4.3 \times \$35.59 = \$153$.

3. Other Test Procedure Topics

In addition to the issues identified earlier in this document, DOE welcomes comment on any other aspect of the existing test procedures for clothes washers. Note that DOE also issued an RFI to seek more information on whether its test procedures are reasonably designed, as required by EPCA, to produce results that measure the energy use or efficiency of a product during a representative average use cycle or period of use. 84 FR 9721 (Mar. 18, 2019). DOE particularly seeks comment on this issue as it pertains to the test procedures for clothes washers, as well as information that would help DOE create a procedure that is not unduly burdensome to conduct. Comments regarding repeatability and reproducibility are also welcome.

L. Compliance Date and Waivers

EPCA prescribes that, if DOE amends a test procedure, all representations of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with that amended test procedure, beginning 180 days after publication of such a test procedure final rule in the **Federal Register**. (42 U.S.C. 6293(c)(2); 42 U.S.C. 6314(d)(1)) To the extent the new test procedure at Appendix J proposed in this document is required only for the evaluation and issuance of updated efficiency standards, use of new Appendix J, if finalized, would not be required until the compliance date of any updated standards. Section 8(d) of appendix A to 10 CFR part 430 subpart C; 10 CFR 431.4.

If DOE were to publish amended test procedures, EPCA provides an allowance for individual manufacturers to petition DOE for an extension of the 180-day period if the manufacturer may experience undue hardship in meeting the deadline. (42 U.S.C. 6293(c)(3); 42 U.S.C. 6314(d)(2)) To receive such an extension, petitions must be filed with DOE no later than 60 days before the end of the 180-day period and must detail how the manufacturer will experience undue hardship. (*Id.*)

Upon the compliance date of test procedure provisions of an amended test procedure, should DOE issue a such an amendment, any waivers that had been previously issued and are in effect that pertain to issues addressed by such provisions are terminated. 10 CFR 430.27(h)(2); 10 CFR 431.401(h)(2). Recipients of any such waivers would be required to test the products subject to the waiver according to the amended test procedures as of the compliance date of the amended test procedures. The amendments proposed in this NOPR pertain to issues addressed by waivers granted to Whirlpool (case no. CW–026) and Samsung (case no. CW–027). 81 FR 26215; 82 FR 17229, respectively.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

The Office of Management and Budget (''OMB'') has determined that this test procedure rulemaking does not constitute ''significant regulatory actions'' under section 3(f) of Executive Order (''E.O.'') 12866, Regulatory Planning and Review, 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive Order by the Office of Information and Regulatory Affairs (''OIRA'') in OMB.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (''IRFA'') 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: *https://energy.gov/gc/office-general-counsel.* DOE reviewed this proposed rule under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. The following sections detail DOE's IRFA for this test procedure rulemaking.

1. Description of Reasons Why Action Is Being Considered

The Energy Policy and Conservation Act, as amended (''EPCA''),[94] requires that, at least once every 7 years, DOE evaluate test procedures for RCWs. (42 U.S.C. 6291–6317) EPCA also requires the test procedures for CCWs to be the same as the test procedures established for RCWs. (42 U.S.C. 6314(a)(8)) As with the test procedures for RCWs, EPCA requires that DOE evaluate, at least once every 7 years, the test procedures for CCWs.

2. Objective of, and Legal Basis for, Rule

EPCA, as amended, authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B[95] of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles, which sets forth a variety of provisions designed to improve energy efficiency. These products include RCWs. (42 U.S.C. 6292(a)(7)) Title III, Part C[96] of EPCA, added by Public Law 95–619, Title IV, § 441(a), established the Energy Conservation Program for Certain Industrial Equipment. This equipment includes CCWs. (42 U.S.C. 6311(1)(H)) Both RCWs and CCWs are the subject of this document.

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered product, including RCWs, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(1)(A))

EPCA requires the test procedures for CCWs to be the same as the test procedures established for RCWs. (42 U.S.C. 6314(a)(8)) As with the test procedures for RCWs, EPCA requires that DOE evaluate, at least once every 7 years, the test procedures for CCWs to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle. (42 U.S.C. 6314(a)(1))

3. Description and Estimate of Small Entities Regulated

DOE uses the Small Business Administration's (''SBA'') small business size standards to determine whether manufacturers qualify as small

[94] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020).

[95] For editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.

[96] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A–1.

businesses, which are listed by the North American Industry Classification System (''NAICS''). The SBA considers a business entity to be a small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. The NAICS code for clothes washers is 335220, major household appliance manufacturing. The threshold number for NAICS code 335220 is 1,500 employees.[97] This employee threshold includes all employees in a business's parent company and any other subsidiaries. DOE identified 15 original equipment manufacturers (''OEMs'') of covered products and equipment. Of those companies, one is a small business that offers a single model of RCWs.

DOE requests comment on its initial determination that there is one small, domestic OEM of RCWs and no small, domestic OEMs of CCWs.

4. Description and Estimate of Compliance Requirements

In this NOPR, DOE proposes to amend Appendix J2 and Appendix J3 by (1) further specifying supply water temperature test conditions; (2) further specifying water meter resolution requirements; (3) adding specifications for measuring wash water temperature using submersible data loggers; (4) expanding the load size table to accommodate up to 8.0 ft^3 in capacity; (5) defining user-adjustable automatic WFCS; (6) specifying more explicitly the cycle selection for clothes washers with a range of wash time settings; (7) specifying how the energy test cycle flow charts apply to clothes washers that internally generate hot water; (8) specifying that the energy test cycle flow charts be evaluated using the Maximum load size; (9) specifying that testing is to be conducted with any network settings disabled if instructions are available to the user to disable these functions; (10) further specifying the conditions under which data from a test cycle would be discarded; (11) adding a product-specific enforcement provision to accommodate the potential for lot-to-lot variation in RMC; (12) deleting obsolete definitions, metrics, and the clothes washer-specific waiver section; (13) consolidating all test cloth-related specifications in Appendix J3; and (14) codifying the test cloth material verification procedure as used by industry into Appendix J3. DOE has initially determined these proposed amendments to Appendix J2 and Appendix J3 would not result in manufacturers needing to re-rate clothes washers. The amendment (2) above may require more precise hot water meters for clothes washers with hot water usage less than 0.1 gallons in any of the energy test cycles. However, DOE's analysis of the small manufacturer's product offering indicates that the amendment would not apply and no capital expenditures would be necessary for the business.

Next, this NOPR proposes to specify a new Appendix J, to be applicable upon the compliance date of any future amended energy conservation standards for clothes washers. The proposed new Appendix J would include modifications beyond Appendix J2 that: (1) Modify the hot water supply target temperature and clothes washer pre-conditioning requirements; (2) modify the Extra-Hot Wash threshold temperature; (3) add measurement and calculation of average cycle time; (4) reduce the number of required test cycles by requiring the use of no more than two Warm Wash/Cold Rinse cycles, and no more than two Warm Wash/Warm Rinse cycles; (5) reduce the number of required test cycles by removing the need for one or more cycles used for measuring RMC; (6) reduce the number of load sizes from three to two for units with automatic water fill controls; (7) modify the load size definitions consistent with two, rather than three, load sizes; (8) update the water fill levels to be used for testing to reflect the modified load size definitions; (9) specify the installation of single-inlet clothes washers, and simplify the test procedure for semi-automatic clothes washers; (10) define new performance metrics that are functions of the weighted-average load size rather than clothes container capacity: ''energy efficiency ratio,'' ''active-mode energy efficiency ratio,'' and ''water efficiency ratio''; (11) update the number of annual clothes washer cycles from 295 to 234; and (12) update the number of hours assigned to low-power mode to be based on the clothes washer's measured cycle time rather than an assumed fixed value. Due to the reduction in number of loads and number of wash cycles, the proposed new Appendix J would be less burdensome than Appendix J2 for industry. However, the small manufacturer would need to re-rate its one model when any future amended energy conservation standard requires the use of the proposed new Appendix J. The cost of re-rating one model would have a cost of less than $1000. DOE estimates this to be less than 0.1 percent of revenue for the small manufacturer.

DOE requests comment on its initial determination that the proposed amendments would result in small incremental test burdens on the small business manufacturers of RCWs and CCWs in the United States.

5. Duplication, Overlap, and Conflict With Other Rules and Regulations

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the rule being considered today.

6. Significant Alternatives to the Rule

DOE considered alternative test methods and modifications to the test procedures for RCWs and CCWs, and tentatively determined that there are no better alternatives than the modifications and procedures proposed in this NOPR. DOE expects the proposed amendments to Appendix J2 to result in zero cost to the small manufacturer. DOE expects the new Appendix J would have no impact before an amended energy conservation standard is adopted. After an amended energy conservation standard is adopted, DOE expects the proposed new Appendix J to have *de minimis* cost impact on the small manufacturer.

Additional compliance flexibilities may be available through other means. EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8 million may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. (42 U.S.C. 6295(t)) Additionally, section 504 of the Department of Energy Organization Act, 42 U.S.C. 7194, provides authority for the Secretary to adjust a rule issued under EPCA in order to prevent ''special hardship, inequity, or unfair distribution of burdens'' that may be imposed on that manufacturer as a result of such rule. Manufacturers should refer to 10 CFR part 430, subpart E, and part 1003 for additional details.

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of RCWs and CCWs must certify to DOE that their products comply with any applicable energy conservation standards. To certify compliance, manufacturers must first obtain test data for their products according to the DOE test procedures, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer

[97] Available online at: *www.sba.gov/document/support--table-size-standards.*

products and commercial equipment, including RCWs and CCWs. (See generally 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (''PRA''). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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

D. Review Under the National Environmental Policy Act of 1969

In this proposed rule, DOE proposes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for residential and commercial clothes washers. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment is consistent with activities identified in 10 CFR part 1021, appendix A to subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (Aug. 10, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *https://energy.gov/gc/office-general-counsel.*

DOE examined this proposed rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

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

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

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights'' 53 FR 8859

(March 18, 1988), that this proposed regulation would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQI%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

The proposed regulatory action to amend the test procedures for measuring the energy efficiency of RCWs and CCWs is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

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

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

The proposed modifications to the test procedures for clothes washers would continue to incorporate testing methods contained in certain sections of the following commercial standards: AATCC Test Method 79–2010, AATCC Test Method 118–2007, AATCC Test Method 135–2010, and IEC 62031. DOE has evaluated these standards and is unable to conclude whether it fully complies with the requirements of section 32(b) of the FEAA (*i.e.,* whether it was developed in a manner that fully provides for public participation, comment, and review.) DOE will consult with both the Attorney General and the Chairman of the FTC concerning the impact of these test procedures on competition, prior to prescribing a final rule.

M. Description of Materials Incorporated by Reference

In this NOPR, DOE proposes to incorporate by reference the test standard published by AATCC, titled ''Absorbency of Textiles,'' AATCC Test Method 79–2010. DOE also proposes to incorporate by reference the test standard published by AATCC, titled ''Oil Repellency: Hydrocarbon Resistance Test,'' AATCC Test Method 118–2007. AATCC 79–2010 and AATCC 118–2007 are industry-accepted test procedure that verify the presence or absence of water repellent finishes on fabric by measuring the water absorbency and oil repellency of the fabric, respectively.

In this NOPR, DOE proposes to incorporate by reference the test standard published by AATCC, titled ''Dimensional Changes of Fabrics after Home Laundering,'' AATCC Test Method 135–2010. AATCC 135–2010 is an industry-accepted test procedure for measuring dimensional changes in fabric (''shrinkage'') due to laundering.

All three of these AATCC test methods are currently incorporated by reference for use in Appendix J2. This NOPR proposes to transfer the references to these test methods to Appendix J3. Copies of AATCC test methods can be obtained from AATC, P.O. Box 12215, Research Triangle Park, NC 27709, (919) 549–3526, or by going to *www.aatcc.org.*

In this NOPR, DOE proposes to incorporate by reference the test standard published by IEC, titled ''Household electrical appliances—Measurement of standby power,'' (Edition 2.0, 2011–01), IEC 62301. IEC 62301 is an industry-accepted test procedure for measuring standby energy consumption. IEC 62301 is currently incorporated by reference for use in Appendix J2, which references specific provisions of the industry standard. See 10 CFR 430.3(o)(6). This NOPR proposes to include the same references in the proposed new Appendix J.

Copies of IEC 62301 available from the American National Standards Institute, 25 W 43rd Street, 4th Floor, New York, NY 10036, (212) 642–4900, or by going to *webstore.ansi.org.*

V. Public Participation

A. Participation in the Webinar

The time and date of the webinar are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=68&action=viewlive.* Participants are responsible for ensuring their systems are compatible with the webinar software.

Additionally, you may request an in-person meeting to be held prior to the close of the request period provided in the **DATES** section of this document. Requests for an in-person meeting may be made by contacting Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *Appliance_Standards_Public_Meetings@ee.doe.gov.*

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this proposed rulemaking, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit requests to speak by sending an email to *ResClothesWasher2016TP0011@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

Persons requesting to speak should briefly describe the nature of their interest in this rulemaking and provide a telephone number for contact. DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least two weeks before the webinar. At its discretion, DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Office. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of the Webinar

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

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

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the webinar will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the webinar.

A transcript of the webinar will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this document and will be accessible on the DOE website. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule 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 document.

Submitting comments via www.regulations.gov. The *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 *www.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 *www.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 *www.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 *www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email. Comments and documents submitted via email also will be posted to *www.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. No 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 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 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. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

(1) DOE requests comment on its proposal to require a hot water meter resolution no larger than 0.01 gallons for clothes washers that use less than 0.1 gallons in any of the individual cycles within the energy test cycle. DOE requests comment on the extent to which manufacturers and test laboratories already use water meters with this greater resolution. DOE also requests comment on whether proposing this requirement for Appendix J2 would require manufacturers to retest any basic models that have already been certified under the existing water meter resolution requirements.

(2) DOE requests comment on its proposal to require all single-inlet clothes washers to be installed to the cold water supply only. DOE also requests comment on whether this requirement should be included in only the proposed new Appendix J, or whether, if adopted, it should be included as an amendment to Appendix J2.

(3) DOE requests comment on its proposal to update the hot water supply temperature for the proposed new Appendix J from 130–135 °F to 120–125 °F. DOE seeks more recent data on hot water supply temperatures in consumer clothes washer installations. DOE also requests comment on any potential impact to testing costs that may occur by harmonizing temperatures between the clothes washer and dishwasher test procedures, and the impacts on manufacturer burden associated with any changes to the hot water supply temperature.

(4) DOE requests comment on its proposal to specify in the proposed new Appendix J that the Extra-Hot Wash/Cold Rinse designation would apply to a wash temperature greater than or equal to 140 °F. DOE requests any additional data on the wash temperature of cycles that meet the Appendix J2 definition of Extra-Hot Wash/Cold Rinse. DOE is also interested in data and information on any potential impact to testing costs that may occur by changing the Extra-Hot Wash temperature threshold, and the impacts on manufacturer burden associated with any changes to the Extra-Hot Wash/Cold Rinse definition.

(5) DOE requests comment on its proposal to remove the target temperatures and instead specify water supply temperature ranges as 55 °F to 60 °F for cold water in both Appendix J2 and the proposed new Appendix J, 130 °F to 135 °F for hot water in Appendix J2, and 120 °F to 125 °F for hot water in the proposed new Appendix J.

(6) DOE requests comment on its proposal to allow the use of a submersible temperature logger in Appendix J2 and the proposed new Appendix J as an option to confirm that an Extra-Hot Wash temperature greater than the Extra-Hot Wash threshold has been achieved during the wash cycle. DOE requests data and information confirming (or disputing) DOE's discussion of the benefits and limitations of using a submersible temperature logger, including DOE's determination that a submersible logger's failure to measure a temperature greater than the Extra-Hot Wash threshold does not necessarily indicate that the cycle under test does not meet the definition of an Extra-Hot Wash/Cold Rinse cycle.

(7) DOE requests comment on its proposal to specify the same pre-conditioning requirements for all clothes washers and to remove the ''water-heating clothes washer'' and ''non-water-heating clothes washer'' definitions in the proposed new Appendix J. DOE also requests information regarding whether test laboratories typically pre-condition water-heating and non-water-heating clothes washers using the same procedure.

(8) DOE requests comment on its proposal to expand the load size table in both Appendix J2 and the proposed new Appendix J to accommodate RCWs with capacities up to 8.0 ft3.

(9) DOE requests comment on its proposal to replace the minimum, maximum, and average load sizes with the small and large load sizes in the proposed new Appendix J. DOE seeks comment on how reducing the number of load sizes tested would impact the representativeness of test results. DOE also requests data and information to quantify the reduction in test burden that would result from reducing the number of load sizes from three to two for clothes washers with automatic WFCS.

(10) DOE requests comment on its proposal to change the water fill level selections in the proposed new Appendix J for clothes washers with manual and user-adjustable automatic WFCS to reflect the proposed small and large test load sizes. DOE seeks data and information on how the proposed changes to the water fill level selection for clothes washers with manual and user-adjustable automatic WFCS would impact test procedure representativeness.

(11) DOE requests comment on the proposal to require in the proposed new Appendix J testing only the hottest and the coldest Warm Wash/Cold Rinse settings. DOE seeks data and information on how this proposed change to the Warm Wash temperature settings required for testing would impact representativeness, testing costs, and manufacturer burden.

(12) DOE requests comment on its proposal to revise the RMC procedure so that RMC would be measured at the default spin setting for each temperature selection and load size, and the individual RMC values would be averaged using TUFs and LUFs to calculate the final RMC. DOE seeks data and information regarding how this change to the RMC calculation would impact testing costs and manufacturer test burden.

(13) DOE further requests comment on whether DOE should implement any changes to the RMC calculation in Appendix J2 to address clothes washers with spin settings that are available only on certain temperature selections.

(14) DOE requests comment on its tentative conclusion not to propose changes to the bone-dry definition and associated dryer temperature measurement method.

(15) DOE requests comment on its proposal to require that each test cycle use a bone-dry test load in the proposed new Appendix J. DOE requests comment on whether test laboratories start test cycles with the test load at bone-dry or at up to 104 percent of the bone-dry weight. DOE further requests feedback on its assessment that this change would not affect test burden.

(16) DOE requests comment on its proposal to add cycle time measurements and to calculate average cycle time using the weighted-average method in the proposed new Appendix J. DOE also requests comment on its assertion that adding cycle time measurements and a calculation of a weighted-average cycle time would not increase testing costs or overall test burden.

(17) DOE requests comment on its tentative determination to maintain the current capacity measurement method.

(18) DOE requests comment on the proposed criteria for determining whether test data are to be discarded. Specifically, DOE requests comment on the proposal that test data are discarded if a washing machine either signals to the user by means of a visual or audio alert that an out-of-balance condition has occurred or terminates prematurely. DOE requests comment on whether additional or alternate criteria would provide objective and observable indication during a single test that test data are to be discarded.

(19) DOE requests comment on its proposal for testing semi-automatic clothes washers in the proposed new Appendix J that would require testing only the wash/rinse temperature combinations that do not require a wash temperature change between the wash and rinse portions of the cycle (*i.e.,* Hot/Hot, Warm/Warm, and Cold/Cold).

(20) DOE requests feedback on its proposal to test semi-automatic clothes washers using TUF values of 0.14 for Hot, 0.49 for Warm, and 0.37 for Cold.

(21) DOE further requests comment on whether the temperature selections and TUFs that DOE has proposed for semi-automatic clothes washers would be representative of consumer use; and if not, which temperature selections and TUF values would better reflect consumer use.

(22) DOE requests comment on whether to include explicit instructions for how to test semi-automatic clothes washers in Appendix J2, and if so, whether DOE should implement the same procedures being proposed for the proposed new Appendix J.

(23) DOE requests feedback on how manufacturers of semi-automatic clothes washers are currently testing their products using Appendix J2.

(24) DOE requests comment on its proposal to require semi-automatic clothes washers to test only the Cold cycle, and to determine the representative values for the Warm and Hot cycles formulaically, for the proposed new Appendix J.

(25) DOE requests comment on the test burden associated with determining the apportionment between wash water use and rinse water use on semi-automatic clothes washers.

(26) DOE requests comment on maintaining the current requirement to use the manufacturer default settings for optional cycle modifiers.

(27) DOE requests comment on its proposed amendment to Appendix J2 and the proposed new Appendix J to specify that network settings (on clothes washers with network capabilities) must be disabled during testing if such settings can be disabled by the end-user, and the product's user manual provides instructions on how to do so.

(28) DOE requests feedback on its characterization of connected clothes washers currently on the market. Specifically, DOE requests input on the types of features or functionality enabled by connected clothes washers that exist on the market or that are under development.

(29) DOE requests data on the percentage of users purchasing connected clothes washers, and, for those users, the percentage of the time when the connected functionality of the clothes washer is used.

(30) DOE requests data on the amount of additional or reduced energy use of connected clothes washers.

(31) DOE requests data on the pattern of additional or reduced energy use of connected clothes washers; for example, whether it is constant, periodic, or triggered by the user.

(32) DOE requests information on any existing testing protocols that account for connected features of clothes washers, as well as any testing protocols that may be under development within the industry.

(33) DOE requests comment on its proposal to replace the capacity term with weighted-average load size in the energy efficiency metrics and the water efficiency metric in the proposed new Appendix J.

(34) DOE requests comment on its proposed names for the proposed new efficiency metrics: energy efficiency ratio (EER), active-mode energy efficiency ratio (AEER), and water efficiency ratio (WER).

(35) DOE requests comment on its proposal to invert the water efficiency metric and calculate the newly defined WER metric as the quotient of the weighted-average load size divided by the total weighted per-cycle water consumption for all wash cycles.

(36) DOE requests data on the annual amount of laundry washed by consumers, and whether the annual amount of laundry washed by consumers is correlated with clothes washer capacity.

(37) DOE requests comment on its proposed updated representation and sampling requirements for RCWs and CCWs.

(38) DOE requests comment on its proposal to update the number of annual wash cycles to 234 in the proposed new Appendix J and 10 CFR 430.23(j)(1)(i) and (j)(3)(i).

(39) DOE requests comment on maintaining the assumed final moisture content of 4 percent in the drying energy equation, or whether it should update the assumed final moisture content to 2 percent to align with DOE's Appendix D2 clothes dryer test procedure.

(40) DOE requests comment on maintaining the current DEF value of 0.5 kWh/lb.

(41) DOE requests comment on maintaining the current DUF value of 0.91.

(42) DOE requests comment on its proposal to update the number of hours spent in low-power mode from a fixed 8,465 total hours to a formula based on measured cycle time and an assumed number of annual cycles.

(43) DOE requests comment on maintaining the current TUF values.

(44) DOE requests comment on its proposal to update the LUFs for the small and large load sizes to be equal to 0.5, consistent with the proposed load size definitions in the proposed new Appendix J.

(45) DOE requests comment on maintaining the current water heater efficiency assumptions.

(46) DOE requests comment on its proposal to specify the use of hoses not to exceed 72 inches in length in the proposed new Appendix J. DOE also requests comment on the length of inlet hose typically used for testing.

(47) DOE requests comment on whether it should amend the test procedure to accommodate potential future clothes washer models for which the maximum load size required by the test procedure conflicts with the maximum load size intended or able to be washed with the cycle required for testing. If so, DOE seeks additional comment on the approaches it has considered, or on any other approaches

that could be considered, that would address this issue in the test procedure.

(48) DOE requests comment on its proposed changes to the definition of ''fixed water fill control system'' and on its proposal to add a definition for ''user-adjustable automatic water fill control system.''

(49) DOE requests comment on its proposal to update the wording of section 3.2.6.2.2 of Appendix J2 and section 3.2.3.2.2 of the proposed new Appendix J from ''the setting that will give the most energy intensive result'' to ''the setting that uses the most water;'' and from ''the setting that will give the least energy intensive result'' to ''the setting that uses the least water.''

(50) DOE requests comment on its proposal to require that the energy test cycle flow charts be evaluated using the large load size for all wash/rinse temperature settings in the proposed new Appendix J. DOE also requests comment on its proposal to require that the energy test cycle flow charts be evaluated using the maximum load size, except for the Cold/Cold flow chart, in Appendix J2.

(51) DOE requests comments on its proposal to update the flowcharts for Cold Wash/Cold Rinse and Warm Wash/Warm Rinse in both Appendix J2 and the proposed new Appendix J to explicitly address clothes washers that internally generate hot water.

(52) DOE requests comment on its proposal to clarify the wording of the wash time setting specifications in section 3.2.5 of Appendix J2 and section 3.2.2 of the proposed new Appendix J.

(53) DOE requests comment on its proposal to add a clause in section 3.2.5.2 of Appendix J2 and section 3.2.2.2 of the proposed new Appendix J stating that the requirement to rotate the dial in the direction of increasing wash time would only apply to dials that can rotate in both directions.

(54) DOE requests comment on its proposal to add a definition of ''wash time'' to section 1 of both Appendix J2 and the proposed new Appendix J.

(55) DOE requests comment on its proposed updates to the annual operating cost calculations in 10 CFR 430.23(j)(1).

(56) DOE requests comment on its proposed structure of the proposed new Appendix J to simplify and improve readability as compared to Appendix J2.

(57) DOE requests comment on its proposal to delete Appendix J1 to subpart B of 10 CFR part 430 along with all references to Appendix J1 in 10 CFR parts 429, 430, and 431.

(58) DOE requests comment on its proposal to remove obsolete metric definitions.

(59) DOE requests comment on its proposal to delete the following definitions from section 1 of Appendix J2: ''adaptive control system,'' ''compact,'' ''manual control system,'' ''standard,'' and ''thermostatically controlled water valves.'' DOE also requests comment on its proposal to simplify the definition of ''energy test cycle.'' DOE also requests comment on its proposal to remove section 1.30 ''Symbol usage'' from Appendix J2. Lastly, DOE requests comment on its proposal to remove the numbering of all definitions in section 1 of Appendix J2 and section 2 of Appendix J3, and to instead list the definitions in alphabetical order.

(60) DOE requests comment on its proposal to remove section 6, Waivers and Field Testing, of Appendix J2 and proposal not to include a parallel section in the proposed new Appendix J.

(61) DOE requests comment on its proposal to make the minor typographical corrections and formatting modifications described in this section.

(62) DOE requests comment on its proposal to consolidate into Appendix J3 the test cloth specifications and procedures from section 2.7 of Appendix J2 that are not intended to be conducted as part of each individual clothes washer test performed under Appendix J2.

(63) DOE requests comment on its proposed edits to Appendix J3 to codify the ''uniformity check'' procedure and to restructure Appendix J3 to improve the overall logical flow of the procedure.

(64) DOE requests comment on its proposal to extend its product-specific enforcement provisions for clothes washers to accommodate up to a 3-percentage point variation in the corrected RMC measurement based on the test cloth lot used for testing. DOE also requests comment on alternate enforcement approaches that could be implemented.

(65) DOE requests comment, specifically from manufacturers and third-party test laboratories, on whether costs would be incurred for each laboratory as a result of the proposals in this NOPR to specify more precise hot water meters and to explicitly allow the use of submersible temperature loggers; and if so, the total incurred cost associated with outfitting each test stand with the specified instrumentation. DOE also requests comment on the potential cost savings to be expected from enabling the use of submersible temperature loggers.

(66) DOE requests comment on its characterization of the expected costs of the proposed amendments to Appendix J2 and Appendix J3 and on DOE's preliminary determination that the proposed amendments would not be unduly burdensome.

(67) DOE requests comment on any aspect of the estimated testing costs and savings associated with DOE's proposed test procedures.

(68) DOE requests comment on its initial determination that there is one small, domestic OEM of RCWs and no small, domestic OEMs of CCWs.

(69) DOE requests comment on its initial determination that the proposed amendments would result in small incremental test burdens on the small business manufacturers of RCWs and CCWs in the United States.

VI. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, 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.

10 CFR Part 431

Administrative practice and procedure, Confidential business information, Energy conservation test procedures, Incorporation by reference, and Reporting and recordkeeping requirements.

Signing Authority

This document of the Department of Energy was signed on August 5, 2021, by Kelly Speakes-Backman, Principal Deputy Assistant Secretary and Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This

administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on August 5, 2021.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy.

For the reasons stated in the preamble, DOE is proposing to amend parts 429, 430, and 431 of chapter II of title 10, 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; 28 U.S.C. 2461 note.

■ 2. Section 429.20 is amended by revising introductory paragraphs (a)(2)(i) and (ii), and (a)(3) to read as follows:

§ 429.20 Residential clothes washers.

* * * * *

(a) * * *

(2) * * *

(i) Any represented value of the 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 integrated modified energy factor, energy efficiency ratio, water efficiency ratio, 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:

* * * * *

(3) The clothes container capacity of a basic model reported in accordance with paragraph (b)(2) of this section shall be the mean of the measured clothes container capacity, C, of all tested units of the basic model.

* * * * *

■ 3. Section 429.46 is amended by revising introductory paragraph (a)(2)(ii) to read as follows:

§ 429.46 Commercial clothes washers.

* * * * *

(a) * * *

(2) * * *

(ii) Any represented value of the modified energy factor, active-mode energy efficiency ratio, water efficiency ratio, or other measure of energy or water consumption of a basic model for which consumers would favor higher values shall be greater than or equal to the higher of:

* * * * *

■ 4. Section 429.134 is amended by revising paragraph (c)(1) to read as follows:

§ 429.134 Product-specific enforcement provisions.

* * * * *

(c) *Clothes washers*—(1) *Determination of Remaining Moisture Content.* These provisions address anomalous remaining moisture content (RMC) results that are not representative of a basic model's performance, as well as differences in RMC values that may result from DOE using a different test cloth lot than was used by the manufacturer for testing and certifying the basic model.

(i) When testing according to appendix J to subpart B of part 430:

(A) If the measured RMC value of a tested unit is equal to or lower than the certified RMC value of the basic model (expressed as a percentage), the measured RMC value will be considered the tested unit's final RMC value and will be used as the basis for the calculation of per-cycle energy consumption for removal of moisture from the test load for that unit.

(B) If the measured RMC value is higher than the certified RMC value of the basic model, the measured RMC value of a tested unit will be considered the tested unit's final RMC value unless DOE used a different test cloth lot than was used by the manufacturer for testing and certifying the basic model; in which case, DOE may apply paragraph (c)(1)(i)(C) of this section if the difference between the measured and certified RMC values would affect the unit's compliance with the applicable standards.

(C) If DOE uses a different test cloth lot than was used by the manufacturer for testing and certifying the basic model:

(*1*) If the difference between the tested unit's measured RMC value and the certified RMC value of the basic model is less than or equal to three RMC percentage points, then the certified RMC value of the basic model may be considered the tested unit's final RMC value.

(*2*) If the tested unit's measured RMC value is more than three RMC percentage points higher than the certified RMC value of the basic model, then a value three RMC percentage points less than the measured RMC value may be considered the tested unit's final RMC value.

(ii) When testing according to appendix J2 to subpart B of part 430:

(A) The procedure for determining remaining moisture content (RMC) will be performed once in its entirety, pursuant to the test requirements of section 3.8 of appendix J2 to subpart B of part 430, for each unit tested.

(B) If the measured RMC value of a tested unit is equal to or lower than the certified RMC value of the basic model (expressed as a percentage), the measured RMC value will be considered the tested unit's final RMC value and will be used as the basis for the calculation of per-cycle energy consumption for removal of moisture from the test load for that unit.

(C) If the difference between the measured RMC value and the certified RMC value of the basic model is less than or equal to two RMC percentage points, the measured RMC value of a tested unit will be considered the tested unit's final RMC value unless DOE used a different test cloth lot than was used by the manufacturer for testing and certifying the basic model; in which case, DOE may apply paragraph (c)(1)(ii)(E) of this section if the difference between the measured and certified RMC values would affect the unit's compliance with the applicable standards.

(D) If the measured RMC value of a tested unit is more than two RMC percentage points higher than the certified RMC value of the basic model, DOE will perform two replications of the RMC measurement procedure, each pursuant to the provisions of section 3.8.5 of appendix J2 to subpart B of part 430, for a total of three independent RMC measurements of the tested unit. The average of the three RMC measurements will be calculated.

(*1*) If the average of the three RMC measurements is equal to or lower than the certified RMC value of the basic model, the average RMC value will be considered the tested unit's final RMC value.

(*2*) If the average of the three RMC measurements is higher than the certified RMC value of the basic model, the average RMC value will be considered the tested unit's final RMC value unless DOE used a different test cloth lot than was used by the manufacturer for testing and certifying the basic model; in which case, DOE may apply paragraph (c)(1)(ii)(E) of this section if the difference between the average and certified RMC values would affect the unit's compliance with the applicable standards.

(E) If DOE uses a different test cloth lot than was used by the manufacturer for testing and certifying the basic model:

(*1*) If the difference between the tested unit's measured RMC value (or average RMC value pursuant to paragraph (c)(1)(ii)(D) of this section) and the certified RMC value of the basic model is less than or equal to three RMC percentage points, then the certified RMC value of the basic model may be considered the tested unit's final RMC value.

(*2*) If the tested unit's measured RMC value (or average RMC value pursuant to paragraph (c)(1)(ii)(D) of this section) is more than three RMC percentage points higher than the certified RMC value of the basic model, then a value three RMC percentage points less than the measured RMC value may be considered the tested unit's final RMC value.

* * * * *

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

■ 6. Section 430.3 is amended by revising paragraphs (d) and (o)(6) to read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

(d) *AATCC.* American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709, (919) 549–3526, or go to *www.aatcc.org.*

(1) AATCC Test Method 79–2010, Absorbency of Textiles, Revised 2010, IBR approved for appendix J3 to subpart B.

(2) *AATCC* Test Method 118–2007, Oil Repellency: Hydrocarbon Resistance Test, Revised 2007, IBR approved for appendix J3 to subpart B.

(3) *AATCC* Test Method 135–2010, Dimensional Changes of Fabrics after Home Laundering, Revised 2010, IBR approved for appendix J3 to subpart B.

* * * * *

(o) * * *

(6) IEC 62301 (''IEC 62301''), *Household electrical appliances—Measurement of standby power,* (Edition 2.0, 2011–01), IBR approved for appendices C1, D1, D2, F, G, H, I, J, J2, N, O, P, Q, X, X1, Y, Z, BB, and CC to subpart B.

* * * * *

■ 7. Section 430.23 is amended by:

■ a. Revising paragraphs (j)(1)(i) and (ii);
■ b. Removing paragraph (j)(2)(i);
■ c. Redesignating paragraph (j)(2)(ii) as (j)(2)(i);
■ d. Adding paragraph (j)(2)(ii);
■ e. Revising paragraph (j)(3)(i);
■ f. Removing paragraph (j)(4)(i);
■ g. Redesignating paragraph (j)(4)(ii) as (j)(4)(i);
■ h. Revising newly redesignated paragraph (j)(4)(i);
■ i. Adding paragraph (j)(4)(ii); and
■ j. Revising paragraph (j)(5).

The additions and revisions read as follows:

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

* * * * *

(j) * * *

(1) * * *

(i) When using appendix J (see the note at the beginning of appendix J),

(A) When electrically heated water is used,

$$(N \times (ME_T + HE_T + E_{TLP}) \times C_{KWH})$$

Where:

N = the representative average residential clothes washer use of 234 cycles per year according to appendix J,

ME_T = the total weighted per-cycle machine electrical energy consumption, in kilowatt-hours per cycle, determined according to section 4.1.6 of appendix J,

HE_T = the total weighted per-cycle hot water energy consumption using an electrical water heater, in kilowatt-hours per cycle, determined according to section 4.1.3 of appendix J,

E_{TLP} = the per-cycle combined low-power mode energy consumption, in kilowatt-hours per cycle, determined according to section 4.6.2 of appendix J, 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,

$$(N \times (((ME_T + E_{TLP}) \times C_{KWH}) + (HE_{TG} \times C_{BTU})))$$

Where:

N, ME_T, E_{TLP}, and C_{KWH} are defined in paragraph (j)(1)(i)(A) of this section,

HE_{TG} = 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 J, and

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

(ii) When using appendix J2 (see the note at the beginning of appendix J2),

(A) When electrically heated water is used

$$(N_2 \times (E_{TE2} + E_{TLP2}) \times C_{KWH})$$

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_{TLP2} = 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} = 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,

$$(N_2 \times (((ME_{T2} + E_{TLP2}) \times C_{KWH}) + (HE_{TG2} \times C_{BTU})))$$

Where:

N_2, E_{TLP2}, and C_{KWH} 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,

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, and

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

(2) * * *

(ii) The energy efficiency ratio for automatic and semi-automatic clothes washers is determined according to section 4.9 of appendix J (when using appendix J). The result shall be rounded off to the nearest 0.1 pound per kilowatt-hour per cycle.

(3) * * *

(i) When using appendix J, the product of the representative average-use of 234 cycles per year and the total weighted per-cycle water consumption in gallons per cycle determined according to section 4.2.4 of appendix J.

* * * * *

(4)(i) The integrated water factor must be determined according to section 4.2.12 of appendix J2, with the result rounded to the nearest 0.1 gallons per cycle per cubic foot.

(ii) The water efficiency ratio for automatic and semi-automatic clothes washers is determined according to section 4.7 of appendix J (when using appendix J). The result shall be rounded off to the nearest 0.1 pound per gallon per cycle.

(5) Other useful measures of energy consumption for automatic or semi-automatic clothes washers shall be those measures of energy consumption that the Secretary determines are likely to assist consumers in making purchasing decisions and that are derived from the

application of appendix J or appendix J2, as appropriate.

* * * * *

■ 8. Appendix J to subpart B of part 430 is added to read as follows:

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

Note: Manufacturers must use the results of testing under Appendix J2 to determine compliance with the relevant standards for clothes washers from § 430.32(g)(4) and from § 431.156(b) as they appeared in January 1, 2021 edition of 10 CFR parts 200–499. Specifically, before [*Date 180 days following publication of the final rule*] representations must be based upon results generated either under Appendix J2 as codified on [*Date 30 days following publication of the final rule*] or under Appendix J2 as it appeared in the 10 CFR parts 200–499 edition revised as of January 1, 2021. Any representations made on or after [*Date 180 days following publication of the final rule*] but before the compliance date of any amended standards for clothes washers must be made based upon results generated using Appendix J2 as codified on [*Date 30 days following publication of the final rule*].

Manufacturers must use the results of testing under Appendix J to determine compliance with any amended standards for clothes washers provided in § 430.32(g) and in § 431.156 that are published after January 1, 2021. Any representations related to energy or water consumption of residential or commercial clothes washers must be made in accordance with the appropriate appendix that applies (*i.e.,* Appendix J or Appendix J2) when determining compliance with the relevant standard. Manufacturers may also use Appendix J to certify compliance with any amended standards prior to the applicable compliance date for those standards.

1. Definitions

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 and cycle finished modes.

Active-mode energy efficiency ratio means the quotient of the weighted-average load size 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.

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.

Adaptive water fill control system means a clothes washer automatic water fill control system that is capable of automatically adjusting the water fill level based on the size or weight of the clothes load placed in the clothes container.

Automatic water fill control system means a clothes washer water fill control system that does not allow or require the user to determine or select the water fill level, and includes adaptive water fill control systems and fixed water fill control systems.

Bone-dry means a condition of a load of test cloth that 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.

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

Cold rinse means the coldest rinse temperature available on the machine, as indicated to the user on the clothes washer control panel.

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

Cycle finished mode means an active mode that provides continuous status display, intermittent tumbling, or air circulation following operation in active washing mode.

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

Energy efficiency ratio means the quotient of the weighted-average load size 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; and

(d) The combined low-power mode energy consumption.

Energy test cycle means the complete set of wash/rinse temperature selections required for testing, as determined according to section 2.12 of this appendix.

Fixed water fill control system means a clothes washer automatic water fill control system that automatically terminates the fill when the water reaches a pre-defined level that is not based on the size or weight of the clothes load placed in the clothes container, without allowing or requiring the user to determine or select the water fill level.

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).

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.

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

Lot means a quantity of cloth that has been manufactured with the same batches of cotton and polyester during one continuous process.

Manual water fill control system means a clothes washer water fill control system that requires the user to determine or select the water fill level.

Normal cycle means the cycle recommended by the manufacturer (considering manufacturer instructions, control panel labeling, and other markings on the clothes washer) for normal, regular, or typical use for washing up to a full load of normally-soiled cotton clothing. For machines where multiple cycle settings are recommended by the manufacturer for normal, regular, or typical use for washing up to a full load of normally-soiled cotton clothing, then the Normal cycle is the cycle selection that results in the lowest EER or AEER value.

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.

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

(a) Facilitating 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.

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.

User-adjustable automatic water fill control system means an automatic clothes washer fill control system that allows the user to adjust the amount of water that the machine provides, which is based on the size or weight of the clothes load placed in the clothes container.

Wash time means the wash portion of the cycle, which begins when the cycle is initiated and includes the agitation or tumble time, which may be periodic or continuous during the wash portion of the cycle.

Water efficiency ratio means the quotient of the weighted-average load size divided by the total weighted per-cycle water consumption for all wash cycles in gallons.

2. Testing Conditions and Instrumentation

2.1 *Electrical energy supply.*

2.1.1 *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.

2.1.2 *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 (incorporated by reference; see § 430.3). If the power measuring instrument used for testing is unable to measure and record the total harmonic content during the test measurement period, total harmonic content may be measured and recorded immediately before and after the test measurement period.

2.2 *Supply water.* Maintain the temperature of the hot water supply at the water inlets between 120 °F (48.9 °C) and 125 °F (51.7 °C). Maintain the temperature of the cold water supply at the water inlets between 55 °F (12.8 °C) and 60 °F (15.6 °C).

2.3 *Water pressure.* Maintain the static water pressure at the hot and cold water inlet connection of the clothes washer at 35 pounds per square inch gauge (psig) ± 2.5 psig (241.3 kPa ± 17.2 kPa) when the water is flowing.

2.4 *Test room temperature.* For all clothes washers, maintain the test room ambient air temperature at 75 ± 5 °F (23.9 ± 2.8 °C) for active mode testing and combined low-power mode testing. Do not use the test room ambient air temperature conditions specified in Section 4, Paragraph 4.2 of IEC 62301 for combined low-power mode testing.

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 used for weighing test cloth must have a resolution of no larger than 0.2 oz (5.7 g) and a maximum error no greater than 0.3 percent of the measured value.

2.5.1.2 *Weighing scale for clothes container capacity measurement.* The scale used for performing the clothes container capacity measurement must 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 used to measure electrical energy consumption must 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 must 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, the crest factor, power factor, and maximum current ratio may be measured and recorded immediately before and after the test measurement period.

2.5.4 *Water and air temperature measuring devices.* The temperature devices used to measure water and air temperature must have an error no greater than ±1 °F (±0.6 °C) over the range being measured.

2.5.4.1 Non-reversible temperature indicator labels, adhered to the inside of the clothes container, may be used to confirm that an extra-hot wash temperature greater than or equal to 140 °F has been achieved during the wash cycle, under the following conditions. The label must remain waterproof, intact, and adhered to the wash drum throughout an entire wash cycle; provide consistent maximum temperature readings; and provide repeatable temperature indications sufficient to demonstrate that a wash temperature of greater than or equal to 140 °F has been achieved. The label must have been verified to consistently indicate temperature measurements with an accuracy of ±1 °F. If using a temperature indicator label to test a front-loading clothes washer, adhere the label along the interior surface of the clothes container drum, midway between the front and the back of the drum, adjacent to one of the baffles. If using a temperature indicator label to test a top-loading clothes washer, adhere the label along the interior surface of the clothes container drum, on the vertical portion of the sidewall, as close to the bottom of the container as possible.

2.5.4.2 Submersible temperature loggers placed inside the wash drum may be used to confirm that an extra-hot wash temperature greater than or equal to 140 °F has been achieved during the wash cycle, under the following conditions. The submersible temperature logger must have a time resolution of at least 1 data point every 5 seconds and a temperature measurement accuracy of ±1 °F. Due to the potential for a waterproof capsule to provide a thermal insulating effect, failure to measure a temperature of 140 °F does not necessarily indicate the lack of an extra-hot wash temperature. However, such a result would not be conclusive due to the lack of verification of the water temperature requirement, in which case an alternative method must be used to confirm that an extra-hot wash temperature greater than or equal to 140 °F has been achieved during the wash cycle.

2.5.5 *Water meter.* A water meter must be installed in both the hot and cold water lines to measure water flow and/or water consumption. The water meters must 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. If the volume of hot water for any individual cycle within the energy test cycle is less than 0.1 gallons (0.4 liters), the hot water meter must have a resolution no larger than 0.01 gallons (0.04 liters).

2.5.6 *Water pressure gauge.* A water pressure gauge must be installed in both the hot and cold water lines to measure water pressure. The water pressure gauges must have a resolution of 1 pound per square inch gauge (psig) (6.9 kPa) and a maximum error no greater than 5 percent of any measured value.

2.6 *Bone-dryer.* The dryer used for drying the cloth to bone-dry must heat the test cloth load above 210 °F (99 °C).

2.7 *Test cloths.* The test cloth material and dimensions must conform to the specifications in appendix J3 to this subpart. The energy test cloth and the energy stuffer cloths must be clean and must not be used for more than 60 test runs (after preconditioning as specified in section 5 of appendix J3 to this subpart). All energy test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material must not be used for testing a clothes washer. The moisture absorption and retention must be evaluated for each new lot of test cloth using the standard extractor Remaining Moisture Content (RMC) procedure specified in appendix J3 to this subpart.

2.8 *Test Loads.*

2.8.1 *Test load sizes.* Create small and large test loads as defined in Table 5.1 of this appendix based on the clothes container capacity as measured in section 3.1 of this appendix.

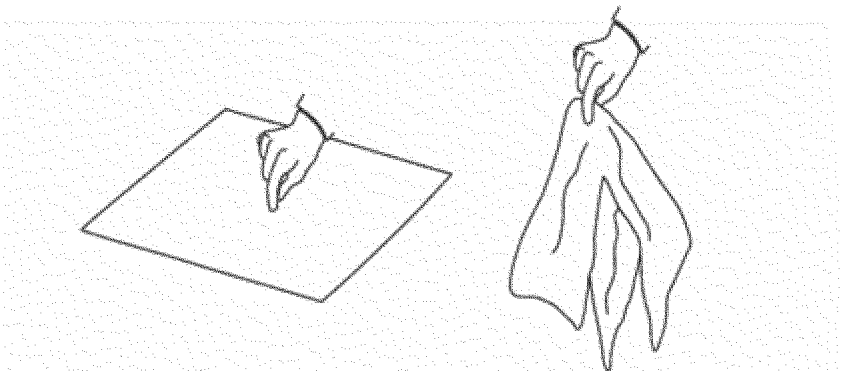
2.8.2 *Test load composition.* Test loads must consist primarily of energy test cloths and no more than five energy stuffer cloths per load to achieve the proper weight.

2.9 *Preparation and loading of test loads.* Use the following procedures to prepare and load each test load for testing in section 3 of this appendix.

2.9.1 Test loads for energy and water consumption measurements must be bone-dry prior to each test cycle.

2.9.2 Prepare the energy test cloths for loading by grasping them in the center, lifting, and shaking them to hang loosely, as illustrated in Figure 2.9.2 of this appendix.

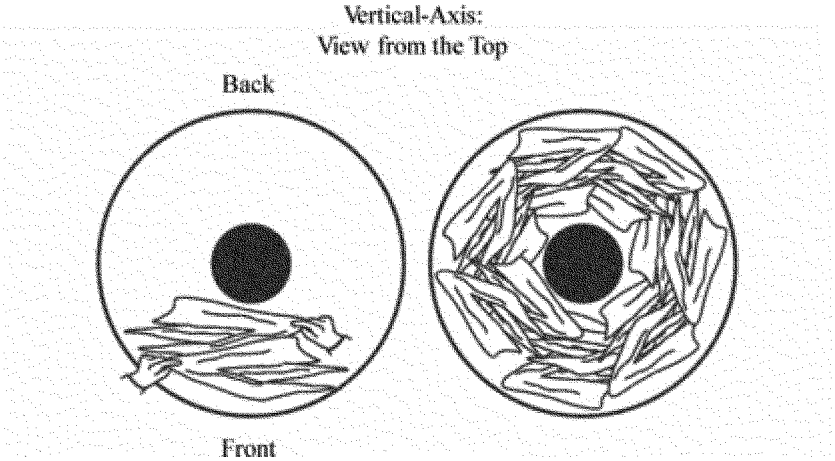
Figure 2.9.2—Grasping Energy Test Cloths in the Center, Lifting, and Shaking to Hang Loosely



For all clothes washers, follow any manufacturer loading instructions provided to the user regarding the placement of clothing within the clothes container. In the absence of any manufacturer instructions regarding the placement of clothing within the clothes container, the following loading instructions apply.

2.9.2.1 To load the energy test cloths in a top-loading clothes washer, arrange the cloths circumferentially around the axis of rotation of the clothes container, using alternating lengthwise orientations for adjacent pieces of cloth. Complete each cloth layer across its horizontal plane within the clothes container before adding a new layer. Figure 2.9.2.1 of this appendix illustrates the correct loading technique for a vertical-axis clothes washer.

Figure 2.9.2.1—Loading Energy Test Cloths into a Top-Loading Clothes Washer



2.9.2.2 To load the energy test cloths in a front-loading clothes washer, grasp each test cloth in the center as indicted in section 2.9.2 of this appendix, and then place each cloth into the clothes container prior to activating the clothes washer.

2.10 *Clothes washer installation.* Install the clothes washer in accordance with manufacturer's instructions.

2.10.1 *Water inlet connections.* If the clothes washer has 2 water inlets, connect the inlets to the hot water and cold water supplies, in accordance with the manufacturer's instructions. If the clothes washer has only 1 water inlet, connect the inlet to the cold water supply, in accordance with the manufacturer's instructions. Use the water inlet hoses provided with the clothes washer; otherwise use commercially available water inlet hoses, not to exceed 72 inches in length, in accordance with manufacturer's instructions.

2.10.2 *Low-power mode testing.* For combined low-power mode testing, install the clothes washer in accordance with Section 5, Paragraph 5.2 of IEC 62301, disregarding the provisions regarding batteries and the determination, classification, and testing of relevant modes.

2.11 *Clothes washer pre-conditioning.* 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.

2.12 *Determining the energy test cycle.*

2.12.1 *Automatic clothes washers.* To determine the energy test cycle, evaluate the wash/rinse temperature selection flowcharts in the order in which they are presented in this section. Use the large load size to evaluate each flowchart. The determination of the energy test cycle must take into consideration all cycle settings available to the end user, including any cycle selections or cycle modifications provided by the manufacturer via software or firmware updates to the product, for the basic model under test. The energy test cycle does not include any cycle that is recommended by the manufacturer exclusively for cleaning, deodorizing, or sanitizing the clothes washer.

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Figure 2.12.1.1—Determination of Cold Wash/Cold Rinse

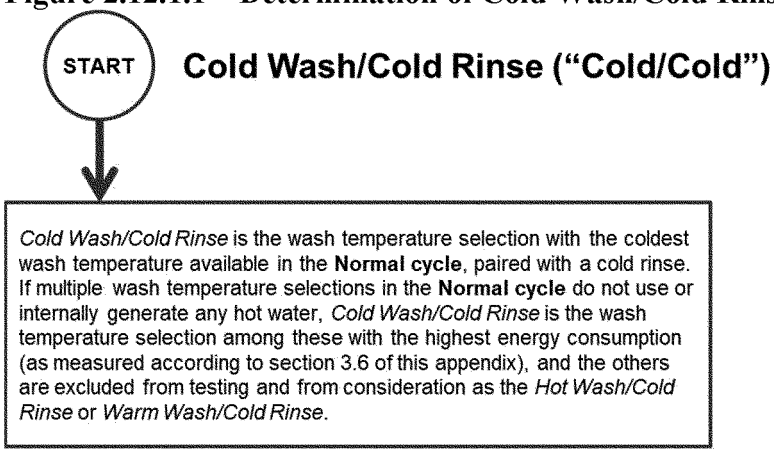


Figure 2.12.1.2—Determination of Hot Wash/Cold Rinse

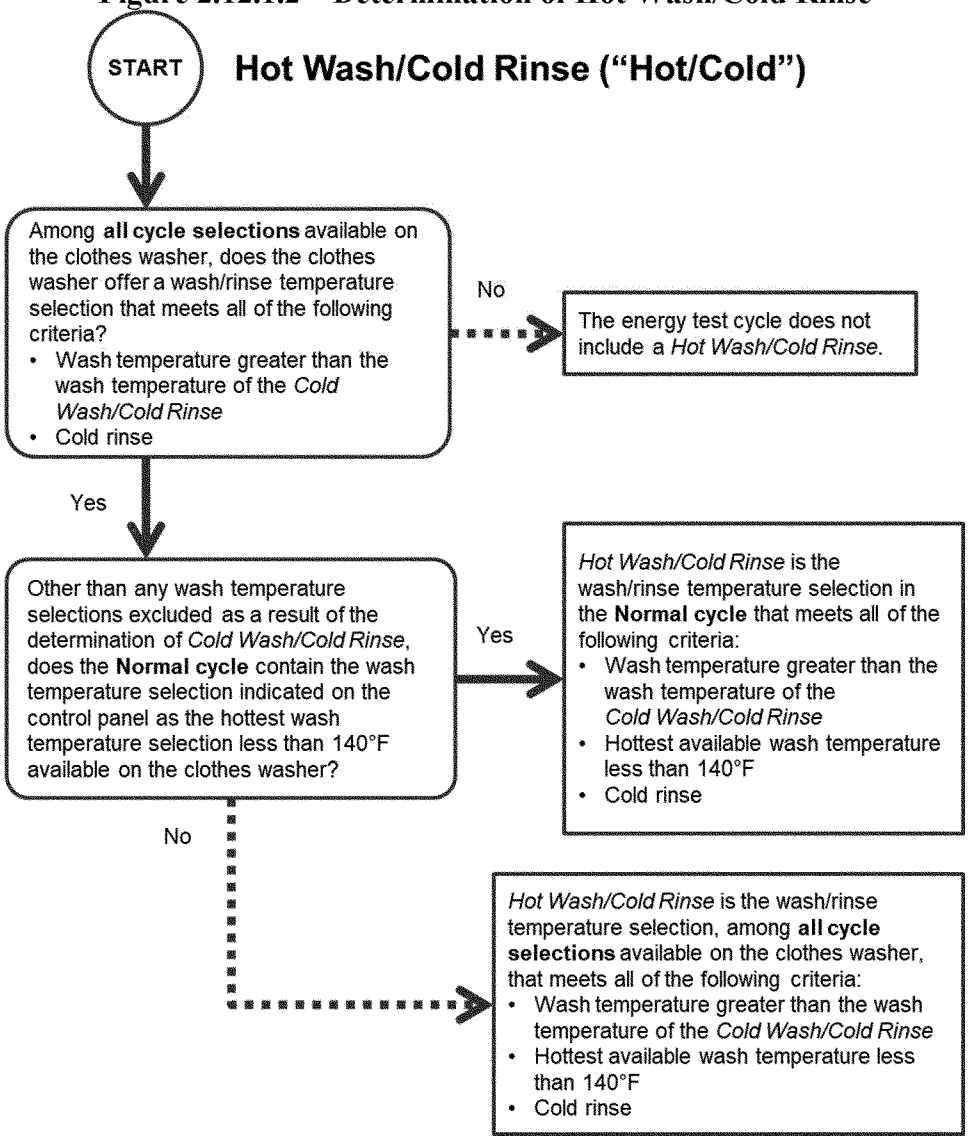


Figure 2.12.1.3—Determination of Warm Wash/Cold Rinse

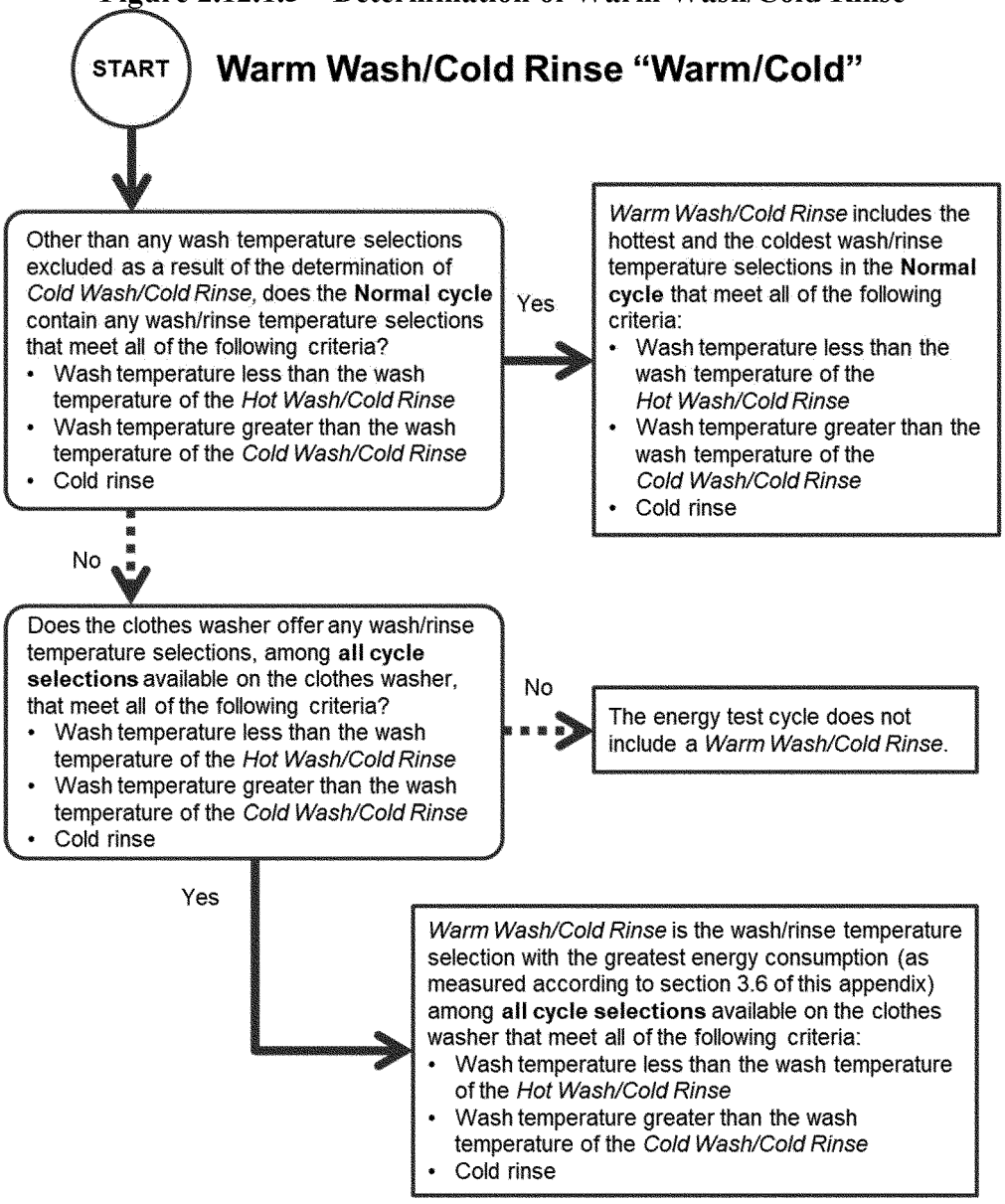


Figure 2.12.1.4—Determination of Warm Wash/Warm Rinse

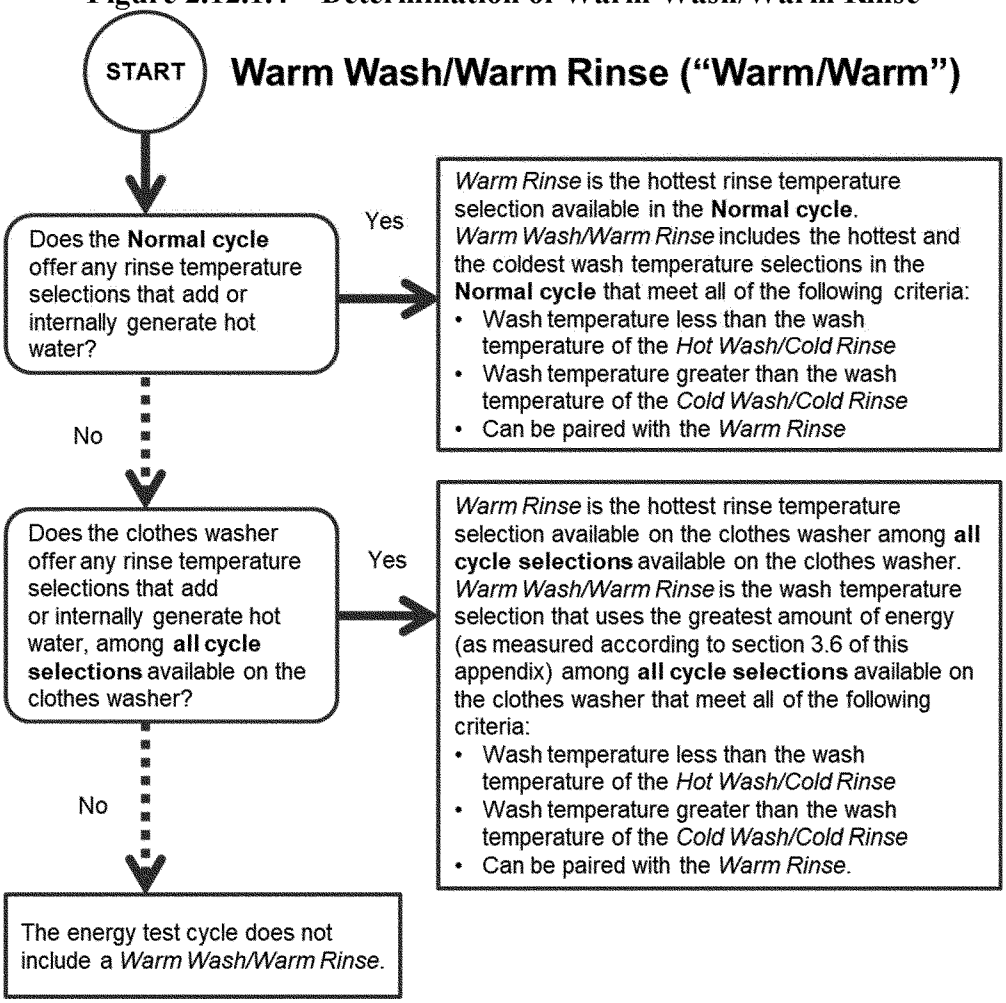
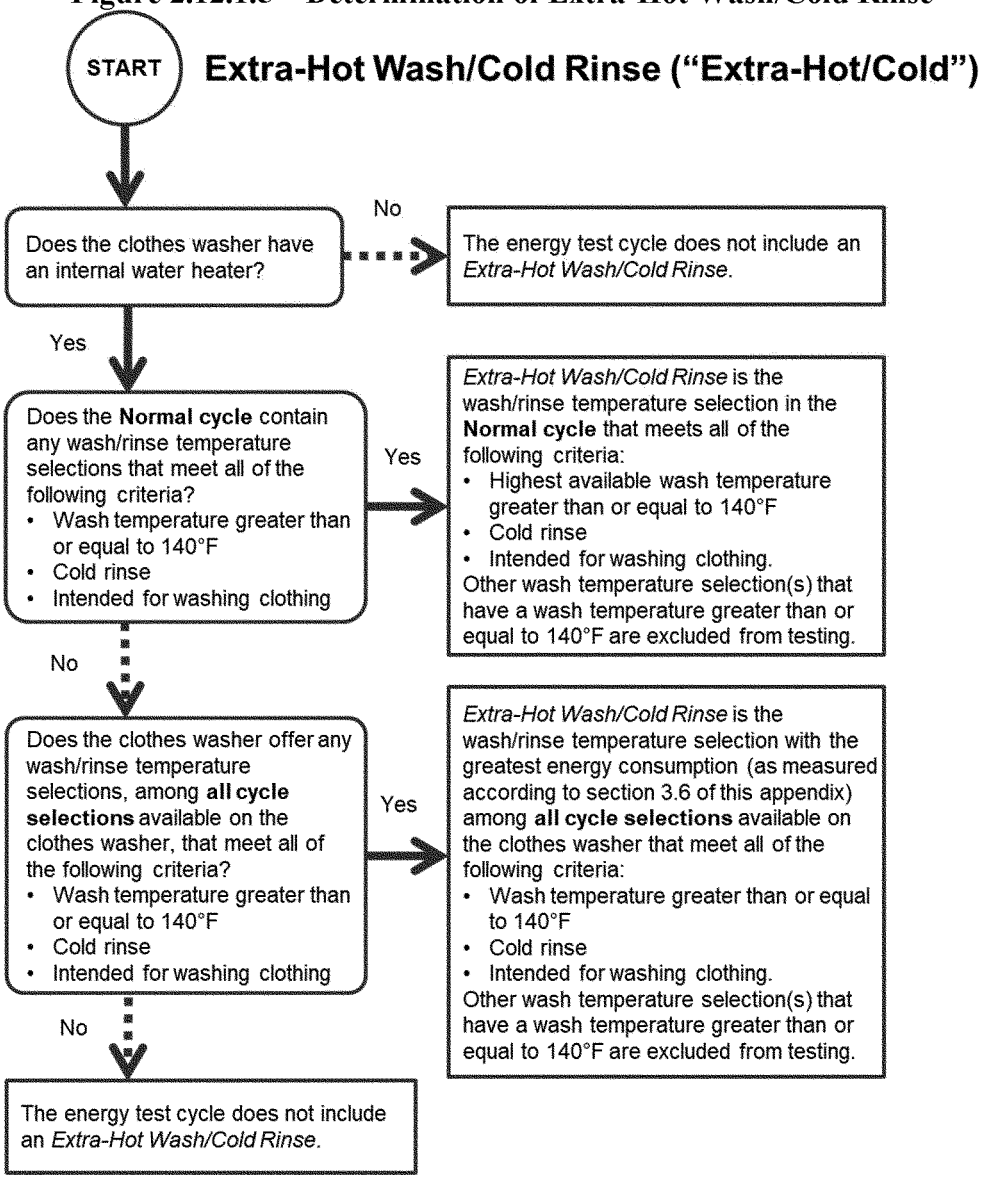


Figure 2.12.1.5—Determination of Extra-Hot Wash/Cold Rinse



2.12.2. *Semi-automatic clothes washers.* The energy test cycle for semi-automatic clothes washers includes only the Cold Wash/Cold Rinse (''Cold'') test cycle. Energy and water use for all other wash/rinse temperature combinations are calculated numerically in section 3.4.2 of this appendix.

3. Test Measurements

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

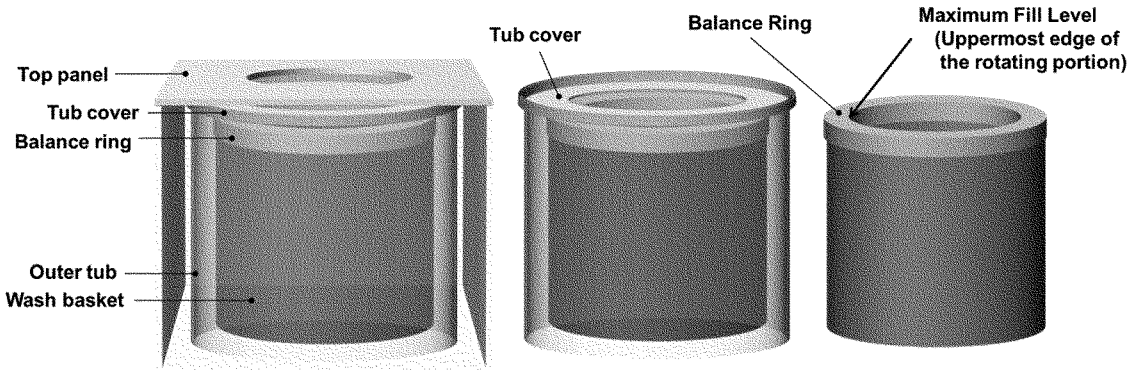
3.1.1 Place the clothes washer in such a position that the uppermost edge of the clothes container opening is leveled horizontally, so that the container will hold the maximum amount of water. For front-loading clothes washers, the door seal and shipping bolts or other forms of bracing hardware to support the wash drum during shipping must remain in place during the capacity measurement. If the design of a front-loading clothes washer does not include shipping bolts or other forms of bracing hardware to support the wash drum during shipping, a laboratory may support the wash drum by other means, including temporary bracing or support beams. Any temporary bracing or support beams must keep the wash drum in a fixed position, relative to the geometry of the door and door seal components, that is representative of the position of the wash drum during normal operation. The method used must avoid damage to the unit that would affect the results of the energy and water testing. For a front-loading clothes washer that does not include shipping bolts or other forms of bracing hardware to support the wash drum during shipping, the laboratory must fully document the alternative method used to support the wash drum during capacity measurement, include such documentation in the final test report, and pursuant to § 429.71 of this chapter, the manufacturer must retain such documentation as part its test records.

3.1.2 Line the inside of the clothes container with a 2 mil thickness (0.051 mm) plastic bag. All clothes washer components that occupy space within the clothes container and that are recommended for use during a wash cycle must be in place and must be lined with a 2 mil thickness (0.051 mm) plastic bag to prevent water from entering any void space.

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

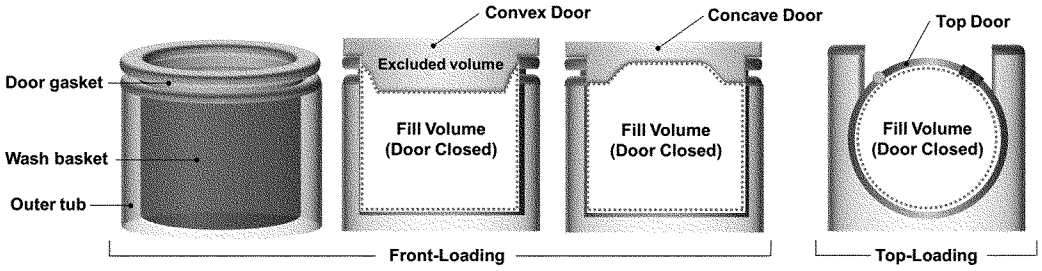
3.1.4 Fill the clothes container manually with either 60 °F ± 5 °F (15.6 °C ± 2.8 °C) or 100 °F ± 10 °F (37.8 °C ± 5.5 °C) water, with the door open. For a top-loading vertical-axis clothes washer, fill the clothes container to the uppermost edge of the rotating portion, including any balance ring. Figure 3.1.4.1 of this appendix illustrates the maximum fill level for top-loading clothes washers.

Figure 3.1.4.1—Maximum Fill Level for the Clothes Container Capacity Measurement of Top-Loading Vertical-Axis Clothes Washers



For a front-loading horizontal-axis clothes washer, fill the clothes container to the highest point of contact between the door and the door gasket. If any portion of the door or gasket would occupy the measured volume space when the door is closed, exclude from the measurement the volume that the door or gasket portion would occupy. For a front-loading horizontal-axis clothes washer with a concave door shape, include any additional volume above the plane defined by the highest point of contact between the door and the door gasket, if that area can be occupied by clothing during washer operation. For a top-loading horizontal-axis clothes washer, include any additional volume above the plane of the door hinge that clothing could occupy during washer operation. Figure 3.1.4.2 of this appendix illustrates the maximum fill volumes for all horizontal-axis clothes washer types.

Figure 3.1.4.2—Maximum Fill Level for the Clothes Container Capacity Measurement of Horizontal-Axis Clothes Washers



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For all clothes washers, exclude any volume that cannot be occupied by the clothing load during operation.

3.1.5 Measure and record the weight of water, W, in pounds.

3.1.6 Calculate the clothes container capacity 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)).

3.1.7 Calculate the clothes container capacity, C, to the nearest 0.01 cubic foot for the purpose of determining test load sizes per Table 5.1 of this appendix and for all subsequent calculations that include the clothes container capacity.

3.2 *Cycle settings.*

3.2.1 *Wash/rinse temperature selection.* For automatic clothes washers, set the wash/rinse temperature selection control to obtain the desired wash/rinse temperature selection within the energy test cycle.

3.2.2 *Wash time setting.*

3.2.2.1 If the cycle under test offers a range of wash time settings, the wash time setting shall be the higher of either the minimum or 70 percent of the maximum wash time available for the wash cycle under test, regardless of the labeling of suggested dial locations. If 70 percent of the maximum wash time is not available on a dial with a discrete number of wash time settings, choose the next-highest setting greater than 70 percent.

3.2.2.2 If the clothes washer is equipped with an electromechanical dial or timer controlling wash time that rotates in both directions, 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 appropriate setting is reached.

3.2.3 *Water fill level settings.*

3.2.3.1 *Clothes washers with manual water fill control system.* For the large test load size, set the water fill level selector to the maximum water fill level setting available for the wash cycle under test. If the water fill level selector has two settings available for the wash cycle under test, for the small test load size, select the minimum water fill level setting available for the wash cycle under test.

If the water fill level selector has more than two settings available for the wash cycle under test, for the small test load size, select the second-lowest water fill level setting.

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

3.2.3.2.1 *Not user-adjustable.* The water level is automatically determined by the water fill control system.

3.2.3.2.2 *User-adjustable.* For the large test load size, set the water fill selector to the setting that uses the most water. For the small test load size, set the water fill selector to the setting that uses the least water.

3.2.3.3 *Clothes washers with automatic water fill control system and alternate manual water fill control system.* If a clothes washer with an automatic water fill control system allows user selection of manual controls as an alternative, test both manual and automatic modes and, for each mode, calculate the energy consumption (HE_T, ME_T, and DE_T) and water consumption (Q_T) values as set forth in section 4 of this appendix. Then, calculate the average of the two values (one from each mode, automatic and manual) for each variable (HE_T, ME_T, DE_T, and Q_T)

and use the average value for each variable in the final calculations in section 4 of this appendix.

3.2.4 *Manufacturer default settings.* For clothes washers with electronic control systems, use the manufacturer default settings for any cycle selections, except for (1) the temperature selection, (2) the wash water fill levels, or (3) network settings. If the clothes washer has network capabilities, the network settings must be disabled throughout testing if such settings can be disabled by the end-user and the product's user manual provides instructions on how to do so. For all other cycle selections, the manufacturer default settings must be used for wash conditions such as agitation/tumble operation, soil level, spin speed, wash times, rinse times, optional rinse settings, water heating time for water heating clothes washers, and all other wash parameters or optional features applicable to that wash cycle. Any optional wash cycle feature or setting (other than wash/rinse temperature, water fill level selection, or network settings on clothes washers with network capabilities) that is activated by default on the wash cycle under test must be included for testing unless the manufacturer instructions recommend not selecting this option, or recommend selecting a different option, for washing normally soiled cotton clothing. For clothes washers with control panels containing mechanical switches or dials, any optional settings, except for the temperature selection or the wash water fill levels, must be in the position recommended by the manufacturer for washing normally soiled cotton clothing. If the manufacturer instructions do not recommend a particular switch or dial position to be used for washing normally soiled cotton clothing, the setting switch or dial must remain in its as-shipped position.

3.2.5 For each wash cycle tested, include the entire active washing mode and exclude any delay start or cycle finished modes.

3.2.6 *Anomalous Test Cycles.* If during a wash cycle the clothes washer: a) signals to the user by means of a visual or audio alert that an out-of-balance condition has been detected; or b) terminates prematurely and thus does not include the agitation/tumble operation, spin speed(s), wash times, and rinse times applicable to the wash cycle under test, discard the test data and repeat the wash cycle. Document in the test report the rejection of data from any wash cycle during testing and the reason for the rejection.

3.3 *Test cycles for automatic clothes washers.* Perform testing on each wash/rinse temperature selection available in the energy test cycle was defined in section 2.12.1 of this appendix. Test each load size as defined in section 2.8 of this appendix with its associated water fill level defined in section 3.2.3 of this appendix. For each test cycle, measure and record the bone-dry weight of the test load before the start of the cycle. Place the test load in the clothes washer and initiate the cycle under test. Measure the values for hot water consumption, cold water consumption, electrical energy consumption, and cycle time for the complete cycle. Record the weight of the test load immediately after completion of the cycle. Table 3.3 of this appendix provides the symbol definitions for each measured value.

TABLE 3.3—SYMBOL DEFINITIONS OF MEASURED VALUES FOR AUTOMATIC CLOTHES WASHER TEST CYCLES

Wash/rinse temperature selection	Load size	Bone-dry weight	Hot water	Cold water	Electrical energy	Cycle time	Cycle complete weight
Extra-hot/cold	Large	WIx_L	Hx_L	Cx_L	Ex_L	Tx_L	WCx_L
	Small	WIx_S	Hx_S	Cx_S	Ex_S	Tx_S	WCx_S
Hot/Cold	Large	WIh_L	Hh_L	Ch_L	Eh_L	Th_L	WCh_L
	Small	WIh_S	Hh_S	Ch_S	Eh_S	Th_S	WCh_S
Warm/Cold *	Large	WIw_L	Hw_L	Cw_L	Ew_L	Tw_L	WCw_L
	Small	WIw_S	Hw_S	Cw_S	Ew_S	Tw_S	WCw_S
Warm/Warm *	Large	$WIww_L$	Hww_L	Cww_L	Eww_L	Tww_L	$WCww_L$
	Small	$WIww_S$	Hww_S	Cww_S	Eww_S	Tww_S	$WCww_S$
Cold/Cold	Large	WIc_L	Hc_L	Cc_L	Ec_L	Tc_L	WCc_L
	Small	WIc_S	Hc_S	Cc_S	Ec_S	Tc_S	WCc_S

* If two cycles are tested to represent the Warm/Cold selection or the Warm/Warm selection, calculate the average of the two tested cycles and use that value for all further calculations.

3.4 *Test cycles for semi-automatic clothes washers.*

3.4.1 *Test Measurements.* Perform testing on each wash/rinse temperature selection available in the energy test cycle as defined in section 2.12.2 of this appendix. Test each load size as defined in section 2.8 of this appendix with the associated water fill level defined in section 3.2.3 of this appendix. For each test cycle, measure and record the bone-dry weight of the test load before the start of the cycle. Place the test load in the clothes washer and initiate the cycle under test. Measure the values for cold water consumption, electrical energy consumption, and cycle time for the complete cycle. Record the weight of the test load immediately after completion of the cycle. Table 3.4.1 of this appendix provides symbol definitions for each measured value for the Cold temperature selection.

TABLE 3.4.1—SYMBOL DEFINITIONS OF MEASURED VALUES FOR SEMI-AUTOMATIC CLOTHES WASHER TEST CYCLES

Temperature selection	Load size	Bone-dry weight	Hot water	Cold water	Electrical energy	Cycle time	Cycle complete weight
Cold	Large	WIc_L	not measured	Cc_L	Ec_L	Tc_L	WCc_L
	Small	WIc_S	not measured	Cc_S	Ec_S	Tc_S	WCc_S

3.4.2 *Calculation of Hot and Warm measured values.* In lieu of testing, the measured values for the Hot and Warm cycles are calculated based on the measured values for the Cold cycle, as defined in section 3.4.1 of this appendix. Table 3.4.2 of this appendix provides the symbol definitions and calculations for each value for the Hot and Warm temperature selections.

TABLE 3.4.2—SYMBOL DEFINITIONS AND CALCULATION OF MEASURED VALUES FOR SEMI-AUTOMATIC CLOTHES WASHER TEST CYCLES

Temperature selection	Load size	Bone-dry weight	Hot water	Cold water	Electrical energy	Cycle time	Cycle complete weight
Hot	Large	$WIh_L = WIc_L$	$Hh_L = Cc_L$		$Eh_L = Ec_L$	$Th_L = Tc_L$	$WCh_L = WCc_L$
	Small	$WIh_S = WIc_S$	$Hh_S = Cc_S$		$Eh_S = Ec_S$	$Th_S = Tc_S$	$WCh_S = WCc_S$
Warm	Large	$WIw_L = WIc_L$	$Hw_L = Cc_L \div 2$	$Cw_L = Cc_L \div 2$	$Ew_L = Ec_L$	$Tw_L = Tc_L$	$WCw_L = WCc_L$
	Small	$WIw_S = WIc_S$	$Hw_S = Cc_S \div 2$	$Cw_S = Cc_S \div 2$	$Ew_S = Ec_S$	$Tw_S = Tc_S$	$WCw_S = WCc_S$

3.5 *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, 2.4, and 2.10.2 of this appendix.

3.5.1 Perform combined low-power mode testing after completion of an active mode wash cycle included as part of the energy test cycle; after removing the test load; without changing the control panel settings used for the active mode wash cycle; with the door closed; and without disconnecting the electrical energy supply to the clothes washer between completion of the active mode wash cycle and the start of combined low-power mode testing.

3.5.2 For a clothes washer that takes some time to automatically enter a stable inactive mode or off mode 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 automatically reach the default inactive/off mode state before proceeding with the test measurement.

3.5.3 Once the stable inactive/off mode state has been reached, measure and record the default inactive/off mode power, $P_{default}$, in watts, following the test procedure for the sampling method specified in Section 5, Paragraph 5.3.2 of IEC 62301.

3.5.4 For a clothes washer with a switch, dial, or button that can be optionally selected by the end user to achieve a lower-power inactive/off mode state than the default inactive/off mode state measured in section 3.5.3 of this appendix, after performing the measurement in section 3.5.3 of this appendix, activate the switch, dial, or button to the position resulting in the lowest power consumption and repeat the measurement procedure described in section 3.5.3 of this appendix. Measure and record the lowest-power inactive/off mode power, P_{lowest}, in Watts.

3.6 *Energy consumption for the purpose of determining the cycle selection(s) to be included in the energy test cycle.* This section is implemented only in cases where the energy test cycle flowcharts in section 2.12.1 of this appendix require the determination of the wash/rinse temperature selection with the highest energy consumption.

3.6.1 For the wash/rinse temperature selection being considered under this section, establish the testing conditions set forth in section 2 of this appendix. Select the applicable cycle selection and wash/rinse temperature selection. For all wash/rinse temperature selections, select the cycle settings as described in section 3.2 of this appendix.

3.6.2 Measure each wash cycle's electrical energy consumption (E_L) and hot water consumption (H_L). Calculate the total energy consumption for each cycle selection (E_{TL}), as follows:

$$E_{TL} = E_L + (H_L \times T \times K)$$

Where:

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

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

T = nominal temperature rise = 65 °F (36.1 °C).

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

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 all load sizes tested.* Calculate the per-cycle temperature-weighted hot water consumption for the large test load size, Vh_L, and the small test load size, Vh_S, expressed in gallons per cycle (or liters per cycle) and defined as:

(a) $Vh_L = [Hx_L \times TUF_x] + [Hh_L \times TUF_h] + [Hw_L \times TUF_w] + [Hww_L \times TUF_{ww}] + [Hc_L \times TUF_c]$

(b) $Vh_S = [Hx_S \times TUF_x] + [Hh_S \times TUF_h] + [Hw_S \times TUF_w] + [Hww_S \times TUF_{ww}] + [Hc_S \times TUF_c]$

Where:

Hx_L, Hh_L, Hw_L, Hww_L, Hc_L, Hx_S, Hh_S, Hw_S, Hww_S, and Hc_S are the hot water consumption values, in gallons per-cycle (or liters per cycle) as measured in section 3.3 of this appendix for automatic clothes washers or section 3.4 of this appendix for semi-automatic clothes washers.

TUF_x, TUF_h, TUF_w, TUF_{ww}, and TUF_c are temperature use factors for Extra-Hot Wash/Cold Rinse, Hot Wash/Cold Rinse, Warm Wash/Cold Rinse, Warm Wash/Warm Rinse, and Cold Wash/Cold Rinse temperature selections, respectively, as defined in Table 4.1.1 of this appendix.

TABLE 4.1.1—TEMPERATURE USE FACTORS

Wash/rinse temperature selections available in the energy test cycle	Clothes washers with cold rinse only					Clothes washers with both cold and warm rinse		
	C/C	H/C C/C	H/C W/C C/C *	XH/C H/C C/C	XH/C H/C W/C C/C	HC/C W/C W/W C/C	XH/C H/C W/W C/C	XH/C H/C W/C W/W C/C
TUFx (Extra-Hot/Cold)				0.14	0.05		0.14	0.05
TUFh (Hot/Cold)		0.63	0.14	** 0.49	0.09	0.14	** 0.22	0.09
TUFw (Warm/Cold)			0.49		0.49	0.22		0.22
TUFww (Warm/Warm)						0.27	0.27	0.27
TUFc (Cold/Cold)	1.00	0.37	0.37	0.37	0.37	0.37	0.37	0.37

* This column applies to all semi-automatic clothes washers.

** On clothes washers with only two wash temperature selections <140 °F, the higher of the two wash temperatures is classified as a Hot Wash/Cold Rinse, in accordance with the wash/rinse temperature definitions within the energy test cycle.

4.1.2 *Total per-cycle hot water energy consumption for all load sizes tested.* Calculate the total per-cycle hot water energy consumption for the large test load size, HE_L, and the small test load size, HE_S, expressed in kilowatt-hours per cycle and defined as:

(a) $HE_L = [Vh_L \times T \times K]$ = Total energy when the large test load is tested.

(b) $HE_S = [Vh_S \times T \times K]$ = Total energy when the small test load is tested.

Where:

Vh_L and Vh_S are defined in section 4.1.1 of this appendix.

T = Temperature rise = 65 °F (36.1 °C).

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

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:

$HE_T = [HE_L \times LUF_L] + [HE_S \times LUF_S]$

Where:

HE_L and HE_S are defined in section 4.1.2 of this appendix.

LUF_L = Load usage factor for the large test load = 0.5.

LUF_S = Load usage factor for the small test load = 0.5.

4.1.4 *Total per-cycle hot water energy consumption using gas-heated or oil-heated water, for product labeling requirements.* 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 load sizes tested.* Calculate the total per-cycle machine electrical energy consumption for the large test load size, ME_L, and the small test load size, ME_S, expressed in kilowatt-hours per cycle and defined as:

(a) $ME_L = [Ex_L \times TUF_x] + [Eh_L \times TUF_h] + [Ew_L \times TUF_w] + [Eww_L \times TUF_{ww}] + [Ec_L \times TUF_c]$

(b) $ME_S = [Ex_S \times TUF_x] + [Eh_S \times TUF_h] + [Ew_S \times TUF_w] + [Eww_S \times TUF_{ww}] + [Ec_S \times TUF_c]$

Where:

Ex_L, Eh_L, Ew_L, Eww_L, Ec_L, Ex_S, Eh_S, Ew_S, Eww_S, and Ec_S are the electrical energy consumption values, in kilowatt-hours per cycle as measured in section 3.3 of this appendix for automatic clothes washers or section 3.4 of this appendix for semi-automatic clothes washers.

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

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

$ME_T = [ME_L \times LUF_L] + [ME_S \times LUF_S]$

Where:

ME_L and ME_S are defined in section 4.1.5 of this appendix.

LUF_L and LUF_S are defined in section 4.1.3 of this appendix.

4.2 *Water consumption of clothes washers.*

4.2.1 *Per cycle total water consumption for each large load size tested.* Calculate the per-cycle total water consumption of the large test load for the Extra-Hot Wash/Cold Rinse cycle, Qx_L, Hot Wash/Cold Rinse cycle, Qh_L, Warm Wash/Cold Rinse cycle, Qw_L, Warm Wash/Warm Rinse cycle, Qww_L, and Cold Wash/Cold Rinse cycle, Qc_L, defined as:

(a) $Qx_L = Hx_L + Cx_L$

(b) $Qh_L = Hh_L + Ch_L$

(c) $Qw_L = Hw_L + Cw_L$

(d) $Qww_L = Hww_L + Cww_L$

(e) $Qc_L = Hc_L + Cc_L$

Where:

Hx_L, Hh_L, Hw_L, Hww_L, Hc_L, Cx_L, Ch_L, Cw_L, Cww_L, and Cc_L are defined in section 3.3 of this appendix for automatic clothes washers or section 3.4 of this appendix for semi-automatic clothes washers.

4.2.2 *Per cycle total water consumption for each small load size tested.* Calculate the per-cycle total water consumption of the small test load for the Extra-Hot Wash/Cold Rinse cycle, Qx_S, Hot Wash/Cold Rinse cycle, Qh_S, Warm Wash/Cold Rinse cycle, Qw_S, Warm Wash/Warm Rinse cycle, Qww_S, and Cold Wash/Cold Rinse cycle, Qc_S, defined as:

(a) $Qx_S = Hx_S + Cx_S$

(b) $Qh_S = Hh_S + Ch_S$

(c) $Qw_S = Hw_S + Cw_S$

(d) $Qww_S = Hww_S + Cww_S$

(e) $Qc_S = Hc_S + Cc_S$

Where:

Hx_S, Hh_S, Hw_S, Hww_S, Hc_S, Cx_S, Ch_S, Cw_S, Cww_S, and Cc_S are defined in section 3.3 of this appendix for automatic clothes washers or section 3.4 of this appendix for semi-automatic clothes washers.

4.2.3 *Per-cycle total water consumption for all load sizes tested.* Calculate the total per-cycle water consumption for the large test load size, Q_L, and the small test load size, Q_S, expressed in gallons per cycle (or liters per cycle) and defined as:

(a) $Q_L = [Qx_L \times TUFx] + [Qh_L \times TUFh] + [Qw_L \times TUFw] + [Qww_L \times TUFww] + [Qc_L \times TUFc]$

(b) $Q_S = [Qx_S \times TUFx] + [Qh_S \times TUFh] + [Qw_S \times TUFw] + [Qww_S \times TUFww] + [Qc_S \times TUFc]$

Where:

Qx_L, Qh_L, Qw_L, Qww_L, and Qc_L are defined in section 4.2.1 of this appendix.

Qx_S, Qh_S, Qw_S, Qww_S, and Qc_S are defined in section 4.2.2 of this appendix.

TUFx, TUFh, TUFw, TUFww, and TUFc are defined in Table 4.1.1 of this appendix.

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

$Q_T = [Q_L \times LUF_L] + [Q_S \times LUF_S]$

Where:

Q_L and Q_S are defined in section 4.2.3 of this appendix.

LUF_L and LUF_S are defined in section 4.1.3 of this appendix.

4.3 *Remaining moisture content (RMC).*

4.3.1 *Per cycle remaining moisture content for each large load size tested.* Calculate the per-cycle remaining moisture content of the large test load for the Extra-Hot Wash/Cold Rinse cycle, $RMCx_L$, Hot Wash/Cold Rinse cycle, $RMCh_L$, Warm Wash/Cold Rinse cycle, $RMCw_L$, Warm Wash/Warm Rinse cycle, $RMCww_L$, and Cold Wash/Cold Rinse cycle, $RMCc_L$, defined as:

(a) $RMCx_L = (WCx_L - WIx_L)/WIx_L$

(b) $RMCh_L = (WCh_L - WIh_L)/WIh_L$

(c) $RMCw_L = (WCw_L - WIw_L)/WIw_L$

(d) $RMCww_L = (WCww_L - WIww_L)/WIww_L$

(e) $RMCc_L = (WCc_L - WIc_L)/WIc_L$

Where:

WCx_L, WCh_L, WCw_L, $WCww_L$, WCc_L, WIx_L, WIh_L, WIw_L, $WIww_L$, and WIc_L are the bone-dry weights and cycle completion weights as measured in section 3.3 of this appendix for automatic clothes washers or section 3.4 of this appendix for semi-automatic clothes washers.

4.3.2 *Per cycle remaining moisture content for each small load size tested.* Calculate the per-cycle remaining moisture content of the small test load for the Extra-Hot Wash/Cold Rinse cycle, $RMCx_S$, Hot Wash/Cold Rinse cycle, $RMCh_S$, Warm Wash/Cold Rinse cycle, $RMCw_S$, Warm Wash/Warm Rinse cycle, $RMCww_S$, and Cold Wash/Cold Rinse cycle, $RMCc_S$, defined as:

(a) $RMCx_S = (WCx_S - WIx_S)/WIx_S$

(b) $RMCh_S = (WCh_S - WIh_S)/WIh_S$

(c) $RMCw_S = (WCw_S - WIw_S)/WIw_S$

(d) $RMCww_S = (WCww_S - WIww_S)/WIww_S$

(e) $RMCc_S = (WCc_S - WIc_S)/WIc_S$

Where:

WCx_S, WCh_S, WCw_S, $WCww_S$, WCc_S, WIx_S, WIh_S, WIw_S, $WIww_S$, and WIc_S are the bone-dry weights and cycle completion weights as measured in section 3.3 of this appendix for automatic clothes washers or section 3.4 of this appendix for semi-automatic clothes washers.

4.3.3 *Per-cycle remaining moisture content for all load sizes tested.* Calculate the per-cycle temperature-weighted remaining moisture content for the large test load size, RMC_L, and the small test load size, RMC_S, defined as:

(a) $RMC_L = [RMCx_L \times TUF_x] + [RMCh_L \times TUF_h] + [RMCw_L \times TUF_w] + [RMCww_L \times TUF_{ww}] + [RMCc_L \times TUF_c]$

(b) $RMC_S = [RMCx_S \times TUF_x] + [RMCh_S \times TUF_h] + [RMCw_S \times TUF_w] + [RMCww_S \times TUF_{ww}] + [RMCc_S \times TUF_c]$

Where:

$RMCx_L$, $RMCh_L$, $RMCw_L$, $RMCww_L$, and $RMCc_L$ are defined in section 4.3.1 of this appendix.

$RMCx_S$, $RMCh_S$, $RMCw_S$, $RMCww_S$, and $RMCc_S$ are defined in section 4.3.2 of this appendix.

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

4.3.4 *Weighted per-cycle remaining moisture content.* Calculate the weighted per-cycle remaining moisture content, RMC_T, defined as:

$RMC_T = [RMC_L \times LUF_L] + [RMC_S \times LUF_S]$

Where:

RMC_L and RMC_S are defined in section 4.3.3 of this appendix.

LUF_L and LUF_S are defined in section 4.1.3 of this appendix.

4.3.5 Apply the RMC correction curve as described in section 9 of appendix J3 to this subpart to calculate the corrected remaining moisture content, RMC_{corr}, expressed as a percentage as follows:

$RMC_{corr} = (A \times RMC_T + B) \times 100\%$

Where:

A and B are the coefficients of the RMC correction curve as defined in section 8.7 of appendix J3 to this subpart.

RMC_T = As defined in section 4.3.4 of this appendix.

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

$DE_T = [(LUF_L \times \text{Large test load weight}) + (LUF_S \times \text{Small test load weight})] \times (RMC_{corr} - 4\%) \times (DEF) \times (DUF)$

Where:

LUF_L and LUF_S are defined in section 4.1.3 of this appendix.

Large and small test load weights are defined in Table 5.1 of this appendix.

RMC_{corr} = As defined in section 4.3.5 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.

4.5 *Cycle time.*

4.5.1 *Per-cycle temperature-weighted cycle time for all load sizes tested.* Calculate the per-cycle temperature-weighted cycle time for the large test load size, T_L, and the small test load size, T_S, expressed in minutes, and defined as:

(a) $T_L = [Tx_L \times TUF_x] + [Th_L \times TUF_h] + [Tw_L \times TUF_w] + [Tww_L \times TUF_{ww}] + [Tc_L \times TUF_c]$

(b) $T_S = [Tx_S \times TUF_x] + [Th_S \times TUF_h] + [Tw_S \times TUF_w] + [Tww_S \times TUF_{ww}] + [Tc_S \times TUF_c]$

Where:

Tx_L, Th_L, Tw_L, Tww_L, Tc_L, Tx_S, Th_S, Tw_S, Tww_S, and Tc_S are the cycle time values, in minutes as measured in section 3.3 of this appendix for automatic clothes washers or section 3.4 of this appendix for semi-automatic clothes washers.

TUF_x, TUF_h, TUF_w, TUF_{ww}, and TUF_c are temperature use factors for Extra-Hot Wash/Cold Rinse, Hot Wash/Cold Rinse, Warm Wash/Cold Rinse, Warm Wash/Warm Rinse, and Cold Wash/Cold Rinse temperature selections, respectively, as defined in Table 4.1.1 of this appendix.

4.5.2 *Total weighted per-cycle cycle time.* Calculate the total weighted per-cycle cycle time, T_T, expressed in minutes, rounded to the nearest minute, and defined as:

$T_T = [T_L \times LUF_L] + [T_S \times LUF_S]$

Where:

T_L and T_S are defined in section 4.5.1 of this appendix.

LUF_L and LUF_S are defined in section 4.1.3 of this appendix.

4.6 *Combined low-power mode energy consumption.*

4.6.1 *Annual hours in default inactive/off mode.* Calculate the annual hours spent in default inactive/off mode, $S_{default}$, expressed in hours and defined as:

$S_{default} = [8{,}760 - (234 \times T_T/60)]/N$

Where:

T_T = As defined in section 4.5.2 of this appendix, in minutes.

N = Number of inactive/off modes, defined as 1 if no optional lowest-power inactive/off mode is available; otherwise 2.

8,760 = Total number of hours in a year.

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

60 = Conversion from minutes to hours.

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

$E_{TLP} = [(P_{default} \times S_{default}) + (P_{lowest} \times S_{lowest})] \times K_p/234$

Where:

$P_{default}$ = Default inactive/off mode power, in watts, as measured in section 3.5.3 of this appendix.

P_{lowest} = Lowest-power inactive/off mode power, in watts, as measured in section 3.5.4 of this appendix for clothes washers with a switch, dial, or button that can be optionally selected by the end user to achieve a lower-power inactive/off mode than the default inactive/off mode; otherwise, $P_{lowest} = 0$.

$S_{default}$ = Annual hours in default inactive/off mode, as calculated in section 4.6.1 of this appendix.

S_{lowest} = Annual hours in lowest-power inactive/off mode, defined as 0 if no optional lowest-power inactive/off mode is available; otherwise equal to $S_{default}$, as calculated in section 4.6.1 of this appendix.

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

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

4.7 *Water efficiency ratio.* Calculate the water efficiency ratio, WER, expressed in pounds per gallon per cycle (or kilograms per liter per cycle), as:

$WER = [(LUF_L \times \text{Large test load weight}) + (LUF_S \times \text{Small test load weight})]/Q_T$

Where:

LUF_L and LUF_S are defined in section 4.1.3 of this appendix.

Large and small test load weights are defined in Table 5.1 of this appendix.

Q_T = As defined in section 4.2.4 of this appendix.

4.8 *Active-mode energy efficiency ratio.* Calculate the active-mode energy efficiency ratio, AEER, expressed in pounds per kilowatt-hour per cycle (or kilograms per kilowatt-hour per cycle) and defined as:

$AEER = [(LUF_L \times \text{Large test load weight}) + (LUF_S \times \text{Small test load weight})]/(ME_T + HE_T + DE_T)$

Where:

LUF_L and LUF_S are defined in section 4.1.3 of this appendix.

Large and small test load weights are defined in Table 5.1 of this appendix.

ME_T = As defined in section 4.1.6 of this appendix.

HE_T = As defined in section 4.1.3 of this appendix.

DE_T = As defined in section 4.4 of this appendix.

4.9 *Energy efficiency ratio.* Calculate the energy efficiency ratio, EER, expressed in pounds per kilowatt-hour per cycle (or kilograms per kilowatt-hour per cycle) and defined as:

$EER = [(LUF_L \times \text{Large test load weight}) + (LUF_S \times \text{Small test load weight})]/(ME_T + HE_T + DE_T + E_{TLP})$

Where:

LUF_L and LUF_S are defined in section 4.1.3 of this appendix.

Large and small test load weights are defined in Table 5.1 of this appendix.

ME_T = As defined in section 4.1.6 of this appendix.

HE_T = As defined in section 4.1.3 of this appendix.

DE_T = As defined in section 4.4 of this appendix.

E_{TLP} = As defined in section 4.6.2 of this appendix.

5. Test Loads

TABLE 5.1—TEST LOAD SIZES

Container volume		Small load		Large load	
cu. ft.	liter	lb	kg	lb	kg
≥<	≥<				
0.00–0.80	0.00–22.7	3.00	1.36	3.00	1.36
0.80–0.90	22.7–25.5	3.10	1.41	3.35	1.52
0.90–1.00	25.5–28.3	3.20	1.45	3.70	1.68
1.00–1.10	28.3–31.1	3.30	1.50	4.00	1.81
1.10–1.20	31.1–34.0	3.40	1.54	4.30	1.95
1.20–1.30	34.0–36.8	3.45	1.56	4.60	2.09
1.30–1.40	36.8–39.6	3.55	1.61	4.95	2.25
1.40–1.50	39.6–42.5	3.65	1.66	5.25	2.38

TABLE 5.1—TEST LOAD SIZES—Continued

Container volume		Small load		Large load	
cu. ft.	liter	lb	kg	lb	kg
≥<	≥<				
1.50–1.60	42.5–45.3	3.75	1.70	5.55	2.52
1.60–1.70	45.3–48.1	3.80	1.72	5.85	2.65
1.70–1.80	48.1–51.0	3.90	1.77	6.20	2.81
1.80–1.90	51.0–53.8	4.00	1.81	6.50	2.95
1.90–2.00	53.8–56.6	4.10	1.86	6.80	3.08
2.00–2.10	56.6–59.5	4.20	1.91	7.10	3.22
2.10–2.20	59.5–62.3	4.30	1.95	7.45	3.38
2.20–2.30	62.3–65.1	4.35	1.97	7.75	3.52
2.30–2.40	65.1–68.0	4.45	2.02	8.05	3.65
2.40–2.50	68.0–70.8	4.55	2.06	8.35	3.79
2.50–2.60	70.8–73.6	4.65	2.11	8.70	3.95
2.60–2.70	73.6–76.5	4.70	2.13	9.00	4.08
2.70–2.80	76.5–79.3	4.80	2.18	9.30	4.22
2.80–2.90	79.3–82.1	4.90	2.22	9.60	4.35
2.90–3.00	82.1–85.0	5.00	2.27	9.90	4.49
3.00–3.10	85.0–87.8	5.10	2.31	10.25	4.65
3.10–3.20	87.8–90.6	5.20	2.36	10.55	4.79
3.20–3.30	90.6–93.4	5.25	2.38	10.85	4.92
3.30–3.40	93.4–96.3	5.35	2.43	11.15	5.06
3.40–3.50	96.3–99.1	5.45	2.47	11.50	5.22
3.50–3.60	99.1–101.9	5.55	2.52	11.80	5.35
3.60–3.70	101.9–104.8	5.65	2.56	12.10	5.49
3.70–3.80	104.8–107.6	5.70	2.59	12.40	5.62
3.80–3.90	107.6–110.4	5.80	2.63	12.75	5.78
3.90–4.00	110.4–113.3	5.90	2.68	13.05	5.92
4.00–4.10	113.3–116.1	6.00	2.72	13.35	6.06
4.10–4.20	116.1–118.9	6.10	2.77	13.65	6.19
4.20–4.30	118.9–121.8	6.15	2.79	14.00	6.35
4.30–4.40	121.8–124.6	6.25	2.83	14.30	6.49
4.40–4.50	124.6–127.4	6.35	2.88	14.60	6.62
4.50–4.60	127.4–130.3	6.45	2.93	14.90	6.76
4.60–4.70	130.3–133.1	6.55	2.97	15.25	6.92
4.70–4.80	133.1–135.9	6.60	2.99	15.55	7.05
4.80–4.90	135.9–138.8	6.70	3.04	15.85	7.19
4.90–5.00	138.8–141.6	6.80	3.08	16.15	7.33
5.00–5.10	141.6–144.4	6.90	3.13	16.50	7.48
5.10–5.20	144.4–147.2	7.00	3.18	16.80	7.62
5.20–5.30	147.2–150.1	7.05	3.20	17.10	7.76
5.30–5.40	150.1–152.9	7.15	3.24	17.40	7.89
5.40–5.50	152.9–155.7	7.25	3.29	17.70	8.03
5.50–5.60	155.7–158.6	7.35	3.33	18.05	8.19
5.60–5.70	158.6–161.4	7.45	3.38	18.35	8.32
5.70–5.80	161.4–164.2	7.50	3.40	18.65	8.46
5.80–5.90	164.2–167.1	7.60	3.45	18.95	8.60
5.90–6.00	167.1–169.9	7.70	3.49	19.30	8.75
6.00–6.10	169.9–172.7	7.80	3.54	19.60	8.89
6.10–6.20	172.7–175.6	7.90	3.58	19.90	9.03
6.20–6.30	175.6–178.4	7.95	3.61	20.20	9.16
6.30–6.40	178.4–181.2	8.05	3.65	20.55	9.32
6.40–6.50	181.2–184.1	8.15	3.70	20.85	9.46
6.50–6.60	184.1–186.9	8.25	3.74	21.15	9.59
6.60–6.70	186.9–189.7	8.30	3.76	21.45	9.73
6.70–6.80	189.7–192.6	8.40	3.81	21.80	9.89
6.80–6.90	192.6–195.4	8.50	3.86	22.10	10.02
6.90–7.00	195.4–198.2	8.60	3.90	22.40	10.16
7.00–7.10	198.2–201.0	8.70	3.95	22.70	10.30
7.10–7.20	201.0–203.9	8.80	3.99	23.05	10.46
7.20–7.30	203.9–206.7	8.85	4.01	23.35	10.59
7.30–7.40	206.7–209.5	8.95	4.06	23.65	10.73
7.40–7.50	209.5–212.4	9.05	4.11	23.95	10.86
7.50–7.60	212.4–215.2	9.15	4.15	24.30	11.02
7.60–7.70	215.2–218.0	9.25	4.20	24.60	11.16
7.70–7.80	218.0–220.9	9.30	4.22	24.90	11.29
7.80–7.90	220.9–223.7	9.40	4.26	25.20	11.43
7.90–8.00	223.7–226.5	9.50	4.31	25.50	11.57

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

Appendix J1 [Removed and Reserved]

■ 9. Remove and reserved Appendix J1 to subpart B of part 430.

■ 10. Appendix J2 to subpart B of part 430 is amended by:

■ a. Revising the introductory note and section 1;

■ b. Revising the heading for section 2;

■ c. Revising section 2.2;

■ d. Adding section 2.5.4.1 and 2.5.4.2;

■ e. Revising sections 2.5.5, 2.7 and 2.12;

■ f. Removing sections 2.7.1, 2.7.2, 2.7.3, 2.7.4, 2.7.4.1, 2.7.4.2, 2.7.4.3, 2.7.4.4, 2.7.4.5, 2.7.4.6, 2.7.4.6.1, 2.7.4.6.2, 2.7.4.7, and 2.7.5;

■ g. Removing ''energy stuffer clothes'' and adding in its place, ''energy stuffer cloths'' in section 2.8;

■ h. Removing ''Siszes'' and adding in its place, ''Sizes'' in the title of Table 2.8;

■ i. Revising section 3.2.5;

■ j. Adding sections 3.2.5.1 and 3.2.5.2;

■ k. Revising sections 3.2.6.2.2, 3.2.7 and 3.2.9;

■ l. Revising sections 3.3 and 3.6;

■ m. Removing ''section 7 of appendix J3'' and adding in its place, ''section 9 of appendix J3'', and removing ''section 6.1 of appendix J3'' and adding in its place, ''section 8.7 of appendix J3'' in sections 3.8.2.6, 3.8.3.2, and 3.8.3.4;

■ n. Removing section 4.2.12;

■ o. Redesignating section 4.2.13 as 4.2.12;

■ p. Revising Table 5.1; and

■ q. Removing section 6.

The additions and revisions 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

Note: Manufacturers must use the results of testing under Appendix J2 to determine compliance with the relevant standards for clothes washers from § 430.32(g)(4) and from § 431.156(b) as they appeared in January 1, 2021 edition of 10 CFR parts 200–499. Specifically, before [*Date 180 days following publication of the final rule*] representations must be based upon results generated either under Appendix J2 as codified on [*Date 30 days following publication of the final rule*] or under Appendix J2 as it appeared in the 10 CFR parts 200–499 edition revised as of January 1, 2021. Any representations made on or after [*Date 180 days following publication of the final rule*] but before the compliance date of any amended standards for clothes washers must be made based upon results generated using Appendix J2 as codified on [*Date 30 days following publication of the final rule*]. Manufacturers must use the results of testing under Appendix J to determine compliance with any amended standards for clothes washers provided in 10 CFR 430.32(g) and in § 431.156 that are published after January 1, 2021. Any representations related to energy or water consumption of residential or commercial clothes washers must be made in accordance with the appropriate appendix that applies (*i.e.,* Appendix J or Appendix J2) when determining compliance with the relevant standard. Manufacturers may also use Appendix J to certify compliance with any amended standards prior to the applicable compliance date for those standards.

1. Definitions

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 and cycle finished modes.

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.

Adaptive water fill control system means a clothes washer automatic water fill control system that is capable of automatically adjusting the water fill level based on the size or weight of the clothes load placed in the clothes container.

Automatic water fill control system means a clothes washer water fill control system that does not allow or require the user to determine or select the water fill level, and includes adaptive water fill control systems and fixed water fill control systems.

Bone-dry means a condition of a load of test cloth that 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.

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

Cold rinse means the coldest rinse temperature available on the machine, as indicated to the user on the clothes washer control panel.

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

Cycle finished mode means an active mode that provides continuous status display, intermittent tumbling, or air circulation following operation in active washing mode.

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

Energy test cycle means the complete set of wash/rinse temperature selections required for testing, as determined according to section 2.12 of this appendix.

Fixed water fill control system means a clothes washer automatic water fill control system that automatically terminates the fill when the water reaches a pre-defined level that is not based on the size or weight of the clothes load placed in the clothes container, without allowing or requiring the user to determine or select the water fill level.

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).

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.

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; and

(d) The combined low-power mode energy consumption.

Integrated water factor means the quotient of the total weighted per-cycle water consumption for all wash cycles in gallons divided by the cubic foot (or liter) capacity of the clothes washer.

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

Lot means a quantity of cloth that has been manufactured with the same batches of cotton and polyester during one continuous process.

Manual water fill control system means a clothes washer water fill control system that requires the user to determine or select the water fill level.

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.

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

Normal cycle means the cycle recommended by the manufacturer (considering manufacturer instructions, control panel labeling, and other markings on the clothes washer) for normal, regular, or typical use for washing up to a full load of normally-soiled cotton clothing. For machines where multiple cycle settings are recommended by the manufacturer for normal, regular, or typical use for washing up to a full load of normally-soiled cotton clothing, then the Normal cycle is the cycle selection that results in the lowest IMEF or MEF value.

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.

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

(a) Facilitating 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.

(c) 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.

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.

User-adjustable automatic water fill control system means an automatic clothes washer fill control system that allows the user to adjust the amount of water that the machine provides, which is based on the size or weight of the clothes load placed in the clothes container.

Wash time means the wash portion of the cycle, which begins when the cycle is initiated and includes the agitation or tumble time, which may be periodic or continuous during the wash portion of the cycle.

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

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 and Instrumentation

* * * * *

2.2 *Supply water.* Maintain the temperature of the hot water supply at the water inlets between 130 °F (54.4 °C) and 135 °F (57.2 °C). Maintain the temperature of the cold water supply at the water inlets between 55 °F (12.8 °C) and 60 °F (15.6 °C).

* * * * *

2.5.4 * * *

2.5.4.1 Non-reversible temperature indicator labels, adhered to the inside of the clothes container, may be used to confirm that an extra-hot wash temperature greater than 135 °F has been achieved during the wash cycle, under the following conditions. The label must remain waterproof, intact, and adhered to the wash drum throughout an entire wash cycle; provide consistent maximum temperature readings; and provide repeatable temperature indications sufficient to demonstrate that a wash temperature of greater than 135 °F has been achieved. The label must have been verified to consistently indicate temperature measurements with an accuracy of ±1 °F if the label provides a temperature indicator at 135 °F. If the label does not provide a temperature indicator at 135 °F, the label must have been verified to consistently indicate temperature measurements with an accuracy of ±1 °F if the next-highest temperature indicator is greater than 135 °F and less than 140 °F, or ±3 °F if the next-highest temperature indicator is 140 °F or greater. If the label does not provide a temperature indicator at 135 °F, failure to activate the next-highest temperature indicator does not necessarily indicate the lack of an extra-hot wash temperature. However, such a result would not be conclusive due to the lack of verification of the water temperature requirement, in which case an alternative method must be used to confirm that an extra-hot wash temperature greater than 135 °F has been achieved during the wash cycle. If using a temperature indicator label to test a front-loading clothes washer, adhere the label along the interior surface of the clothes container drum, midway between the front and the back of the drum, adjacent to one of the baffles. If using a temperature indicator label to test a top-loading clothes washer, adhere the label along the interior surface of the clothes container drum, on the vertical portion of the sidewall, as close to the bottom of the container as possible.

2.5.4.2 Submersible temperature loggers placed inside the wash drum may be used to confirm that an extra-hot wash temperature greater than 135 °F has been achieved during the wash cycle, under the following conditions. The submersible temperature logger must have a time resolution of at least 1 data point every 5 seconds and a temperature measurement accuracy of ±1 °F. Due to the potential for a waterproof capsule to provide a thermal insulating effect, failure to measure a temperature of 135 °F does not necessarily indicate the lack of an extra-hot wash temperature. However, such a result would not be conclusive due to the lack of verification of the water temperature requirement, in which case an alternative method must be used to confirm that an extra-hot wash temperature greater than 135 °F has been achieved during the wash cycle.

2.5.5 *Water meter.* A water meter must be installed in both the hot and cold water lines to measure water flow and/or water consumption. The water meters must 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. If the volume of hot water for any individual cycle within the energy test cycle is less than 0.1 gallons (0.4 liters), the hot water meter must have a resolution no larger than 0.01 gallons (0.04 liters).

* * * * *

2.7 *Test cloths.* The test cloth material and dimensions must conform to the specifications in appendix J3 to this subpart. The energy test cloth and the energy stuffer cloths must be clean and must not be used for more than 60 test runs (after preconditioning as specified in section 5 of appendix J3 to this subpart). All energy test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material must not be used for testing a clothes washer. The moisture absorption and retention must be evaluated for each new lot of test cloth using the standard extractor Remaining Moisture Content (RMC) procedure specified in appendix J3 to this subpart.

* * * * *

2.12 *Determining the energy test cycle.* To determine the energy test cycle, evaluate the wash/rinse temperature selection flowcharts in the order in which they are presented in this section. Except for Cold Wash/Cold Rinse, use the maximum load size to evaluate each flowchart. The determination of the energy test cycle must take into consideration all cycle settings available to the end user, including any cycle selections or cycle modifications provided by the manufacturer via software or firmware updates to the product, for the basic model under test. The energy test cycle does not include any cycle that is recommended by the manufacturer exclusively for cleaning, deodorizing, or sanitizing the clothes washer.

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Figure 2.12.1—Determination of Cold Wash/Cold Rinse

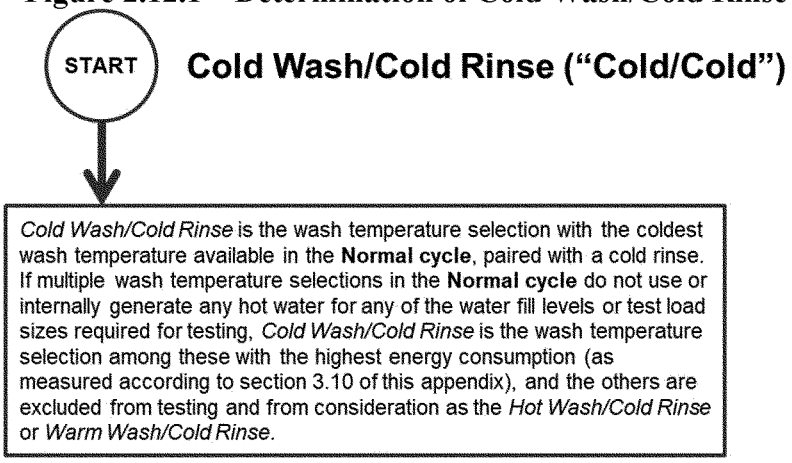


Figure 2.12.2—Determination of Hot Wash/Cold Rinse

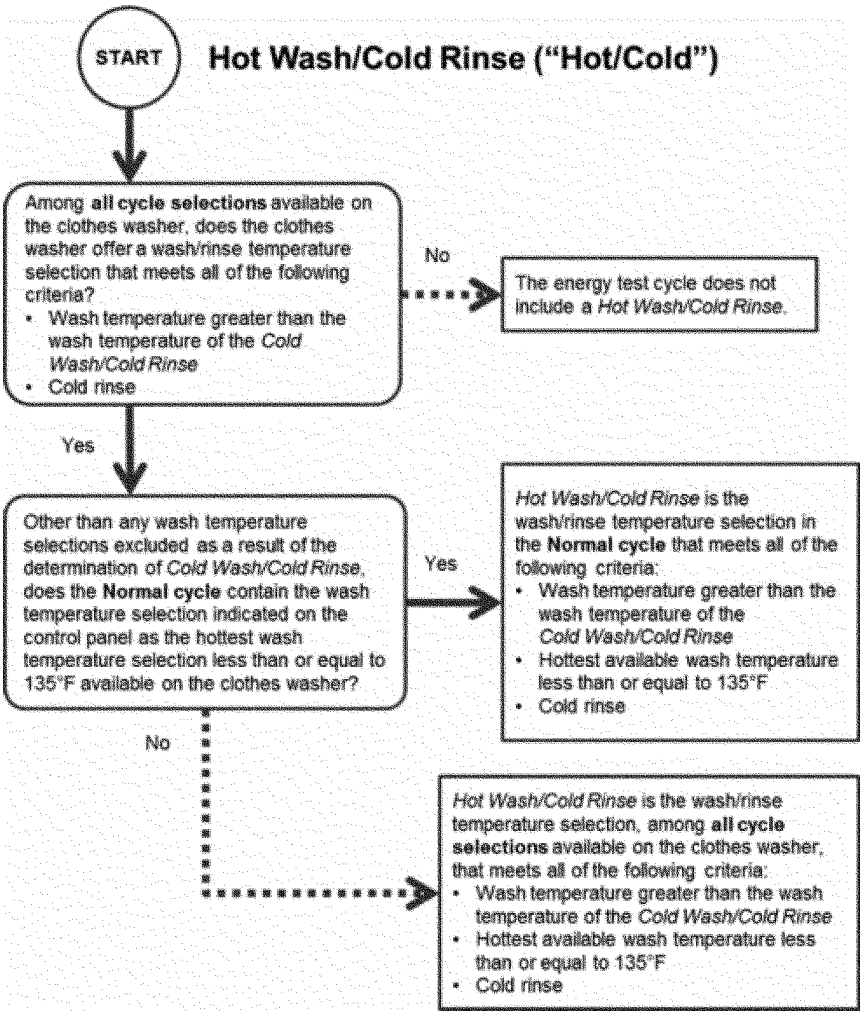


Figure 2.12.3—Determination of Warm Wash/Cold Rinse

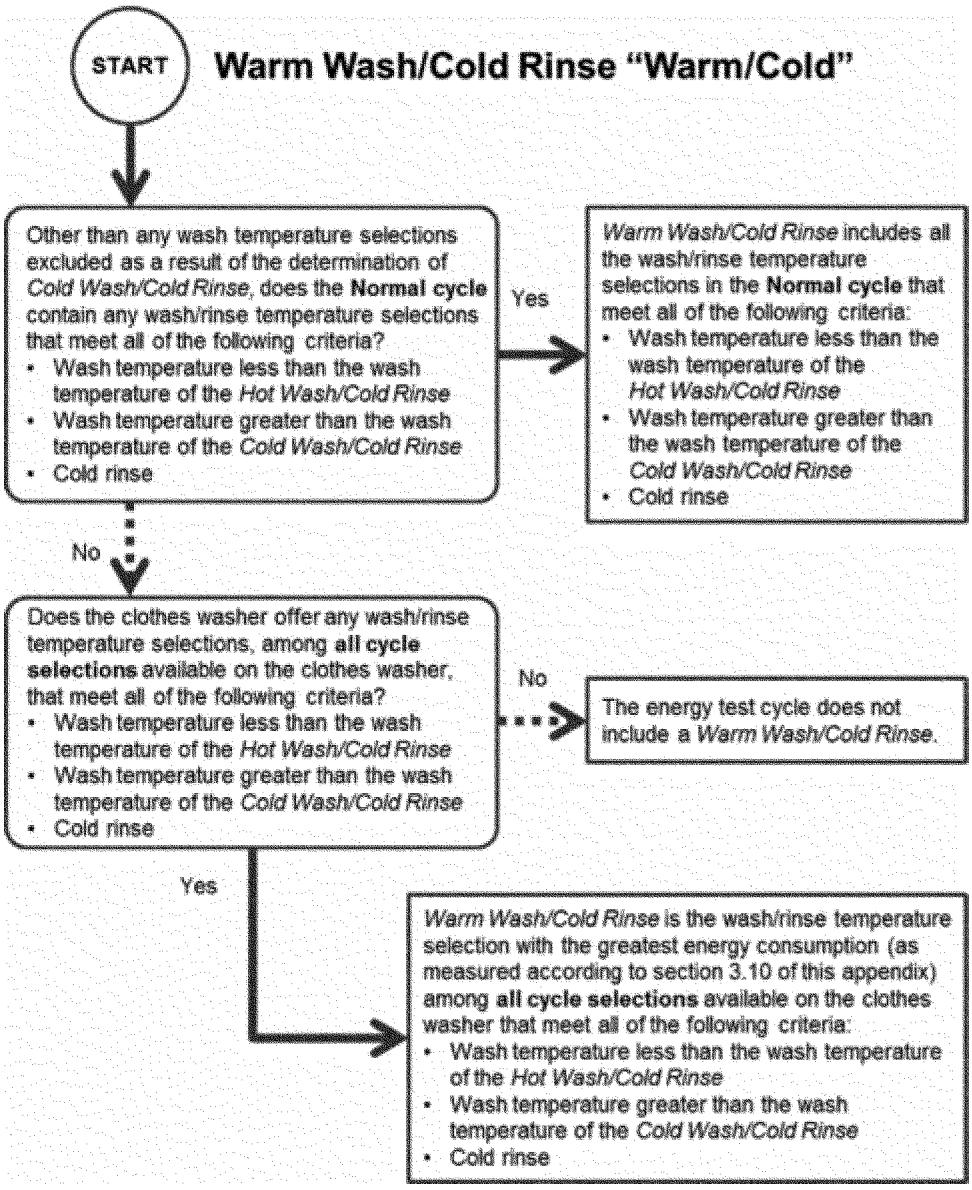


Figure 2.12.4—Determination of Warm Wash/Warm Rinse

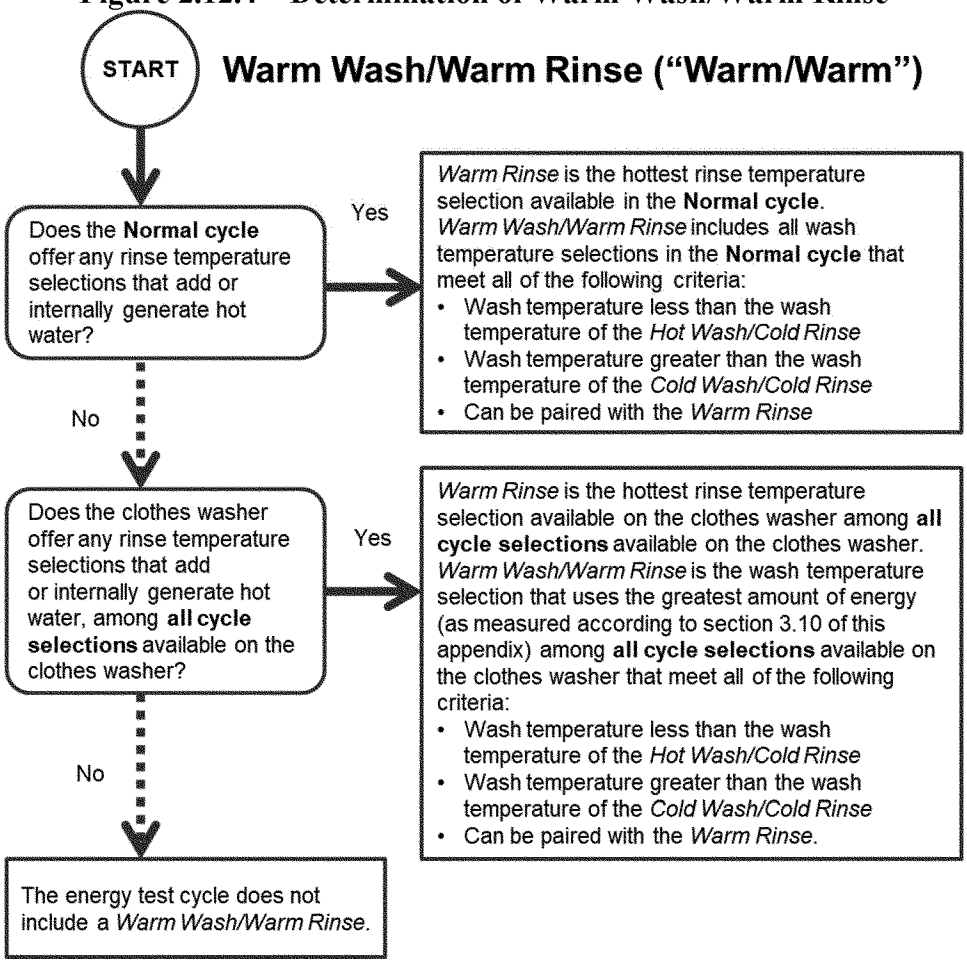
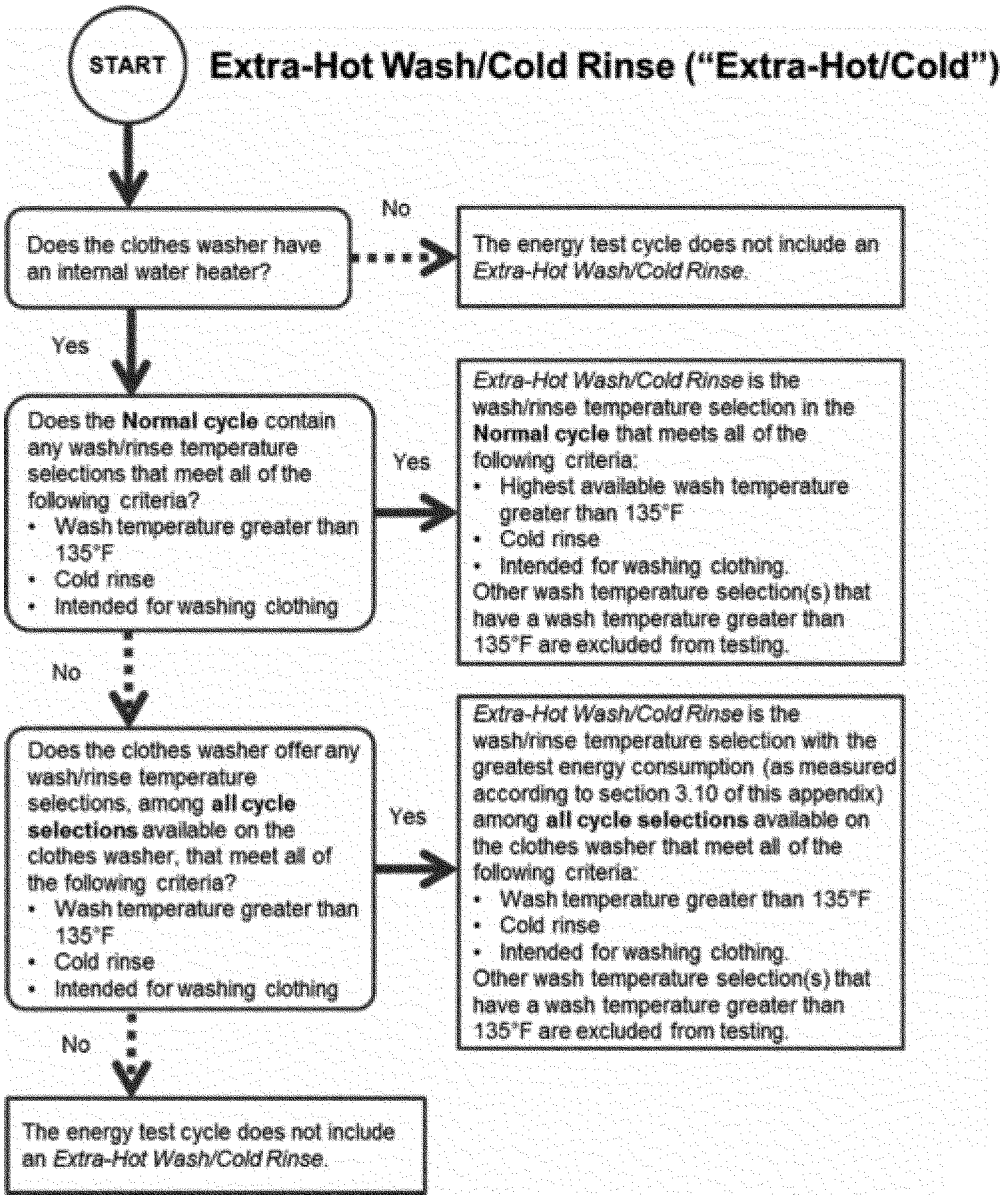


Figure 2.12.5—Determination of Extra-Hot Wash/Cold Rinse



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3. Test Measurements

* * * * *

3.2.5 *Wash time setting.*

3.2.5.1 If the cycle under test offers a range of wash time settings, the wash time setting shall be the higher of either the minimum or 70 percent of the maximum wash time available for the wash cycle under test, regardless of the labeling of suggested dial locations. If 70 percent of the maximum wash time is not available on a dial with a discrete number of wash time settings, choose the next-highest setting greater than 70 percent.

3.2.5.2 If the clothes washer is equipped with an electromechanical dial or timer controlling wash time that rotates in both directions, 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 appropriate setting is reached.

* * * * *

3.2.6 * * *

* * * * *

3.2.6.2.2 *User-adjustable.* Conduct four tests on clothes washers with user-adjustable automatic water fill controls. Conduct the first test using the maximum test load and with the automatic water fill control system set in the setting that uses the most water. Conduct the second test using the minimum test load and with the automatic water fill control system set in the setting that uses the least water. Conduct the third test using the average test load and with the automatic water fill control system set in the setting that uses the most water. Conduct the fourth test using the average test load and with the automatic water fill control system set in the setting that uses the least water. Average the results of the third and fourth tests to obtain the energy and water consumption values for the average test load size.

* * * * *

3.2.7 *Manufacturer default settings.* For clothes washers with electronic control systems, use the manufacturer default settings for any cycle selections, except for (1) the temperature selection, (2) the wash water fill levels, (3) if necessary, the spin speeds on wash cycles used to determine remaining moisture content, or (4) network settings. If the clothes washer has network capabilities, the network settings must be disabled throughout testing if such settings can be disabled by the end-user and the product's user manual provides instructions on how to do so. For all other cycle selections, the manufacturer default settings must be used for wash conditions such as agitation/tumble operation, soil level, spin

speed on wash cycles used to determine energy and water consumption, wash times, rinse times, optional rinse settings, water heating time for water heating clothes washers, and all other wash parameters or optional features applicable to that wash cycle. Any optional wash cycle feature or setting (other than wash/rinse temperature, water fill level selection, spin speed on wash cycles used to determine remaining moisture content, or network settings on clothes washers with network capabilities) that is activated by default on the wash cycle under test must be included for testing unless the manufacturer instructions recommend not selecting this option, or recommend selecting a different option, for washing normally soiled cotton clothing. For clothes washers with control panels containing mechanical switches or dials, any optional settings, except for (1) the temperature selection, (2) the wash water fill levels, or (3) if necessary, the spin speeds on wash cycles used to determine remaining moisture content, must be in the position recommended by the manufacturer for washing normally soiled cotton clothing. If the manufacturer instructions do not recommend a particular switch or dial position to be used for washing normally soiled cotton clothing, the setting switch or dial must remain in its as-shipped position.

* * * * *

3.2.9 *Anomalous Test Cycles.*

If during a wash cycle the clothes washer: (a) Signals to the user by means of a visual or audio alert that an out-of-balance condition has been detected; or (b) terminates prematurely and thus does not include the agitation/tumble operation, spin speed(s), wash times, and rinse times applicable to the wash cycle under test, discard the test data and repeat the wash cycle. Document in the test report the rejection of data from any wash cycle during testing and the reason for the rejection.

3.3 *Extra-Hot Wash/Cold Rinse.* Measure the water and electrical energy consumption for each water fill level and test load size as specified in sections 3.3.1 through 3.3.3 of this appendix for the Extra-Hot Wash/Cold Rinse as defined within the energy test cycle.

* * * * *

3.6 *Warm Wash/Warm Rinse.* Measure the water and electrical energy consumption for each water fill level and/or test load size as specified in sections 3.6.1 through 3.6.3 of this appendix for the applicable Warm Wash/Warm Rinse temperature selection(s), as defined within the energy test cycle. For a clothes washer with fewer than four discrete Warm Wash/Warm Rinse temperature selections, test all Warm Wash/Warm Rinse selections. For a clothes washer that offers four or more Warm Wash/Warm Rinse 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. For each reportable value to be used for the Warm Wash/Warm Rinse temperature selection, calculate the average of all Warm Wash/Warm Rinse temperature selections tested pursuant to this section.

* * * * *

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
≥<	≥<						
0.00–0.80	0.00–22.7	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
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

TABLE 5.1—TEST LOAD SIZES—Continued

Container volume		Minimum load		Maximum load		Average load	
cu. ft.	liter	lb	kg	lb	kg	lb	kg
≥<	≥<						
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
6.00–6.10	169.9–172.7	3.00	1.36	24.80	11.25	13.90	6.30
6.10–6.20	172.7–175.6	3.00	1.36	25.20	11.43	14.10	6.40
6.20–6.30	175.6–178.4	3.00	1.36	25.60	11.61	14.30	6.49
6.30–6.40	178.4–181.2	3.00	1.36	26.00	11.79	14.50	6.58
6.40–6.50	181.2–184.1	3.00	1.36	26.40	11.97	14.70	6.67
6.50–6.60	184.1–186.9	3.00	1.36	26.90	12.20	14.95	6.78
6.60–6.70	186.9–189.7	3.00	1.36	27.30	12.38	15.15	6.87
6.70–6.80	189.7–192.6	3.00	1.36	27.70	12.56	15.35	6.96
6.80–6.90	192.6–195.4	3.00	1.36	28.10	12.75	15.55	7.05
6.90–7.00	195.4–198.2	3.00	1.36	28.50	12.93	15.75	7.14
7.00–7.10	198.2–201.0	3.00	1.36	28.90	13.11	15.95	7.23
7.10–7.20	201.0–203.9	3.00	1.36	29.30	13.29	16.15	7.33
7.20–7.30	203.9–206.7	3.00	1.36	29.70	13.47	16.35	7.42
7.30–7.40	206.7–209.5	3.00	1.36	30.10	13.65	16.55	7.51
7.40–7.50	209.5–212.4	3.00	1.36	30.50	13.83	16.75	7.60
7.50–7.60	212.4–215.2	3.00	1.36	31.00	14.06	17.00	7.71
7.60–7.70	215.2–218.0	3.00	1.36	31.40	14.24	17.20	7.80
7.70–7.80	218.0–220.9	3.00	1.36	31.80	14.42	17.40	7.89
7.80–7.90	220.9–223.7	3.00	1.36	32.20	14.61	17.60	7.98
7.90–8.00	223.7–226.5	3.00	1.36	32.60	14.79	17.80	8.07

■ 11. Appendix J3 to subpart B of part 430 is revised to read as follows:

Appendix J3 to Subpart B of Part 430—Energy Test Cloth Specifications and Procedures for Determining Correction Coefficients of New Energy Test Cloth Lots

Note: DOE maintains an historical record of the standard extractor test data and final correction curve coefficients for each approved lot of energy test cloth. These can be accessed through DOE's web page for standards and test procedures for residential clothes washers at DOE's Building Technologies Office Appliance and Equipment Standards website.

1. Objective

This appendix includes the following: (1) Specifications for the energy test cloth to be used for testing clothes washers; (2) procedures for verifying that new lots of energy test cloth meet the defined material specifications; and (3) procedures for developing a set of correction coefficients that correlate the measured remaining moisture content (RMC) values of each new test cloth lot with a set of standard RMC values established as an historical reference point. These correction coefficients are applied to the RMC measurements performed during testing according to appendix J or appendix J2 to this subpart, ensuring that the final corrected RMC measurement for a clothes washer remains independent of the test cloth lot used for testing.

2. Definitions

AHAM means the Association of Home Appliance Manufacturers.

Bone-dry means a condition of a load of test cloth that 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.

Lot means a quantity of cloth that has been manufactured with the same batches of cotton and polyester during one continuous process.

Roll means a subset of a lot.

3. Energy Test Cloth Specifications

The energy test cloths and energy stuffer cloths must meet the following specifications:

3.1 The test cloth 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 the test cloth material meets the specifications listed in sections 3.2 through 3.6 of this appendix.

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

3.3 *Fabric weight.* 5.60 ± 0.25 ounces per square yard (190.0 ± 8.4 g/m^2).

3.4 *Thread count.* 65 × 57 per inch (warp × fill), ±2 percent.

3.5 *Fiber content of warp and filling yarn.* 50 percent ± 4 percent cotton, with the balance being polyester, open end spun, 15/1 ± 5 percent cotton count blended yarn.

3.6 Water repellent finishes, such as fluoropolymer stain resistant finishes, must not be applied to the test cloth.

3.7. *Test cloth dimensions.*

3.7.1 *Energy test cloth.* The energy test cloth must be made from energy test cloth material, as specified in section 3.1 of this appendix, that is 24 ± ½ inches by 36 ± ½ inches (61.0 ± 1.3 cm by 91.4 ± 1.3 cm) and has been hemmed to 22 ± ½ inches by 34 ± ½ inches (55.9 ± 1.3 cm by 86.4 ± 1.3 cm) before washing.

3.7.2 *Energy stuffer cloth.* The energy stuffer cloth must be made from energy test cloth material, as specified in section 3.1 of this appendix, that is 12 ± ¼ inches by 12 ± ¼ inches (30.5 ± 0.6 cm by 30.5 ± 0.6 cm) and has been hemmed to 10 ± ¼ inches by 10 ± ¼ inches (25.4 ± 0.6 cm by 25.4 ± 0.6 cm) before washing.

3.8 The test cloth must be clean and must not be used for more than 60 test runs (after pre-conditioning as specified in section 5 of this appendix). All test cloth must be permanently marked identifying the lot number of the material. Mixed lots of material must not be used for testing a clothes washer according to appendix J or appendix J2 to this subpart.

4. Equipment Specifications

4.1 *Extractor.* Use a North Star Engineered Products Inc. (formerly Bock) Model 215 extractor (having a basket diameter of 20 inches, height of 11.5 inches, and volume of 2.09 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, height, volume, and hole configuration) and variable speed drive. Table 4.1 of this appendix shows the extractor spin speed, in revolutions per minute (RPM), that must be used to attain each required g-force level.

TABLE 4.1—EXTRACTOR SPIN SPEEDS FOR EACH TEST CONDITION

"g Force"	RPM
100	594 ± 1
200	840 ± 1
350	1,111 ± 1
500	1,328 ± 1
650	1,514 ± 1

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

5. Test Cloth Pre-Conditioning Instructions

Use the following instructions for performing pre-conditioning of new energy test cloths and energy stuffer cloths as specified throughout section 7 and section 8 of this appendix, and before any clothes washer testing using appendix J or appendix J2 to this subpart:

Perform five complete 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 pound 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). Dry the load to bone-dry between each of the five wash-rinse-spin cycles. The maximum shrinkage after preconditioning must not be more than 5 percent of the length and width. Measure per AATCC Test Method 135–2010 (incorporated by reference; see § 430.3).

6. Extractor Run Instructions

Use the following instructions for performing each of the extractor runs specified throughout section 7 and section 8 of this appendix:

6.1 *Test load size.* Use a test load size of 8.4 lbs.

6.2 Measure the average RMC for each sample loads as follows:

6.2.1 Dry the test cloth until it is bone-dry according to the definition in section 2 of this appendix. Record the bone-dry weight of the test load (WI).

6.2.2 Prepare the test load for soak by grouping four test cloths into loose bundles. Create the bundles by hanging four cloths vertically from one corner and loosely wrapping the test cloth onto itself to form the bundle. Bundles should be wrapped loosely to ensure consistency of water extraction. Then place the bundles into the water to 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.

6.2.3 Soak the test load for 20 minutes in 10 gallons of soft (<17 ppm) water. The entire test load must be submerged. Maintain a water temperature of 100 °F ± 5 °F (37.8 °C ± 2.8 °C) at all times between the start and end of the soak.

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

6.2.5 Manually place the test cloth bundles in the basket of the extractor, distributing them evenly by eye. The draining and loading process must take no longer 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. Begin the timer when the extractor meets the required spin speed for each test.

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

6.2.7 Calculate the remaining moisture content of the test load as (WC − WI)/WI.

6.2.8 Draining the soak tub is not necessary if the water bath is corrected for water level and temperature before the next extraction.

6.2.9 Drying the test load in between extraction runs is not necessary. However, the bone-dry weight must be checked after every 12 extraction runs to make sure the bone-dry weight is within tolerance (8.4 ± 0.1 lbs). Following this, the test load must be soaked and extracted once before continuing with the remaining extraction runs. Perform this extraction at the same spin speed used for the extraction run prior to checking the bone-dry weight, for a time period of 4 minutes. Either warm or cold soak temperature may be used.

7. Test Cloth Material Verification Procedure

7.1 *Material Properties Verification.* The test cloth manufacturer must supply a certificate of conformance to ensure that the energy test cloth and stuffer cloth samples used for prequalification testing meet the specifications in section 3 of this appendix. The material properties of one energy test cloth from each of the first, middle, and last rolls must be evaluated as follows, prior to pre-conditioning:

7.1.1 *Dimensions.* Each hemmed energy test cloth must meet the size specifications in section 3.7.1 of this appendix. Each hemmed stuffer cloth must meet the size specifications in section 3.7.2 of this appendix.

7.1.2 *Oil repellency.* Perform AATCC Test Method 118–2007, Oil Repellency: Hydrocarbon Resistance Test, (incorporated by reference, see § 430.3), to confirm the absence of Scotchguard™ or other water-repellent finish. An Oil Repellency Grade of 0 (Fails Kaydol) is required.

7.1.3 *Absorbency.* Perform AATCC Test Method 79–2010, Absorbency of Textiles, (incorporated by reference, see § 430.3), to confirm the absence of Scotchguard™ or other water-repellent finish. The time to absorb one drop must be on the order of 1 second.

7.2 *Uniformity Verification.* The uniformity of each test cloth lot must be evaluated as follows.

7.2.1 *Pre-conditioning.* Pre-condition the energy test cloths and energy stuffer cloths used for uniformity verification, as specified in section 5 of this appendix.

7.2.2 *Distribution of samples.* Test loads must be comprised of cloth from three different rolls from the sample lot. Each roll from a lot must be marked in the run order that it was made. The three rolls are selected based on the run order such that the first, middle, and last rolls are used. As the rolls are cut into cloth, fabric must be selected from the beginning, middle, and end of the roll to create separate loads from each location, for a total of nine sample loads according to Table 7.2.2.

TABLE 7.2.2—DISTRIBUTION OF SAMPLE LOADS FOR PREQUALIFICATION TESTING

Roll No.	Roll location
First	Beginning. Middle. End.
Middle	Beginning. Middle. End.
Last	Beginning. Middle. End.

7.2.3 Measure the remaining moisture content of each of the nine sample test loads, as specified in section 6 of this appendix, using a centripetal acceleration of 350g (corresponding to 1111 ± 1 RPM) and a spin duration of 15 minutes ± 5 seconds.

7.2.4 Repeat section 7.2.3 of this appendix an additional two times and calculate the arithmetic average of the three RMC values to determine the average RMC value for each sample load. It is not necessary to dry the load to bone-dry the load before the second and third replications.

7.2.5 Calculate the coefficient of variation (CV) of the nine average RMC values from each sample load. The CV must be less than or equal to 1 percent for the test cloth lot to be considered acceptable and to perform the standard extractor RMC testing.

8. RMC Correction Curve Procedure

8.1 *Pre-conditioning.* Pre-condition the energy test cloths and energy stuffer cloths

used for RMC correction curve measurements, as specified in section 5 of this appendix.

8.2 *Distribution of samples.* Test loads must be comprised of randomly selected cloth at the beginning, middle and end of a lot. Two test loads may be used, with each load used for half of the total number of required tests. Separate test loads must be used from the loads used for uniformity verification.

8.3 Measure the remaining moisture content of the test load, as specified in section 6 of this appendix at five g-force 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. Table 4.1 of this appendix provides the corresponding spin speeds for each g-force level.

8.4 Repeat section 8.3 of this appendix using soft (<17 ppm) water at 60 °F ± 5 °F (15.6 °C ± 2.8 °C).

8.5 Repeat sections 8.3.3 and 8.3.4 of this appendix an additional two times, so that three replications at each extractor condition are performed. When this procedure is performed in its entirety, a total of 60 extractor RMC test runs are required.

8.6 Average the values of the 3 replications performed for each extractor condition specified in section 8.3 of this appendix.

8.7 Perform a linear least-squares fit to determine coefficients A and B such that the standard RMC values shown in Table 8.7 of this appendix ($RMC_{standard}$) are linearly related to the average RMC values calculated in section 8.6 of this appendix (RMC_{cloth}):

$$RMC_{standard} \sim A \times RMC_{cloth} + B$$

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

TABLE 8.7—STANDARD RMC VALUES ($RMC_{standard}$)

"g Force"	RMC percentage			
	Warm soak		Cold soak	
	15 min. spin (percent)	4 min. spin (percent)	15 min. spin (percent)	4 min. spin (percent)
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

8.8 Perform an analysis of variance with replication test using two factors, spin speed and lot, to check the interaction of speed and lot. Use the values from section 8.6 of this appendix and Table 8.7 of this appendix in the calculation. The "P" value of the F-statistic for interaction between spin speed and lot in the variance analysis must 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 measure of interaction based on an analysis of variance.

9. Application of the RMC Correction Curve

9.1 Using the coefficients A and B calculated in section 8.7 of this appendix:

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

9.2 Apply this RMC correction curve to measured RMC values in appendix J and appendix J2 to this subpart.

PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 12. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 13. Section 431.152 is revised to read as follows:

§ 431.152 Definitions concerning commercial clothes washers.

AEER means active-mode energy efficiency ratio, in pounds per kilowatt-hour per cycle (lbs/kWh/cycle), as determined in section 4.8 of appendix J to subpart B of part 430 of this chapter (when using appendix J).

Basic model means all units of a given type of covered product (or class thereof) manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency.

Commercial clothes washer means a soft-mounted front-loading or soft-mounted top-loading clothes washer that—

(1) Has a clothes container compartment that—

(i) For horizontal-axis clothes washers, is not more than 3.5 cubic feet; and

(ii) For vertical-axis clothes washers, is not more than 4.0 cubic feet; and

(2) Is designed for use in—

(i) Applications in which the occupants of more than one household will be using the clothes washer, such as multi-family housing common areas and coin laundries; or

(ii) Other commercial applications.

IWF means integrated water factor, in gallons per cubic feet per cycle (gal/cu ft/cycle), as determined in section 4.2.12 of appendix J2 to subpart B of part 430 of this chapter (when using appendix J2).

MEF_{J2} means modified energy factor, in cu ft/kWh/cycle, as determined in section 4.5 of appendix J2 to subpart B of part 430 (when using appendix J2).

WER means water efficiency ratio, in pounds per gallon per cycle (lbs/gal/cycle), as determined in section 4.7 of appendix J to subpart B of part 430 of this chapter (when using appendix J).

■ 14. Section 431.154 is revised to read as follows:

§ 431.154 Test procedures.

The test procedures for clothes washers in appendix J2 to subpart B of part 430 of this chapter must be used to determine compliance with the energy conservation standards at § 431.156(b).

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