DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[EERE–2016–BT–TP–0012]

RIN 1904–AD96

Energy Conservation Program: Test Procedure for Dishwashers

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

ACTION: Final rule.

SUMMARY: The U.S. Department of Energy (''DOE'') is amending the current test procedures for dishwashers, adopting a new test procedure appendix, incorporating by reference Association of Home Appliance Manufacturers (''AHAM'') standards—AHAM DW–1–2020 and DW–2–2020—and applying certain provisions of the industry standards to the test procedures appendices. The amendments to the current appendix establish requirements for water hardness, relative humidity, and loading pattern; update requirements for ambient temperature, detergent dosage, and standby power measurement; and include testing approaches from published dishwasher waivers. The new test procedure appendix additionally includes provisions for a minimum cleaning index threshold to validate the selected test cycle and updated annual number of cycles and low-power mode hours for the calculation of annual energy consumption.

DATES: The effective date of this rule is February 17, 2023. The amendments to appendix C1 will be mandatory for product testing starting July 17, 2023. Manufacturers will be required to use the amended test procedure at appendix C1 until the compliance date of any final rule establishing amended energy conservation standards based on the newly established test procedure at appendix C2. At such time, manufacturers will be required to begin using the newly established test procedure at appendix C2. The incorporation by reference of certain publications listed in the rule is approved by the Director of the Federal Register on February 17, 2023.

ADDRESSES: The docket, which includes **Federal Register** notices, webinar attendee lists and transcripts, 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, not all documents listed in the index may be publicly available, such as those containing information that is exempt from public disclosure.

A link to the docket web page can be found at *www.regulations.gov/docket/EERE-2016-BT-TP-0012.* The docket web page contains instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket, contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

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SUPPLEMENTARY INFORMATION: DOE maintains and updates a previously approved incorporation by reference and incorporates by reference the following industry standards into title 10 of the Code of Federal Regulations (''CFR'') part 430:

AHAM DW–1–2020, ''Uniform Test Method for Measuring the Energy Consumption of Dishwashers'', (copyright 2020).

AHAM DW–2–2020, ''Household Electric Dishwashers'', (copyright 2020).

Copies of AHAM DW–1–2020 and AHAM DW–2–2020 can be obtained from Association of Home Appliance Manufacturers, 1111 19th Street NW, Suite 402, Washington, DC 20036; or by going to AHAM's online store at *www.aham.org/AHAM/AuxStore.*

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

A copy of IEC 62301 Ed. 2.0 can be obtained from the International Electrotechnical Commission (''IEC''), 3 Rue de Varembe, Case Postale 131, 1211 Geneva 20, Switzerland; +41 22 919 02 11, *https://webstore.iec.ch/.*

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

Table of Contents

I. Authority and Background
A. Authority
B. Background
II. Synopsis of the Final Rule
III. Discussion
A. General Comments
B. Scope of Applicability
C. Updates to Industry Standards
D. Metrics
E. Test Setup
1. Water Hardness
2. Relative Humidity
3. Ambient Temperature
4. 208-Volt Power
5. Built-In Water Reservoir
6. In-Sink Installation
7. Absence of Main Detergent Compartment
8. Water Meter
F. Test Cycle Amendments
1. Cycle Selections
2. Drying Energy Measurement
3. Annual Number of Cycles
G. Energy and Water Consumption Test Methods
1. Test Load Items
2. Soils
3. Loading Pattern
4. Preconditioning Cycles
5. Detergent
6. Rinse Aid
7. Water Softener Regeneration Cycles
8. Water Re-Use System
9. Water Heater Efficiency
H. Cleaning Performance
1. General Comments
2. Cleaning Performance Test Method
3. Cleaning Index Threshold
4. Validation of the Test Cycle
5. Determining the Most Energy-Intensive Cycle
I. Standby Mode Test Method
1. Standby Power Measurement
2. Annual Combined Low-Power Mode Energy Consumption Calculation
J. Network Mode
K. Test Cycle Duration and Updates to 10 CFR 430.32
L. Test Procedure Costs and Harmonization
1. Test Procedure Costs and Impact
2. Harmonization With Industry Standards
M. Effective and Compliance Dates
IV. Procedural Issues and Regulatory Review
A. Review Under Executive Orders 12866 and 13563
B. Review Under the Regulatory Flexibility Act
C. Review Under the Paperwork Reduction Act of 1995
D. Review Under the National Environmental Policy Act of 1969
E. Review Under Executive Order 13132
F. Review Under Executive Order 12988
G. Review Under the Unfunded Mandates Reform Act of 1995
H. Review Under the Treasury and General Government Appropriations Act, 1999
I. Review Under Executive Order 12630
J. Review Under Treasury and General Government Appropriations Act, 2001
K. Review Under Executive Order 13211
L. Review Under Section 32 of the Federal Energy Administration Act of 1974
M. Congressional Notification
N. Description of Materials Incorporated by Reference
V. Approval of the Office of the Secretary

I. Authority and Background

Dishwashers are included in the list of ''covered products'' for which the U.S. Department of Energy (''DOE'') is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6292(a)(6)) DOE's test procedure for dishwashers is currently prescribed at 10 CFR 430.23(c) and appendix C1 to subpart B of part 430 (''appendix C1''). The following sections discuss DOE's authority to establish test procedures for dishwashers and relevant background information regarding DOE's consideration of test procedures for this product.

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 dishwashers, the subject of this document. (42 U.S.C. 6292(a)(6))

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), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

The 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 under EPCA (42 U.S.C. 6295(s)), and (2) making other representations about the efficiency of those products (42 U.S.C. 6293(c)). Similarly, DOE must use these test procedures to determine whether the products comply with any relevant standards promulgated under EPCA. (42 U.S.C. 6295(s))

Federal energy efficiency requirements for covered products established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297) 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))

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

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered product, including dishwashers, 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 her 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. The comment period on a proposed rule to amend a test procedure shall be at least 60 days and may not exceed 270 days. 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. (42 U.S.C. 6293(b)(2)) If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures. (42 U.S.C. 6293(b)(1)(A)(ii))

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 into the overall energy efficiency, energy consumption, or other energy descriptor, unless the current test procedure already incorporates the standby mode and off mode energy consumption, or if such integration is technically infeasible. (42 U.S.C. 6295(gg)(2)(A)) If an integrated test procedure is technically infeasible, DOE must prescribe separate standby mode and off mode energy use test procedures for the covered product, if a separate test is technically feasible. (*Id.*) Any such amendment must consider the most current versions of the International Electrotechnical Commission (''IEC'') Standard 62301 [3] and IEC Standard 62087 [4] as applicable. (42 U.S.C. 6295(gg)(2)(A))

DOE is publishing this final rule in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6293(b)(1)(A))

B. Background

DOE most recently amended its dishwasher test procedures in a final rule published October 31, 2012, that established a new test procedure at appendix C1. 77 FR 65942 (''October 2012 Final Rule''). (For additional information on the history of test procedure rulemaking for dishwashers, please see the October 2012 Final Rule.) Appendix C1 follows the same general procedures as those included in the previously established appendix (*i.e.,* ''appendix C''), with updates to: (1) revise the provisions for measuring energy consumption in standby mode or off mode; (2) add requirements for dishwashers with water softeners to account for regeneration cycles; (3) require an additional preconditioning cycle; (4) include clarifications regarding certain definitions, test conditions, and test setup; and (5) replace obsolete test load items and soils. 77 FR 65942, 65982–65987. Appendix C1 is currently required to demonstrate compliance with DOE's energy conservation standards for dishwashers at 10 CFR 430.32(f).

The current version of the DOE test procedure includes provisions for determining estimated annual energy use (''EAEU'') in kilowatt-hours per year (''kWh/year''), estimated annual operating cost (''EAOC'') in dollars per year, and water consumption in gallons

[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), which reflect the last statutory amendments that impact Parts A and A–1 of EPCA.

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

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

[4] IEC 62087, *Audio, video and related equipment—Methods of measurement for power consumption* (Edition 1.0, Parts 1–6: 2015, Part 7: 2018).

per cycle (''gal/cycle''). 10 CFR 430.23(c). On December 13, 2016, DOE published a final determination (''December 2016 Final Determination'') regarding the energy conservation standards for dishwashers in which DOE removed appendix C, which was applicable only to dishwashers manufactured before May 30, 2013. *See* 81 FR 90072, 90073.

On August 20, 2019, DOE published a request for information (''August 2019 RFI'') seeking comments on the existing test procedure for dishwashers. 84 FR 43071. In the August 2019 RFI, DOE requested comments, information, and data about a number of issues, including cycle selections, cycle options, test load items, soils, annual number of cycles, loading pattern, detergent, rinse aid, water hardness, standby testing, room ambient conditions, incorporating requirements from existing waivers for testing dishwashers, repeatability and reproducibility of the test procedure, and efficiency metrics. *Id.*

On December 22, 2021, DOE published a notice of proposed rulemaking (''December 2021 NOPR'') that proposed to amend appendix C1, adopt a new test in appendix C2, incorporate by reference AHAM standards—AHAM DW–1–2020, ''Uniform Test Method for Measuring the Energy Consumption of Dishwashers'' (''AHAM DW–1–2020'') and AHAM DW–2–2020, ''Household Electric Dishwashers'' (''AHAM DW–2–2020'')—and apply certain provisions of the industry standards to the test procedures appendices, and include provisions for a minimum cleaning index threshold to validate the selected test cycle. 86 FR 72738. DOE requested comments from interested parties on the proposal. *Id.* DOE received comments in response to the December 2021 NOPR from the interested parties listed in Table I.1.

TABLE I.1—LIST OF COMMENTERS WITH WRITTEN SUBMISSIONS IN RESPONSE TO THE DECEMBER 2021 NOPR

Commenter(s)	Reference in this final rule	Comment No. in the docket	Commenter type
Association of Home Appliance Manufacturers	AHAM	[5] 17, 26	Trade Association.
Pacific Gas and Electric Company, San Diego Gas and Electric, and Southern California Edison; collectively, the California Investor-Owned Utilities.	CA IOUs	19	Utilities.
GE Appliances, a Haier company	GEA	20	Manufacturer.
Appliance Standards Awareness Project, National Consumer Law Center, on behalf of its low-income clients, and Natural Resources Defense Council.	Joint Commenters	18	Efficiency Organizations.
Samsung Electronics America, Inc	Samsung	21	Manufacturer.
Whirlpool Corporation	Whirlpool	16	Manufacturer.

DOE also received feedback from AHAM during an *ex parte* meeting held on October 19, 2022 (''October 2022 *ex parte* meeting''). (AHAM, No. 27)

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[6] To the extent that interested parties have provided written comments that are substantively consistent with any oral comments provided during the February 3, 2022, public meeting (hereafter referred to as the ''December 2021 NOPR public meeting''), DOE cites the written comments throughout this final rule. Any oral comments provided during the webinar that are not substantively addressed by written comments are summarized and cited separately throughout this final rule.

II. Synopsis of the Final Rule

In this final rule, DOE incorporates by reference into 10 CFR part 430 the new industry standards AHAM DW–1–2020 and AHAM DW–2–2020. Specifically, this final rule amends the dishwasher test procedure to:

(1) Incorporate by reference AHAM DW–1–2020 into 10 CFR part 430 and apply certain provisions of the industry standards to appendix C1, including the following:

a. Add the water hardness specification in section 2.11 of AHAM DW–1–2020;

b. Add the relative humidity specification in section 2.5.1 of AHAM DW–1–2020 and the associated tolerance for the measurement instrument in Section 3.7 of AHAM DW–1–2020;

c. Update the active mode ambient temperature as specified in section 2.5.1 of AHAM DW–1–2020;

d. Update the loading pattern requirement by applying the direction specified in section 2.6 of AHAM DW–1–2020;

e. Update the specifications for detergent usage consistent with section 2.10 of AHAM DW–1–2020. This includes changing the type of detergent used and the calculation of detergent dosage to be used for the prewash and main wash cycles of dishwashers other than water re-use system dishwashers;

f. Add specific dishwasher door configuration requirements during standby mode testing by incorporating the specifications in section 4.2 of AHAM DW–1–2020 and update the annual combined low-power mode hours based on cycle duration; and

g. Incorporate the requirements from AHAM DW–1–2020 for the test methods pertaining to two granted waivers for dishwashers with specific design features.

(2) Establish new appendix C2, which would generally require testing as in appendix C1, with the following additional updates:

a. Specify provisions for scoring the test load and calculating a per-cycle cleaning index metric as specified in AHAM DW–2–2020 and establish a minimum cleaning index threshold of 70 as a condition for a test cycle to be valid.

b. Update number of annual cycles and low-power mode hours used for calculating the estimated annual energy use as specified in Section 5 of AHAM DW–1–2020.

For both appendix C1 and new appendix C2, this final rule additionally adds provisions to incorporate the test methods specified in a waiver for testing a basic model of dishwasher that does not hook up to a water supply line, but has a manually filled, built-in water

[5] AHAM's supplemental comment (No. 26) was received 192 days after the comment submission deadline. DOE generally will not consider late-filed comments, but may exercise its discretion to do so where necessary and appropriate. In this case, DOE is considering AHAM's comment because its tardiness has not disrupted DOE's consideration of this matter and because the comment regards a subject important to this matter.

[6] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for dishwashers. (Docket No. EERE–2016–BT–TP–0012, which is maintained at *www.regulations.gov.*) The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

tank and in a waiver for basic models of dishwashers that are installed in-sink (as opposed to built-in to the cabinetry or placed on countertops).

The adopted amendments are summarized in Table II.1 compared to the test procedure provision prior to the amendment, as well as the reason for the adopted change.

TABLE II.1—SUMMARY OF CHANGES IN THE AMENDED TEST PROCEDURE

DOE test procedure prior to amendment	Amended test procedure	Applicable test procedure	Attribution
References provisions of ANSI/AHAM DW–1–2010 for some aspects of the test procedure.	References provisions of AHAM DW–1–2020 newly incorporated into 10 CFR part 430, with limited modifications.	Appendix C1 and appendix C2.	Harmonize with industry standard and practice.
Does not specify a water hardness requirement.	Adds water hardness requirement to be consistent with AHAM DW–1–2020, which specifies 0 to 85 parts per million of calcium carbonate.	Appendix C1 and appendix C2.	Harmonize with industry standard and practice.
Does not specify any range for relative humidity.	Adds a relative humidity (''RH'') requirement consistent with AHAM DW–1–2020, which specifies 35 percent ± 15 percent.	Appendix C1 and appendix C2.	Harmonize with industry standard and practice.
Does not specify any instrumentation for measuring relative humidity.	References the instrumentation requirements from AHAM DW–1–2020 for measuring relative humidity.	Appendix C1 and appendix C2.	Harmonize with industry standard and practice.
Specifies that the ambient temperature must be maintained at 75 °F ±5 °F.	References the ambient temperature requirement from AHAM DW–1–2020, including maintaining it at a target temperature of 75 °F.	Appendix C1 and appendix C2.	Harmonize with industry standard and practice.
Does not specify a loading pattern	References the loading pattern from AHAM DW–1–2020, which specifies the same loading requirements as the ENERGY STAR Cleaning Performance Test Method.	Appendix C1 and appendix C2.	Harmonize with industry standard and practice.
References the detergent type and detergent dosing requirements from ANSI/AHAM DW–1–2010, which specifies Cascade with the Grease Fighting Power of Dawn as the detergent and dosing requirements based on water volumes in the prewash and main wash cycles.	References the detergent type and detergent dosing requirements from AHAM DW–1–2020, which references AHAM DW–2–2020 and specifies Cascade Complete Powder detergent and dosing requirements based on number of place settings.	Appendix C1 and appendix C2.	Harmonize with industry standard and practice.
Uses 215 annual cycles for calculating annual energy use.	Reduces the annual number of cycles to 184 for calculating annual energy use.	Appendix C2	Improve representativeness.
Does not specify whether the dishwasher door should be open or closed during standby mode testing.	References the requirement from AHAM DW–1–2020, which specifies that the door must be opened at the end of an active cycle and closed immediately prior to standby power measurement.	Appendix C1 and appendix C2.	Harmonize with industry standard and practice.
Uses 8,465 hours to calculate combined low-power mode energy consumption for dishwashers that do not have a fan-only mode.	References the requirement from AHAM DW–1–2020 to use the measured cycle duration to calculate combined low-power mode hours.	Appendix C2	Harmonize with industry standard and practice.
Does not include a method to test dishwashers operating on 208-volt power supply.	Adds a test method from AHAM DW–1–2020 to test dishwashers intended for a 208-volt power supply.	Appendix C1 and appendix C2.	Response to waiver and harmonize with industry standard and practice.
Does not include a method to test dishwashers with a water re-use system that uses water recovered from prior use.	Adds a test method from AHAM DW–1–2020 for dishwashers with a water re-use system.	Appendix C1 and appendix C2.	Response to waiver and harmonize with industry standard and practice.
Specifies installation instructions and test provisions only for dishwashers that connect to a water supply line.	Specifies installation instructions and test provisions for dishwashers that do not connect to a water supply line, but instead have a built-in water tank.	Appendix C1 and appendix C2.	Response to waiver.
Specifies installation instructions only for under-counter and under-sink dishwashers.	Specifies installation instructions for ''in-sink'' dishwashers.	Appendix C1 and appendix C2.	Response to waiver.
Requires placing detergent within a main wash detergent compartment.	Specifies detergent placement instructions for dishwashers that do not have a main wash detergent compartment.	Appendix C1 and appendix C2.	Response to waiver.
Does not specify a minimum cleaning index threshold to validate a test cycle.	Requires measurement of a per-cycle cleaning index based on section 5.12.3.1 of AHAM DW–2–2020 (*i.e.,* reflecting soil particles only), and establishes a threshold value of 70 as a condition for a test cycle to be valid.	Appendix C2	Ensure the test procedure produces test results which measure energy and water use during a representative average use cycle.

DOE has determined that the amendments adopted in this final rule would not require DOE to amend the energy and water conservation standards for dishwashers. The additional amendments specified in the newly established appendix C2 would alter the calculated energy consumption of dishwashers as discussed further in each relevant section of this final rule. However, testing in accordance with appendix C2 would not be required until such time as compliance is required with any amended energy conservation standards based on appendix C2. Discussion of DOE's actions are addressed in detail in section III of this document.

The effective date for the amended test procedures adopted in this final rule is 30 days after publication of this document in the **Federal Register**. Representations of energy use or energy efficiency must be based on testing in accordance with the amended test procedure in appendix C1 beginning 180 days after the publication of this final rule.

III. Discussion

In the December 2021 NOPR, DOE requested stakeholder feedback on several topics including test setup, test cycles, energy and water consumption test methods, cleaning performance, and standby mode test method. 86 FR 72738. In the following sections, DOE addresses the topics on which it requested feedback in the December 2021 NOPR, summarizes stakeholder comments received, responds to these comments, and finalizes the test procedure based on comments and DOE's analyses.

A. General Comments

AHAM commented that it supported DOE in its efforts to save energy and ensure a national marketplace through the Appliance Standards Program. AHAM stated that repeatable and reproducible test procedures that are representative of average consumer use, but not unduly burdensome to conduct, are an integral part of the standards program. (AHAM, No. 17 at p. 1) AHAM also commented that it supported DOE's decision to incorporate by reference AHAM DW–1–2020 into the dishwasher test procedure at 10 CFR part 430. (AHAM, No. 17 at pp. 1–2) The CA IOUs commented that they support several changes DOE has made to improve representativeness of the test procedure regarding water hardness, relative humidity, and loading pattern. (CA IOUs, No. 19 at p. 4)

GEA commented that it supported comments submitted by AHAM. (GEA, No. 20 at p. 2) Whirlpool commented that it supported many of DOE's proposals from the December 2021 NOPR, which largely harmonize with existing industry standards. (Whirlpool, No. 16 at p. 3)

AHAM also commented that the 60-day December 2021 NOPR comment period and the comment period for the preliminary analysis evaluating amended energy conservation standards for dishwashers that DOE published on January 24, 2022 (''January 2022 Preliminary Analysis;'' 87 FR 3450) [7] overlapped by 30 days and that DOE should have first considered stakeholder comments on the major changes proposed in the December 2021 NOPR, particularly in light of the scant data DOE provided on the docket to support the inclusion of a cleaning performance requirement or the performance threshold chosen in the test procedure, before proceeding with the energy conservation standard itself. (AHAM, No. 17 at p. 18)

AHAM commented that it recognized and supported DOE's interest in moving rulemakings forward, especially rules such as the dishwasher energy conservation standards and test procedure, which have missed statutory deadlines, but DOE should have released the test procedure proposal before conducting its preliminary analysis. AHAM suggested that this would have provided both commenters and DOE more time to understand the impact of a proposed test on potential standards while allowing the rulemaking process to move along more swiftly. (AHAM, No. 17 at pp. 18–19) AHAM commented that DOE's desire to move quickly on the standards and test procedure rulemakings was disingenuous, given that it had missed statutory deadlines before and diminished the value of early stakeholder engagement, which is problematic given the significance of the proposal. (AHAM, No. 17 at p. 19)

In response to AHAM's comment regarding the publication of the December 2021 NOPR and the January 2022 Preliminary Analysis, neither the prior version nor the current version of DOE's ''Procedures, Interpretations, and Policies for Consideration of New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Certain Commercial/Industrial Equipment'' (''Process Rule'') specify that a final amended test procedure will be issued prior to issuing standards pre-NOPR rulemaking documents (*e.g.,* a standards preliminary analysis). *See* 10 CFR part 430, subpart C, appendix A (Jan. 1, 2020 edition); 86 FR 70892, 70928 (Dec. 13, 2021). Additionally at the time the January 2022 Preliminary Analysis was published, the current version of the Process Rule was in effect and it generally provides that new test procedures and amended test procedures that impact measured energy use or efficiency will be finalized at least 180 days prior to the close of the comment period for a NOPR proposing new or amended energy conservation standards. 86 FR 70892, 70928. DOE will continue to conduct additional analyses based on this finalized test procedure before proposing any new energy conservation standards, and stakeholders will be provided an opportunity to comment on any updated analysis as part of any proposal published regarding amended standards.

B. Scope of Applicability

This rulemaking applies to dishwashers. A dishwasher is a cabinet-like appliance, which with the aid of water and detergent, washes, rinses, and dries (when a drying process is included) dishware, glassware, eating utensils, and most cooking utensils by chemical, mechanical, and/or electrical means and discharges to the plumbing drainage system. 10 CFR 430.2. DOE is not amending the scope of the dishwasher test procedure.

C. Updates to Industry Standards

The current dishwasher test procedure at appendix C1 references the AHAM industry standard, ANSI/AHAM DW–1–2010, for certain provisions of the DOE test procedure. ANSI/AHAM DW–1–2010 includes test methods to determine dishwasher cleaning performance and energy and water consumption among other tests. ANSI/AHAM DW–1–2010 was superseded by AHAM DW–1–2019, which contains updates pertaining to the number of place settings, detergent dosage, *etc.* and includes test methods for evaluating cleaning performance, but does not include the measurements of energy and water consumption that were previously included in ANSI/AHAM DW–1–2010. AHAM DW–1–2019 was further superseded by AHAM DW–2–2020,[8] which also includes test methods for evaluating cleaning performance but does not include test methods for determining energy and water consumption. Additionally, AHAM published AHAM DW–1–2020, which is an industry test procedure for determining the energy and water consumption of dishwashers and updates the relevant energy and water consumption test method provisions that were previously specified in ANSI/AHAM DW–1–2010. The following paragraphs provide an overview of the two most recently published standards, AHAM DW–1–2020 and AHAM DW–2–2020.

[7] The Notification of a Webinar and Availability of the Preliminary Technical Support Document for energy conservation standards for dishwashers, along with the Preliminary Technical Support Document, are available at *www.regulations.gov/docket/EERE-2019-BT-STD-0039.*

[8] AHAM updated its numbering scheme for dishwasher standards, wherein DW–2 measures cleaning performance, whereas DW–1 measures energy and water consumption.

AHAM DW–1–2020 specifies definitions, testing conditions, instrumentation, test cycle and measurements, and calculations for energy and water consumption of dishwashers. AHAM DW–1–2020 also references the IEC Standard 62301, ''Household electrical appliances—Measurement of standby power'', Edition 2.0, 2011–01 (''IEC 62301 Ed. 2.0'') for measuring standby mode and off mode power consumption. AHAM DW–1–2020 was developed by AHAM based upon the current appendix C1 and references, as applicable, AHAM DW–2–2020 in each instance, where appendix C1 currently references ANSI/AHAM DW–1–2010.[9]

AHAM DW–2–2020 supersedes the AHAM DW–1–2019 industry standard, which superseded ANSI/AHAM DW–1–2010. AHAM included minor changes and illustrations to improve consistency throughout the document, to reflect the latest representative items used for testing, and to eliminate ambiguity in test preparation. In the December 2021 NOPR, DOE proposed to reference relevant sections of AHAM DW–2–2020, which includes setup, measurement, and calculation instructions for evaluating dishwasher cleaning performance, for its proposal to specify a per-cycle cleaning index threshold as a condition for a valid test cycle. 86 FR 72738, 72743.

In the December 2021 NOPR, DOE proposed to incorporate by reference into 10 CFR part 430 the currently applicable industry test procedure for dishwashers, AHAM DW–1–2020. *Id.* DOE also proposed to update the industry standard incorporated by reference in 10 CFR part 430 from ANSI/AHAM DW–1–2010 to AHAM DW–2–2020. *Id.* In addition, DOE proposed to reference in appendix C1 and the new appendix C2 specific provisions of AHAM DW–1–2020 and AHAM DW–2–2020, with modifications, to clarify provisions where the applicable industry consensus standards would not produce test results that are representative of the energy and water use of certain products. *Id.* DOE requested comment on its proposal to incorporate by reference into 10 CFR part 430 the most recent version of the industry standard for dishwasher energy and water use measurement, AHAM DW–1–2020, as well as the industry performance standard, AHAM DW–2–2020, both with modifications. *Id.* DOE sought comment on its preliminary conclusion that the proposed modifications to the industry standards are necessary so that the DOE test method satisfies the requirements of EPCA. *Id.*

DOE did not receive any comments on the industry standards incorporated by reference, except as discussed in section III.A of this final rule. Accordingly, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to incorporate by reference into 10 CFR part 430 the most recent version of the industry standard for dishwasher energy and water use measurement, AHAM DW–1–2020, as well as the industry performance standard, AHAM DW–2–2020, both with modifications.

D. Metrics

DOE's dishwasher test procedures in 10 CFR 430.23(c) and appendix C1 provide results for dishwasher EAEU in kWh/year and water consumption in gal/cycle.

In the December 2021 NOPR, DOE summarized comments it received in response to the August 2019 RFI regarding an energy and water use metric on a per-place setting basis. 86 FR 72738, 72743. Most commenters opposed such a metric, claiming that no correlation exists between capacity and energy or water use, a per-place setting metric would be confusing for consumers, and it would be dependent on a claimed value of place setting capacity. *Id.* In the NOPR, DOE proposed to maintain the current metrics used for measuring dishwasher energy and water consumption. 86 FR 72738, 72743.

DOE did not receive any additional comments on this topic and is finalizing its proposal, consistent with the December 2021 NOPR, to maintain the current efficiency metrics in appendix C1 and the new appendix C2.

E. Test Setup

1. Water Hardness

The currently applicable appendix C1 does not currently specify any water hardness requirement for testing.

To reduce potential variability across testing facilities, DOE proposed in the December 2021 NOPR to incorporate the water hardness requirements in section 2.11 of AHAM DW–1–2020, which specifies a maximum water hardness of 85 parts per million (''ppm'') of $CaCO_3$. 86 FR 72738, 72743. DOE stated in the December 2021 NOPR that certain manufacturers may already be testing their dishwashers according to these water hardness specifications because this water hardness requirement is specified in the ENERGY STAR Test Method for Determining Residential Dishwasher Cleaning Performance (''ENERGY STAR Cleaning Performance Test Method''). *Id.* at 86 FR 72744. DOE explained that AHAM had commented that it expected laboratories already have the capability to control water hardness to within these specifications. *Id.* Furthermore, in the December 2021 NOPR, DOE noted that nine dishwasher brands are included in the ENERGY STAR's Most Efficient database,[10] and that manufacturers of these models must report cleaning performance as measured by the ENERGY STAR Cleaning Performance Test Method. *Id.* DOE stated in the December 2021 NOPR that it did not expect this proposal to be unduly burdensome or impact the rated energy and water use of dishwashers. *Id.*

Additionally, as described further in section III.H of this document, in the December 2021 NOPR, DOE proposed to specify a minimum cleaning index threshold as a condition for a valid test cycle, which may also be impacted by water hardness. *Id.* DOE requested comment on its proposal to require use of the water hardness requirements from section 2.11 of AHAM DW–1–2020. *Id.*

The Joint Commenters stated that they supported DOE's proposal to incorporate a water hardness specification consistent with AHAM DW–1–2020. The Joint Commenters agreed that the requirement would add clarity to the test procedure and help reduce potential variability across testing facilities. (Joint Commenters, No. 18 at p. 1)

DOE has more recently observed that 12 dishwasher brands are now included in the ENERGY STAR's Most Efficient database, indicating that many manufacturers are already meeting the specified water hardness requirement and have the capability to meet these requirements.[11] Additionally, while DOE is establishing a cleaning performance threshold only in the new appendix C2 (as discussed in section III.H of this document), since the water hardness requirement is expected to support reproducibility of results without increasing test burden for testing facilities, DOE is finalizing its proposal to require use of the water hardness requirements from section 2.11 of AHAM DW–1–2020 in both appendix

[9] The current references to ANSI/AHAM DW–1–2010 specify place settings, serving pieces, soiling procedures, loading procedures, and detergent specifications—all of which are now specified in AHAM DW–2–2020.

[10] ENERGY STAR Most Efficient database. Available at *www.energystar.gov/most-efficient/me-certified-dishwashers.* Last accessed July 6, 2022.

[11] The ENERGY STAR Program recently also finalized the ENERGY STAR V. 7.0 Specification for dishwashers, which includes a cleaning performance requirement for any dishwasher seeking the ENERGY STAR label. This specification does not go into effect until July 19, 2023. See ENERGY STAR Version 7.0 Residential Dishwasher Final Specification Cover Letter.

C1 and the new appendix C2, consistent with the December 2021 NOPR.

2. Relative Humidity

The currently applicable appendix C1 does not specify an ambient relative humidity for testing.

In the December 2021 NOPR, DOE proposed amending appendix C1 to include the relative humidity requirement of AHAM DW–1–2020, which specifies in Section 2.5.1 that an ambient relative humidity condition of 35 percent ±15 percent must be maintained in the testing room throughout the soiling application and 2-hour air dry period. 86 FR 72738, 72744. DOE also proposed to include this same requirement in the new appendix C2. *Id.*

DOE's testing experience suggests that ambient relative humidity could potentially impact the adherence of the applied soils to the test load during the 2-hour air-dry period specified in AHAM DW–2–2020 (which is the same as that specified in ANSI/AHAM DW–1–2010 and AHAM DW–1–2019). 86 FR 72738, 72744. The adherence of the applied soil loads to the dishware could impact the amount of energy and water required to remove those soils for soil-sensing dishwashers, which constitute a significant percentage of dishwashers on the market. *Id.* Further, adherence of the applied soil loads could impact cleaning performance, which in turn could impact the determination of the validity of each test cycle.[12] *Id.* Establishing a relative humidity requirement would limit any such potential variation and increase repeatability and reproducibility of test results. *Id.* As discussed, the proposed relative humidity requirement is the same as the requirement in AHAM dishwasher standards, indicating that this reflects current industry practice. *Id.* As such, DOE stated in the December 2021 NOPR that it does not expect this requirement to increase test burden as compared to current industry practice. *Id.*

In conjunction with this proposed relative humidity test condition, in the December 2021 NOPR, DOE also proposed to include the relative humidity measuring device requirement specified in section 3.7 of AHAM DW–1–2020, which states that relative humidity measurement equipment must have a resolution of at least 1 percent relative humidity, and an accuracy of at least ±6 percent relative humidity over the temperature range of 75 degrees Fahrenheit (''°F'') ±5 °F. 86 FR 72738, 72744.

[12] *See* section III.H of this document for more details.

DOE stated in the December 2021 NOPR that it had compared this proposed requirement to the relative humidity measuring device requirements currently specified in other DOE test procedures. 86 FR 72738, 72744. The Uniform Test Method for Measuring the Energy Consumption of Clothes Dryers at 10 CFR part 430, subpart B, appendix D1 and appendix D2; appendix E (Water Heaters); appendix H (Television Sets); appendix M and appendix M1 (Central Air Conditioners and Heat Pumps); appendix O (Vented Home Heating Equipment); appendix U (Ceiling Fans); appendix X1 (Dehumidifiers); and appendix AA (Furnace Fans) all require the use of a measuring device with a specified error tolerance to measure relative humidity. These appendices specify tolerances for the relative humidity measuring device ranging from 0.7 percent to 5 percent relative humidity. Therefore, DOE stated in the December 2021 NOPR that its proposal specifying a maximum error of no greater than ±6 percent relative humidity to ensure accurate measurement of relative humidity, while testing should not cause undue burden, since testing facilities that test other covered consumer products or equipment that require control of the ambient relative humidity already have the capability to meet the proposed requirement. *Id.*

In the December 2021 NOPR, DOE requested comment on its proposal to reference AHAM DW–1–2020 for the relative humidity and associated instrumentation requirements, which specifies a relative humidity test condition of 35 percent ±15 percent, and a resolution of at least 1 percent relative humidity and an accuracy of at least ±6 percent relative humidity over the temperature range of 75 °F ±5 °F for the relative humidity measuring device. *Id.* at 86 FR 72744–72745. DOE also requested data regarding the impact of relative humidity on dishwasher energy and water usage. *Id.* at 86 FR 72744.

DOE did not receive any comments on this topic. Based on the reasons already discussed in this section, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to reference AHAM DW–1–2020 for the relative humidity and associated instrumentation requirements in appendix C1 and the new appendix C2.

3. Ambient Temperature

Section 2.5.1 of the currently applicable appendix C1 specifies an ambient temperature of 75 °F ±5 °F for active mode testing.

Section 2.5.1 of AHAM DW–1–2020 specifies an ambient temperature of 75 °F ±5 °F and further specifies a target temperature of 75 °F. In the December 2021 NOPR, DOE proposed to reference these ambient temperature requirements in AHAM DW–1–2020 in appendix C1 and the new appendix C2. 86 FR 72738, 72745. DOE stated that this proposed amendment would improve repeatability and reproducibility of results, while minimizing additional test burden, and that as the amendment is consistent with the industry standard, it reflects current industry practice. *Id.* Additionally, this amendment is consistent with the approach used to specify ambient temperature in the clothes washer test procedure at appendix J2. *Id.*

DOE requested input on its proposal to specify a target nominal ambient temperature of 75 °F for active mode testing, as referenced from AHAM DW–1–2020. 86 FR 72738, 72745.

The CA IOUs recommended that DOE would be able to more effectively accomplish its goal of improving repeatability and reproducibility of the test method by specifying an average temperature tolerance to the ambient temperature condition in addition to the existing 75 ± 5 °F minimum and maximum ambient temperature tolerance, rather than use ambiguous language of a ''target temperature.'' (CA IOUs, No. 19 at pp. 3–4)

DOE understands the CA IOUs' concern but notes that the intent of the ambient temperature requirement has always been to conduct the test at 75 °F, or as close to it as feasible, to the extent possible. The goal of adding ''target temperature'' in the requirement is to emphasize this point. Additionally, DOE does not have data to determine the appropriate tolerance for the average temperature that would ensure that the temperature stays as close to 75 °F as possible.

For the reasons stated above, DOE is finalizing its proposal, consistent with the December 2021 NOPR, specifying a target nominal ambient temperature of 75 °F for active mode testing, as referenced from AHAM DW–1–2020, in appendix C1 and the new appendix C2.

4. 208-Volt Power

On April 10, 2017, DOE published a Decision and Order granting Miele, Inc. (''Miele'') a test procedure waiver (''Miele waiver'') for testing a specified basic model intended for a 208-volt power supply rather than the 115 volts or 240 volts specified in the currently applicable appendix C1. 82 FR 17227

(Case No. DW–12).[13] Miele is required to test the basic model specified in the Miele waiver using appendix C1, except that it must maintain the electrical supply to the dishwasher at 208 volts ±2 percent and within 1 percent of its nameplate frequency as specified by the manufacturer; and maintain a continuous electrical supply to the unit throughout testing, including the preconditioning cycles, specified in section 2.9 of appendix C1, and in between all test cycles. *Id.* at 82 FR 17228–17229.

Subsequently, AHAM published the AHAM DW–1–2020 standard, which includes provisions in section 2.2.2 for testing dishwashers that operate with an electrical supply of 208 volts that is comparable to the Miele waiver.

As soon as practicable after the granting of any waiver, DOE is required to publish in the **Federal Register** a NOPR to amend its regulations so as to eliminate any need for the continuation of such waiver. 10 CFR 430.27(l). As soon thereafter as practicable, DOE will publish in the **Federal Register** a final rule. *Id.* Since AHAM DW–1–2020 includes the language from the Miele waiver, DOE proposed in the December 2021 NOPR to reference these requirements in appendix C1 and the new appendix C2 for dishwashers that operate at 208 volts. 86 FR 72738, 72745.

In the December 2021 NOPR, DOE requested comment on its proposal to reference in appendix C1 and the new appendix C2 the testing provisions from AHAM DW–1–2020 to address the Miele waiver for dishwashers that operate at 208 volts. *Id.*

DOE did not receive any comments on this topic. DOE is finalizing its proposal, consistent with the December 2021 NOPR, to reference in appendix C1 and the new appendix C2 the testing provisions from AHAM DW–1–2020 to address the Miele waiver for dishwashers that operate at 208 volts.

5. Built-In Water Reservoir

DOE published a Decision and Order on December 9, 2020 (''December 2020 Decision and Order''), granting CNA International Inc. (''CNA'') a test procedure waiver (''CNA waiver'') for a basic model of a compact dishwasher that does not connect to a water supply line and instead has a built-in reservoir that must be manually filled with water. 85 FR 79171 (Case No. 2020–008).[14] In the December 2021 NOPR, DOE proposed amendments regarding the specific design characteristics addressed in the CNA waiver, generalized to be applicable to any future dishwasher models with this design characteristic, so as to eliminate any need for the continuation of this waiver. 86 FR 72738, 72745.

Specifically, DOE proposed the following provisions in appendix C1 and the new appendix C2 for testing such models:

(1) Refer to the full reservoir capacity as reported by the manufacturer (rather than specifying the full capacity as 5 liters);

(2) Require following any sequence of events specified in the manufacturer instructions (rather than specifying the particular sequence of events required for the basic model subject to the CNA waiver);

(3) Use the prewash fill water volume (if any) and main wash water fill volume as reported by the manufacturer (rather than specifying a main wash fill water volume of 1.5 liters);

(4) Water consumption for each test cycle is the value reported by the manufacturer (rather than specifying the water consumption as 4.8 liters).

86 FR 72738, 72746.

In the December 2021 NOPR, DOE requested comment on its proposal to incorporate the requirements of the CNA waiver for any dishwasher with a built-in reservoir. *Id.* In particular, DOE requested stakeholder feedback on using the detergent dosage requirement based on number of place settings rather than main wash water volume in the new appendix C2, for dishwashers with built-in reservoirs. *Id.*

DOE did not receive any comments on this topic and is finalizing its proposal, consistent with the December 2021 NOPR, to incorporate the requirements of the CNA waiver for any dishwasher with a built-in reservoir in appendix C1 and the new appendix C2.

6. In-Sink Installation

On October 15, 2020, FOTILE Kitchen Ware Co. Ltd. (''FOTILE'') filed a petition for waiver and interim waiver seeking a waiver from the installation requirements specified in the currently applicable appendix C1, which pertain to under-counter or under-sink dishwashers. 86 FR 26712, 26713.

In granting FOTILE an interim waiver on February 8, 2021, DOE noted that FOTILE's alternate test procedure specified a test enclosure that differed from the installation instructions provided in the operation manual. 86 FR 8548, 8549. Specifically, the alternate test procedure retained a requirement that the enclosure be brought into the closest contact with the appliance that the configuration of the dishwasher allows. In the case of FOTILE's basic models, this would include close contact between the bottom of the enclosure and the underside of the in-sink dishwasher. In the FOTILE interim waiver notice, DOE noted that because the height of the product is 21 5/16 inches (541 millimeters (''mm'')), placing the bottom part of the enclosure as close as possible to the bottom of the compact in-sink dishwasher would conflict with the installation instructions in the operation manual, which specify a minimum enclosure height of 35 7/16 inches (900 mm). *Id.* This may potentially result in differing heat losses from the dishwasher that could impact energy consumption during the cycle. *Id.* In the interim waiver notice, DOE further noted that specifying the enclosure would be consistent with the manufacturer installation instructions and would provide results that are more representative of average use and requested comment on this topic. 86 FR 8548, 8551.

On May 17, 2021, DOE published a Decision and Order granting FOTILE the waiver (''FOTILE waiver''). 86 FR 26712, 26715–26716 (Case No. 2020–020).[15] Specifically, according to the published FOTILE waiver, FOTILE is required to test compact in-sink dishwashers using the currently applicable appendix C1 with modifications to install these dishwasher basic models from the top of a rectangular enclosure (as opposed to the front). *Id.* at 86 FR 26713. DOE also specified the use of the installation requirements that were proposed in the alternate test procedure in the FOTILE interim waiver, with modifications to the provisions pertaining to the enclosure in which the dishwasher is tested. *Id.* at 86 FR 26714–26715.

On July 22, 2021, DOE published a notification of extension of waiver granting a waiver to additional in-sink FOTILE basic model dishwashers. 86 FR 38700 (Case No. 2021–005).

In the December 2021 NOPR, DOE proposed to incorporate into appendix C1 and the new appendix C2 the alternate test procedures in the FOTILE waiver, such that the installation requirements would be applicable for any in-sink dishwasher. 86 FR 72738, 72746. Specifically, DOE proposed that the requirements pertaining to the rectangular enclosure for under-counter or under-sink dishwashers that are specified in section 2.1 of AHAM DW–1–2020 would not be applicable to in-

[13] All materials regarding the Miele waiver are available in docket EERE–2016–BT–WAV–0039 at *www.regulations.gov.*

[14] All materials regarding the CNA waiver are available in docket EERE–2020–BT–WAV–0024 at *www.regulations.gov.*

[15] All materials regarding the FOTILE waiver are available in docket EERE–2020–BT–WAV–0035 at *www.regulations.gov.*

sink dishwashers. *Id.* For such dishwashers, DOE proposed that the rectangular enclosure must consist of a front, a back, two sides, and a bottom. *Id.* The front, back, and sides of the enclosure must be brought into the closest contact with the appliance that the dishwasher configuration allows. DOE additionally proposed that the height of the enclosure must be as specified in the manufacturer's instructions for installation height. *Id.* If no instructions are provided, DOE proposed that the enclosure height must be 36 inches, since this is the typical height of kitchen cabinetry with counters attached, which is where such a dishwasher would be installed. *Id.* DOE also proposed that the dishwasher must be installed from the top and mounted to the edges of the enclosure. *Id.*

In the December 2021 NOPR, DOE requested comment on its proposal to incorporate into appendix C1 and the new appendix C2 the installation requirements for in-sink dishwashers from the FOTILE waiver. *Id.*

DOE did not receive any comments on this topic and is finalizing its proposal, consistent with the December 2021 NOPR, to incorporate into appendix C1 and the new appendix C2 the installation requirements for in-sink dishwashers from the FOTILE waiver.

7. Absence of Main Detergent Compartment

In addition to seeking a waiver for the installation requirements for in-sink dishwashers, the basic models for which FOTILE sought a waiver do not have a main detergent compartment. 86 FR 26712, 26713. Specifically, according to the published FOTILE waiver, FOTILE is required to test compact in-sink dishwashers placing the detergent directly into the washing chamber. *Id.* at 86 FR 26715. In the December 2021 NOPR, DOE proposed to incorporate the provisions for detergent placement specified in the FOTILE waiver into both appendix C1 and the new appendix C2, generalizing this provision such that it would be applicable to any dishwasher that does not have a detergent compartment. 86 FR 72738, 72746.

In the December 2021 NOPR, DOE requested comment on its proposal that the detergent must be placed directly into the dishwasher chamber for any dishwasher that does not have a prewash or main wash detergent compartment. *Id.* at 86 FR 72746–72747.

AHAM commented that the language pertaining to the detergent amount and placement in the FOTILE waiver was broad and would conflict with the detergent placement provisions of the current DOE dishwasher test procedure. (AHAM, No. 17 at p. 17) AHAM stated the following concerns: (1) the proposed requirement was too prescriptive in specifying that the detergent be placed directly in the ''wash chamber'' and eliminated the possibility for the manufacturer to specify an alternate location, which is allowed in the current test procedure; (2) the term ''main wash compartment,'' as found in section 2.10 of the current test procedure, is not defined and could be interpreted as being synonymous with ''wash chamber''; and (3) the proposed language removed reference to section 2.10.1 of appendix C1, thus eliminating the option of adding prewash detergent in another location as may be specified by the manufacturer. (*Id.*)

AHAM proposed adding the phrase ''or other location recommended by the manufacturer,'' as currently specified in section 2.10 of appendix C1, which would be in line with AHAM's view of the current test procedure's intent and leave open the possibility of alternative designs for this dishwasher type and others that may follow. (AHAM, No. 17 at pp. 17–18)

AHAM suggested that DOE should update the language in section 2.10 of appendix C1 to remove the following language proposed in the December 2021 NOPR, ''For compact in-sink dishwashers with a combination sink that have neither prewash program nor a main detergent compartment, determine the amount of main wash detergent (in grams) to be added directly into the washing chamber according to section 2.10.2 of this appendix'' and instead add the phrase, ''or other location recommended by the manufacturer'' following the words ''main wash compartment'' in the clause. (*Id.*)

DOE's intent with the requirement specified in the FOTILE waiver as well as the December 2021 NOPR was to require that, should the dishwasher not have a main wash detergent compartment and the manufacturer does not specify a location for the placement of the detergent, the detergent must be placed directly into the washing chamber. To clarify this instruction, in this final rule, DOE is updating the language in section 2.6 of appendix C1 and the new appendix C2 regarding placement of the detergent to note that if no main wash compartment is provided and no location is recommended by the manufacturer for the main wash detergent, the main wash detergent must be placed directly into the dishwasher chamber.

8. Water Meter

Section 3.3 in Appendix C1 specifies that the water meter must have a resolution of no larger than 0.1 gallons and a maximum error no greater than ±1.5 percent of the measured flow rate for all water temperatures encountered in the test cycle. These same requirements are also specified in section 3.3 of AHAM DW–1–2020, and DOE did not propose any changes to these requirements in the December 2021 NOPR.

AHAM commented that the proposed allowances for resolution and flow rate error for the water meter are too large and have the potential to introduce uncertainty in the measurement, negatively impacting repeatability and reproducibility. (AHAM, No. 17 at p. 16) AHAM stated that manufacturers often account for this by introducing additional margin in their per-cycle water usage. (*Id.*) AHAM provided an example that for a dishwasher approaching the current DOE standard for water consumption of 5.0 gallons per cycle, a resolution of 0.1 would introduce an error of ±2.0 percent, increasing to ±2.9 percent for dishwashers at the ENERGY STAR V. 6.0 level of 3.5 gallons per cycle. (*Id.*) AHAM explained that adding in a maximum of ±1.5 percent error of the measured flow rate, a root mean square uncertainty calculation would yield a measurement uncertainty of ±2.5 percent for a unit using 5.0 gallons per cycle and ±3.3 percent for a unit using 3.5 gallons per cycle. (*Id.*) Accordingly, AHAM recommended revising the test procedure specification for the water meter to specify a minimum resolution of 0.01 gallons and a maximum flow rate measurement error of ±0.5 percent. AHAM stated that the technology was widely available to meet these tolerances and that these specifications would further enhance repeatability and reproducibility. (*Id.*)

As discussed in a final rule to establish new and amended clothes washers test procedures, DOE noted that most, if not all, third-party laboratories already have water meters with more precise resolution. 87 FR 33316, 33324–33325 (June 1, 2022). Additionally, DOE estimated the cost of a water meter that provides a resolution of 0.01 gallons, including associated hardware, to be around $600 for each device. *Id.* However, DOE did not discuss water meter resolution in the December 2021 NOPR and has not provided stakeholders an opportunity to provide feedback on this topic. Therefore, DOE is not changing the water meter resolution requirements at this time.

DOE will consider AHAM's comment in a future rulemaking. Additionally, DOE notes that manufacturers and laboratories that already have water meters with a resolution of 0.01 gallons, could use such water meters when testing dishwashers according to the currently applicable appendix C1 as well as the amended appendix C1 and new appendix C2.

F. Test Cycle Amendments

1. Cycle Selections

In the December 2021 NOPR, DOE proposed to continue using the normal cycle for dishwasher testing, unless the normal cycle did not meet a specified cleaning index threshold at any soil-load, in which scenario DOE proposed that the most energy-intensive cycle be tested and used for certification purposes at that soil load (see section III.H of this document for further detail). 86 FR 72738, 72747. In the December 2021 NOPR, DOE stated that this alternative approach would better represent an average use cycle by capturing those consumers that may select other cycle types for washing dishes if the cleaning performance of the normal cycle did not meet their expectations, because higher energy use provides increased thermal and mechanical action for removing soils, thus correlating generally with improved cleaning performance. *Id.* DOE also did not propose to add any additional cycle options to the tested normal cycle. *Id.*

Whirlpool commented that since the normal cycle is still overwhelmingly the cycle type most used by consumers, the current test method is already representative of typical consumer usage and it would be inappropriate to possibly mandate that the most energy-intensive cycle be used for testing and certification. (Whirlpool, No. 16 at p. 4)

Whirlpool commented that consumers consider their dishes/items, soil level, fullness of the dishwasher, efficiency, type of soils, past experiences, and cycle time when considering which cycle types and options to run. (Whirlpool, No. 16 at pp. 4–5) Whirlpool also commented that consumers running a load of heavily-soiled dishes with hard-to-clean soils may be likely to select a more energy-intensive cycle than the normal cycle. Whirlpool additionally commented that it does not recommend these possible more energy-intensive cycles to consumers for daily, typical, or regular use for normally soiled dishes. (*Id.*)

DOE proposed in the December 2021 NOPR to maintain the use of the normal cycle for testing dishwashers. The most energy-intensive cycle was proposed only if the normal cycle did not meet the proposed cleaning index threshold, which would indicate that the normal cycle was not providing a consumer-acceptable level of cleaning performance (*i.e.,* the normal cycle was not a representative average use cycle). For such dishwashers, DOE expects that consumers would use a more energy-intensive cycle type, since increased energy and/or water use would likely improve cleaning performance. Therefore, to ensure that the dishwasher test procedures are reasonably designed to produce test results which measure energy use during a representative average use cycle and are not unduly burdensome to conduct, in accordance with EPCA (42 U.S.C. 6293(b)(3)), the normal cycle must be the cycle type used for testing, unless it does not meet the minimum cleaning index threshold specified in the new appendix C2 at a particular soil level, in which case the most energy-intensive cycle shall be used for testing and certification purposes.

For the reasons stated above, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to maintain the dishwasher test cycle selections and cycle options to the tested normal cycle, except with regard to validating the test cycle type pursuant to the minimum cleaning index included in the new appendix C2. See section III.H of this final rule for further discussion regarding cleaning performance.

2. Drying Energy Measurement

Section 5.3 of appendix C1 specifies a methodology for determining the ''drying energy'' consumption of a dishwasher. Dishwashers typically incorporate technologies to assist with drying the dishes after completion of the rinse portion of the cycle. Some dishwashers use an exposed resistance heater to heat the air inside the washing chamber after the final rinse to evaporate the water from the dishware. Other dishwasher models, however, do not use a resistance heater to heat the air, but instead achieve drying by raising the temperature of the final rinse water. The heated rinse water evaporates more quickly from the dishes after completion of the rinse portion of the cycle.

Section 1.14 of appendix C1 defines ''power-dry feature'' as the introduction of electrically generated heat into the washing chamber for the purpose of improving the drying performance of the dishwasher. Further, the definition of ''normal cycle'' in section 1.12 of appendix C1 specifically includes the power-dry feature as part of the normal cycle. Section 5.3 of appendix C1 specifies a methodology for calculating the energy consumed by the power-dry feature *after the termination of the last rinse option* (*emphasis added*). Half of this drying energy is subtracted from the total dishwasher energy calculations of EAOC and EAEU at 10 CFR 430.23(c)(1) and (2), respectively.[16]

Because the application of section 5.3 is limited to drying energy consumed only after the termination of the last rinse option, it would not be applicable to the drying energy use of a dishwasher that employs heated rinse technology, since such energy is consumed as part of the final rinse rather than after the final rinse. Rather, the energy use associated with the heated rinse would be captured as part of the normal cycle machine energy consumption. As a result, the energy use associated with heated rinse drying technology would be factored into EAOC and EAEU in its entirety, rather than only by half, as described for units with conventional power-dry technology that occurs after the final rinse.

In the December 2021 NOPR, DOE summarized comments it received in response to the August 2019 RFI regarding the drying energy for a dishwasher that employs heated rinse. 86 FR 72738, 72747–72748. Commenters opposed the addition of cycle options, including a power-dry option. However, as noted in the December 2021 NOPR, appendix C1 already requires testing of a power-dry cycle option, if available. 86 FR 72738, 72748. Accordingly, DOE did not propose any changes to the measurement of drying energy to accommodate units that use heated rinse to achieve drying. *Id.* DOE stated that the current measurement of drying energy consumption is dependent upon a clearly identifiable boundary between the conclusion of the final rinse and the activation of electrically generated heat into the washing chamber. *Id.* For units that use heated rinse to achieve drying, DOE initially determined in the December 2021 NOPR that it would be burdensome to isolate the energy specifically attributable to raising the temperature of the final rinse, since such energy use would be embedded within the total energy use measured during that portion of the cycle; *i.e.,* it would not be possible to determine the ''drying energy'' without, for example, sub-metering the electrical energy use of the internal water heater. *Id.* For these reasons, DOE did not propose any

[16] This reflects consumer use of the power-dry feature for 50 percent (*i.e.,* half) of dishwasher cycles.

changes to the existing requirements for measuring drying energy in the December 2021 NOPR. *Id.*

DOE did not receive any comments on this topic and is maintaining the existing requirements for measuring drying energy.

3. Annual Number of Cycles

Section 5.7 of the currently applicable appendix C1 calculates combined low-power mode energy consumption, which factors into the EAEU calculation, using 215 annual cycles. DOE established the 215-cycle value in a final rule published on August 29, 2003, relying on data from several sources on consumer dishwasher usage behavior, including the 1997 version of the Residential Energy Consumption Survey (''RECS''), several consumer dishwasher manufacturers, detergent manufacturers, energy and consumer interest groups, independent researchers, and government agencies. 68 FR 51887, 51889–51890.

In the December 2021 NOPR, DOE proposed to update the current annual cycles estimate to reflect more recent trends in dishwasher usage. 86 FR 72738, 72748. DOE's analysis of 2015 RECS data indicates annual use of 185 cycles.[17] AHAM also specifies a value of 184 cycles per year in AHAM DW–1–2020 based on industry consensus. DOE thus proposed in the December 2021 NOPR to amend the current annual number of cycles estimate from 215 to 184 cycles, through reference to AHAM DW–1–2020. *Id.* at 86 FR 72748–72749. The proposed value closely aligns with DOE's analysis of 2015 RECS data. In the December 2021 NOPR, DOE initially determined that the 2015 RECS is a suitable source for updating the annual number of cycles estimate because (1) it is the most recent RECS edition available, (2) RECS is nationally representative for all U.S. households, and (3) it provides direct survey data on the typical number of dishwasher cycles run by consumers each week, rather than providing binned response options. *Id.* at 86 FR 72749.

The proposal to update the annual cycle value for calculating EAEU, if finalized, would change the certified and reported EAEU values. DOE also noted in the December 2021 NOPR that the existing energy conservation standards are based on the EAEU as determined under the current test procedure. *Id.* As such, DOE noted that the use of the 184 cycles-per-year value would be in conjunction with any future amended energy conservation standards for dishwashers that account for the updated annual cycle value. Accordingly, in the December 2021 NOPR, DOE proposed to specify this requirement in the new appendix C2. *Id.* Manufacturers would be required to use the results of testing under the new appendix C2 to determine compliance with any future amended energy conservation standards.

DOE requested input on its proposal to update the estimated number of annual cycles from 215 to 184 cycles per year for future calculations of EAEU. *Id.* DOE also requested comment on its approach to propose a new appendix C2 with the updated annual number of cycles, the use of which would be required for compliance with any amended energy conservation standards. *Id.*

DOE did not receive any comments on this topic. DOE notes that RECS 2020 microdata was released in July 2022, from which DOE estimated that the number of annual dishwasher cycles increased to 196.5 cycles per year.[18] DOE does not have sufficient information to determine whether this value, obtained from surveys of consumers during the coronavirus-19 pandemic, is representative of overall average consumer use of dishwashers as compared to the estimate of 184 cycles per year proposed in the December 2021 NOPR, due to potentially different usage patterns of dishwashers by consumers during the coronavirus-19 pandemic. Accordingly, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to update the number of annual cycles from 215 to 184 cycles per year for future calculations of EAEU in the new appendix C2 and to require the use of the new appendix C2 with the updated annual number of cycles for compliance with any amended energy conservation standards.

G. Energy and Water Consumption Test Methods

1. Test Load Items

The current test load and test load items are specified in sections 2.6 and 2.7 of appendix C1. Non-soil-sensing dishwashers are tested with six serving pieces plus eight place settings, or six serving pieces plus the number of place settings equal to the capacity of the dishwasher if the latter is less than eight place settings. Soil-sensing compact and soil-sensing standard dishwashers are tested with four place settings and eight place settings, respectively, along with six serving pieces each.

In the December 2021 NOPR and in response to comments received on the August 2019 RFI, DOE noted that no data has been presented that would justify changing the test load items at that time. 86 FR 72738, 72749. Although no data was presented regarding the use of plastic items, DOE stated in the December 2021 NOPR that it recognizes that the minimal thermal mass of plastic test load items would likely result in little, if any, change to the energy and water consumption. *Id.*

DOE stated in the December 2021 NOPR that it observed that some of the test load items specified in the currently applicable appendix C1 differ from the items specified in section 3.4 of AHAM DW–2–2020, which is also referenced by section 2.7.1 of AHAM DW–1–2020. *Id.* As presented in the December 2021 NOPR, the test load items as stated in the current appendix C1 and AHAM DW–2–2020 are shown in Table III.1. *Id.* at 86 FR 72749–72750.

TABLE III.1—TEST LOAD ITEMS IN THE CURRENTLY APPLICABLE APPENDIX C1 AND AHAM DW–2–2020

Item	Appendix C1			AHAM DW–2–2020	
	Company/designation	Description	Alternate	Company/designation	Size
Dinner Plate	Corning Comcor®/ Corelle® #6003893.	10 inch Dinner Plate		Corelle® #5256294	10 inch (25.4cm).
Bread and Butter Plate	Corning Comcor®/ Corelle® #6003887.	6.75 inch Bread & Butter	Arzberg #8500217100 or 2000–00001–0217–1.	Corelle® #5256286	6.7 inch (17.0cm).
Fruit Bowl	Corning Comcor®/ Corelle® #6003899.	10 oz. Dessert Bowl	Arzberg #3820513100	Corelle® #5256297	10 oz. (296mL).

[17] In the 2015 RECS, the Energy Information Administration (''EIA'') collected the number of times per week that households used their dishwasher as point values rather than ranges as EIA had done in previous surveys. For households using their dishwashers, multiplying weekly usage by number of weeks in the year results in annual usage rates. A weighted average of annual usage employs the household weight and produces a nationally weighted annual usage value.

[18] 2020 RECS Survey Data. Available at: *www.eia.gov/consumption/residential/data/2020/index.php?view=microdata.*

TABLE III.1—TEST LOAD ITEMS IN THE CURRENTLY APPLICABLE APPENDIX C1 AND AHAM DW–2–2020—Continued

Item	Appendix C1			AHAM DW–2–2020	
	Company/designation	Description	Alternate	Company/designation	Size
Cup	Corning Comcor®/ Corelle® #6014162.	8 oz. Ceramic Cup	Arzberg #1382–00001–4732.	Arzberg #1382–00001–4732.	7 oz. (207mL).
Saucer	Corning Comcor®/ Corelle® #6010972.	6 inch Saucer	Arzberg #1382–00001–4731.	Arzberg #1382–00001–4731.	5.5 inch (14.0cm).
Serving Bowl	Corning Comcor®/ Corelle® #6003911.	1 qt. Serving Bowl		Corelle® #5256304	1 qt. (950mL).
Platter	Corning Comcor®/ Corelle® #6011655.	9.5 inch Oval Platter		Corelle® #6011655 OR ALTERNATE Corelle® #5256290.	Oval—9.5 inch by 7.5 inch (24.1cm by 19.1cm). Round—8.5 inch (21.6cm).
Glass—Iced Tea	Libbey #551HT			Libbey #551HT	12.5 oz.
Flatware—Knife	Oneida®—Accent 2619KPVF.		WMF—Gastro 0800 12.0803.6047.	WMF 12.0803.6047.	
Flatware—Dinner Fork	Oneida®—Accent 2619FRSF.		WMF—Signum 1900 12.1905.6040.	WMF 12.1905.6040.	
Flatware—Salad Fork	Oneida®—Accent 2619FSLF.		WMF—Signum 1900 12.1964.6040.	WMF 12.1964.6040.	
Flatware—Teaspoon	Oneida®—Accent 2619STSF.		WMF—Signum 1900 12.1910.6040.	WMF 12.1910.6040.	
Flatware—Serving Fork	Oneida®—Flight 2865FCM.		WMF—Signum 1900 12.1902.6040.	WMF 12.1902.6040.	
Flatware—Serving Spoon	Oneida®—Accent 2619STBF.		WMF—Signum 1900 12.1904.6040.	WMF 12.1904.6040.	

For the cup, saucer, and flatware items, the alternate options listed in the currently applicable appendix C1 are the primary options specified in AHAM DW–2–2020. The iced tea glass is the only item that is the same for both test procedures. The remaining items specify Corelle® as the manufacturer for both appendix C1 and AHAM DW–2–2020, but these items have new model numbers in AHAM DW–2–2020. DOE stated in the December 2021 NOPR that it understands that the Corelle® model numbers listed in the currently applicable appendix C1 are no longer in production, and the model numbers listed in AHAM DW–2–2020 are the newer editions for these out-of-production items. *Id.* at 86 FR 72750. Additionally, AHAM DW–2–2020 contains an alternative selection only for the serving platter. For the other test load items, AHAM DW–2–2020 provides instructions to contact AHAM for assistance to identify suitable alternatives.

As illustrated in Table III.1, AHAM DW–2–2020, which is referenced in AHAM DW–1–2020, includes newer model numbers of the test load items as compared to the currently applicable appendix C1. Therefore, in the December 2021 NOPR, DOE proposed to reference section 2.7.1 of AHAM DW–1–2020, which specifies that the test load must be as stated in section 3.4 of AHAM DW–2–2020. *Id.* Specifically, DOE proposed to apply the provisions of section 3.4 of AHAM DW–2–2020 to appendices C1 and C2, excluding the Note accompanying section 3.4 regarding AHAM assistance with determining alternatives. *Id.*

In the December 2021 NOPR, DOE also proposed to continue including the test load items specified in the currently applicable appendix C1 as alternate options, so that test laboratories can continue using the existing test load if they already have these items. *Id.* This proposal would be applicable to both appendix C1 and the new appendix C2. Pursuant to EPCA requirements, this approach would not impose an undue burden, but rather minimize test burden as it would not require manufacturers and/or test laboratories to procure new items if they already have the existing test load items.

DOE requested comment on specifying that the test load items be as specified in AHAM DW–1–2020 (which references section 3.4 of AHAM DW–2–2020), while additionally retaining, as an alternative, the current test load specifications in appendix C1 and the new appendix C2. *Id.*

DOE did not receive any comments on this topic and is finalizing its proposal, consistent with the December 2021 NOPR, to specify that the test load items be as specified in AHAM DW–1–2020 (which references section 3.4 of AHAM DW–2–2020), while additionally retaining, as an alternative, the current test load specifications in appendix C1 and the new appendix C2.

2. Soils

As stated in the December 2021 NOPR, the soil load specified in the currently applicable appendix C1 has been developed by DOE to produce a measure of energy and water use of soil-sensing dishwashers in a representative usage cycle. 86 FR 72738, 72751. DOE also stated that DOE did not have data on the operation of a soil-sensing function that would suggest that a field use factor to adjust testing results would be appropriate and therefore, DOE did not propose a field use factor for appendix C1 or the proposed new appendix C2 in the December 2021 NOPR. *Id.* DOE additionally requested feedback and data regarding soiling level and whether there have been changes to consumers' pre-rinsing behavior. *Id.* DOE also sought information regarding the impact of different soil levels on energy and water use in dishwashers currently on the market. *Id.*

Section 2.7.4 of the currently applicable appendix C1 states that the soils shall be as specified in section 5.4 of ANSI/AHAM DW–1–2010, except for the following substitutions:

- *Margarine.* The margarine shall be Fleischmann's Original stick margarine.
- *Coffee.* The coffee shall be Folgers Classic Decaf.

Additionally, section 2.7.5 of the currently applicable appendix C1 states that soils shall be prepared according to section 5.5 of ANSI/AHAM DW–1–2010, with the following additional specifications:

- *Milk.* The nonfat dry milk shall be reconstituted before mixing with the oatmeal and potatoes. It shall be reconstituted with water by mixing ⅔ cup of nonfat dry milk with 2 cups of water until well mixed. The reconstituted milk may be stored for use over the course of 1 day.
- *Instant mashed potatoes.* The potato mixture shall be applied within 30 minutes of preparation.

• *Ground beef.* The 1-pound packages of ground beef shall be stored frozen for no more than 6 months.

In the December 2021 NOPR, DOE noted that Table 3 in section 5.4 of AHAM DW–2–2020 specifies Fleischmann's™ Original Stick margarine and Folgers™ Classic Decaf coffee, consistent with DOE's substitutions in section 2.7.4 of the currently applicable appendix C1. *Id.* These AHAM DW–2–2020 soiling specifications are also referenced in section 2.7.4 of AHAM DW–1–2020. Therefore, in the December 2021 NOPR, DOE proposed to remove the substitution for margarine and coffee from regulatory text in appendix C1 and apply the soiling requirements in section 2.7.4 of AHAM DW–1–2020 instead. *Id.*

Additionally, section 2.7.5 of AHAM DW–1–2020 includes the additional soil preparation requirements for milk, instant mashed potatoes, and ground beef, which are currently specified in appendix C1. Therefore, in the December 2021 NOPR, DOE proposed to remove the additional soil preparation specifications from section 2.7.5 in appendix C1 and apply the requirements in section 2.7.5 of AHAM DW–1–2020 instead. *Id.*

DOE requested comment on its proposal to remove the soil substitution and soil preparation requirements from sections 2.7.4 and 2.7.5 of appendix C1 and apply these same requirements from AHAM DW–1–2020 instead. *Id.* DOE particularly requested data and information on how the proposed soil composition would affect energy and water use in current dishwashers. *Id.*

Samsung commented that pre-rinsing drastically increases the water and energy use beyond what the test procedure measures today and cited a Lawrence Berkeley National Laboratory (''LBNL'') survey which indicated that 55 percent of consumers pre-rinse dishes.[19] (Samsung, No. 21 at p. 3)

Samsung commented that it believes the consumer advocacy by dishwasher manufacturers, consumer advocates, detergent manufacturers, and the Environmental Protection Agency to educate consumers against pre-rinsing would only be successful if consumers believe their dishwasher will provide satisfactory cleaning without pre-rinsing. (*Id.;* Samsung, Public Meeting Transcript, No. 22 at p. 7) To that end, Samsung recommended that DOE consider updating soil loads that do not assume pre-rinsing by introducing heavier test soil loads that match the best practice of scraping foods off the plates rather than the soil levels one would find after pre-rinsing dishes with water. (*Id.*)

During the December 2021 NOPR public meeting, the CA IOUs commented that the soil loads used for the DOE test procedure should be representative. The CA IOUs further commented that the soil loads should be more representative of scraping compared to pre-rinsing as it would be more beneficial from energy and water savings perspective. (CA IOUs, Public Meeting Transcript, No. 22 at pp. 43–44) In written comments, the CA IOUs commented that the soil loads as defined by AHAM DW–2–2020 do not align with the definition of a ''normal cycle'' as being recommended for typical use with a ''full load of normally soiled dishes,'' because they do not believe a normally soiled load of dishes is at most half soiled (as is implied by the soil level of ''heavy'' load in AHAM DW–2–2020) and the medium and light soil loads include a majority of clean dishes. (CA IOUs, No. 19 at p. 2) The CA IOUs commented that DOE should therefore consider increasing the number of tableware that are soiled as part of the cleaning performance test. (*Id.*)

The soil loads specified in the currently applicable appendix C1, which are the same as the soil loads specified in AHAM DW–2–2020, have been developed by DOE to produce a measure of energy and water use of soil-sensing dishwashers in a representative usage cycle. While the soils are only applied to some of the place settings at each soil load, these soils represent the total quantities of soils that would enter a dishwasher for a fully soiled load of dishes at the various soil levels. DOE does not have, nor did commenters submit, any specific information about the types of soils that would be used to reflect pre-rinsing, or lack thereof, or the consumer relevance of such soils. Absent such data, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to remove the additional soil preparation specifications from section 2.7.5 in appendix C1 and apply the requirements in section 2.7.5 of AHAM DW–1–2020 instead. DOE is also finalizing its proposal, consistent with the December 2021 NOPR, to remove the soil substitution and soil preparation requirements from sections 2.7.4 and 2.7.5 of appendix C1 and apply these same requirements from AHAM DW–1–2020 instead. Finally, the new appendix C2 mirrors the language in the amended appendix C1.

3. Loading Pattern

Section 2.6 of the currently applicable appendix C1 references section 5.8 of ANSI/AHAM DW–1–2010 for loading the dishwasher prior to running active mode tests, which requires loading in accordance with the manufacturer's recommendation.

In the December 2021 NOPR, DOE recognized that the positioning of soiled test load items in relation to unsoiled ones could impact the rate at which soils are removed from the test load items, and therefore also impact soil sensor responses. 86 FR 72738, 72751. This could lead to variation in energy and water consumption. Specifying a loading pattern requirement would improve the repeatability of the testing procedure and reproducibility of results across both individual tests and testing facilities. AHAM has included the loading pattern requirements specified in the ENERGY STAR Cleaning Performance Test Method in section 2.6.3.4 of AHAM DW–1–2020. These requirements are applicable to soil-sensing dishwashers that are tested with both clean and soiled place settings. In the December 2021 NOPR, DOE proposed to apply these AHAM DW–1–2020 loading requirements to appendix C1 and the new appendix C2 to reduce potential variation in the test procedure. *Id.* Additionally, DOE proposed that these loading requirements would apply to both soil-sensing and non-soil-sensing dishwashers as non-soil-sensing dishwashers would be required to use soil loads for testing under the proposed cleaning index threshold (discussed in section III.H of this document). *Id.* DOE requested input on its proposal to use the loading requirements specified in section 2.6.3.4 of AHAM DW–1–2020. *Id.*

AHAM commented that DOE had no data to support that specifying a loading pattern requirement would improve the repeatability of the test procedure and reproducibility of the results, especially as it pertains to determining the cleaning performance of dishwashers. (AHAM, No. 17 at p. 10)

The Joint Commenters stated that they supported the proposal to include the loading pattern requirements specified in AHAM DW–1–2020, explaining that the current lack of specificity with regards to loading pattern can impact repeatability and reproducibility of test results. (Joint Commenters, No. 18 at pp. 1–2)

The ENERGY STAR Cleaning Performance Test Method specifies the same loading pattern that DOE proposed in the December 2021 NOPR. During development of the ENERGY STAR

[19] ''Dishwashers in the Residential Sector: A Survey of Product Characteristics, Usage, and Consumer Preferences.'' Section 4.3.2.1. Available at *www.osti.gov/biblio/1827934.* Last accessed July 6, 2022.

Cleaning Performance Test Method, DOE noted that the loading pattern had minimal effect on cleaning performance; however, DOE specified loading patterns that distribute the soils throughout the dishwasher as evenly as possible to ensure consistency from test laboratory to test laboratory.[20] In the absence of any additional data, DOE maintains that given that the test load does not include all soiled items (*i.e.,* only some of the place settings are soiled while others are clean), the placement of the soiled items may impact soil sensor response or the cleaning index, especially if a given unit does not uniformly clean all items within the wash chamber. Therefore, specifying the placement of the clean and soiled items for each test would ensure that the test is run consistently each time.

For the reasons stated previously, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to use the loading requirements specified in section 2.6.3.4 of AHAM DW–1–2020 in appendix C1 and the new appendix C2.

4. Preconditioning Cycles

Section 2.9 of the currently applicable appendix C1 requires manufacturers to precondition the dishwasher by running the normal cycle twice with no load after the testing conditions are established. The prewash fill water volume, if any, and the main wash fill water volume are measured during the second preconditioning cycle to calculate the detergent amounts to be used during the energy and water consumption tests. The prescribed procedure ensures an accurate calculation of detergent dosing, priming of the water lines and sump area of the pump, successful sensor calibration, and machine cleaning without adding significant test burdens.

In the December 2021 NOPR, DOE did not propose to modify the requirement for two preconditioning cycles currently in appendix C1, and proposed to apply this requirement to the new appendix C2.

DOE did not receive any comments on this topic and is maintaining the requirement for two preconditioning cycles currently in appendix C1 and is applying this requirement to the new appendix C2.

5. Detergent

Section 2.10 of appendix C1 specifies using Cascade with the Grease Fighting Power of Dawn powder as the detergent formulation. This section also provides the method to calculate the detergent quantities to be added to the prewash (if available) and main wash compartments, which is based on the prewash (if available) and main-wash water volumes, respectively.

The powder detergent currently specified in appendix C1—Cascade with the Grease Fighting Power of Dawn—is no longer commercially available. Instead, a new powder detergent, Cascade Complete Powder, which has a slightly different formulation [21] from Cascade with the Grease Fighting Power of Dawn, is now available on the market. AHAM has updated AHAM DW–2–2020 to reference this new detergent for testing purposes. AHAM DW–1–2020 references AHAM DW–2–2020 for detergent formulation as well as dosage.

In addition to a change in the detergent to be used for testing, both AHAM DW–1–2020 and AHAM DW–2–2020 also specify new dosage requirements in comparison to the current requirements of appendix C1.[22] Section 4.1 of AHAM DW–2–2020 specifies the detergent dosage as 1.8 grams per place setting in the main compartment of the detergent dispenser and 1.8 grams per place setting in the prewash compartment of the detergent dispenser or other location. Section 2.10.1 of AHAM DW–1–2020 further specifies to use half the quantity of detergent that is specified in section 4.1 of AHAM DW–2–2020 for both prewash and main wash detergent for the energy and water consumption tests. Prewash detergent is specified only for those units if it is recommended by the manufacturer's instructions for conditions that are consistent with the test procedure. This includes, but is not limited to, manufacturer instructions that recommend the use of prewash detergent for the normal cycle, normally soiled loads, or for water hardness between 0 and 85 ppm. Additionally, if manufacturer instructions lead to the use of the prewash detergent requirements, the prewash detergent is placed as instructed by the manufacturer or, if no instructions are provided, the prewash detergent is placed on the inner door near the detergent cup.

In the December 2021 NOPR, DOE presented preliminary data comparing the energy and water use of four dishwashers when tested according to the current detergent and dosing method and the new detergent and dosing method. 86 FR 72738, 72752–72753. In the December 2021 NOPR, DOE noted that given the small sample size of only four test units, DOE believed that additional testing would be required to determine whether the observed variation in results is due to the change in detergent and dosage, or whether it could be attributed to unrelated differences in the sensor response of these soil-sensing dishwashers, or other factors. *Id.*

Given the uncertainty about whether the new detergent and dosing requirements would impact the energy and water consumption of dishwashers, in the December 2021 NOPR, DOE proposed that both the current detergent and dosage requirements as well as the new detergent and new dosage requirements would be allowable to use for testing according to appendix C1. *Id.* at 86 FR 72753. By maintaining the use of the current detergent and dosing requirements, manufacturers would not be required to re-test currently certified dishwashers. Because DOE proposed the detergent type and dosage specifications in AHAM DW–1–2020 in addition to the current requirements, this proposal would not require the re-rating or re-certification of dishwashers currently on the market. Additionally, permitting the optional use of the detergent and dosing specifications in AHAM DW–1–2020 would avoid the need for manufacturers to request test procedure waivers should the currently required detergent become unavailable and would harmonize with current industry practice.

For the new appendix C2, which would be required at the time compliance is required with updated energy and water conservation standards, DOE proposed in the December 2021 NOPR to specify only the new detergent and dosage requirements from AHAM DW–1–2020. *Id.*

The current dosage requirements specify detergent dosage based on water volume, which requires distinguishing the water used in the prewash from the

[20] ENERGY STAR® Program Requirements. Product Specification for Residential Dishwashers. Draft 1 Test Method for Determining Residential Dishwasher Cleaning Performance. Rev. Feb.-2012. *www.energystar.gov/sites/default/files/specs//Draft_1_Test_Method_Dishwasher_Cleaning_Performance.pdf.*

[21] DOE participated in AHAM's task force for the development of AHAM DW–1–2020. Stakeholders mentioned during the AHAM task force calls that they were informed by the detergent manufacturer that the only difference between Cascade with the Grease Fighting Power of Dawn and Cascade Complete Powder is related to the enzymes used in the detergent. DOE was not able to verify this information independently because the ingredient list for Cascade with the Grease Fighting Power of Dawn is not available on product packaging (or online).

[22] As discussed, the detergent dosage for the currently applicable appendix C1 is based on measurements of the prewash fill water volume, if any, and the main wash fill water volume measured during the second preconditioning cycle.

water used in the main wash. In the December 2021 NOPR, DOE stated that it has observed, and stakeholders have also expressed, that uncertainty in differentiating the prewash and main-wash cycles to estimate detergent dosage could be a potential source of test variation. *Id.* As stated, the new detergent dosage is based on the number of place settings, rather than measurement of prewash and main-wash water volumes, potentially providing more consistent dosing. More consistent dosing would improve the repeatability and reproducibility of the results. Additionally, the new dosage would reduce test burden, since it would eliminate the need to identify, isolate, and calculate the prewash and main-wash water volumes.

DOE requested comment on its proposal to adopt in appendix C1 the new detergent and new dosage requirements as specified in AHAM DW–1–2020, while also retaining the current detergent and dosage requirements in appendix C1. *Id.* The use of either set of detergent requirements would be allowable for testing under appendix C1. DOE also requested comment on the detergent currently being used by manufacturers and test laboratories for testing and certification of dishwashers. *Id.*

DOE stated that if stakeholder comments indicate that the currently specified detergent, Cascade with the Grease Fighting Power of Dawn, is no longer being used by manufacturers, DOE may instead consider including only the new detergent, Cascade Complete Powder, and dosage requirements from AHAM DW–1–2020 in appendix C1, rather than allowing both the current and new detergent and dosage requirements. *Id.* DOE also welcomed comments and data on the impact of the new detergent and dosage on energy and water use. *Id.*

DOE did not receive any written comments in response to this topic. During the December 2021 NOPR public meeting, Fisher & Paykel noted that AHAM DW–2–2020 specifies 1.8 grams of detergent per place setting, but AHAM DW–1–2020 specifies to use half of that quantity for the energy and water consumption tests. Fisher & Paykel additionally noted that cleaning performance would also be evaluated using half the quantity of detergent that is specified in AHAM DW–2–2020 (the standard that specifies the cleaning performance test method). Fisher & Paykel stated that DOE's proposal would require meeting the proposed cleaning index threshold using only half as much detergent. (Fisher & Paykel, Public Meeting Transcript, No. 22 at p. 56)

DOE notes that while AHAM DW–1–2020 specifies half the quantity of detergent compared to AHAM DW–2–2020, the number of soiled place settings are also fewer when testing is conducted according to AHAM DW–1–2020 compared to AHAM DW–2–2020. Specifically, AHAM DW–2–2020 requires eight place settings to be soiled when conducting the test, while sections 2.6.3.1, 2.6.3.2, and 2.6.3.3 of AHAM DW–1–2020 require four, two, and one place settings to be soiled for the heavy, medium, and light soil loads, respectively. Additionally, DOE's goal in specifying the cleaning performance threshold is to evaluate cleaning performance on the same cycles that are used to evaluate energy and water use. Therefore, DOE believes it is appropriate to use the same amount of detergent to evaluate cleaning performance as is used to determine energy and water use.

In this final rule, DOE finalizes its proposal, consistent with the December 2021 NOPR, to adopt in appendix C1 the new detergent and new dosage requirements as specified in AHAM DW–1–2020, while also retaining the current detergent and dosage requirements in appendix C1. Additionally, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to adopt in the new appendix C2 only the new detergent and new dosage requirements as specified in AHAM DW–1–2020.

6. Rinse Aid

Section 2.1 of the currently applicable appendix C1 requires that testing be conducted without the use of rinse aid, and that any rinse aid reservoirs remain empty for testing. In the December 2021 NOPR, DOE maintained its conclusions from past rulemakings that the test procedure should preclude the use of rinse aid, and that the rinse aid container should remain empty during testing. 86 FR 72738, 72754. Adding a rinse aid requirement would increase test burden without information indicating that it would improve the representativeness of the test results, and it could potentially cause variation in test results. For these reasons, DOE did not propose a rinse aid requirement in appendix C1 or the new appendix C2, which is consistent with the specifications in AHAM DW–1–2020 that DOE proposed to reference in the December 2021 NOPR. *Id.*

During the December 2021 NOPR public meeting, Electrolux questioned if cleaning performance would be evaluated for soils only, without evaluating spots, streaks, and rack contact marks, due to the lack of the use of rinse aid during the energy and water consumption tests. (Electrolux, Public Meeting Transcript, No. 22 at p. 19) AHAM commented that if DOE moves forward with a cleaning performance metric, DOE should evaluate either the use of rinse aid to decrease variation in scoring or running the energy test without rinse aid and adjusting the scoring to only score soils and not spots or streaks on glassware. (AHAM, No. 17 at p. 15) During the October 2022 *ex parte* meeting, AHAM commented that DOE's test procedure should not include the use of rinse aid and the test load should be score based only on soil particles, without including scores for spots or streaks. (AHAM, No. 27 at p. 40)

Whirlpool stated that if DOE finalizes its proposals to include a minimum cleaning index requirement, Whirlpool recommended that rinse aid be a requirement. Whirlpool explained that the use of rinse aid improves repeatability and lowers variation in a dishwasher performance test, including making glasses and silverware easier to accurately score. (Whirlpool, No. 16 at p. 10; see also Whirlpool, No. 16 at p. 4) Whirlpool also commented that it would assist DOE in determining the appropriate amount of rinse aid to specify in the test procedure. (Whirlpool, No. 16 at p. 10)

Whirlpool also commented that if DOE does not finalize the test procedure with a cleaning index requirement, Whirlpool maintains its existing position that rinse aid is not needed in a test that only assesses energy and water consumption, since rinse aid does not impact energy and water use. (*Id.*)

DOE recognizes that the use of rinse aid, or lack thereof, can impact the scoring of spots or streaks on glassware. Given DOE is not specifying the use of rinse aid, as discussed in section III.H of this document, DOE has updated the cleaning index calculation to score only soils and not include the scores of spots, streaks, or rack contact marks on the glassware because, as noted by commenters, the lack of use of rinse aid would impact the scores of spots, streaks, and rack contact marks.

This final rule does not require the use of rinse aid in appendix C1 or the new appendix C2, consistent with the specifications in AHAM DW–1–2020 and the currently applicable DOE test procedure.

7. Water Softener Regeneration Cycles

In the October 2012 Final Rule, DOE adopted a method for measuring the energy consumed during regeneration

cycles for water softeners built into certain residential dishwashers. 77 FR 65942, 65960. The adopted approach relies on manufacturer-reported values for the energy and water use for each regeneration cycle and the number of annual regeneration cycles. *Id.* The current calculations for water softener regeneration cycles are provided in sections 5.1.3, 5.4.3, 5.5.1.2, 5.5.2.2, 5.6.1.2, and 5.6.2.2 of appendix C1. In response to the August 2019 RFI, DOE did not receive any comment regarding the energy and water use during water softener regeneration cycles, and thus did not propose any changes in the December 2021 NOPR with regards to water softener regeneration cycles, aside from maintaining the associated definitions and calculations specified in AHAM DW–1–2020. 86 FR 72738, 72754.

AHAM commented that dishwashers with built-in water softeners should be tested in the as-shipped condition, where the default typically is that the water softeners are turned off, rather than tested with the water softener activated since it does not expect consumers to use the water softener function often due to the high prevalence of home water softeners in the United States. (AHAM, No. 17 at p. 15) AHAM commented that it does not believe this will have a statistically significant impact on energy usage. (*Id.*) Whirlpool commented that it supported AHAM's position on the technical issues concerning built-in water softener dishwashers. (Whirlpool, No. 16 at p. 2)

AHAM has not submitted any data to support its claim that dishwashers with water softeners typically have the water softener turned off. DOE notes that the current test procedure accounts for the additional energy and water use associated with water softener regeneration cycles as a manufacturer-reported value that is added to the tested values for the calculation of EAEU, EAOC, and water consumption. In the June 2011 BSH Corporation (''BSH'') Decision and Order, BSH included a 50-percent deduction in energy and water based on an estimate that at least 50 percent of homes already have a water softening system. 76 FR 38144, 38145. In this Decision and Order, DOE noted that BSH submitted no data to support this claim. *Id.* DOE further stated that to maintain the same methodology used in a similar waiver granted to Whirlpool, DOE was not including the 50-percent deduction in its final waiver for BSH. *Id.* In the absence of additional data, DOE's position remains the same as that stated in the June 2011 BSH Decision and Order.

Accordingly, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to maintain the associated definitions and calculations specified in AHAM DW–1–2020 for water softener regeneration cycles.

8. Water Re-Use System

On November 1, 2013, DOE published a Decision and Order (''November 2013 Decision and Order'') granting Whirlpool a test procedure waiver (''Whirlpool waiver'') for testing specified basic models equipped with a ''water use system,'' in which water from the final rinse cycle is stored for use in the subsequent cycle, with periodic draining (''drain out'') and cleaning (''clean out'') events. 78 FR 65629 (Case No. DW–11).[23] Whirlpool is required to test the basic model specified in the November 2013 Decision and Order using appendix C1, with the following modifications:

(1) ''Water use system'' water and energy consumption shall be accounted for during dishwasher water and energy measurement and reporting, subject to the following:

a. For ''drain out'' events, constant values of 0.072 gallons per cycle and 2.6 kWh/year shall be added to values measured by appendix C1.

b. For ''clean out'' events, constant values of 0.071 gallons per cycle and 10.3 kWh/year shall also be added to values measured by appendix C1.

c. To calculate the detergent quantity for testing, a constant value of 0.91 gallons for the water fill amount shall be used, representing both saved water fill and house supply water fill.

d. If a ''drain out'' or ''clean out'' event occurs during testing, any results from that use of the test procedure shall be disregarded. Disconnect and reconnect power to the dishwasher, then restart the test procedure.

(2) To detect a ''drain out'' event, measure the water volume supplied during the first fill. A cycle shall be considered to have a ''drain out'' event if the first fill uses approximately 1 gallon from the water supply. Without a ''drain out'' event, the first fill would use approximately 0.11 gallons from the water supply.

(3) To detect a ''clean out'' event, monitor the temperature of the sump water using an additional temperature measuring device. The device shall be placed inside the sump in an area such that the device will always be submerged in water and will not interfere with the operation of the dishwasher. A cycle shall be considered to have a ''clean out'' event if the temperature of the sump water during wash and rinse portions of the cycle reaches 150 °F. Without a ''clean out'' event, the highest sump water temperatures would reach approximately 140 °F.

78 FR 65629, 65631.

Subsequently, AHAM published the AHAM DW–1–2020 standard, which includes provisions for testing water re-use system dishwashers. Specifically, sections 1.3, 1.9, and 1.29 of AHAM DW–1–2020 include definitions for a clean out event, drain out event, and water re-use system dishwasher, respectively. These definitions are consistent with those specified in the November 2013 Decision and Order. AHAM DW–1–2020 also specifies the detergent dosing requirements, methods to measure the energy and water consumption of water re-use system dishwashers, including detection of drain out and clean out events, and calculations for energy and water consumption. Sections 2.10.2, 4.1.3, 5.1.4, 5.1.5, 5.4.4, 5.4.5, 5.5.1.3, 5.5.1.4, 5.5.2.3, 5.5.2.4, 5.6.1.3, 5.6.1.4, 5.6.2.3, and 5.6.2.4 of AHAM DW–1–2020. All of these requirements are consistent with the alternate test procedure specified in the November 2013 Decision and Order granting the waiver to Whirlpool for water re-use systems, except for the specified water energy consumption equations in sections 5.6.1.3, 5.6.1.4, 5.6.2.3, and 5.6.2.4, which use an incorrect constant.[24]

As soon as practicable after the granting of any waiver, DOE is required to publish in the **Federal Register** a NOPR to amend its regulations so as to eliminate any need for the continuation of such waiver. 10 CFR 430.27(l). As soon thereafter as practicable, DOE will publish in the **Federal Register** a final rule. *Id.* Since AHAM DW–1–2020 includes the language from the Whirlpool waiver, in the December 2021 NOPR, DOE proposed to reference these requirements in appendix C1 and the new appendix C2, with added modifications to the equations in sections 5.6.1.3, 5.6.1.4, 5.6.2.3, and 5.6.2.4 of AHAM DW–1–2020. 86 FR 72738, 72754.

DOE requested comment on its proposal to reference in appendix C1 and the new appendix C2 the testing provisions from AHAM DW–1–2020 to address the Whirlpool waiver for water re-use system dishwashers. *Id.*

DOE did not receive any comments on this topic and is finalizing its proposal, consistent with the December 2021 NOPR, to reference in appendix C1 and the new appendix C2 the testing provisions from AHAM DW–1–2020 to address the Whirlpool waiver for water re-use system dishwashers.

[23] All materials regarding the Whirlpool waiver are available in docket EERE–2013–BT–WAV–0042 at *www.regulations.gov*.

[24] The equations in the noted sections improperly use the constant K = specified heat of water in kWh per gal per °F, instead of C/e, where C = specific heat of water in Btus per gal per °F, and e = nominal gas or oil water heater recovery efficiency.

9. Water Heater Efficiency

Section 5 of appendix C1 specifies the calculations of derived results from test measurements, including machine energy consumption, fan-only mode energy consumption, drying energy consumption, water consumption, and water energy consumption. For water energy consumption, DOE specifies different equations based on whether an electric water heater is used, or a gas-heated or oil-heated water heater is used. For electric water heaters, appendix C1 assumes a 100 percent efficiency,[25] while for gas/oil water heaters, appendix C1 specifies the calculation assuming a 75 percent efficiency. DOE did not propose any changes to this requirement in the December 2021 NOPR.

The Joint Commenters recommended that DOE amend assumptions for water heater efficiencies to better reflect real-world water heater efficiencies, as they would improve representativeness of the test procedure and more accurately reflect the relative contribution of water heating energy use to the total dishwasher energy use. (Joint Commenters, No. 18 at p. 3) The Joint Commenters stated that the efficiency assumptions in the test procedure are higher than those found in the existing housing stock and underestimate the energy use associated with water heating and estimated that the shipment-weighted efficiencies for new water heaters are 92 percent for electric water heaters and 62 percent for gas water heaters. (*Id.*)

As discussed in the clothes washer test procedure final rule published on June 1, 2022, (*See* 87 FR 33316, 33355–33356), based on the values presented, DOE interprets the Joint Commenters statement as referring to a value of uniform energy factor (''UEF''). DOE notes that UEF is a measure of efficiency based in part on a 24-hour simulated use test that measures both energy use associated with recovery periods (*i.e.,* the energy embedded within each water draw) and energy losses during the time in which water is not being withdrawn from the water heater (*i.e.,* standby energy losses), and incorporates simulated household water draw patterns. In a residential household, numerous appliances draw hot water from the water heater, in addition to dishwashers. Given the number of factors not directly related to dishwasher usage that factor into the UEF metric, DOE has determined that it would not be appropriate to use UEF as the basis for determining an estimate of water heating energy in the dishwashers test procedure. The appropriate water heater efficiency metric to use for dishwashers is the recovery efficiency, which represents the ratio of energy delivered to the water to the energy content of the fuel consumed by the water heater. *Id.* Based on a qualitative evaluation of the electric and gas water heater efficiencies in its public Compliance Certification Management System (''CCMS'') database,[26] DOE determines that the efficiencies listed in the current dishwasher test procedure are appropriate. Additionally, DOE did not discuss water heater efficiencies in the December 2021 NOPR and has not provided stakeholders an opportunity to provide feedback on this topic. DOE will revisit the Joint Commenters' comments in a future rulemaking.

Therefore, DOE is not making any changes to the water heater efficiency in the dishwasher test procedures at appendix C1 and the new appendix C2.

H. Cleaning Performance

EPCA requires DOE to establish test procedures that are reasonably designed to produce test results that measure energy efficiency, energy use, water use (for certain products), or estimated annual operating cost of a covered product during a representative average use cycle or period of use, as determined by the Secretary, and shall not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) DOE's test procedure for dishwashers identifies the ''normal cycle'' as the cycle type representative of consumer use, defines the term ''normal cycle,'' and requires testing using the ''normal cycle.'' Compliance with the applicable standards is determined based on the measured energy and water use of the ''normal cycle.'' 10 CFR 430.23(c) and 10 CFR 430 subpart B appendix C1. The ''normal cycle'' is defined as the cycle type, including washing and drying temperature options, recommended in the manufacturer's instructions for daily, regular, or typical use to completely wash a full load of normally soiled dishes including the power-dry feature. If no cycle or more than one cycle is recommended in the manufacturer's instructions for daily, regular, or typical use to completely wash a full load of normally soiled dishes, the most energy-intensive of these cycles shall be considered the normal cycle. In the absence of a manufacturer recommendation on washing and drying temperature options, the highest energy consumption options must be selected. Section 1.12 of appendix C1. The currently applicable test procedure in appendix C1 does not define what constitutes ''completely wash[ing]'' a full load of normally soiled dishes (*i.e.,* the cleaning performance).

For dishwashers, the cleaning performance at the completion of a cycle influences how a consumer uses the product. If the cleanliness of the dishware after completion of a cleaning cycle does not meet consumer expectations, consumers may alter their use of the dishwasher. For example, consumers may alter the use of the product by selecting a different cycle type that consumes more energy and water to provide a higher level of cleaning, operating the selected cycle type multiple times, or prewashing the dishware, flatware, and glassware before loading into the dishwasher to achieve an acceptable level of cleaning. In the December 2021 NOPR, DOE summarized a comment received from Samsung in response to the August 2019 RFI in which Samsung stated that consumers unsatisfied with the cleaning performance of the ''normal cycle'' may opt to select a different mode that could result in increased energy consumption. (Samsung, No. 9 at p. 3) DOE also asserted in the December 2021 NOPR that it is possible that dishwashers exist on the market that are currently tested by manufacturers using a ''normal cycle'' that does not ''completely wash'' dishes. 86 FR 72738, 72755.

In general, a consumer-acceptable level of cleaning performance (*i.e.,* a representative average use cycle) can be easier to achieve through the use of higher amounts of energy and water use during the dishwasher cycle.[27] Conversely, maintaining acceptable cleaning performance can be more difficult as energy and water levels are reduced.[28] Improving one aspect of

[25] Section 5.5 of appendix C1 specifies the calculations for water energy consumption for dishwashers using electrically heated water. The equations specified in this section do not include a constant for the water heater recovery efficiency (as specified in section 5.6 for gas or oil-heated water), which indicates that the calculations for water energy consumption for dishwashers using electric water heaters assume a 100-percent water heater efficiency.

[26] U.S. Department of Energy Compliance Certification Database, available at *www.regulations.doe.gov/certification-data.* Last accessed July 8, 2022.

[27] Higher energy use may provide increased thermal and mechanical action for removing soils. Similarly, higher water use may provide better rinsing performance by reducing the amount of soil re-deposition on the dishware.

[28] In the December 2014 NOPR that proposed amended energy and water use standards for dishwashers, DOE noted that cleaning performance could be maintained up to Efficiency Level 3, which was defined as 234 kWh/year and 3.1 gal/cycle. 79 FR 76141, 76165 (Dec. 19, 2014). In the December 2016 Final Determination, DOE

dishwasher performance, such as reducing energy and/or water use as a result of energy conservation standards, may require a trade-off with one or more other aspects of performance, such as cleaning performance. DOE stated in the December 2021 NOPR that it expects, however, that consumers maintain the same expectations of cleaning performance regardless of the efficiency of the dishwasher. *Id.* at 86 FR 72755. As the dishwasher market continuously evolves to higher levels of efficiency—either as a result of mandatory minimum standards or in response to voluntary programs such as ENERGY STAR—it becomes increasingly more important that DOE ensures that its test procedure continues to reflect representative use. As such, the normal cycle that is used to test the dishwasher for energy and water performance must be one that provides a consumer-acceptable level of cleaning performance, even as efficiency increases.

In order for DOE's test procedure to more accurately and fully test dishwashers during a representative average use cycle, DOE stated in the December 2021 NOPR that it believes that amending the test procedure to define what constitutes completely washing a full load of normally soiled dishes (*i.e.,* the cleaning performance) will better represent consumer use of the product. *Id.* at 86 FR 72755. As such, in the December 2021 NOPR, DOE proposed additional direction for selecting the appropriate test cycle type, *i.e.,* for determining whether the cycle ''can completely wash a full load of normally soiled dishes.'' *Id.* DOE proposed to include a cleaning index methodology and minimum threshold to validate the selection of the test cycle in appendix C1 and the new appendix C2.[29] *Id.*

DOE received several comments on its proposal to include a cleaning performance test and minimum cleaning index threshold as a condition for a valid test cycle. General comments, including whether to adopt these provisions in the currently applicable test procedure at appendix C1 or in the new appendix C2, are summarized in the following section and topic-specific comments are addressed in subsequent sections.

1. General Comments

Samsung, ASAP, the Joint Commenters, and the CA IOUs supported the inclusion of a cleaning performance test method and minimum cleaning index threshold. (Samsung, No. 21 at p. 2; Public Meeting Transcript, No. 22 at p. 7; ASAP, Public Meeting Transcript, No. 22 at pp. 21–22; Joint Commenters, No. 18 at p. 2; CA IOUs, Public Meeting Transcript, No. 22 at p. 43; CA IOUs, No. 19 at pp. 1–2) AHAM, Whirlpool, and GEA opposed the inclusion of a cleaning performance test method and minimum cleaning index threshold. (AHAM, No. 17 at p. 2; Whirlpool, No. 16 at p. 2; GEA, No. 20 at p. 2)

Samsung commented that it agreed with DOE's position that the cleaning performance requirements would help define what constitutes completely washing a full load of normally soiled dishes (*i.e.,* the cleaning performance), which would allow the test cycle type to better represent consumer use of the product. (Samsung, No. 21 at p. 2) The CA IOUs commented that they supported the cleaning performance test method, stating that it would provide base-level cleanliness performance assurances that have the potential to increase representative use of the expected ''normal'' cycle, reduce pre-rinsing of dishes, and increase the overall consumer use of dishwashers. (CA IOUs, No. 19 at pp. 1–2) ASAP commented that consumers often shift from the normal cycle to an alternate cycle type with better cleaning performance, which would result in increased energy consumption; therefore, adopting a minimum cleaning index threshold would help ensure representativeness of the normal cycle and would better meet consumer expectations of cleaning performance. (ASAP, Public Meeting Transcript, No. 22 at pp. 21–22) The CA IOUs commented that it would be helpful to consumers in their energy and water use savings by assuring that there is satisfaction with the normal cycle. (CA IOUs, Public Meeting Transcript, No. 22 at p. 43) The Joint Commenters stated that a cleaning performance requirement will result in tested cycle types that are more representative of energy and water consumption during consumer use. (Joint Commenters, No. 18 at p. 2) DOE appreciates stakeholder support for the inclusion of the cleaning index threshold and agrees that specifying such a threshold will ensure that the rated energy and water consumption of dishwashers is representative for completely washing a full load of normally soiled dishes with a consumer-acceptable level of cleaning.

AHAM and Whirlpool commented that should DOE move ahead with a performance metric in the test procedure, they urged that compliance with the cleaning performance threshold should be required only with amended standards. (AHAM, No. 17 at p. 13; AHAM, No. 27 at p. 3; Whirlpool, No. 16 at p. 4) During the December 2021 NOPR public meeting, AHAM commented that the inclusion of a cleaning performance metric would intrinsically change test results and sought clarity on why DOE was including the cleaning performance metric in appendix C1. (AHAM, Public Meeting Transcript, No. 22 at p. 33) During the October 2022 *ex parte* meeting, AHAM reiterated its opposition to include cleaning performance requirements in appendix C1, stating that the cleaning performance would impact measured efficiency. (AHAM, No. 27 at p. 3) AHAM commented that DOE could not produce data on whether including cleaning performance requirements in appendix C1 would impact measured energy or provide any data on why it made the proposal to include the performance requirements in appendix C1, rather than including it in the proposed new appendix C2 and applying it when compliance with possible amended standards is required. (AHAM, No. 17 at pp. 13–14)

AHAM stated that the requirements potentially violate the investment and associated recovery assumptions underlying the manufacturer impact analysis that DOE presented in its preliminary technical support document on possible amended energy conservation standards. (*Id.* at p. 13) AHAM further commented that, based on DOE's data, about 18 percent of models would need to be tested using the most energy-intensive cycle[30] and the response of granting a waiver for products that fail to meet the cleaning index threshold on the most energy-intensive cycle would completely diminish the point of the requirement. (*Id.*) AHAM also referenced DOE's test data from the January 2022 Preliminary

additionally noted that manufacturers generally indicated that by using all available design options to improve efficiency, it would likely be able to maintain performance with a maximum energy consumption between 250 and 260 kWh/year and water consumption at 3.1 gal/cycle. 81 FR 90072, 90082.

[29] This approach is analogous to the one used for clothes dryers, in which the DOE test procedure at appendix D2 defines a threshold dryness level for automatic cycle termination of clothes dryers as a condition for the test cycle to be valid. Specifically, Section 3.3.2 of appendix D2 specifies that if the final moisture content after completion of the drying cycle is greater than 2 percent, the test shall be invalid and a new run shall be conducted using the highest dryness level setting.

[30] As discussed further in section III.H.4 of this document, DOE proposed in the December 2021 NOPR that if a dishwasher failed to achieve the minimum cleaning index threshold for a given soil load on the normal cycle, the unit would be re-tested at the same soil load using the most energy-intensive cycle. 86 FR 72738, 72747, 727560 72759.

Analysis and stated that most models currently on the market are at Efficiency Level (''EL'') 1 (which is the ENERGY STAR V. 6.0 level) and at that level, the majority of products would need to be re-tested using the most energy-intensive cycle for the heavy and/or medium soil load. AHAM additionally stated that for the 33 percent of models in DOE's data set that would require re-testing at the heavy soil load, it is possible that these products may not meet the current energy conservation standards or that some models currently meeting the ENERGY STAR criteria may no longer meet the baseline after being re-tested using the most energy-intensive cycle. (*Id.*)

Whirlpool commented that if DOE's proposal for the minimum cleaning index goes into effect with an amended appendix C1 test procedure, it would create a tremendous burden on manufacturers by potentially requiring them to re-test all models for compliance with the minimum cleaning index requirement and potentially redesign cycle types to continue to sell into the U.S. market, all within a 6-month window. (Whirlpool, No. 16 at p. 9; Whirlpool, Public Meeting Transcript, No. 22 at pp. 34–35) Whirlpool commented that it is impractical and overly burdensome to require manufacturers to re-test all their models in such a short window, particularly when manufacturers and test laboratories have other ongoing, competing laboratory needs. (Whirlpool, No. 16 at p. 9) Whirlpool stated that product redesigns are likely to occur as a result of this cleaning performance proposal. (*Id.*) Whirlpool commented that redesigning a product can take many months or years and would be a huge disruption in the market, and due to the stated flaws in the cleaning index, it was not even certain whether redesigning a dishwasher model to be compliant with the proposed cleaning index would lead to more consumer satisfaction. (*Id.*)

DOE understands from the comments that manufacturers are identifying basic models currently on the market that may require re-testing as a result of the inclusion of cleaning performance testing because the basic models may not meet the cleaning performance threshold on the normal cycle at all soil loads. Therefore, although DOE proposed to include the cleaning performance threshold in both appendix C1 and the proposed new appendix C2 in the December 2021 NOPR, DOE is finalizing these amendments only in the new appendix C2, which will be required for use to determine compliance with amended standards.

AHAM commented that while it agreed with DOE that dishwasher performance is a concern, it could not support DOE's proposal to include a performance metric in the test procedure without DOE providing data and information to address the significant concerns AHAM raised in its comments. (AHAM, No. 17 at p. 2) AHAM commented that it agreed that performance needs to be maintained for the consumer, but that the cleaning performance test would drive the opposite result by forcing manufacturers to focus on only one aspect of cleaning performance to the detriment of other important performance functionalities. (AHAM, No. 26 at p. 5)

AHAM commented that EPCA authorizes DOE to develop test procedures that measure only energy efficiency, energy use, water use, or estimated annual operating cost, and that EPCA does not authorize DOE to develop test procedures that measure product performance. (AHAM, No. 17 at p. 3) AHAM commented that DOE had not produced sufficient information or data to show that its proposed cleaning performance requirement meets EPCA's requirements. (AHAM, No. 17 at p. 3)

As discussed, EPCA requires that any test procedures prescribed or amended shall be reasonably designed to produce test results which measure energy efficiency, energy use, or estimated annual operating cost of a covered product *during a representative average use cycle or period of use* [emphasis added] and shall not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) As discussed in the December 2021 NOPR, the cleaning performance at the completion of a cycle type influences how a consumer uses a dishwasher. 86 FR 72738, 72755. If the cleanliness of the dishware after completion of a cleaning cycle does not meet consumer expectations, consumers may alter their use of the dishwasher. *Id.* Indeed, comments received from Samsung expressed concern that consumers unsatisfied with the cleaning performance of the normal cycle may opt to select a different mode that could result in increased energy consumption. *Id.* As discussed further in section III.H.3 of this document, DOE notes that cycle selection data indicates consumer use of cycle types other than the normal cycle and LBNL's survey on dishwasher characteristics, usages, and consumer preferences [31] found that that 17 percent of the respondents ''sometimes'' re-run their dishwasher due to inadequate cleaning. Amending the test procedure to define what constitutes completely washing a full load of normally soiled dishes (*i.e.,* establishing a cleaning performance threshold) will ensure that the test procedure produces test results that measure energy and water use during a representative average use cycle or period of use.

AHAM asserted that DOE has not provided sufficient support for its proposals, that the proposal to include a cleaning performance method and to establish a minimum cleaning index threshold was not based on data and, therefore, was arbitrary and capricious under the Administrative Procedure Act (''APA'') [32] and did not meet the requirements of the Data Quality Act.[33] (AHAM, No. 17 at pp. 3, 4–5, 7, 8, 10; AHAM, No. 26 at p. 4) Similarly, GEA asserted that EPCA, the APA, and the Data Quality Act require that DOE's regulations be properly supported by relevant data, but that DOE did not have relevant data to support its proposed cleaning metric. GEA argued that the issue in this rulemaking is not the quality or sufficiency of the data, or how the data is interpreted, but the very existence of the data. (GEA, No. 20 at p. 2)

DOE has met the APA's requirements, as DOE has explained in the December 2021 NOPR and throughout this final rule discussion its justification for including a cleaning performance measurement and for establishing a minimum cleaning index threshold to define what constitutes completely washing a full load of normally soiled dishes. As discussed in detail in the following sections, DOE has presented the details of the analysis performed by DOE, which builds upon comprehensive investigation and analysis of dishwasher cleaning performance conducted by DOE over the course of the development of the ENERGY STAR Cleaning Performance Test Method and previous dishwasher energy conservation standards rulemakings, and using the best available data that DOE has to establish the specific cleaning index threshold that aligns with consumer expectations for completely washing a full load of normally soiled dishes.

AHAM also commented that DOE's published data are not transparent and requested that DOE provide its full data set including generic model identifiers to allow commenters to fully evaluate

[31] ''Dishwashers in the Residential Sector: A Survey of Product Characteristics, Usage, and Consumer Preferences.'' Section 4.3.2.1. Available at *www.osti.gov/biblio/1827934*. Last accessed July 6, 2022.

[32] Public Law 79–404 (June 11, 1946).

[33] Public Law 106–554 (Dec. 21, 2000). AHAM did not provide any details as to which specific requirements of the Data Quality Act it believes the proposals in the December 2021 NOPR did not satisfy.

DOE's test data. AHAM asserted that DOE's failure to provide that data is not consistent with the requirements under the Data Quality Act and other applicable statutory provisions. (AHAM, No. 17 at p. 12)

In the December 2021 NOPR, DOE presented the results of its test data aggregated to a level appropriate for determining a cleaning index threshold that most closely corresponded to consumer cycle selection data. As discussed further in section III.H.3 of this document, DOE presented graphs in the December 2021 NOPR showing the total percentage of each of the soil test cycles that met the threshold at each potential threshold level among all the units in the test sample. 86 FR 72738, 72757. This aggregated data informed the selection of the proposed cleaning index threshold. *Id.* Presenting model-level data would not have provided insights into the selection of an appropriate cleaning performance index. Further, DOE has complied with DOE's guidelines for implementing the Data Quality Act that ensure the quality, objectivity, utility, and integrity of the data presented in this document.[34]

AHAM commented that in order to establish or amend representative average use cycles or periods of use, DOE must have national, statistically significant, field use data on consumer use, and that without such data, it is impossible and inappropriate for DOE to determine or change the average use cycle in a test procedure. (AHAM, No. 17 at p. 2) AHAM stated that the current dishwasher test procedure is based on consumer use studies, and that changing the test would require showing that something has changed with regard to consumer behavior or that more accurate consumer use study data are available. (*Id.*)

As DOE discussed in the December 2021 NOPR, it has become increasingly more important that DOE ensure that its test procedure continues to reflect representative use as the dishwasher market continuously evolves to higher levels of efficiency. 86 FR 72738, 72755. DOE notes that it did not propose to change the cycle type used for testing (*i.e.,* the normal cycle), but rather to ensure that the cycle type tested as the normal cycle produces results that are representative of consumer use. As discussed in the December 2021 NOPR and further in section III.H.3 of this document, DOE determined the proposed cleaning performance threshold based on confidential consumer cycle selection data provided by industry. *Id.* at 72756. DOE believes this data to be nationally representative and based on field use data and/or consumer survey data. This final rule also presents an analysis of consumer usage data based on a survey report published October 28, 2021, by LBNL,[35] which further supports the cleaning index threshold value defined in this final rule (see section III.H.3 of this document).

AHAM also commented that DOE's rationale for adopting a minimum cleaning index threshold did not establish a direct connection to the product's energy use or energy efficiency; rather, it tied the threshold to avoiding certain consumer behavior in cases of what DOE deemed to be unacceptable performance. (AHAM, No. 17 at p. 4) AHAM asserted that EPCA does not permit this approach for incorporating performance criteria. (*Id.*)

DOE is adopting a minimum cleaning index threshold to define what constitutes ''completely wash[ing]'' a full load of normally soiled dishes so as to better represent consumer use of the product (*i.e.,* to produce test results that are more representative of an average consumer use cycle), as discussed in the December 2021 NOPR. 86 FR 72738, 72755. As discussed in the December 2021 NOPR and summarized earlier in this section, a consumer-acceptable level of cleaning performance can be easier to achieve through the use of higher amounts of energy and water use during the dishwasher cycle type (*i.e.,* the amount of energy or water use of a dishwasher can directly affect the level of cleaning performance). Conversely, reducing energy and water consumption may negatively impact cleaning performance to a level that is not consumer-acceptable.[36]

AHAM commented that it recognized that unacceptable performance may drive consumers toward less energy efficient behavior, but asserted that there are other ways of ensuring that performance is maintained for the consumer that DOE must consider during the standards development process. (AHAM, No. 17 at p. 4) DOE believes AHAM is referring to EPCA's criteria for prescribing amended standards; specifically, that DOE must consider any lessening of the utility or performance of the covered products likely to result from the imposition of the standard. (42 U.S.C. 6295(o)(2)(B)(i)(IV)) In accordance with this provision, DOE has explicitly addressed consumer utility concerns related to cleaning performance in previous rulemakings addressing dishwasher energy conservation standards, as well as in the January 2022 Preliminary Analysis. (*See* 77 FR 31918, 31956–31957; 81 FR 90072, 90082–83; 87 FR 3450[37]). In each of these rulemakings, DOE has presented analysis and findings regarding the impacts of cleaning performance on the ability for manufacturers to offer dishwashers that comply with energy conservation standards at the considered efficiency levels. In DOE's conclusions regarding the economic justification of potentially higher standards, DOE did not establish more stringent standards that would require manufacturers to compromise cleaning performance in order for dishwasher models to demonstrate compliance, thereby fulfilling the consideration required under 42 U.S.C. 6295(o)(2)(B(i)(IV). *Id.* Although not necessitated by the current energy conservation standards, manufacturers may choose to achieve compliance or further reductions in energy and water use through the use of control strategies and design approaches that reduce cleaning performance.[38]

In response to AHAM's comment that unacceptable cleaning may drive consumers toward less efficient behavior, DOE is ensuring test results that are representative of an average use cycle, in accordance with the requirements of 42 U.S.C. 6295(o)(2)(B(i)(IV) of EPCA, by establishing a minimum cleaning performance threshold in the new appendix C2. Establishing a cleaning

[34] See the discussion of the Data Quality Act in the December 2021 NOPR. 86 FR 72738, 72767; see also *www.energy.gov/sites/prod/files/cioprod/documents/finalinfoqualityguidelines03072011.pdf.*

[35] ''Dishwashers in the Residential Sector: A Survey of Product Characteristics, Usage, and Consumer Preferences.'' Section 4.3.2.1. Available at *www.osti.gov/biblio/1827934.* Last accessed July 6, 2022.

[36] During the previous standards rulemaking, AHAM and a group of its members presented data from two sets of manufacturer testing: one set consistent of a modified DOE sensor heavy soil load tested in dishwashers reprogrammed to match three energy and water use levels (307 kWh/year and 4.1 gal/cycle, 255 kWh/year and 3.1 gal/cycle, and 234 kWh/year and 3.1 gal/cycle and another set consisting of two dishwashers that were each loaded with ten place settings soiled with a modified ANSI/AHAM DW–1–2010 soil load, with each dishwasher programmed to match two energy and water use levels (307 kWh/year and 5.0 gal/cycle and 234 kWh/year and 3.1 gal/cycle). 81 FR 90072, 90082–90083. Based on the results of these tests, AHAM commented that any standards at the lower energy and water consumption levels (*i.e.,* 234—255 kWh/year and 3.1 gal/cycle) would result in worse cleaning performance than products that were then on the market could achieve. *Id.*

[37] See chapter 5 of the Preliminary Technical Support Document, available at *www.regulations.gov/docket/EERE=2019=BT=STD=0039.*

[38] For example, manufacturers may reduce wash or rinse temperatures and/or reduce fill volumes for wash or rinse portions of the test cycle without implementing any additional design options.

index threshold as part of the new appendix C2 ensures that energy and water savings are being realized for products that comply with any future new or amended energy conservation standards for dishwashers.

AHAM commented that DOE's proposal, which focuses only on cleaning performance using a metric that does not adequately measure or represent consumer satisfaction, was more likely to drive negative, unintended consequences for consumers relating to overall dishwasher performance. (AHAM, No. 17 at pp. 4–5) AHAM commented that cleaning performance is a function of washing temperature, length of washing cycle, type and amount of detergent applied, and mechanics (*i.e.,* power), such that if DOE wanted to reduce energy and water use and maintain cleaning performance, it is likely that cycle time could reach a level unacceptable to consumers or that other elements of performance could be impacted. (AHAM, No. 17 at p. 5) AHAM commented not all elements of wash performance can be altered and maintain product functionality; for example, since the water must be warm enough to activate the detergent and remove fatty soils, manufacturers have few options to consider other than lengthening cycles, reducing drying performance or eliminating drying altogether, or increasing the noise level of the dishwasher to allow for greater power, in order to maintain cleaning performance while also meeting more stringent standards. (*Id.*)

AHAM further commented that a performance threshold that addresses only a single performance attribute is not consumer relevant because it ignores the fact that the dishwasher is a holistic system. AHAM stated that by requiring energy and water levels and a cleaning performance level, DOE could essentially force manufacturers into designing dishwashers that satisfy DOE's test procedure requirements, but do not satisfy consumers not only on the factors that are not addressed, but also with regard to the cleaning performance itself because, according to AHAM, DOE had failed to demonstrate that the cleaning index threshold it had selected correlated to consumer satisfaction. (*Id.*)

DOE testing indicates that a wide range of dishwashers are currently available on the market that achieve the proposed cleaning index threshold (which is equivalent to the cleaning index threshold finalized in this document) on each soil load tested as part of the normal cycle. In particular, such models are available at the DOE minimum standard level, the ENERGY STAR V. 6.0 standard level, and the current ENERGY STAR Most Efficient level (which is also the ENERGY STAR V. 7.0 level that goes into effect in July 2023). Based on this wide range of dishwashers currently available on the market, DOE has concluded that the finalized cleaning performance threshold, as discussed in section III.H.3 of this document, will not result in dishwasher performance that is unacceptable to consumers or that would result in detrimental impacts to other consumer-relevant elements of performance. Furthermore, the discussion in section III.H. 3 of this document demonstrates that the cleaning index threshold correlates to consumer satisfaction of dishwasher performance. DOE expects that this final rule will have positive effects for consumers by ensuring that the rated energy and water use of dishwashers is based on a test cycle type that completely washes a full load of normally soiled dishes.

Whirlpool commented that it supported positions presented by AHAM, specifically noting that the proposal to include a minimum cleaning performance threshold score was unsubstantiated and not consumer relevant. (Whirlpool, No. 16 at p. 2) Whirlpool commented that it was pleased to see DOE sought to maintain performance and consumer satisfaction of dishwashers, but that the need to do so should serve as a signal that standards should not be amended further. (Whirlpool, No. 16 at p. 3)

As discussed, by establishing a minimum cleaning performance threshold in the new appendix C2, DOE is ensuring test results that are representative of an average use cycle. Establishing a cleaning index threshold as part of the new appendix C2 ensures that energy and water savings are being realized for products that comply with any future new or amended energy conservation standards for dishwashers. DOE will evaluate concerns regarding the impact of new or amended energy conservation standards on performance and consumer satisfaction within the energy conservation standards rulemaking process.

Whirlpool commented that DOE should not finalize the dishwasher test procedure with a minimum cleaning index threshold given the excessive burden caused by testing and potentially redesigning models and potential certification, verification, and enforcement risks associated with the requirement. (Whirlpool, No. 16 at p. 3) Whirlpool stated that DOE's approach to specify a cleaning index threshold as a way to address consumer satisfaction with dishwasher cleaning performance was misplaced. (Whirlpool, No. 16 at p. 10) Whirlpool stated that the proposed test procedure is variable, and that it would lead to enormous manufacturer burden, competitive harm, and possible verification failures. (*Id.*)

In the December 2021 NOPR, DOE quantified the additional test burden expected to result from its proposal. 86 FR 72738, 72763–72764. Specifically, in the NOPR, DOE estimated that the cost to test a soil-sensing dishwasher to be approximately $2,330 per basic model and that for a non-soil-sensing dishwasher to be approximately $790 per basic model, which included the cost for the additional 1 hour per soil load that DOE estimated as the additional time required to score a load at the end of the cycle and calculate the cleaning index. 86 FR 72738, 72763. Section III.L.1 of document presents DOE's finalized estimates of the expected costs associated with these amendments. However, while DOE proposed to include these amendments in both appendix C1 and the proposed new appendix C2 in the December 2021 NOPR, DOE now is only including these amendments in the new appendix C2, which will reduce the immediate burden incurred by manufacturers. Appendix C2 will be required only for use to determine compliance with any future new or amended standards for dishwashers.

As stated, DOE is introducing the cleaning performance requirement to ensure the test results are representative of an average consumer use cycle, but the cleaning performance requirement is only being included as part of the new appendix C2 and will only pertain to any future new or amended energy conservation standards for dishwashers. DOE testing indicates that a wide range of dishwashers are currently available on the market that achieve the proposed cleaning index threshold (which is equivalent to the cleaning index threshold finalized in this document) on each soil load tested as part of the normal cycle. In particular, such models are available from multiple manufacturers at the DOE minimum standard level, the ENERGY STAR V. 6.0 level, and the current ENERGY STAR Most Efficient level (which is the same as the ENERGY STAR V. 7.0 level that goes into effect in July 2023). Therefore, DOE has determined that the cleaning performance threshold will not introduce competitive harm and that dishwashers achieving this threshold are capable of meeting the existing DOE energy and water conservation standards (as well as more efficient performance levels).

The following sections discuss DOE's proposal in the December 2021 NOPR, additional comments received in response to the proposals, and DOE's response and final requirements for cleaning performance.

2. Cleaning Performance Test Method

In the December 2021 NOPR, DOE proposed to adopt a cleaning performance test method that would help determine if a dishwasher, when tested according to the DOE test procedure, ''completely washes a normally soiled load of dishes,'' according to the representative consumer use. 86 FR 72738, 72755. Specifically, DOE proposed to include the cleaning performance evaluation setup, procedures, and calculations that are specified in the ENERGY STAR Cleaning Performance Test Method, which references ANSI/AHAM DW–1–2010, in appendix C1 and the new appendix C2. *Id.*

The ENERGY STAR Cleaning Performance Test Method specifies a procedure to determine cleaning performance at the same test loads described in the DOE test procedure. For soil-sensing dishwashers, cleaning performance is evaluated on the same cycles that are used to determine energy and water consumption (*i.e.,* the heavy, medium, and light soil loads). (ENERGY STAR Cleaning Performance Test Method section 5.1.B) For non-soil-sensing dishwashers, cleaning performance is evaluated on three additional cycles at the heavy, medium, and light soil loads that are run immediately after the clean-load cycle that is used to determine energy and water consumption. (ENERGY STAR Cleaning Performance Test Method section 5.1.C) Each test load item is quantitatively evaluated for cleanliness under prescribed lighting conditions referenced from ANSI/AHAM DW–1–2010. (ENERGY STAR Cleaning Performance Test Method section 4.B) Additionally, section 5.2 of the ENERGY STAR Cleaning Performance Test Method specifies criteria to score the load; it references section 5.10 of ANSI/AHAM DW–1–2010, which specifies the following requirements:

- Each test load item receives a score based on the number and size of soil particles that remain on the item following the termination of a test cycle type.
- Glassware items are additionally evaluated for the number and size of remaining spots, streaks, and rack contact marks.
- A score of 0 indicates a completely clean test load item, and a single test load item cannot exceed a cumulative score of 9.
- The number of test items that receive each score is counted (*i.e.,* number of items in the test load that receive a score of 0, 1, 2, . . . , 9) and the weighted average of these counts is subtracted from 100 to produce a final cleaning index for the test cycle.
- A score of 100 indicates perfect cleaning performance.

Accordingly, in the December 2021 NOPR, DOE proposed to include the requirements specified in sections 4(B), 5.2, and 5.3 of the ENERGY STAR Cleaning Performance Test Method, as follows:

Section 4(B) of the ENERGY STAR Cleaning Performance Test Method establishes the lighting requirements for the evaluation room for scoring the test load, as specified in ANSI/AHAM DW–1–2010. These same lighting requirements are also specified in section 5.10 of AHAM DW–2–2020; therefore, DOE proposed to reference section 5.10 of AHAM DW–2–2020 to specify the lighting requirements for the evaluation room. 86 FR 72738, 72756.

Section 5.2 of the ENERGY STAR Cleaning Performance Test Method establishes the scoring procedure to evaluate each dishware item in the test load after completion of the test cycle, as specified in ANSI/AHAM DW–1–2010. The scoring method is also specified in section 5.10.1 of AHAM DW–2–2020; therefore, DOE proposed to reference the scoring requirements specified in AHAM DW–2–2020. *Id.*

Section 5.3 of the ENERGY STAR Cleaning Performance Test Method specifies the equation for calculating a cleaning index for each test cycle, which is also specified in section 5.12.3.2 of AHAM DW–2–2020; therefore, DOE proposed to reference the calculation of cleaning index for each test cycle from AHAM DW–2–2020. *Id.*

In the December 2021 NOPR, DOE noted that the calculation to determine per-cycle cleaning index is based on the individual score of each item such that dishware and flatware are scored based on soil particles, while glassware is scored based on soil particles as well as spots, streaks, and rack contact marks. *Id.* DOE further noted that AHAM DW–2–2020 provides two separate equations for calculating the total cleaning index for one test run. *Id.* The equation in section 5.12.3.1 of AHAM DW–2–2020 specifies a soil-only cleaning index, which is calculated using the scores of each test load item (including glassware) based only on soil particles. Section 5.12.3.2 of AHAM DW–2–2020 uses the same equation as that in the ENERGY STAR Cleaning Performance Test Method (and ANSI/AHAM DW–1–2010) and defines the total cleaning index calculation using the scores of dishware and flatware based on soil particles and glassware based on soil particles as well as spots, streaks, and rack contact marks. DOE proposed to reference section 5.12.3.2 of AHAM DW–2–2020 to calculate the total cleaning index of a cycle type because DOE stated that it expects that consumers would evaluate the cleanliness of their load items at the completion of a cycle type. *Id.* DOE requested feedback on whether it should consider referencing section 5.12.3.1 of AHAM DW–2–2020 instead, which would calculate the cleaning index based on soil particles only. *Id.* DOE stated that if it were to calculate the cleaning index using soil particles only, it would reevaluate the per-cycle cleaning index threshold value [discussed further in section III.H.3 of this document] to reflect this change. *Id.* DOE requested stakeholder feedback on an appropriate threshold to consider. *Id.*

DOE also requested feedback on the proposed methodology to test, score, and calculate a cleaning index to validate the tested cycle and sought comment on whether other methodologies should be considered for validating the cleaning performance of the tested cycle. *Id.*

DOE requested feedback on whether it should consider referencing section 5.12.3.1 of AHAM DW–2–2020 to measure cleaning performance, which would calculate the cleaning index based on soil particles only. *Id.* DOE noted that if it were to calculate cleaning index using soil particles only, it would reevaluate the per-cycle cleaning index threshold value to reflect this change. *Id.*

As discussed in section III.G.6 of this document, stakeholders commented that if DOE does not specify the use of rinse aid, the cleaning index should be calculated based on soil particles only, without including spots, streaks, or rack contact marks. (Electrolux, Public Meeting Transcript, No. 22 at p. 19; AHAM, No. 17 at p. 15 [39]) During the October 2022 *ex parte* meeting, AHAM commented that while it supported calculating cleaning indices based on soil particles only, it did not support

[39] AHAM provided the same recommendation to DOE during the October 2022 *ex parte* meeting and included the meeting materials in an attachment to its memorandum summarizing the meeting. Specifically, AHAM's recommendation regarding the determination of the cleaning index in the absence of a specification for the use of rinse aid may be found in the October 2022 *ex parte* memorandum at (AHAM, No. 27 at p. 40).

raising the cleaning index threshold score of 65 much or at all as a result of this change to alleviate some burden and reduce false findings of noncompliance. (AHAM, No. 27 at pp. 2–3)

Given that DOE is not specifying the use of rinse aid in the new appendix C2, DOE has reevaluated the requirement to score glassware and calculate the cleaning index based on soil particles only, which is discussed in section III.H.3 of this document. Accordingly, DOE has updated its reference, in the new appendix C2, to section 5.10.1.1 of AHAM DW–2–2020 to score items based on soil particles and section 5.12.3.1 of AHAM DW–2–2020 to measure cleaning performance.

AHAM referenced EPCA's requirement that new and amended test procedures be *reasonably designed* [emphasis added] to produce test results that measure energy efficiency, energy use, water use, or estimated annual operating cost of covered products or equipment during a representative average use cycle or period of use, while also not be unduly burdensome to conduct; and commented that a test cannot be considered reasonably designed if it is not accurate, repeatable, and reproducible. (AHAM, No. 17 at p. 3; AHAM No. 26 at p. 1) AHAM further stated that the cleaning performance test was too variable to be used for mandatory criteria. (AHAM, No. 26 at p. 1) AHAM commented that AHAM DW–2–2020 was designed for companies to use in their product development efforts, and that it was not designed to be used as a regulatory tool. AHAM stated that AHAM DW–2–2020 does not require the same precision in repeatability and reproducibility as a mandatory performance threshold does, and that that the AHAM DW–2–2020 test method does not claim to replicate consumer interaction with dishwashers, such as how they load it, how much soil is on the dishes, how many dishes are in the dishwasher, the amount and type of detergent used, whether rinse aid is used, *etc.;* rather it was intended to assess redeposition. (AHAM, No. 17 at p. 6)

AHAM commented that the proposed test procedure, which is based on the ENERGY STAR Cleaning Performance Test Method (which is based on AHAM DW–2–2020 and uses DW–2–2020's scoring method) continues to be too variable to be used for mandatory criteria and referenced comments made in response to the EPA's ENERGY STAR Program. (AHAM, No. 17 at p. 8; AHAM, Public Meeting Transcript, No. 22 at pp. 29–30)

AHAM additionally commented that it conducted round robin testing in 2018 across seven test laboratories on non-soil-sensing units and determined a within-laboratory standard deviation of 7.7 points. AHAM commented that these results indicate that the test is not sufficiently repeatable or reproducible to be used as a mandatory regulatory test procedure. (AHAM, No. 17 at pp. 8–9) AHAM further claimed that there is such a high standard deviation of test runs that it is possible that the same dishwasher model may pass one test and fail on another test, even within the same laboratory. (AHAM, No. 17 at p. 10) Similarly, Whirlpool commented that due to the extreme variation between test laboratories, it is likely that the same model may receive different scores at different laboratories. (Whirlpool, No. 16 p. 8) Whirlpool commented that a dishwasher could potentially receive a passing score at one manufacturer's laboratory, while another manufacturer's laboratory may produce a failing score, leading to competitive harm between manufacturers. (*Id.*) Whirlpool also stated that there could be a difference of up to 6 to 8 points in scoring even among experienced technicians in a single laboratory, and a single technician may grade the exact same item differently between runs. (Whirlpool, No. 16 at pp. 4, 10)

AHAM commented that results from round robin testing that it conducted in 2013 are more relevant to DOE's proposed test procedure because the 2018 round robin included more soiled dishes in the load than DOE's proposed test procedure. AHAM stated that the 2013 round robin evaluated variation under the same or very similar conditions to DOE's current proposal. (AHAM, No. 26 at p. 2) AHAM stated that the 2013 round robin, which was used to evaluate the ENERGY STAR performance test and DOE's proposed test procedure is based on that, included two units at six laboratories and each unit was tested two times by two technicians. (AHAM, No. 26 at p. 3) AHAM commented that for a soil-sensing unit, the standard deviation was as high as 6.8 percent, meaning whether a unit passes or fails DOE's proposed criteria depends significantly on who is doing the grading. (*Id.*) AHAM further commented that DOE's proposed test procedure focuses only on one aspect of performance (*i.e.,* cleaning) and ignores others (*i.e.,* drying effectiveness, cycle length, and noise), which could frustrate consumers and drive them away from dishwasher use, thus increasing energy and water use. (AHAM, No. 26 at p. 4)

Whirlpool commented that DOE has not addressed or resolved these longstanding issues with repeatability and reproducibility of the AHAM DW–2 test method, and stated that AHAM has documented the huge amount of variation that exists within a laboratory and lab-to-lab with this AHAM performance test. (Whirlpool, No. 16 at p. 8) Whirlpool and AHAM stated that DOE has not presented data to demonstrate the proposed test is repeatable or reproducible. (Whirlpool, No. 16 at p. 8; AHAM, No. 17 at p. 10) AHAM commented that its own data demonstrated that the test was not sufficiently repeatable or reproducible to provide accurate results and that DOE should not adopt it on this basis alone. (AHAM, No. 17 at p. 10)

Conversely, Samsung commented that it supported DOE's proposal to adopt the ENERGY STAR Cleaning Performance Test Method and use of AHAM DW–2–2020 to determine the cleaning index for the test cycle. (Samsung, No. 21 at p. 2) Samsung stated that this test method is subject to variability, but that it is the best option available to measure cleaning performance, and that the minimum threshold score level could be set to accommodate this variability. (*Id.*)

The CA IOUs commented that manufacturers were familiar with the ENERGY STAR Cleaning Performance Test Method and 117 dishwasher models across 12 brands meet the cleaning index of 70 that is required for all three test loads to qualify for the ENERGY STAR Most Efficient product designation. (CA IOUs, No. 19 at p. 2)

Based on an evaluation of currently available industry standards, DOE believes the AHAM DW–2–2020 standard is the best standard available for testing U.S. dishwasher models. To the extent that industry were to update its test method to evaluate other aspects of dishwasher performance, DOE will consider whether to adopt such standards for the DOE test procedure.

Additionally, during the development of the ENERGY STAR Cleaning Performance Test Method, DOE had presented data and noted that the ''test method is reproducible as long as the unit under test operates consistently.'' [40] That is, cleaning performance was generally reflective of the energy and water used by a soil-sensing dishwasher; if the turbidity sensor of soil-sensing dishwashers triggered

[40] ENERGY STAR® Residential Dishwasher Cleaning Performance Draft 2 Test Method Stakeholder Webinar. October 16, 2012. Page 18. Available at *www.energystar.gov/sites/default/files/specs//Draft%202%20Test%20Method%20Dishwasher%20Cleanability%20Webinar_0.pdf.*

different machine responses (*i.e.,* it is inconsistent) resulting in differing amounts of water or energy used for test cycles at a given soil level, there would be larger associated variation in the cleaning indices among these cycles.

DOE notes that AHAM's comment did not specify key information that would help DOE evaluate AHAM's claims. For instance, with regard to the 2018 round-robin test data that AHAM provided as the basis for its conclusion that the cleaning performance test demonstrates significant variability in test results, AHAM did not specify which test method and cycle type was selected for testing. Section 5.2 of ANSI/AHAM DW–1–2010 specifies ten soiled place settings, while section 5.2 of AHAM DW–1–2019 and AHAM DW–2–2020 specify eight soiled place settings. Using either test method, the number of soiled place settings is higher compared to the DOE test procedure which requires a maximum of four (out of eight) soiled place settings for the heavy soil load. The medium and light soil loads have two and one soiled place setting, respectively. It is important to know the number of soiled place settings because DOE has observed that variation in the cleaning index increases as the number of soiled place settings increase. Figure III–1 shows the average standard deviation of the cleaning index at the heavy, medium, and light soil loads (depicted as four, two, and one soiled place setting, respectively) for the repeatability and reproducibility testing that DOE conducted on non-soil-sensing dishwashers during development of the ENERGY STAR Cleaning Performance Test Method. The figure also shows the standard deviation reported by AHAM as part of its round robin testing on non-soil-sensing dishwashers; for the purposes of this graph, DOE assumed that AHAM soiled eight place settings during round robin testing. As seen in the graph, the average standard deviation of the cleaning index tends to increase as the number of soiled place settings increase, which indicates that the expected standard deviation for the soils specified in the DOE test procedure would be significantly smaller than the 7.7 points indicated by AHAM.

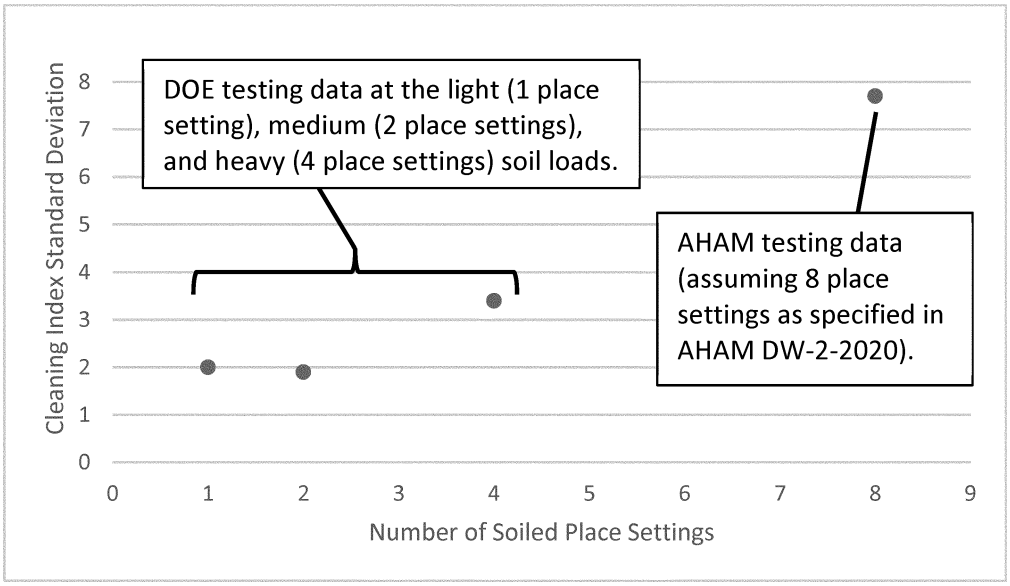

Figure III–1 Average Standard Deviation of the Cleaning Index at Different Soil Loads, Represented by the Number of Soiled Place Settings.

DOE also evaluated AHAM's 2013 round robin data discussed in AHAM's late comment. (*See* AHAM, No. 26 at p. 2) DOE notes that the test procedure in this final rule specifies additional test setup and instrumentation requirements compared to the ENERGY STAR Cleaning Performance Test Method (which was the basis for AHAM's 2013 round robin) to limit variability. These include specifying a relative humidity requirement along with relative humidity measuring device requirement; explicitly stating the target temperature at which the test should be conducted; specifying a new detergent dosing methodology, which is based on number of place settings rather than prewash and main wash fill water volumes, and hence, less prone to the uncertainty associated with differentiating the prewash and main wash cycles; and, specifying that cleaning indices must be calculated without scoring for spots, streaks, and rack contact marks on glassware given that rinse aid is not used during the test.

DOE acknowledges that while AHAM's 2013 round robin data shows that the standard deviation for a soil-sensing unit was *as high as* 6.8, *the average* within-laboratory (*i.e.,* repeatability) cleaning index standard deviation was 2.05, while the average between-laboratories (*i.e.,* reproducibility) cleaning index standard deviation was 3.35. For some of the tests with high within-laboratory variation (including the unit that had the highest standard deviation of 6.8), DOE observed that the energy or water use were different between two tests at the same laboratory, which also impacted the cleaning indices. That is, if a unit's soil-sensors trigger a different response to the soil load, which changes the energy or water use at the same soil load, then the cleaning index varies accordingly. DOE also observed that for all but one test laboratory, the average difference in cleaning indices between two technicians for the same test was 1.24. These results indicate that repeatable and reproducible results for cleaning performance are already achievable with currently experienced laboratory technicians as long as the sensor response of test units is consistent. As discussed, the additional test procedure requirements incorporated in this final rule would further limit variability in testing.

AHAM commented that variation in the proposed performance metric can only be reduced to a certain point due

to potential human error (*i.e.,* a human soils and scores the test load, which would make the result inherently subjective). AHAM asserted that while technician training can help reduce variation, the training would be burdensome to conduct and may not sufficiently reduce variation, especially lab-to-lab. (AHAM, No. 17 at p.10) AHAM commented that it is focused on reproducibility because of the consequences for units that may pass in one laboratory and fail in another, which could lead to non-compliance and costly fines. (*Id.*) Similarly, Whirlpool contends that the unreasonable variation is due to the human factor of the test. (Whirlpool, No. 16 at p. 8) During the October 2022 *ex parte* meeting, AHAM recommended that DOE, together with AHAM and other stakeholders as DOE deems appropriate or necessary, develop a process to qualify laboratories to conduct the DOE test procedure. AHAM stated that a process for qualifying laboratories and technicians, would help accomplish the goal that technicians are trained and skilled and laboratories, including manufacturer laboratories, have a common understanding for scoring. AHAM stated that it has a process for qualifying laboratories as part of its air cleaner certification program, which has been successful in reducing variation, which could be used as a starting point. (AHAM, No. 27 at pp. 3–4) As it has for other newly adopted test procedures (*e.g.,* the conventional cooking tops test procedure), DOE considers individual requests for assisting testing laboratories in gaining familiarity with test conduct. DOE also notes that many manufacturers have already gained experience with soiling and scoring test loads through participation in the ENERGY STAR Most Efficient dishwashers program, which includes a reporting requirement for cleaning performance.

AHAM commented that the cleaning performance test is subject to high variation and that verification and enforcement would be virtually impossible. (AHAM, No. 17 at p. 13) AHAM commented that if DOE continues with the proposal to include a cleaning performance test method, it should allow for a wide tolerance of scores to address the subjectivity and lack of reproducibility of the test. (*Id.*) AHAM commented that due to the high variation in the cleaning performance test, it would be virtually impossible to conduct enforcement of cleaning scores and it is likely that there would be false findings of both compliance and non-compliance with DOE's proposed cleaning performance requirements. (AHAM, No. 26 at p. 4) During the October 2022 *ex parte* meeting, AHAM proposed that DOE's enforcement policy should be similar to other products such as refrigerator/freezers. Specifically, AHAM commented that if DOE's test results are within 14 percent of the proposed cleaning index threshold of 65, DOE will use the normal cycle for the assessment/enforcement test. Otherwise, if the tested score is not within that range, DOE would follow the test's requirements for when the score of 65 is not achieved. AHAM stated that its proposal is based on the data it provided in the comments in response to the December 2021 NOPR, wherein AHAM stated that the standard deviation can be as high as 7 and the 14 percent tolerance represents a 95-percent confidence interval defined by two times the standard deviation. (AHAM, No. 27 at p. 3) Samsung also stated that there was precedent for a minimum performance threshold requirement for test validity, citing the threshold dryness level for automatic termination of clothes dryers as a condition for a test cycle to be valid. (*Id.*) Further, Samsung stated that it believes that DOE has the authority to require that valid energy tests must reflect at least a minimum functionality and cleaning performance under EPCA to ensure representativeness of the test cycle. (*Id.*)

DOE notes that its specified cleaning index threshold does not include any additional tolerance because the specified value represents a minimum threshold that DOE's analysis has indicated is indicative of a consumer-accepted level of cleaning performance. This approach is also consistent with the test procedure for clothes dryers tested according to appendix D2, which specifies a threshold dryness level for automatic cycle termination as a condition for a valid test cycle. Section 3.3.2 of 10 CFR appendix D2 to subpart B of part 430.

Regarding AHAM's reference to enforcement provisions for refrigerators and freezers, DOE notes that those provisions specify tolerances to determine the validity of certified refrigerated volumes based on the average of individual test measurements. 10 CFR 429.134(b). Refrigerated volume is the basis for determining the product class and corresponding energy conservation standard for a given basic model of refrigerator, refrigerator-freezer, or freezer. Thus, the refrigerated volume measurement and its associated tolerance is not analogous to the cleaning index threshold established by this final rule for dishwashers.

GEA commented that any DOE test procedure must statutorily be repeatable and reproducible per 42 U.S.C. 6293(b)(3) in EPCA and any test procedure that fails to satisfy these two fundamental engineering principles cannot be said to produce test results that actually measure energy use as required by EPCA. (GEA, No. 20 at p. 2) GEA commented that DOE had not demonstrated that the cleaning performance test method meets EPCA's requirements. GEA contends that DOE admitted in the public meeting that it lacks any data on the reproducibility of the proposed cleaning metric. GEA stated that data provided by AHAM and its members demonstrated poor reproducibility results for the test procedure. (*Id.*) GEA commented that the lack of data regarding repeatability and reproducibility undermined the credibility and effectiveness of any enforcement action DOE may take. GEA suggested that if DOE attempts to assert a penalty for a product that is alleged to have failed to complete a valid test as a result of the cleaning performance metric, the validity of the test procedure and the validity of the cleaning performance evaluation will be challenged. (*Id.*) Relatedly, Whirlpool reiterated that it is not acceptable for DOE to verify and enforce a requirement with such extreme variation, especially when there could be a large monetary penalty for noncompliance for individual manufacturers. Whirlpool also noted that the proposal to include the cleaning performance test and cleaning index threshold would cause an enormous disruption to the marketplace. (Whirlpool, No. 16 at pp. 9–10) GEA commented that AHAM DW–2–2020 was not designed for and is not appropriate to be used as a test procedure for a regulatory enforcement program. GEA stated that even if AHAM DW–2–2020 was fully incorporated into the DOE test procedure, GEA would oppose the incorporation because the test was not designed for and does not provide the low level of variability which is required for a test used in a regulatory enforcement program. Further, GEA explained that AHAM DW–2–2020 does not contain a prescriptive threshold. (GEA, No. 20 at p. 3) Whirlpool claimed that DOE lacked the adequate justification necessary to make cleaning performance a mandatory regulatory performance requirement and that the proposal contained unsolved repeatability and reproducibility issues. (Whirlpool, No. 16 at p. 3)

As mentioned previously in this document, DOE's analysis indicates that repeatable and reproducible results for cleaning performance are achievable as long as the sensor response of test units is consistent. Additionally, the amendments to appendix C1, which are also specified in the new appendix C2, are intended to further limit variability in testing. Further, to mitigate the potential impact to the marketplace, DOE is specifying cleaning performance requirements only in the new appendix C2, which would go into effect only when compliance is required with any amended standards.

AHAM commented that DOE's proposed metric ignored all performance aspects other than cleaning performance and that DOE did not appear to have made an effort to determine the consumer relevance of the other performance attributes that may be impacted. (AHAM, No. 17 at p. 5) AHAM also commented that DOE had not addressed how grease and detergent buildup over time may impact the proposed minimum cleaning index threshold. (AHAM, No. 17 at p. 6; AHAM, Public Meeting Transcript, No. 22 at p. 30) AHAM commented that DOE's proposed cleaning performance test focuses only on whether or not the soils are removed from the dishware and not redeposited. AHAM reiterated its earlier comment that the cleaning performance test does not address grease or detergent buildup over time, stating that this is a significant issue when consumers pre-rinse because the detergent has less to attach itself to and, as a result, there is more soil left on the dishes when the cycle ends. (AHAM, No. 26 at p. 5)

DOE agrees with AHAM that the test procedure proposed in the December 2021 NOPR evaluates the cleaning index on the basis of soils remaining on the test load items at the conclusion of the test cycle, including particles that are redeposited as well as those that are not removed in the first place. Regarding AHAM's concern that the test procedure does not account for grease buildup over time, DOE notes that the cleaning index threshold was determined based on analysis of consumer usage of dishwashers over time, and thus already factors in the presence of grease buildup in determining a consumer-accepted level of cleaning performance.

Accordingly, consistent with the December 2021 NOPR, DOE is finalizing in the new appendix C2 its proposal to test, score, and calculate a cleaning index to validate the tested dishwasher cycle type. DOE is referencing AHAM DW–2–2020 for the lighting requirements, scoring method, and equation for calculating a cleaning index for each test cycle.

3. Cleaning Index Threshold Value

In the December 2021 NOPR, DOE proposed to provide direction in the test procedure as to what constitutes whether a cycle type under test can completely wash a full load of normally soiled dishes by establishing a minimum cleaning index threshold as a condition for each individual test cycle to be valid. 86 FR 72738, 72756. The threshold is intended to represent a level of cleaning such that if the dishwasher did not meet this threshold after operating in the ''normal cycle,'' the consumer would be expected to operate the dishwasher using a more energy-intensive cycle than the ''normal cycle.'' Specifically, DOE proposed that if the normal cycle at a particular soil level (*i.e.,* heavy, medium, or light) does not achieve the defined cleaning index threshold, that soil level (*i.e.,* heavy, medium, or light) would need to be re-tested using the most energy-intensive cycle (to be determined using the methodology discussed in section III.H.4 of this document) that achieves the defined cleaning index threshold. *Id.* The data from the most energy-intensive cycle would be used to represent that soil level in the downstream calculations.

To determine an appropriate threshold value, DOE aggregated confidential consumer cycle selection data provided by industry for the December 2021 NOPR and considered past consumer comments and test data collected in support of the short cycle product class rulemaking that was published on October 30, 2020 (''October 2020 Final Rule'' *See* 85 FR 68723).[41] *Id.*

In the December 2021 NOPR, DOE stated that it understands general consumer satisfaction as a fundamental characteristic of a functioning market, and that consumers are largely satisfied with the performance of dishwashers currently on the market. *Id.* However, based on comments DOE received from Samsung in response to the August 2019 RFI as well as qualitative comments that DOE received during the rulemaking that culminated in the October 2020 Final Rule, DOE recognized that the cleaning performance of the normal cycle may not always meet consumer expectations of cleaning performance. (*See* for example: Toronto, EERE–2018–BT–STD–0005, No. 2304 at p. 1; Carley, EERE–2018–BT–STD–0005, No. 2950 at p. 1; Bruggeman, EERE–2018–BT–STD–0005, No. 3038 at p. 1; *etc.*) *Id.* at 86 FR 72756–72757. Further, confidential data submitted by manufacturers indicate, in the aggregate, that roughly 25 to 45 percent of all dishwasher cycles are conducted on a cycle type other than the normal cycle. DOE recognized that among these other selected cycle types, some would be expected to be less energy-intensive than the normal cycle (*e.g.,* a glassware cycle type), while others would be expected to be more energy-intensive than the normal cycle (*e.g.,* a pots and pans cycle type). *Id.* at 86 FR 72757. The data provided by manufacturers do not indicate which cycle types comprise the percentage of cycles not conducted on the normal cycle. In lieu of additional details regarding the dataset, DOE proceeded under the assumption that either option (alternatively selecting a more energy-intensive or less energy-intensive cycle) is equally as likely. *Id.* Accordingly, DOE estimated that one-half (*i.e.,* 12 to 23 percent) of cycles not conducted on the normal cycle are instead conducted on a cycle that is more energy-intensive than the normal cycle. *Id.*

In the December 2021 NOPR, DOE stated that since it expects that consumers unsatisfied with the cleaning performance of the normal cycle would select alternate cycle types that are more energy-intensive to achieve better cleaning results, the cycle selection data serve as a reasonable proxy for consumer acceptance of the cleaning performance of the normal cycle. *Id.* To identify an appropriate cleaning index threshold, DOE sought to select a cleaning index value that aligned with the cycle selection data. *Id.* That is, DOE sought to identify the cleaning index value that was achieved between 77 to 88 percent of the time when a dishwasher was operated on the normal cycle, indicating that the remaining 12 to 23 percent of the time the cleaning performance on the normal cycle would be worse and thus would result in consumers selecting more energy-intensive cycles. *Id.* DOE evaluated the cleaning indices measured for the heavy, medium, and light soil load cycles as defined in the DOE dishwasher test procedure, using the market-representative dishwasher test sample from the October 2020 Final Rule.[42] *Id.* Using these data, DOE plotted the rate at which test cycles would meet or exceed different cleaning

[41] See Dishwasher NODA Test Data (5–21–20), available at *www.regulations.gov/document/EERE2018-BT-STD-0005-3213.*

[42] The test sample consisted of 31 units spanning 13 brands. The units selected for testing represented over 95 percent of dishwasher manufacturers and were broadly representative of the current dishwasher market. 85 FR 68723, 68724.

index values (in increments of 5 on the Cleaning Index scale). *Id.*

In determining a threshold, DOE sought to establish a level that ensures the tested cycle type produces test results that measure energy use and water use of the dishwasher during a representative average use cycle. *Id.* Establishing a threshold level that is ''too high'' would indicate that a substantial number of dishwasher cycles performed by consumers do not meet consumer expectations for cleaning performance on the normal cycle, which would not appropriately reflect general consumer usage of the normal cycle. Whereas, establishing a threshold that is ''too low'' would not appropriately reflect the percentage of cycles for which consumers are likely to select a more energy-intensive cycle to achieve better cleaning performance than can be achieved on the normal cycle. DOE used test data and consumer usage weighting factors specified in appendix C1 (and intended to be retained in appendix C1 and specified in the proposed new appendix C2) for the heavy (0.05), medium (0.33), and light (0.62) soil loads to calculate the percentage of cycles that would not meet the threshold on the normal cycle. *Id.* at 86 FR 72758. DOE plotted the percentage of cycles that would not meet the threshold on the normal cycle, along with the range for the percentage of cycles that would operate on a more energy-intensive cycle than the normal cycle as estimated from industry data. *Id.* Based on the results of its analysis, DOE proposed establishing a minimum cleaning index of 65 as the threshold level for a test cycle to be valid. *Id.*

DOE proposed to specify the same cleaning index threshold value for all tested soil loads because it did not have information to suggest that consumer expectations for the cleaning performance of the load at the end of the cycle differ based on the initial soil load of the dishware. *Id.* at 86 FR 72759.

DOE requested feedback on the proposed cleaning index threshold value of 65 for each test cycle or whether it should consider a threshold value of 70 instead. *Id.*

DOE requested additional data on consumer dishwasher cycle type selections. *Id.* In particular, DOE requested data indicating the frequency with which consumers select the normal cycle; and, for cycles not conducted on the normal cycle, the frequency with which a more energy-intensive cycle is selected. *Id.*

DOE also requested additional data on how frequently consumers are dissatisfied with the cleaning performance of the normal cycle as well as the actions, and the frequency of each action, that consumers would take if the load is not satisfactorily clean. *Id.*

AHAM commented that DOE did not provide any data or consumer research to show that a cleaning index of 65 is consumer relevant or that 65 is the ''tipping point'' between ''good'' and ''poor'' dishwasher performance. AHAM stated that DOE has not done consumer research to show that a cleaning index of 65 reflects consumer expectations of cleaning performance. (AHAM, No. 17 at p. 6; AHAM, Public Meeting Transcript, No. 22 at pp. 21–22; AHAM No. 26 at p. 5) During the December 2021 NOPR public meeting, AHAM commented that it had provided comments in the past stating that the ENERGY STAR Most Efficient cleaning index threshold of 70 is not based on any consumer data demonstrating correlation or satisfaction. (AHAM, Public Meeting Transcript, No. 22 at pp. 24–25) Further, AHAM commented that DOE had not presented any consumer data to demonstrate that its proposed test and/or threshold are relevant to the consumer or correlate to consumer satisfaction. (AHAM, No. 17 at p. 4; AHAM, No. 26 at p. 5) AHAM commented that without this data, DOE's proposal is arbitrary and capricious and does not satisfy the Data Quality Act. (*Id.*)

Whirlpool stated that DOE did not justify the development of the cleaning index with an acceptable level of data nor demonstrated that a score of 65 will lead to consumer satisfaction and prevent consumers from using more energy- and water-intensive cycles. (Whirlpool, No. 16 at p. 3) Whirlpool stated that DOE had not provided any data or justification to indicate that 65 was the right threshold for a minimum cleaning index. (Whirlpool, No. 16 at p. 8)

Conversely, the Joint Commenters stated that a minimum cleaning index threshold of 65 was reasonable, based on the data available to DOE. (Joint Commenters, No. 18 at p. 2) Samsung commented that it supported DOE's proposed cleaning index threshold value of 65 and the approach DOE took to determine this value, given that no known study exists showing direct correlation between the cleaning index and customer acceptance. (Samsung, No. 21 at p. 2) Samsung additionally commented that DOE's approach was substantiated by the 2021 LBNL survey,[43] which indicated 17 percent of respondents sometimes re-run their dishwasher due to inadequate cleaning. Samsung explained that of the 17 percent of respondents that re-run their dishwasher ''sometimes,'' over half, 56 percent, reported that they re-run their dishwasher between one and three times per week. (Samsung, No. 21 at pp. 2–3)

AHAM also commented that the only data that DOE's proposal is based on is manufacturer data indicating that 24 to 46 percent of selected cycle types are not the normal cycle and are instead done on another cycle type along with an unproven assumption that the only reason a consumer might use a cycle type other than the normal cycle is because the consumer is not satisfied with the normal cycle's performance. (AHAM, No. 17 at p. 6) AHAM stated that DOE's assumption that consumers select a more energy-intensive cycle 50 percent of the time when they do not select the normal cycle did not have any basis. AHAM commented that it does not agree that cycle selection data serves as a proxy for consumer acceptance of normal cycle cleaning performance and DOE has presented no data upon which to base the accuracy or reasonableness of that assumption. AHAM stated that DOE has no data and without it, DOE's proposal did not meet the requirements of the APA or the Data Quality Act. (AHAM, No. 17 at p. 7)

Whirlpool reiterated that the proposed minimum cleaning index is built on flawed data and contain numerous layered assumptions. (Whirlpool, No. 16 at p. 4) Whirlpool commented that it is a big assumption that half of the cycle types use more energy/water than the normal cycle, and half use less. Whirlpool stated that there is no justification for such an assumption, and DOE cannot use consumer selection of other non-normal cycles as any proxy for consumer satisfaction in the normal cycle. (*Id.*) Whirlpool commented that the proposed industry cleaning performance test would need to correlate strongly with consumer satisfaction to be justified, but its data indicate otherwise and due to the significant variation in actual consumer usage patterns, there is doubt over whether such a metric that accurately represents consumer cleaning performance satisfaction could ever exist. (Whirlpool, No. 16 at pp. 7–8)

DOE notes that its goal in establishing a minimum cleaning index threshold is to ensure that testing is representative of consumer use and does not prevent consumers from using more energy-intensive cycles. DOE also notes that while it may not have data that shows a direct correlation between various

[43] ''Dishwashers in the Residential Sector: A Survey of Product Characteristics, Usage, and Consumer Preferences.'' Section 4.3.2.1. Available at *www.osti.gov/biblio/1827934.* Last accessed July 6, 2022.

cleaning indices and consumer satisfaction at each respective cleaning index threshold, DOE evaluated consumer satisfaction of the cleaning performance of a dishwasher by analyzing cleaning performance data with the frequency at which consumers are likely to use a more energy-intensive cycle. DOE proxied the use of more energy-intensive cycles as dissatisfaction with performance when using the normal cycle.[44] Based on this relationship, DOE estimated that consumers are likely to run a more energy-intensive cycle between 12 and 23 percent of the time. This estimate is based on the assumption that consumers select a more energy-intensive cycle 50 percent of the time when they do not select the normal cycle. DOE's estimate that consumers select a more energy-intensive cycle between 12 and 23 percent of the time is further validated based on results from LBNL's survey on dishwasher characteristics, usages, and consumer preferences.[45] The sample methodology for this survey was designed to be as reflective of the U.S. population (in terms of demographics such as age, income, *etc.*) of recent purchasers of dishwashers as possible (see section 2.4 of the LBNL report). The LBNL report states that 17 percent of the respondents indicated that they ''sometimes'' re-run their dishwasher due to inadequate cleaning, and DOE estimates that these cycles represent up to 75 percent[46] of their weekly dishwasher cycles. In other words, consumers on average may re-run their dishwasher due to inadequate cleaning up to 13 percent of the time (17 percent of consumers times 75 percent of usage cycles). DOE expects the percentage of cycles that are represented by proxy by a more energy-intensive cycle to be somewhat greater than the maximum reported 13 percent because these consumers may also take other more energy-intensive actions besides re-running the cycle, such as handwashing or pre-rinsing, for additional weekly cycles that fail to achieve adequate cleaning. All of the cycles which fail to achieve adequate cleaning, including up to 13 percent of cycles that are re-run and additional cycles for which consumers take other more energy-intensive actions, are represented in aggregate by DOE's estimate of the 12 to 23 percent range.

GEA commented that DOE did not have any data to support that its proposed cleaning index threshold of 65 is relevant to consumers or representative of consumer cleaning performance satisfaction. (GEA, No. 20 at p. 3) GEA commented that if DOE did not have any evidence that the cleaning index threshold is relevant to consumers, then DOE could not have confidence that continued performance is ensured in the face of ever-increasing energy conservation standards. (*Id.*) GEA stated that DOE's minimum cleaning index value is arbitrary and is not connected to consumer preference as the vast majority of consumers are satisfied with the performance of their dishwashers. (*Id.*) DOE's analysis of the available data indicates that a majority of test cycle types would meet the proposed cleaning index, aligning with GEA's comment that the vast majority of consumers are satisfied with their dishwasher cleaning performance.

Whirlpool commented that even with adequate data that showed that the most energy-intensive cycle is consumer-representative, it does not believe that DOE could move forward with the proposal, citing little correlation between scores from the AHAM DW–2 performance test and actual consumer satisfaction data. (Whirlpool, No. 16 at p. 6) Whirlpool cited a study it conducted in which it charted consumer satisfaction data gathered with proprietary algorithms versus AHAM DW–2–2020 cleaning indices and found poor correlation between the AHAM cleaning indices and consumer satisfaction. (*Id.* at pp. 6–7) While DOE appreciates the data provided by Whirlpool, DOE would require additional information regarding how Whirlpool quantified consumer wash sentiment. Based on the data available at this time, DOE believes that the cleaning performance threshold provides a reasonable proxy for when consumers are likely to be dissatisfied with performance on the normal cycle.

Therefore, DOE's approach and methodology to determine the appropriate cleaning index threshold at which consumers are likely to re-run their dishwasher cycle is reasonable and DOE has used this same approach to determine its cleaning index threshold. As noted in section III.H.2 of this document, DOE is specifying that the cleaning index be calculated using soil particles only and the scores associated with spots, streaks, and rack contact marks on glassware items should be excluded when calculating the cleaning index. Accordingly, DOE re-ran its analysis to calculate cleaning indices for each tested unit without the scores of spots, streaks, and rack contact marks included. This resulted in an increase in cleaning indices for all units at all cycles. DOE used these cleaning indices for each unit and plotted the rate at which test cycles would meet or exceed different cleaning index values (in increments of 5 on the Cleaning Index scale). Figure III–2 shows the percentage of each of the soil test cycles that meet the threshold at each potential threshold level among all the units in the test sample. DOE then used these data and the consumer usage weighting factors specified in appendix C1 (and the new appendix C2) for the heavy (0.05), medium (0.33), and light (0.62) soil loads to calculate the percentage of cycles that would not meet the threshold on the normal cycle. The percentage of cycles that that would not meet the threshold on the normal cycle is shown in Figure III–3, along with the range for the percentage of cycles that would operate on a more energy-intensive cycle than the normal cycle as estimated from industry data and LBNL's survey data. Based on these results, DOE observes that a cleaning index of 70, calculated using only soil particles and excluding spots, streaks, and rack contact marks, is equivalent to the cleaning index threshold of 65 that it proposed in the December 2021 NOPR. Accordingly, in this final rule, DOE is finalizing a cleaning index threshold of 70 in the new appendix C2, calculated using only soil particles and excluding spots, streaks, and rack contact marks.

[44] DOE used a similar correlation in the clothes dryer test procedure at appendix D2, wherein DOE determined that 5-percent final remaining moisture content (''RMC'') of a real-world load is the maximum consumer-accepted final moisture level, and implemented a threshold value of final RMC in the test procedure for clothes dryers with automatic cycle termination to ensure the tested cycle produces energy use results that are representative. Because the test cloth used to test clothes dryers according to appendix D2 is uniform, for purposes of repeatability and reproducibility, it dries faster and more uniformly than a real-world load of varying weights, composition, and size. Therefore, DOE specified a 2-percent final RMC threshold for clothes dryers with automatic cycle termination when testing with the DOE test cloth as a proxy for the 5-percent maximum consumer-accepted final RMC in real-world loads, because testing to 5-percent final RMC with the DOE test cloth would produce energy use results that were too low to represent actual consumer behavior. 78 FR 49608, 49613–49614.

[45] ''Dishwashers in the Residential Sector: A Survey of Product Characteristics, Usage, and Consumer Preferences.'' Section 4.3.2.1. Available at *www.osti.gov/biblio/1827934*. Last accessed July 6, 2022.

[46] The LBNL report states that, of the respondents that reported they ''sometimes'' re-run their dishwasher, ''over half (56 percent) of respondents reported that they re-run their dishwasher between 1 and 3 times per week.'' DOE calculated 184 annual cycles to be 4 cycles per week. If consumers are re-running their cycles up to 3 times per week, that would be 75 percent of their total cycles run (¾ = 0.75).

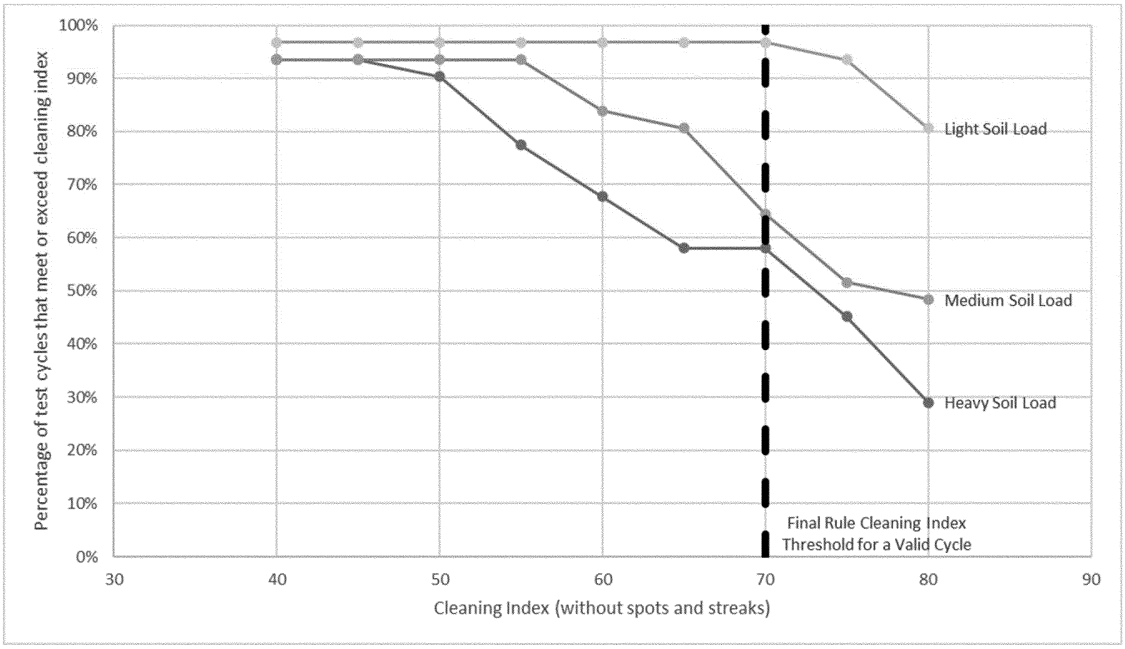

Figure III–2 Percentage of Heavy, Medium, and Light Soil Test Cycles When Tested on the Normal Cycle, That Meet or Exceed Cleaning Index

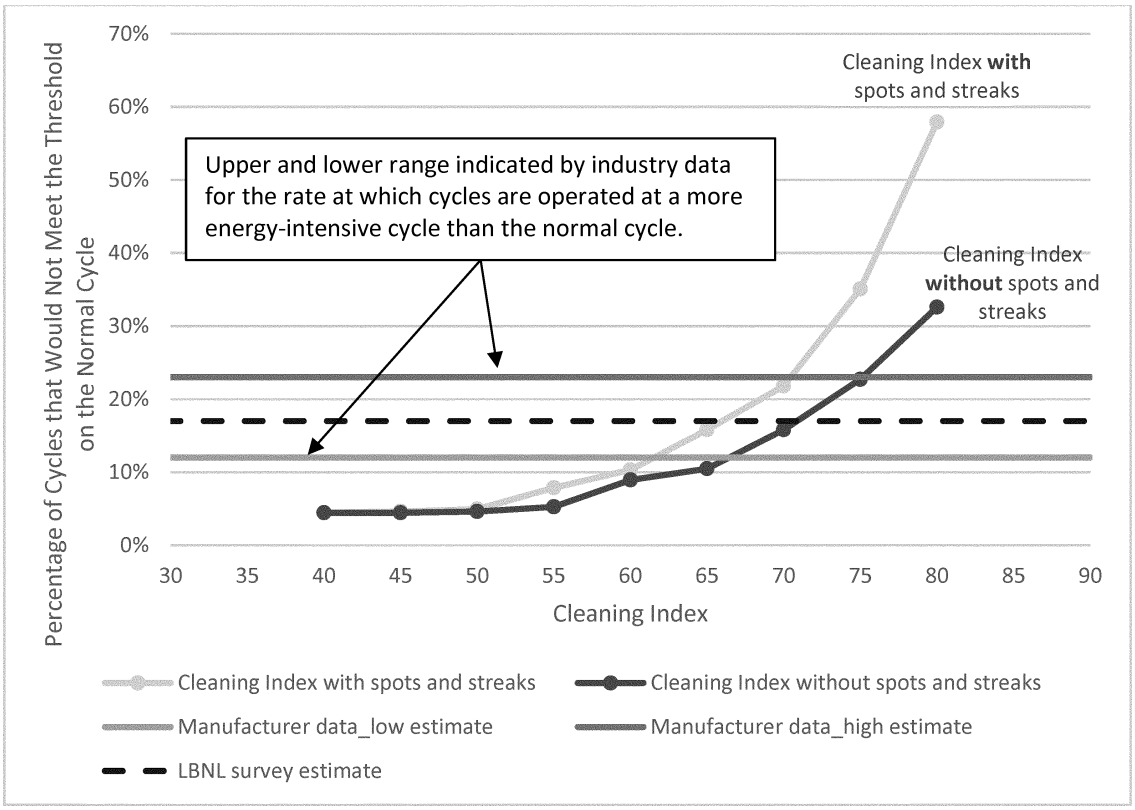

Figure III–3 Percentage of Cycles That Would Not Meet the Threshold on the Normal Cycle at Each Cleaning Index Threshold

At a cleaning index of 65, the percentage of test cycles at each soil level that would achieve the minimum cleaning index threshold is 97 percent for lightly soiled loads, 81 percent for medium soiled loads, and 58 percent for heavily soiled loads. On a weighted-average basis, the measured normal test cycles would reach the threshold cleaning index of 65 approximately 90 percent of the time (*i.e.,* 10 percent of cycles would not meet the threshold, as shown in Figure III–3).[47] For comparison, at a cleaning index of 70, the percentage of test cycles at each soil level that would achieve the minimum cleaning index threshold is 97 percent for lightly soiled loads, 65 percent for medium soiled loads, and 58 percent for heavily soiled loads. On a weighted-average basis, the measured normal test cycles would reach the threshold cleaning index of 70 approximately 84 percent of the time (*i.e.,* 16 percent of cycles would not meet the threshold, as shown in Figure III–3). At a cleaning index of 75, the percentage of test cycles at each soil level that would achieve the minimum cleaning index threshold is 94 percent for lightly soiled loads, 52 percent for medium soiled loads, and 45 percent for heavily soiled loads. On a weighted-average basis, the measured normal test cycles would reach the threshold cleaning index of 75 approximately 77 percent of the time (*i.e.,* 23 percent of cycles would not meet the threshold, as shown in Figure III–3). The 16-percent rate—representing the overall percentage of cycles that would not meet the threshold on the normal cycle—at a cleaning index threshold of 70—would align with DOE's estimate of roughly 12 to 23 percent of cycles being operated using a more energy-intensive cycle than the normal cycle as well as LBNL's survey data, which noted that about 17 percent of consumers sometimes re-run their dishwasher due to inadequate cleaning. On the other hand, at a cleaning index threshold of 65, only 10 percent of cycles would be operated using a more energy-intensive cycle, which falls outside the 12 to 23 percent range that DOE has estimated for the percentage of cycles that are likely to be operated on a more energy-intensive cycle and at a cleaning index threshold of 75, 23 percent of cycles would be operated using a more energy-intensive cycle, which is exactly at the upper limit of the range estimated by DOE. Therefore, DOE is establishing a cleaning index of 70 in appendix C2 to determine a valid test cycle.

4. Validation of the Test Cycle

Similar to the ENERGY STAR Cleaning Performance Test Method, in the December 2021 NOPR, DOE proposed that the cleaning index of the test cycles be determined for the same test cycle types required for the energy and water tests for both soil-sensing and non-soil-sensing dishwashers. 86 FR 72738, 72759. However, in the December 2021 NOPR, DOE proposed a slightly different test method for both soil-sensing and non-soil-sensing dishwashers, compared to the ENERGY STAR Cleaning Performance Test Method. Specifically, for soil-sensing dishwashers, DOE proposed that if the normal cycle did not meet the proposed cleaning index threshold, it would be re-run at the most energy-intensive cycle that could meet the proposed threshold. DOE also proposed that the filter should be cleaned prior to testing the soil level at the most energy-intensive cycle. For non-soil-sensing dishwashers, DOE proposed in the December 2021 NOPR that these dishwashers be tested using the heavy soil load (as opposed to the clean test load). If the dishwasher met the proposed cleaning index threshold using the heavy soil load, no additional tests were proposed. If the dishwasher did not meet the proposed cleaning index threshold using the heavy soil load, DOE proposed that the unit be tested using the most energy-intensive cycle that met the proposed threshold as well as the medium soil load using the normal cycle. This process would be repeated for the light soil load, if the medium soil load did not meet the proposed threshold. Additionally, for compact dishwashers with less than four place settings, DOE proposed the number of place settings that should be soiled at the heavy, medium, and light soil loads. *Id.* DOE also presented alternate approaches to re-testing at the most energy intensive cycle, such as applying an ''adder'' or multiplicative factor to the energy and water consumption values for any test cycles that do not achieve the defined cleaning index threshold. *Id.*

Based on this proposal, DOE sought comments on several topics in the December 2021 NOPR including its proposed approach for soil-sensing dishwashers, non-soil-sensing dishwashers, and compact dishwashers, cleaning the filter prior to testing at the most energy intensive cycle, and other potential methods to validate that the measured dishwasher energy and water consumption is representative of consumer use. *Id.* DOE also requested comments and data on cycle types that would be selected under the proposed test procedure, and the extent to which manufacturers would need to redefine the normal cycle to meet the proposed cleaning index threshold or if the proposal would result in an altered measured energy use for dishwashers that are currently minimally compliant. *Id.*

AHAM commented that it analyzed the notice of data availability (''NODA'') data published by DOE and found that over a third of products would need to re-test the heavy soil level on the most energy-intensive cycle, and for products at the ENERGY STAR V. 6.0 level, which is a significant number of models, 73 percent of models would need to re-test on the most energy-intensive cycle for the heavy soil load and 60 percent would need to re-test for the medium soil load. AHAM commented that it assumed 1 sigma for test variation (*i.e.,* 7 points) based on the test variation determined by AHAM and discussed elsewhere in this document. (AHAM, No. 17 at pp. 11–12) AHAM further stated that it could be possible that some of the current ENERGY STAR V. 6.0 certified units may not even meet the DOE maximum energy consumption standard when re-tested at the most energy-intensive cycle. (AHAM, No. 17 at p. 14)

GEA referenced data provided in AHAM's comments to state that at least 75 percent of the units currently at EL 1 would not be able to meet DOE's proposed cleaning index threshold, and at least 30 percent of dishwashers meeting the current DOE minimum standard would fail to complete the four-place setting test (*i.e.,* the heavy soil load) at a cleaning index threshold of 65. (GEA, No. 20 at p. 3)

DOE notes that when estimating the number of cycles that would need to be retested on the most energy-intensive cycle, AHAM and GEA's analysis for the number of dishwashers in DOE's test sample not meeting the cleaning index threshold proposed in the December 2021 NOPR includes cycles that scored within 1 sigma higher than the proposed cleaning index threshold of 65 along with those that scored below 65. That is, cycles that met or exceeded the proposed cleaning index threshold, but scored less than 65 + 1 sigma, were included in the count of cycles that would need to be retested. However, as discussed in section III.H.2 of this document, DOE did not propose, nor is it specifying in this final rule, a tolerance on the cleaning index value.

[47] DOE estimates the overall rate as a weighted average of the rate at each soil load times the frequency of consumer usage of each soil load; *i.e.,* (97 percent lightly soiled × 0.62) + (81 percent × 0.33) + (58 percent × 0.05) = 90 percent overall rate that meets a threshold of 65. Therefore, 10 percent of cycles would not meet the threshold of 65.

Including cycles that scored within 1 sigma higher than the proposed cleaning index threshold of 65 in the count of cycles that would need to be retested because they did not meet the threshold value inaccurately represents the data presented by DOE in the December 2021 NOPR. DOE also notes that, while its data show some test cycles that did not meet the specified cleaning index threshold, it determined that the percentage of such cycles, when weighted by the prevalence of consumers choosing each soil load as represented by the weighting factors in appendix C1 and the new appendix C2, is equivalent to the percentage of estimated cycles that are re-run or run by consumers at a more energy-intensive cycle. For the cycles that cannot meet the specified cleaning index threshold, DOE understands that these cycle types likely cannot ''completely wash a full load of normally soiled dishes,'' *i.e.,* the cycle type(s) are not representative of average consumer use and, therefore, it would not be appropriate to test these cycle types to represent energy and water consumption. DOE also notes that many manufacturers are already evaluating the cleaning performance of their dishwasher basic models to meet the ENERGY STAR Most Efficient requirements.

AHAM commented that EPCA does not contemplate or require test procedures to measure every possible cycle, combination of options, or use pattern, but requires test procedures measure only a ''representative average use cycle or period of use.'' (42 U.S.C. 6293(b)(3)) (AHAM, No. 17 at p. 2) DOE agrees and notes that the inclusion of the cleaning performance test will not require testing of every possible cycle. Instead, it will ensure that representations made using the test procedure are representative of average consumer use, as required by EPCA.

During the December 2021 NOPR public meeting, AHAM questioned if DOE had any data to show that consumers would select a more energy-intensive cycle because they are not satisfied with cleaning performance. AHAM commented that consumers could select a more energy-intensive cycle for other reasons (*e.g.,* they want to wash pots and pans). (AHAM, Public Meeting Transcript, No. 22 at p. 23) AHAM commented that manufacturers provide other cycle types on the dishwasher to address specific consumer needs, so consumers may select cycle types other than the normal cycle for reasons other than dissatisfaction with normal cycle cleaning performance. (AHAM, No. 17 at p. 7) AHAM questioned whether a dishwasher model could be sold or certified if it does not meet the cleaning index threshold on the most energy-intensive cycle. (AHAM, Public Meeting Transcript, No. 22 at p. 39) During the October 2022 *ex parte* meeting, AHAM commented that the ''most'' energy-intensive cycle will almost never meet the proposed standards because it will likely be one that uses high heat to provide specific consumer utility such as, for example, sanitization or cleaning of pots and pans. (AHAM, No. 27 at p. 2) Instead, AHAM recommended that the test procedure be set up such that if the tested cycle type does not meet the cleaning index threshold requirement, it is tested at the ''next more'' energy-intensive cycle type that meets the cleaning performance threshold. AHAM acknowledged that this approach would not decrease test burden, but noted that this approach would not have the unintended consequence of eliminating cycle types that rely on high heat to provide consumer utility. AHAM stated that this approach would allow manufacturers to provide consumers with incremental levels of energy and cleanliness. (*Id.*)

During the December 2021 NOPR public meeting, Whirlpool questioned if there were any data to indicate that the most energy-intensive cycles are for daily, regular, typical use to completely wash a full load of normally soiled dishes. (Whirlpool, Public Meeting Transcript, No. 22 at p. 18) Whirlpool commented that while its products all have a normal cycle intended for daily, regular, or typical use to completely wash a full load of normally soiled dishes, consumers may have specialty cycle type needs or use cases for dishwashers beyond daily, regular, or typical use for normally soiled dishes. (Whirlpool, No. 16 at p. 4) Whirlpool claimed that manufacturers may make non-normal cycle types more efficient in case they are tested as the most energy-intensive in the event that a dishwasher does not meet the cleaning index threshold. (Whirlpool, No. 16 at p. 9) Whirlpool commented that these cycle types provide specialty purposes for consumers and are not recommended for daily, typical, or regular use to completely wash a full load of normally soiled dishes. (*Id.*) Whirlpool commented that consumers would accept higher energy and water consumption to clean hard to remove soils on pots and pans. (*Id.*) Whirlpool commented that if manufacturers redesign cycle types to be more efficient, consumers may not get the performance that they desire and may resort to other more energy-intensive options to compensate for worse performance, such as handwashing items that may have been previously washing in the dishwasher, using cycle options that increase energy and/or water consumption, running the dishwasher multiple times, *etc.,* which could lead to lost energy savings. (*Id.)*

DOE notes that the inclusion of the cleaning performance test and minimum cleaning index threshold is to ensure that the tested cycle type is representative of average consumer use. To the extent that the normal cycle can meet the specified cleaning index threshold, it would be representative of average consumer use and testing would not be required on any additional cycles. However, if the normal cycle cannot meet the specified cleaning index threshold, this cycle is likely not representative of average consumer use and consumers would likely use a more energy-intensive cycle to achieve their desired cleaning performance as cleaning performance is expected to improve with increased energy and water use. As noted previously, this aligns with survey data presented by LBNL in its report, wherein 17 percent of consumers stated they sometimes re-run their dishwasher due to inadequate cleaning. To the extent that manufacturers design the normal cycle to be representative of average consumer use with respect to cleaning performance, additional cycle types provided for specialty reasons would continue to be non-regulated and would not be considered in the measurement of energy and water consumption. Additionally, DOE's requirement that the most energy-intensive cycle be selected for testing, rather than a more energy-intensive cycle that meets the cleaning index threshold, aligns with the definition of normal cycle, which specifies, in part, that if no cycle or more than one cycle is recommended for daily, regular, or typical use to completely wash a full load of normally soiled dishes, the most energy-intensive cycle is considered the normal cycle. Section 1.12 of appendix C1. This requirement also harmonizes with the approach DOE has taken for other test procedures in which a threshold level for validity is defined (*e.g.,* the dryness level setting for clothes dryers with automatic cycle termination in the DOE clothes dryer test procedure at appendix D2, wherein if the final moisture content after completion of the drying cycle is greater than 2 percent, the test is considered invalid and a new run is conducted using the highest dryness level setting.) Section 3.3.2 of 10 CFR

appendix D2 to subpart B of part 430. Further, given that the dishwasher cleaning performance requirement is included only in appendix C2, which will not go into effect until the compliance date of any future amended energy conservation standards, manufacturers will have sufficient time to redesign the normal cycle, if needed, to ensure it meets the specified cleaning index threshold and avoid the need for additional testing with the most energy-intensive cycle.

AHAM commented that even if consumers were equally likely to select a more energy-intensive cycle as they were to select a less energy-intensive cycle, the decision to measure cleaning performance on the most energy-intensive cycle was still unjustified because there is no evidence that if a consumer selects a more energy-intensive cycle to achieve better performance that they would most often or always use that single cycle to get better performance. (AHAM, No. 17 at p. 7)

Whirlpool commented that there are many different potential responses if a consumer was not satisfied with cleaning performance of the dishwasher, including handwashing and prerinsing more, using more or different detergent, high temperature wash and rinse options, running the dishwasher twice, or selecting a different cycle type, and DOE ultimately did not present any data to show that consumers would most likely turn to the most energy-intensive cycle if they are unsatisfied with the performance of their dishwasher. (Whirlpool, No. 16 at p. 6)

DOE does not disagree that consumers that are dissatisfied with the cleaning performance of their dishwasher on the normal cycle may turn to other behaviors that improve cleaning of the dishware, including the example behaviors described by Whirlpool. Indeed, as noted in the LBNL report, 55 percent of respondents indicated that they typically pre-rinse dishes before loading them in the dishwasher.[48] In the event a dishwasher is unable to adequately clean a load of dishes on the normal cycle, DOE expects consumers to take one or more energy-intensive actions since using more water or energy would generally help improve dishwasher cleaning performance, consistent with Whirlpool's comment: pre-washing; hand-washing dishes following a normal cycle; re-washing dishes on a normal cycle; re-washing dishes on a more-intensive cycle. DOE lacks data adequate to predict exactly how many consumers will elect one or more of those energy-intensive actions. In the absence of such data, DOE believes that testing on the most energy-intensive cycle provides the best available heuristic for the behavior of a consumer dissatisfied by the cleaning performance on the normal cycle.

When promulgating dishwasher test procedures, DOE must comport with the EPCA requirement that the test procedures produce measures of energy and water consumption representative of an average use cycle or period of use and not be unduly burdensome to conduct. DOE concludes that, given the array of possible alternative consumer behaviors when a dishwasher does not achieve acceptable cleaning performance, testing that soil load just once more on the most energy-intensive cycle is the most representative, least burdensome proxy that accounts for the additional energy and water consumption that would be incurred.

AHAM commented that DOE had failed to adequately consider what happens if a product fails to meet a cleaning index score of 65 on a test cycle, if scores are to be averaged to meet the 65 threshold, and if so, how many test cycles can be averaged in that process. AHAM recommended that DOE should not proceed with its proposal to include a performance metric until it has addressed these concerns. (AHAM, No. 17 at pp. 12–13) During the October 2022 *ex-parte* meeting, AHAM recommended that DOE should use the average cleaning index of each soil level across all tested units. (AHAM, No. 27 at p. 2) AHAM commented that this is the method used by the ENERGY STAR Program and it is a better method because it would recognize that there is significant test variation. (*Id.*)

Regarding AHAM's comment that DOE failed to adequately consider what happens if a product fails to meet a cleaning index score of 65 on a test cycle, DOE explicitly described in the December 2021 NOPR the implications if a product fails to meet a cleaning index score of 65. Specifically, DOE explained that if a test cycle at a particular soil level does not achieve the defined cleaning index threshold, that soil level would need to be re-tested using the most energy-intensive cycle that achieves a cleaning index threshold of 65 or greater. 86 FR 72738, 72759. For the soil level under consideration, the test results from the most energy-intensive valid cycle that achieves a cleaning index threshold of 65 or greater would be used in the calculation of EAOC, EAEU, and per-cycle water consumption. *Id.* As discussed, DOE is finalizing a cleaning index threshold of 70 in this document, calculated using only soil particles and excluding spots, streaks, and rack contact marks. If a test cycle at a particular soil level does not achieve the defined cleaning index threshold, that soil level would need to be re-tested using the most energy-intensive cycle that achieves a cleaning index threshold of 70 or greater. DOE notes that if a test cycle at a particular soil level fails to achieve a cleaning index threshold of 70 or greater on any cycle type available on the dishwasher, the measured energy and water consumption of the dishwasher at that soil level would not reflect a representative average use cycle, since it would not have washed the dishware to a consumer-accepted level of cleaning performance. Such test results may not be used for certification of compliance with energy conservation standards.

Regarding AHAM's comment that DOE failed to adequately consider if scores are to be averaged to meet the 65 threshold, and if so, how many test cycles can be averaged in that process, DOE explicitly stated in the December 2021 NOPR how scores are to be calculated. Specifically, DOE proposed that *each* [emphasis added] of the sensor heavy, medium, and light response test cycles would be required to achieve a cleaning index of 65 or greater to constitute a valid cycle. 86 FR 72738, 72759. In other words, scores are not averaged to meet the defined cleaning index threshold; rather, each individual soil response test cycle must achieve the defined cleaning index. DOE notes that, unlike for the ENERGY STAR Cleaning Performance Test Method, it is technically infeasible in the test procedure DOE proposed in the December 2021 NOPR to average the cleaning index at each soil level for the test sample because the proposed DOE test procedure is specified for a single test unit, and must produce a representative measure of energy use for each dishwasher that is tested. For each tested unit, the proposed test procedure requires that the test be conducted sequentially, starting at the heavy soil load, followed by the medium and light soil loads, with cleaning performance evaluated at each soil load. To proceed to the next soil load test (*e.g.,* from heavy soil load to medium soil load), a given soil load (*i.e.,* heavy soil load) would be required to be tested at the normal cycle or the most energy-intensive cycle type if the normal cycle does not meet the specified cleaning index threshold. That is, a given unit's test cannot proceed until each soil load

[48] "Dishwashers in the Residential Sector: A Survey of Product Characteristics, Usage, and Consumer Preferences." Section 4.3.2.1. Available at *www.osti.gov/biblio/1827934*. Last accessed July 6, 2022.

meets the cleaning index threshold. It is not feasible to hinge the determination of which cycle type must be tested for each soil load on an average value of multiple test units. Accordingly, this final rule maintains the requirements from the December 2021 NOPR that each tested cycle is required to achieve the specified cleaning index threshold to constitute a valid cycle.

AHAM commented that DOE had not considered potential secondary effects, such as impacts to minimally compliant products, recertification requirements for products that do not meet the cleaning index threshold, and labeling impacts. (AHAM, No. 17 at p. 13)

DOE's test sample included two units that just meet current energy conservation standards, and both of these units met or exceeded the cleaning index threshold for all soil loads, including for the heavy soil load test cycle. Because better cleaning performance is typically easier to achieve with higher energy and water consumption, and minimally compliant dishwashers are those that use relatively more energy and water, DOE concludes that minimally compliant products are capable of meeting the cleaning index threshold requirements. Additionally, DOE is finalizing the cleaning performance requirements in the new appendix C2, which will only take affect with any future amended standards, so there will not be any direct impacts on minimally compliant products, recertification requirements, or labeling.

Additionally, DOE is not amending the certification or reporting requirements for dishwashers in this final rule to require reporting of the cleaning index when the use of the new appendix C2 is required. Instead, DOE may consider proposals to amend the certification and reporting requirements for dishwashers under a separate rulemaking regarding appliance and equipment certification.

AHAM commented that if the performance metric is included in the final test procedure, DOE should determine what occurs when a machine has an anomalous cycle as DOE has done this for other products. (AHAM, No. 17 at p. 15) Whirlpool commented that it supported AHAM's position on anomalous cycles. (Whirlpool, No. 16 at p. 2) From testing, DOE has observed that dishwashers typically do not have ''anomalous cycles.'' For dishwashers that may have increased energy or water use for some cycles but not others, DOE's testing experience has indicated that ''anomalous behavior'' typically occurs in response to the machine's sensor response. That is, the dishwasher operation is not anomalous, but accurate in terms of how the unit's sensor is likely designed to respond. Accordingly, DOE is not providing any additional requirements for what stakeholders are referring to as ''anomalous cycles.''

AHAM commented that the proposed cleaning performance requirement adds test burden with respect to dishwashers that do not have soil sensors. (AHAM, No. 17 at p. 12) AHAM commented that currently, testing of non-soil-sensing dishwashers does not require soiled dishes for a test run. (*Id.*) AHAM commented that DOE's proposal adds the extra burden of adding soils to dishwashers that do not have soil sensors. AHAM commented that with this proposal, testing with the three soil levels—heavy, medium, and light—the number of tests for non-soil-sensing dishwashers could increase up to threefold. (*Id.*)

DOE recognizes that there would be an increase in test burden for testing non-soil-sensing dishwashers. However, as stated in the December 2021 NOPR, non-soil-sensing dishwashers would not be tested *a priori* at all three soil levels. Rather, to mitigate the burden associated with testing non-soil-sensing dishwashers using a soiled load, DOE proposed in the December 2021 NOPR, and is specifying the same requirement in this final rule, that non-soil-sensing dishwashers must first be tested using only the heavy soil load. If the test with the heavy soil load is representative of average consumer use (*i.e.,* it meets a cleaning index threshold of 70), no additional tests are required. 87 FR 72738, 72759. This approach is less burdensome than requiring that all three soil levels be tested, as specified in the ENERGY STAR Cleaning Performance Test Method, regardless of how the dishwasher performs at each soil level. Section III.L.1 of this document estimates the increase in testing costs for non-soil-sensing dishwashers.

The following paragraphs discuss specific details regarding the implementation of the cleaning performance test for soil-sensing and non-soil-sensing dishwashers, respectively, including compact dishwashers with a capacity of less than four place settings.

For soil-sensing dishwashers, section 2.6.3 of the currently applicable appendix C1 specifies that the normal cycle shall be tested first for the sensor heavy response, then for the sensor medium response, and finally for the sensor light response, using a defined combination of soiled and clean test load items for each test cycle. DOE specifies maintaining this test sequence, which is also specified in section 2.6.3 of AHAM DW–1–2020, in both the amended appendix C1 and the new appendix C2. Additionally, in the new appendix C2, each of the sensor heavy, medium, and light response test cycles would be required to achieve a cleaning index of 70 or greater to constitute a valid cycle. If a test cycle at a particular soil level does not achieve the defined cleaning index threshold, that soil level would need to be re-tested using the most energy-intensive cycle that achieves a cleaning index threshold of 70 or greater. For the soil level under consideration, the test results from the most energy-intensive valid cycle that achieves a cleaning index threshold of 70 or greater would be used in the calculation of EAOC, EAEU, and per-cycle water consumption. In the event that a test cycle at a particular soil level does not achieve the defined cleaning index threshold, the filter should be cleaned prior to testing the soil level at the most energy-intensive cycle that achieves a cleaning index of 70 or greater. Cleaning the filter before transitioning from the normal cycle to the specified most energy-intensive cycle at a given soil load would ensure that residual particles from the normal cycle test run do not impact the cleaning performance evaluation for that most energy-intensive cycle. It would also promote repeatability and reproducibility of the test results when testing according to these amendments (in which the sequence of test cycles may requiring switching from the normal cycle to a different cycle type).

Non-soil-sensing dishwashers are tested with a clean (*i.e.,* unsoiled) test load according to the requirements in the currently applicable appendix C1, and this approach is maintained under the amended appendix C1. For the new appendix C2, which specifies the threshold cleaning index requirement, DOE specifies that non-soil-sensing dishwashers must be tested instead with a soiled load. Specifically, for non-soil-sensing dishwashers, DOE specifies incorporating the same procedure for evaluating the validity of the normal cycle and, if necessary, testing the most energy-intensive cycle that achieves a cleaning index threshold of 70 or greater, as specified for soil-sensing dishwashers. The same equations specified for soil-sensing dishwashers in section 5 of the currently applicable appendix C1, Calculations of Derived Results from Test Measurements, would apply to non-soil-sensing dishwashers in the new appendix C2. The test procedure specifies testing the heavy, medium, and light soil levels, in that sequence. Since non-soil-sensing dishwashers consume a fixed amount of

water and energy independent of the amount of soil present in the test load, it is assumed that if the normal cycle obtains a cleaning index of 70 or greater at a given soil load (*e.g.,* for the sensor heavy response test), that the normal cycle would also achieve the cleaning index threshold for any lesser soil loads (*e.g.,* the sensor medium and sensor light response tests). Therefore, if a tested soil load for a non-soil-sensing dishwasher meets the defined threshold criteria when tested on the normal cycle, no additional testing would be required of cycles with lesser soil loads. If a non-soil-sensing dishwasher is not tested at a certain soil load because the preceding heavier soil load(s) meets the cleaning index threshold on the normal cycle, the energy and water consumption values of the preceding soil load would be used to calculate the weighted-average energy and water consumption values. For example, if the sensor medium response and sensor light response tests on the normal cycle are not conducted, the values of the sensor heavy response test on the normal cycle would be used for all three soil loads; whereas, if only the sensor light response test is not conducted, the values of the sensor medium response test on the normal cycle would be used for the sensor medium and the sensor light response tests.

Further, in the December 2021 NOPR, DOE noted that compact dishwashers that are non-soil-sensing are currently tested at the manufacturer-stated capacity, if the capacity of the dishwasher is less than eight place settings. 86 FR 72738, 72760. Under the proposal to test non-soil-sensing dishwashers with a soiled load, the instructions specify that compact dishwashers must be tested using four place settings plus six serving pieces, and that some of the place settings are soiled for the different soiled loads. However, DOE stated that it is aware that the rated capacity of some compact, non-soil-sensing dishwashers is less than four place settings (*e.g.,* the basic models for which CNA and FOTILE submitted waiver petitions and discussed in sections III.E.5 and III.E.6, respectively, of this document). *Id.* For such dishwashers, as well as any soil-sensing compact dishwashers that have a rated capacity of less than four place settings, DOE specified the following requirements for soiling the test load:

- *Heavy soil load:* Soil two-thirds of the place settings, excluding flatware and serving pieces (rounded up to the nearest integer) or one place setting, whichever is greater;
- *Medium soil load:* Soil one-quarter of the place settings, excluding flatware and serving pieces (rounded up to the nearest integer) or one place setting, whichever is smaller;
- *Light soil load:* Soil one-quarter of the place settings, excluding flatware and serving pieces (rounded up to the nearest integer) or one place setting, whichever is smaller, using half the quantity of soils specified for one place setting. *Id.*

DOE did not receive any comments in response to its proposed requirements for soiling compact dishwashers with a capacity of less than four place settings. Accordingly, DOE is adopting the aforementioned soiling requirements for compact dishwashers with a capacity of less than four place settings in the new appendix C2. For the amended appendix C1, the number of place settings and soiling requirements for compact dishwashers is the same as specified in the currently applicable appendix C1.

5. Determining the Most Energy-Intensive Cycle

In the December 2021 NOPR, DOE proposed instructions for determining the most energy-intensive cycle that could achieve the proposed cleaning index threshold, to be conducted only if the normal cycle of a given unit could not achieve the threshold. 86 FR 72738, 72760. DOE proposed that the most energy-intensive cycle would be determined by conducting a single test cycle with a clean test load for each available cycle type (*e.g.,* Normal, Heavy Duty, Pots and Pans, *etc.*). *Id.*

DOE also proposed that prior to running the clean load test to determine the most energy-intensive cycle, the dishwasher filter should be cleaned so that soil particles from any previous tests does not affect the determination of the most energy-intensive cycle. *Id.*

DOE requested feedback on its proposed methodology for determining the most energy-intensive cycle. *Id.* DOE also requested feedback on whether it should consider determination of the most energy-intensive cycle for sensor response test cycles using the respective soil load. *Id.*

GEA commented that DOE's proposal which requires that, if a machine fails to achieve a minimum cleaning index threshold, the filter must be washed prior to running subsequent cycles is not adequate to return the dishwasher to its pre-tested condition. GEA suggested that in addition to cleaning the filter, the unit under test should be run through a complete normal cycle without dishes, soil, or detergent. Finally, the filter should then be cleaned a second time before the test process proceeds with additional test runs. GEA explained that these steps provide increased assurance that results from one test do not influence the results of a subsequent test. (GEA, No. 20 at p. 4)

DOE notes that cleaning the filter in between different test series is consistent with other industry standards. The IEC standard, for example, specifies cleaning only the filter when conducting cleaning performance tests. Additionally, requiring running an additional test cycle type and cleaning the filter a second time would add additional test burden that may not be necessary in terms of cleaning out the dishwasher unit.

AHAM commented that the process to determine the most energy-intensive cycle is unduly burdensome, since the proposal requires running several cycle types with a clean load to identify the most energy-intensive cycle, and then run another cycle with a soiled load because scoring of cleaning takes place after the energy test. (AHAM, No. 17 at p. 11) AHAM further stated that the additional burden associated with determining the most energy-intensive cycle is likely to apply to most models and makes the test procedure unduly burdensome to conduct. (AHAM, No. 17 at p. 12)

DOE notes that while the procedure to determine the most energy-intensive cycle type would add burden, DOE's considered approach is less burdensome than other alternative approaches that would require running each available test cycle type with a soiled load. DOE additionally clarifies that it expects manufacturers to know the most energy-intensive cycle type for their basic models and as such does not expect manufacturers to need to test each cycle type with a clean load to determine the most energy-intensive cycle as part of testing to determine compliance with any future standards. The procedure that DOE proposed to determine the most energy-intensive cycle type would be conducted only if the most energy-intensive cycle is unknown and is the approach that DOE would use during enforcement testing, should any such testing be conducted. DOE has clarified its intent in the regulatory text in the new appendix C2 and in a new section in 10 CFR part 429.134.

DOE is finalizing its proposal, in the new appendix C2, with minor updates discussed in the preceding paragraph, to determine the most energy-intensive cycle that can achieve a cleaning index threshold of 70 through testing with a clean load, should the normal cycle at a specific soil load be unable to achieve this threshold.

I. Standby Mode Test Method

1. Standby Power Measurement

Section 4.2 of appendix C1 provides instructions for measuring standby mode and off mode power. These instructions do not currently specify if the dishwasher door is to be open or closed when testing in standby mode and off mode.

For the December 2021 NOPR, DOE reviewed recent models from different manufacturers and observed that some newer models have LED lights inside the dishwasher tub as well as other indicators either on the door or on the electronic control panel that illuminate when the dishwasher door is open. 86 FR 72738, 72761. Additional energy use by any such lights and/or indicators could affect the standby power consumption and the resulting EAEU measurement; for example, a 1-watt increase in the standby power consumption could impact the EAEU by up to 5 percent, *i.e.,* conducting standby mode testing with the dishwasher door open as compared to testing with the door closed could result impact test results for EAEU by up to 5 percent if the lights consumed an additional 1 watt of power. *Id.*

Section 4.2 of the AHAM DW–1–2020 standard also includes specific instructions for the door orientation during standby mode testing. It specifies that the standby mode test must be conducted after completing the last active mode test as part of the energy test sequence. Thereafter, the dishwasher door must be opened and immediately closed without changing the control panel settings used for the active mode wash cycle and without disconnecting the electrical supply to the dishwasher. Once the door is closed, the standby mode and off mode measurements should begin.

In the December 2021 NOPR, DOE proposed to reference this requirement from AHAM DW–1–2020 regarding opening and closing the door prior to starting the standby mode and off mode tests. *Id.* DOE initially concluded that performing standby mode and off mode testing with the door closed is likely to be most representative of average consumer use, while also providing a representative measurement, in particular noting CEC's comment in response to the August 2019 RFI that most consumers will keep the dishwasher door closed to prevent disruption of foot traffic patterns in their kitchen.[49] *Id.*

Based on DOE's interactions with test laboratories, dishwashers are already tested with the door closed in standby mode. *Id.* Therefore, DOE stated in the December 2021 NOPR that it does not expect any increase in costs to manufacturers from this proposed update were it made final. *Id.* DOE requested input on its proposal to apply the standby mode and off mode test requirements from section 4.2 of AHAM DW–1–2020 to appendix C1 and the new appendix C2. *Id.*

AHAM commented that it agrees with DOE's proposal to specify that the door be opened and closed ''immediately'' for standby testing, but that DOE provide additional language to require a minimum time for door opening at the end of the test cycle. (AHAM, No. 17 at pp. 15–16) AHAM suggested a minimum door opening time of 10 seconds after completion of the cycle. (*Id.*) During the December 2021 NOPR public meeting, Whirlpool commented that some dishwashers may have ''cycle-finish'' behavior if the door is opened and closed immediately compared to if it is opened for a slightly longer period of time, which would represent a consumer unloading the dishwasher and closing the door after unloading. (Whirlpool, Public Meeting Transcript, No. 22 at pp. 54–55) In written comments, Whirlpool commented that it supported AHAM's position on door opening at the end of the cycle for standby mode power measurement. (Whirlpool, No. 16 at p. 2)

The Joint Commenters commented that they agree with the approach that DOE is proposing to use for standby mode and off mode testing as it will help improve reproducibility of the test procedure by ensuring that all manufacturers are testing standby mode and off mode power in a consistent manner. (Joint Commenters, No. 18 at p. 2)

DOE notes that the intent of its proposal in the December 2021 NOPR was that the dishwasher is in-fact in standby mode when the standby mode test is conducted. However, DOE does not have any data, and AHAM did not provide any additional data, to determine if 10 seconds is sufficient to ensure that the dishwasher transitions from active mode to standby mode. Accordingly, while DOE is not including any clarification in appendix C1 and the new appendix C2 regarding the length of time the door should remain open, DOE notes that the intent of this requirement is to ensure that the dishwasher door is opened for a sufficient period of time such that the dishwasher enters a lower-power state before it is shut, and standby power is measured.

2. Annual Combined Low-Power Mode Energy Consumption Calculation

Section 5.7 of appendix C1 specifies the method to calculate the annual combined low-power mode energy consumption. The combined low-power mode energy consumption includes the power consumption in inactive mode[50] and off mode,[51] depending on whether a unit can enter both of these modes or only one of these modes. To calculate the annual low-power mode energy consumption, section 5.7 of appendix C1 currently assigns 8,465 hours annually to low-power modes for units that do not have a fan-only mode. For units that have a fan-only mode, the annual hours assigned to low-power modes are calculated for each individual unit based on the tested duration in active mode and fan-only mode. Section 5.7 of appendix C1. That is, the combined low-power annual hours for all available modes other than active mode, S_{LP}, is calculated as:

$S_{LP} = [H - \{N \times (L + L_F)\}]$ for dishwashers capable of operating in fan-only mode; otherwise, S_{LP} = 8,465

Where,

H = the total number of hours per year = 8,766 hours per year,

N = the representative average dishwasher use of 215 cycles per year,

L = the average of the duration of the normal cycle and truncated normal cycle, for non-soil-sensing dishwashers with a truncated normal cycle; the duration of the normal cycle, for non-soil-sensing dishwashers without a truncated normal cycle; the average duration of the sensor light response, truncated sensor light response, sensor medium response, truncated sensor medium response, sensor heavy response, and truncated sensor heavy response, for soil-sensing dishwashers with a truncated cycle option; the average duration of the sensor light response, sensor medium response, and sensor heavy response, for soil-sensing dishwashers without a truncated cycle option, and

L_F = the duration of the fan-only mode for the normal cycle for non-soil-sensing

[49] In response to the August 2019 RFI, CEC commented that, ''intuitively, most consumers will keep the dishwasher door closed to prevent disruption of foot traffic patterns in their kitchen.'' (CEC, No. 6 at p. 2)

[50] *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. Section 1.10 of appendix C1.

[51] *Off mode* means a mode in which the dishwasher is connected to a main power source and is not providing any active mode or standby mode function, and where the mode may persist for an indefinite time. An indicator that only shows the user that the product is in the off position is included within the classification of an off mode. Section 1.15 of appendix C1.

dishwashers; the average duration of the fan-only mode for sensor light response, sensor medium response, and sensor heavy response for soil-sensing dishwashers. Section 5.7, appendix C1.

Section 5.7 of AHAM DW–1–2020 updated this calculation such that the combined low-power annual hours, S_{LP}, is a calculated value for all units. That is, dishwashers that do not have a fan-only mode would use the same equation to calculate S_{LP} as dishwashers that do have a fan-only mode. The only difference in calculation of S_{LP} for units without a fan-only mode is that L_F would be equal to 0 for such units.

In the December 2021 NOPR, DOE proposed to reference the annual low-power mode energy consumption calculation specified in section 5.7 of AHAM DW–1–2020, which would also include the updated calculation method for combined low-power annual hours, S_{LP}. 86 FR 72738, 72762. This approach would change the hours assigned to low-power mode from 8,465 hours for dishwashers that do not have a fan-only mode to a value that is dependent on the duration of the normal cycle. Calculating the annual low-power mode energy consumption utilizing the measured active mode duration for each individual unit rather than assigning a constant value across all units would provide a more representative result.

In the December 2021 NOPR, DOE stated that the proposed change to the combined low-power annual hours would potentially impact the measured EAEU. *Id.* DOE also noted that the current energy conservation standard was developed using the method for determining the combined low-power annual hours specified in appendix C1. *Id.* As such, in the December 2021 NOPR, DOE proposed that, if this proposal were adopted, this change would go into effect in conjunction with any amended energy conservation standards for dishwashers. *Id.* Accordingly, DOE proposed that the updated calculation of annual low-power mode energy consumption be included only in the new appendix C2. *Id.* Appendix C1 would continue using the current method for calculating the annual low-power mode energy consumption. DOE requested comment on its proposal to use the updated combined low-power annual hours, specified in Section 5.7 of AHAM DW–1–2020, for the calculation of annual combined low-power mode energy consumption in the new appendix C2. *Id.*

DOE did not receive any comments on this topic and is finalizing its proposal, consistent with the December 2021 NOPR, to use the updated combined low-power annual hours, specified in section 5.7 of AHAM DW–1–2020, for the calculation of annual combined low-power mode energy consumption in the new appendix C2.

J. Network Mode

Appendix C1 currently does not address ''network mode'' power consumption. In the December 2021 NOPR, DOE stated that it is aware of dishwashers with network capabilities that are currently on the market. 86 FR 72738, 72762. However, DOE stated that it did not have sufficient data at the time of publication of the December 2021 NOPR regarding the energy use and consumer use patterns associated with such capabilities to evaluate potential test procedure provisions related to network capabilities. *Id.* Therefore, in the December 2021 NOPR, DOE proposed that all network functions must be disabled during testing. *Id.* Specifically, DOE proposed to include a requirement in appendix C1 and the new appendix C2 that for dishwashers, which can communicate through a network (*e.g.,* Bluetooth® or internet connection), all network functions must be disabled, if it is possible to disable it by means provided in the manufacturer's user manual, for the duration of testing. *Id.* If the manufacturer instructions provided in the user manual do not provide for disabling a connected function, the standby power test procedure is conducted with the connected function in the ''as-shipped'' condition. DOE sought comment on its proposal to require the disablement of all network functions throughout the duration of testing. *Id.* DOE sought the following information regarding connected dishwashers that could inform future test procedure considerations.

DOE requested feedback on connected dishwashers currently on the market. *Id.* Specifically, DOE requested input on the types of features or functionality enabled by connected dishwashers that exist on the market or that are under development. *Id.*

DOE requested data on the percentage of users purchasing connected dishwashers, and, for those users, the percentage of the time when the connected functionality of the dishwashers is used. *Id.* DOE requested data on the amount of additional or reduced energy use of connected dishwashers. *Id.*

DOE requested data on the pattern of additional or reduced energy use of connected dishwashers; for example, whether it is constant, periodic, or triggered by the user. *Id.* DOE requested information on any existing testing protocols that account for connected features of dishwashers, as well as any testing protocols that may be under development within the industry. *Id.*

The CA IOUs recommended that DOE test dishwashers in the as-shipped configuration, rather than disabling network functions as there is no evidence to suggest that consumers actively disable these functions. (CA IOUs, No. 19 at p. 2; CA IOUs, Public Meeting Transcript, No. 22 at p. 69) During the December 2021 NOPR public meeting, ASAP echoed the comments provided by the CA IOUs. (ASAP, Public Meeting Transcript, No. 22 at pp. 69–70)

The CA IOUs referenced a PG&E survey in which 96 percent of consumers with a smart clothes washer as well as 96 percent of consumers with a smart microwave oven reported that they do not make an attempt to disable Wi-Fi or smart application functions. (CA IOUs, No. 19 at pp. 2–3) The CA IOUs commented that even though these are different products, there was no reason to believe the trends would be different for other household appliances and reiterated that DOE should require testing with network functions set in their as-shipped conditions. *Id.*

The Joint Commenters urged DOE to require that all dishwashers be tested with network functions in the ''as-shipped'' condition, instead of DOE's position that all network functions be disabled prior to testing. (Joint Commenters, No. 18 at pp. 2–3) The Joint Commenters expressed concern that DOE's proposal would allow many dishwashers to be tested with network functions disabled even though those functions may be unlikely to be disabled in the field. Specifically, the Joint Commenters stated that if a dishwasher with connected features is shipped with those features enabled, they believe it is unlikely that most consumers will disable those features. The Joint Commenters suggested that DOE require all dishwashers be tested ''as shipped'' regardless of whether the user manual provides instructions for disabling the network functions. (Joint Commenters, No. 18 at p. 3)

As discussed, DOE is aware of a number of dishwashers on the market with varying implementations of connected functionality. DOE has observed different implementations of connected features across different brands, and the design and operation of these features is continuously evolving. Accordingly, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to disable all network functions during testing. Specifically, DOE is finalizing its proposal to include

a requirement in appendix C1 and the new appendix C2 that for dishwashers which can communicate through a network (*e.g.,* Bluetooth® or internet connection), all network functions must be disabled, if it is possible to disable it by means provided in the manufacturer's user manual, for the duration of testing.

K. Test Cycle Duration and Updates to 10 CFR 430.32

In the December 2021 NOPR, DOE proposed to specify a method for determining cycle duration in section 5.3 of appendix C1 and the new appendix C2. 86 FR 72738, 72763. DOE proposed that the test duration be calculated as the weighted average of the sensor heavy response, sensor medium response, and sensor light response tests for all dishwashers (*i.e.,* both soil-sensing and non-soil-sensing dishwashers). *Id.* At the time of issuance of the December 2021 NOPR, there were three product classes for dishwashers: standard dishwashers, compact dishwashers, and standard dishwashers with a cycle duration of 60 minutes or less. Since publication of the December 2021 NOPR, DOE has rescinded the standard dishwashers with a cycle duration of 60 minutes or less product class. See 87 FR 2673. At the time DOE proposed the calculation of test duration, it was to aid in the determination of cycle duration, which would have been used to determine the appropriate product class for a given unit.

In the December 2021 NOPR, DOE also proposed to incorporate by reference AHAM DW–1–2020 in its entirety into 10 CFR part 430, and amend 10 CFR 430.32(f)(1)(iii) to remove the existing reference to appendix C1, and instead reference AHAM DW–1–2020 for the definition of ''normal cycle.'' *Id.* Additionally, DOE proposed to update the references to AHAM DW–1 in the standard size dishwasher and compact size dishwasher descriptions in 10 CFR 430.32. *Id.*

DOE requested comment on the proposal to update the standard size dishwasher, compact size dishwasher, and standard size dishwasher with a ''normal'' cycle time of 60 minutes or less descriptions at 10 CFR 430.32(f)(1)(i)–(iii). *Id.* DOE also requested comment on the proposal to explicitly provide the method for determining cycle duration in appendices C1 and C2.

The CA IOUs commented that while they support DOE's proposal to include a cleaning performance test method and cleaning index threshold, they were concerned that this may inadvertently impact customer dissatisfaction elsewhere, such as cycle time performance. (CA IOUs, No. 19 at p. 3) The CA IOUs therefore reiterated their support for both measurement of cycle time and disclosure of cycle time to allow consumers to better understand these tradeoffs and prioritize their needs regarding cycle time and energy performance. *Id.* The CA IOUs commented in support of DOE's decision to add measurement of cycle time to the test procedure and asked DOE to consider public disclosure and reporting of cycle time, since consumers may be interested in this data. *Id.*

DOE notes that because the standard size dishwasher with a normal cycle time of 60 minutes or less product class was revoked in a final rule published in January 2022 (87 FR 2673), the cycle duration calculation as provided in section 5.3 of appendix C1 and appendix C2 of the December 2021 NOPR is not relevant. Instead, the cycle duration calculation as part of the low-power mode energy consumption calculation would be more relevant for determining dishwasher cycle duration because this calculation is used to determine the annual low-power mode hours and active mode hours. As discussed in section III.I.2 of this document, cycle duration is calculated as the simple average of the sensor heavy, medium, and light response cycles and, for dishwashers with a heated dry option, the duration of the truncated sensor heavy, medium, and light response cycles is also included in the cycle duration calculation. While DOE is not including any reporting requirements in this document, it could consider including a reporting requirement for S_{LP}, which is the combined low-power annual hours and is a calculated value when determining low-power mode energy consumption, in a future certification rulemaking. The cycle duration could then be determined from S_{LP} by subtracting S_{LP} from 8,766 annual hours and dividing by the annual dishwasher cycles (184 cycles per year when testing according to the new appendix C2).

Accordingly, DOE is removing the cycle duration calculation that it proposed in the December 2021 NOPR. Additionally, DOE did not receive any comments on its proposal to update the reference in 10 CFR 430.32 to AHAM DW–1–2020. Therefore, DOE is finalizing its proposal, consistent with the December 2021 NOPR, to update the standard size dishwasher and compact size dishwasher descriptions at 10 CFR 430.32(f)(1)(i)–(iii).

L. Test Procedure Costs and Harmonization

1. Test Procedure Costs and Impact

In this document, DOE amends the existing test procedure for dishwashers at appendix C1 and adopts a new test procedure at appendix C2. The amendments to appendix C1 establish requirements for water hardness, relative humidity, and loading pattern; update requirements for ambient temperature, detergent dosage, and standby power measurement; and include testing approaches from published waivers for dishwashers. The new appendix C2 additionally includes provisions for evaluating cleaning performance and establishing a minimum per-cycle cleaning index threshold as a condition for a valid test, and updated annual number of cycles and low-power mode hours for the calculation of energy consumption.

The amendments to appendix C1 establish new requirements for water hardness and relative humidity and update the requirements for ambient temperature. DOE does not expect these requirements to increase test burden as compared to current industry practice because it expects that laboratories already control water hardness, relative humidity, and ambient temperature to within the proposed specifications, as indicated by manufacturer comments supporting these amendments, as well as general industry acceptance for these requirements as they pertain to dishwashers and other appliances.

DOE is also establishing in appendix C1 a new requirement for loading soiled dishes. DOE does not expect this requirement to change the rated energy and water use because the thermal mass inside the dishwasher chamber will be the same, regardless of how the dishes are loaded in the unit. DOE also does not expect this requirement to increase the cost of conducting the test procedure as compared to the current test procedure based on the large number of brands currently participating in the ENERGY STAR qualification and Most Efficient programs (which require the loading pattern specified in this document).

Further, DOE is also establishing a new detergent type and approach for calculating the detergent dosage in appendix C1. However, DOE is also retaining the current detergent type and dosing requirement. As such, DOE does not expect this requirement to increase test burden as compared to current industry practice. *Id.*

DOE further specifies in appendix C1 that standby mode power consumption be measured with the door closed.

Based on DOE's interactions with test laboratories, dishwashers are already tested with the door closed in standby mode. Therefore, DOE does not expect any increase in costs to manufacturers from this update.

The amendments to appendix C1 will not impact the representations of dishwasher energy and water use. Manufacturers will be able to rely on data generated under the test procedure in effect prior to the adoption of the amended appendix C1. As such, retesting of dishwashers will not be required solely as a result of DOE's adoption of the amendments to appendix C1.

In addition to the amendments to appendix C1, DOE is also establishing a new appendix C2. As stated, use of the new appendix C2 will be required in conjunction with the compliance date of any future amendments to the energy conservation standards for dishwashers. DOE is specifying the evaluation of cleaning performance in the new appendix C2. Specifically, DOE is requiring that each tested soil load must meet a minimum per-cycle cleaning index threshold of 70 for a test cycle to be considered valid. Further, the new appendix C2 includes changes to the annual number of cycles and low-power mode hours, both of which are used for the calculation of energy consumption. While the requirement to evaluate cleaning performance would increase test burden, the updates to the annual number of cycles and low-power mode hours will change certain inputs to the calculation, but will not impact the burden as compared to conducting the calculation under the test procedure as amended in appendix C1.

DOE estimates the cost to test a soil-sensing dishwasher, according to the new appendix C2, to be approximately $2,334 per basic model and that for a non-soil-sensing dishwasher to be approximately $735 per basic model. These costs were estimated as follows.

Based on its experience conducting dishwasher testing, DOE estimates the total duration to test dishwashers according to the currently applicable version of appendix C1, and the amended appendix C1, to be 25 hours for a soil-sensing dishwasher and 6 hours for a non-soil-sensing dishwasher. The additional time required to score a load at the end of cycle and calculate the cleaning index is estimated to be 1 hour per soil load. The new appendix C2 also prescribes the use of a new detergent type and method to calculate the detergent dosage compared to the detergent dose estimation in the current appendix C1. Based on testing that DOE conducted in support of the October 2020 Final Rule, DOE estimates that the updated detergent dosage methodology will reduce testing time by about 1 hour because the new methodology estimates detergent dosage based on the number of place settings as opposed to the prewash and main wash fill water volumes as required under the currently applicable (and amended) appendix C1 test procedure. Determination of the prewash and main wash fill water volumes requires about 1 hour to identify the prewash and main wash phases of a test cycle, isolate the water consumed during these specific portions of the cycle, and then calculate the quantity of detergent required. Therefore, DOE estimates the test duration under the new appendix C2 to be 27 hours for soil-sensing dishwashers (25 hours currently + 1 hour per soil load to score the load and calculate the cleaning index—1 hour using the updated detergent dosage methodology). As discussed previously, DOE does not expect manufacturers to run additional tests as part of compliance testing to determine the most energy-intensive cycle type, in the event that a given basic model cannot meet the specified cleaning index threshold on the normal cycle at any soil load. Accordingly, DOE has not estimated costs for this test.

Non-soil-sensing dishwashers are to be tested on the heavy soil load under the new appendix C2. This will increase testing time by approximately 2.5 hours (in addition to the 1 hour associated with scoring and calculating cleaning index) due to the additional time associated with preparing the soils, soiling the load, allowing the soils to dry, and loading the soiled dishes. To mitigate burden, DOE is additionally specifying that non-soil-sensing dishwashers are required to test the medium and light soil loads only if the next-greater soil load requires the use of the most energy-intensive cycle. To estimate the testing burden associated with the new appendix C2, DOE estimated that most non-soil-sensing dishwashers will only be tested at the heavy soil load. DOE also estimates that the updated detergent dosage methodology will reduce testing time by about 1 hour. Therefore, DOE estimated the total testing duration for non-soil sensing dishwashers under the new appendix C2 to be 8.5 hours (6 hours currently + 2.5 hours to soil the load + 1 hour to score the load and calculate the cleaning index—1 hour using updated detergent dosage methodology). Similar to soil-sensing dishwashers, DOE does not expect manufacturers to run additional tests as part of compliance testing to determine the most energy-intensive cycle type, in the event that a given basic model cannot meet the specified cleaning index threshold on the normal cycle at any soil load. Accordingly, DOE has not estimated costs for this test.

Based on data from the Bureau of Labor Statistics' (''BLS's'') Occupational Employment and Wage Statistics, the mean hourly wage for electrical and electronic engineering technologist and technician is $30.47.[52] 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 estimated that wages make up 70.5 percent of the total compensation for private industry employees.[53] Therefore, DOE estimated that the total hourly compensation (including all fringe benefits) of a technician performing these tests to be approximately $43.22.[54] Using these labor rates and time estimates, DOE estimated that it will cost dishwasher manufacturers approximately $2,334 to test at least two units for each basic model for soil-sensing dishwashers and approximately $735 to test at least two units for each basic model for non-soil-sensing dishwashers.[55]

The incremental increases in testing costs under the new appendix C2 compared to the current and amended appendix C1 are approximately $173 per soil-sensing dishwasher basic model and approximately $216 per non-soil-sensing dishwasher basic model.[56]

As previously discussed, the use of the new appendix C2 would not be required until the time of the compliance date of future amended energy conservation standards for dishwashers, should such amendments be adopted. At that time, manufacturers

[52] 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 2021) to estimate the hourly wage rate of a technician assumed to perform this testing. See *www.bls.gov/oes/current/oes173027.htm.* Last accessed July 4, 2022.

[53] DOE used the June 2022 ''Employer Costs for Employee Compensation'' to estimate that for ''Private Industry Workers,'' ''Wages and Salaries'' are 70.5 percent of the total employee compensation. See *www.bls.gov/news.release/pdf/ecec.pdf.* Last accessed October 19, 2022.

[54] $30.47 ÷ 0.705 = $43.22.

[55] Soil-sensing dishwasher: $43.22 × 27 hours × 2 units per basic model = $2,333.88 (rounded to $2,334); non-soil-sensing dishwasher: $43.22 × 8.5 hours × 2 units per basic model = $734.74 (rounded to $735).

[56] Soil-sensing dishwasher under current appendix C1: $43.22 × 25 hours × 2 units per basic model = $2,161. Non-soil-sensing dishwasher under current appendix C1: $43.22 × 6 hours × 2 units per basic model = $518.64 (rounded to $519). $2,334 − $2,161 = $173. $735 − $519 = $216.

would need to retest models in accordance with appendix C2. In addition to the potential retesting costs, DOE expects that some manufacturers may incur one-time capital costs if their current testing laboratories are at capacity and additional laboratory space or test stations are required. DOE would incorporate the estimated costs associated with testing to the newly established appendix C2 into the analysis of any future energy conservation standards based on appendix C2.

2. Harmonization With Industry Standards

DOE's established practice is to adopt industry test standards as DOE test procedures for covered products and equipment, 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 equipment during a representative average use cycle. Section 8(c) of 10 CFR part 430 subpart C appendix A. 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 procedure.

The current test procedure for dishwashers at appendix C1 references ANSI/AHAM DW–1–2010 in definitions and for testing conditions, and IEC 62301 Ed. 2.0 for test conditions, equipment, and standby mode power consumption measurement. The industry standards DOE is referencing in this document are discussed in further detail in section III.C and section IV.N of this document.

DOE notes that some of its modifications would not require re-testing and recertification of dishwasher basic models as compared to adopting AHAM DW–1–2020 and AHAM DW–2–2020 without modification, while maintaining the representativeness of the DOE test procedure. DOE is maintaining the list of test load items currently in appendix C1 as an alternative to the test load items specified in AHAM DW–1–2020, so test laboratories that currently have the test load items are not required to purchase new items. DOE is also maintaining the current detergent and dosage requirements as alternatives to the detergent and dosage requirements specified in AHAM DW–1–2020 because this would allow manufacturers to continue to rely on existing test data and would not require re-testing or re-certification of dishwashers on the market.

Additionally, DOE is maintaining the annual number of cycles and low-power mode hours currently specified in appendix C1 because these values can impact the EAEU, which provides the basis for the existing energy conservation standards. DOE is adopting the annual number of cycles and low-power mode hours from AHAM DW–1–2020 in the new appendix C2, which would be applicable upon the compliance date of any future amended energy conservation standards for dishwashers. DOE is also adopting the test procedure waiver provisions applicable to dishwashers for which water is supplied through a manually filled attached tank and for in-sink dishwashers without a main detergent compartment. AHAM DW–1–2020 does not have comparable provisions. Adopting these requirements specified in the relevant waivers would eliminate the need of manufacturers of such products from having to seek waivers and would thereby reduce compliance burden. These modifications would ensure, as required by EPCA, that the DOE test procedure is not unduly burdensome to conduct. Additionally, AHAM DW–1–2020 references the relevant sections of AHAM DW–2–2020 for the requirements where appendix C1 currently references ANSI/AHAM DW–1–2010 and maintains references to IEC 62301 Ed. 2.0 for the requirements where appendix C1 already references this standard. Further, DOE's incorporation of a methodology for measuring cleaning performance and including a consumer-representative minimum cleaning performance threshold as a condition for a cycle to be valid in appendix C2 is to be referenced from the relevant sections of AHAM DW–2–2020.

M. Effective and Compliance Dates

The effective date for the adopted test procedures will be 30 days after publication of this final rule in the **Federal Register**. EPCA prescribes that all representations of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with an amended test procedure, beginning 180 days after publication of the final rule in the **Federal Register**. (42 U.S.C. 6293(c)(2)) 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)) 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.*) Manufacturers will be required to use the amended test procedure at appendix C1 until the compliance date of any final rule establishing amended energy conservation standards based on the newly established test procedure at appendix C2. At such time, manufacturers will be required to begin using the newly established test procedure at appendix C2.

Upon the compliance date of test procedure provisions in this final rule 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)(3). Recipients of any such waivers are required to test the products subject to the waiver according to the amended test procedure as of the compliance date of the amended test procedure. The amendments adopted in this document pertain to issues addressed by waivers granted to Whirlpool, Case No. DW–011, Miele, Case No. DW–012, CNA, Case No. 2020–008, and FOTILE, Case No. 2020–020. 78 FR 65629, 82 FR 17227, 85 FR 79171, and 86 FR 26712, respectively.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

Executive Order (''E.O.'')12866, ''Regulatory Planning and Review,'' as supplemented and reaffirmed by E.O. 13563, ''Improving Regulation and Regulatory Review, 76 FR 3821 (Jan. 21, 2011), requires agencies, to the extent permitted by law, to (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing

economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public. DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs (''OIRA'') in the Office of Management and Budget (''OMB'') has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this final regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit ''significant regulatory actions'' to OIRA for review. OIRA has determined that this final regulatory action does not constitute a ''significant regulatory action'' under section 3(f) of E.O. 12866. Accordingly, this action was not submitted to OIRA for review under E.O. 12866.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of a final regulatory flexibility analysis (''FRFA'') for any final rule where the agency was first required by law to publish a proposed rule for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003 to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website: *www.energy.gov/gc/office-general-counsel.* DOE reviewed this final rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003.

DOE has concluded that this rule would not have a significant impact on a substantial number of small entities. The factual basis for this certification is as follows:

The Small Business Administration (''SBA'') considers a business entity to be a small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. DOE used SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. These size standards and codes are established by the North American Industry Classification System (''NAICS'') and are available at *www.sba.gov/document/support--table-size-standards.* Dishwasher manufacturers are classified under NAICS code 335220, ''Major Household Appliance Manufacturing.'' The SBA sets a threshold of 1,500 employees or fewer for an entity to be considered as a small business for this category.

DOE conducted a focused inquiry into small business manufacturers of the products covered by this rulemaking. DOE reviewed its Compliance Certification Database,[57] California Energy Commission's Modernized Appliance Efficiency Database System,[58] and ENERGY STAR's Product Finder dataset [59] to create a list of companies that import or otherwise manufacture the products covered by this proposal. DOE then consulted publicly available data to identify original equipment manufacturers (''OEMs'') selling dishwashers in the U.S. DOE relied on public data and subscription-based market research tools (*e.g.,* Dun & Bradstreet [60]) to determine company location, headcount, and annual revenue. DOE screened out companies that do not offer products covered by this rulemaking, do not meet SBA's definition of a ''small business,'' or are foreign-owned and operated.

DOE identified 21 dishwasher OEMs. Consistent with the preliminary determination in the December 2021 NOPR, DOE did not identify any domestic OEMs that qualify as a ''small business.'' [61]

In this final rule, DOE amends the existing test procedure for dishwashers at appendix C1 and adopts a new test procedure at appendix C2. The amendments to appendix C1 establish requirements for water hardness, relative humidity, and loading pattern; update requirements for ambient temperature, detergent dosage, and standby power measurement; and include testing approaches from published waivers for dishwashers. The new appendix C2 additionally includes provisions for evaluating cleaning performance and establishing a minimum per cycle cleaning index threshold as a condition for a valid test; and updated annual number of cycles and low-power mode hours for the calculation of energy consumption.

DOE has determined that the amendments to appendix C1 would not increase testing costs relative to the current appendix C1 or result in manufacturers needing to re-rate dishwashers. As detailed in the final rule notice, use of the new appendix C2 would not be required until the time of the compliance date of future amended energy conservation standards for dishwashers, should such amendments be adopted. For appendix C2, DOE estimates the incremental increases in testing costs compared to the current and amended appendix C1 are approximately $173 per soil-sensing dishwasher basic model and approximately $216 per non-soil-sensing dishwasher basic model.[62] Therefore, DOE estimates the cost to test a soil-sensing dishwasher according to the new appendix C2 to be approximately $2,334 per basic model and that for a non-soil-sensing dishwasher to be approximately $735 per basic model.[63]

If DOE were to adopt future energy conservation standards based on appendix C2, manufacturers would need to retest models in accordance with appendix C2. In addition to the potential retesting costs, DOE expects that some manufacturers may incur one-time capital costs if their current testing laboratories are at capacity and additional laboratory space or test stations are required. The cost of retesting in accordance with appendix C2 would be incorporated into the analysis of any future energy conservation standards based on appendix C2. DOE would also investigate and include the estimated upfront capital investments associated

[57] U.S. Department of Energy Compliance Certification Database, available at *www.regulations.doe.gov/certification-data/products.html#q=Product_Group_s%3A**. Last accessed July 8, 2022.

[58] California Energy Commission Modernized Appliance Efficiency Database System, available at *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx.* Last accessed June 3, 2022.

[59] ENERGY STAR® Product Finder data set, available at *www.energystar.gov/productfinder.* Last accessed June 3, 2022.

[60] The Dun & Bradstreet Hoovers subscription login is accessible at *app.dnbhoovers.com.* Last accessed June 7, 2022.

[61] 86 FR 72738, 72766.

[62] Soil-sensing dishwasher under current appendix C1: $43.22 × 25 hours × 2 units per basic model = $2,161. Non-soil-sensing dishwasher under current appendix C1: $43.22 × 6 hours × 2 units per basic model = $518.64 (rounded to $519). $2,334 − $2,161 = $173. $735 − $519 = $216.

[63] 27 hours testing time per soil-sensing unit × $43.22 per hour × 2 units per basic model = $2,333.88 (rounded to $2,334) and 8.5 hours test time per non-soil-sensing unit × $43.22 per hour × 2 units per basic model = $734.74 (rounded to $735).

with testing to the newly established appendix C2 in any future analysis of energy conservation standards for dishwashers.

DOE did not receive written comments that specifically addressed impacts on small businesses or that were provided in response to the initial regulatory flexibility analysis (''IRFA'').

Given the lack of small entities with a direct compliance burden, DOE concludes that the cost effects accruing from the final rule would not have a ''significant economic impact on a substantial number of small entities,'' and that the preparation of a FRFA is not warranted. DOE has submitted a certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of dishwashers 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 products and commercial equipment, including dishwashers. (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.

DOE is not amending the certification or reporting requirements for dishwashers in this final rule. Instead, DOE may consider proposals to amend the certification requirements and reporting for dishwashers under a separate rulemaking regarding appliance and equipment certification. DOE will address changes to OMB Control Number 1910–1400 at that time, as necessary.

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 final rule, DOE establishes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for dishwashers. 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 (August 4, 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 examined this final rule and determined that it will 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 final 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, this final 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 regulatory action resulting 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 *www.energy.gov/gc/office-general-counsel.* DOE examined this final 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 final rule will 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 regulation will 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%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this final 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 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 significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use if the regulation is implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This regulatory action 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 modifications to the test procedure for dishwashers adopted in this final rule incorporates testing methods contained in certain sections of the following commercial standards: AHAM DW–1–2020, AHAM DW–2–2020, and IEC 62301 Ed. 2.0. 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 has consulted with both the Attorney General and the Chairman of the FTC about the impact on competition of using the methods contained in these standards and has received no comments objecting to their use.

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule before its effective date. The report will state that it has been determined that the rule is not a ''major rule'' as defined by 5 U.S.C. 804(2).

N. Description of Materials Incorporated by Reference

AHAM DW–1–2020, ''Uniform Test Method for Measuring the Energy Consumption of Dishwashers''. AHAM DW–1–2020 is a voluntary industry-accepted test procedure that measures the energy and water consumption of household electric dishwashers.

AHAM DW–2–2020, ''Household Electric Dishwashers''. AHAM DW–2–2020 is an industry standard to determine the cleaning performance of dishwashers.

The AHAM standards are reasonably available from AHAM (*www.aham.org/AHAM/AuxStore*).

IEC 62301 Ed. 2.0 is an international standard that specifies methods of measurement of electrical power consumption of household appliances in standby mode(s) and other low power modes, as applicable. IEC 62301 Ed. 2.0 is reasonably available from IEC (*https://webstore.ansi.org or https://webstore.iec.ch/*).

V. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Intergovernmental relations, Reporting and recordkeeping requirements, Small businesses.

10 CFR Part 430

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

Signing Authority

This document of the Department of Energy was signed on December 16, 2022, by Francisco Alejandro Moreno, 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 December 19, 2022.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy.

For the reasons stated in the preamble, DOE amends parts 429 and 430 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. Amend § 429.134 by adding paragraph (z) to read as follows:

§ 429.134 Product-specific enforcement provisions.

* * * * *

(z) *Dishwashers*—(1) *Determination of Most Energy-Intensive Cycle.* For any dishwasher basic model that does not meet the specified cleaning index threshold at a given soil load, the most energy-intensive cycle will be determined through testing as specified in sections 4.1.1 and 5.2 of appendix C2 to subpart B of part 430.

(2) [Reserved]

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

■ 4. Amend § 430.3 by:

■ a. Redesignating paragraphs (i)(2) through (6) as (i)(3) through (7);

■ b. Adding new paragraph (i)(2); and

■ c. Revising newly redesignated paragraph (i)(3); and

■ d. In paragraph (p)(7), removing the text ''C1, D1'' and adding in its place ''C1, C2, D1''.

The addition and revision read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

(i) * * *

(2) AHAM DW–1–2020, Uniform Test Method for Measuring the Energy Consumption of Dishwashers, copyright 2020; IBR approved for § 430.32; appendices C1 and C2 to subpart B.

(3) AHAM DW–2–2020, Household Electric Dishwashers, copyright 2020; IBR approved for appendices C1 and C2 to subpart B.

* * * * *

■ 5. Section 430.23 is amended by revising paragraph (c) to read as follows:

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

* * * * *

(c) *Dishwashers.* (1) The Estimated Annual Operating Cost (EAOC) for dishwashers must be rounded to the nearest dollar per year and is defined as follows:

(i) When cold water (50 °F) is used,

$$EAOC = (D_e \times E_{TLP}) + (D_e \times N \times (M + M_{WS} + M_{DO} + M_{CO} + E_F - (E_D/2))).$$

Where,

D_e = the representative average unit cost of electrical energy, in dollars per kilowatt-hour, as provided by the Secretary,

E_{TLP} = the annual combined low-power mode energy consumption in kilowatt-hours per year and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable,

N = the representative average dishwasher use of 215 cycles per year when EAOC is determined pursuant to appendix C1 to this subpart, and 184 cycles per year when EAOC is determined pursuant to appendix C2 to this subpart,

M = the machine energy consumption per cycle, in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable,

M_{WS} = the machine energy consumption per cycle for water softener regeneration, in kilowatt-hours and determined pursuant to section 5 of appendix C1 or appendix C2 to this subpart, as applicable,

M_{DO} = for water re-use system dishwashers, the machine energy consumption per cycle during a drain out event in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable,

M_{CO} = for water re-use system dishwashers, the machine energy consumption per cycle during a clean out event, in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable,

E_F = the fan-only mode energy consumption per cycle, in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable, and

E_D = the drying energy consumption, in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable.

(ii) When electrically heated water (120 °F or 140 °F) is used,

$$EAOC = (D_e \times E_{TLP}) + (De \times N \times (M + M_{WS} + M_{DO} + M_{CO} + E_F - (ED/2))) + (De \times N \times (W + W_{WS} + W_{DO} + W_{CO})).$$

Where,

D_e, E_{TLP}, N, M, M_{WS}, M_{DO}, M_{CO}, E_F, and E_D, are defined in paragraph (c)(1)(i) of this section,

W = the water energy consumption per cycle, in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable,

W_{WS} = the water softener regeneration water energy consumption per cycle in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable,

W_{DO} = The drain out event water energy consumption per cycle in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable, and

W_{CO} = The clean out event water energy consumption per cycle in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable.

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

$$EAOC_g = (D_e \times E_{TLP}) + (D_e \times N \times (M + M_{WS} + M_{DO} + M_{CO} + EF - (ED/2))) + (D_g \times N \times (W_g + W_{WSg} + W_{DOg} + W_{COg})).$$

Where,

D_e, E_{TLP}, N, M, M_{WS}, M_{DO}, M_{CO}, E_F, and E_D, are defined in paragraph (c)(1)(i) of this section,

D_g = the representative average unit cost of gas or oil, as appropriate, in dollars per BTU, as provided by the Secretary,

W_g = the water energy consumption per cycle, in Btus and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable.

W_{WSg} = the water softener regeneration energy consumption per cycle in Btu per cycle and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable,

W_{DOg} = the drain out water energy consumption per cycle in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable, and

W_{COg} = the clean out water energy consumption per cycle in kilowatt-hours and determined according to section 5 of appendix C1 or appendix C2 to this subpart, as applicable.

(2) The estimated annual energy use, EAEU, expressed in kilowatt-hours per year must be rounded to the nearest kilowatt-hour per year and is defined as follows:

$$EAEU = (M + M_{WS} + M_{DO} + M_{CO} + E_F - (E_D/2) + W + W_{WS} + W_{DO} + W_{CO}) \times N + E_{TLP}$$

Where,

M, M_{WS}, M_{DO}, M_{CO}, E_F, E_D, E_{TLP} are all defined in paragraph (c)(1)(i) of this section and W, W_{WS}, W_{DO}, W_{CO} are defined in paragraph (c)(1)(ii) of this section.

(3) The sum of the water consumption, V, the water consumption during water softener regeneration, V_{WS}, the water consumption during drain out events for dishwashers equipped with a water re-use system, V_{DO}, and the water consumption during clean out events for dishwashers equipped with a water re-use system, V_{CO}, expressed in gallons per cycle and defined pursuant to section 5 of appendix C1 or appendix C2 to this subpart, as applicable, must be rounded to one decimal place.

(4) Other useful measures of energy consumption for dishwashers are those which the Secretary determines are likely to assist consumers in making purchasing decisions and which are derived from the application of appendix C1 to this subpart or appendix C2 to this subpart, as applicable.

* * * * *

■ 6. Appendix C1 to subpart B of part 430 is revised to read as follows:

Appendix C1 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Dishwashers

Note: Before July 17, 2023 manufacturers must use the results of testing under this appendix as codified on February 17, 2023 or this appendix as it appeared in the January 1, 2023 edition of 10 CFR parts 200–499 to determine compliance with the relevant standard from § 430.32(f)(1) as it appeared in the January 1, 2023 edition of 10 CFR parts 200–499. Beginning July 17, 2023, manufacturers must use the results of testing under this appendix to determine compliance with the relevant standard from § 430.32(f)(1) as it appeared in the January 1, 2023 edition of 10 CFR parts 200–499. Manufacturers must use the results of testing under appendix C2 to determine compliance with any amended standards for dishwashers provided in 10 CFR 430.32(f)(1) that are published after January 1, 2023. Any representations related to energy or water consumption of dishwashers must be made in accordance with the appropriate appendix that applies (*i.e.,* appendix C1 or appendix C2) when determining compliance with the relevant standard. Manufacturers may also use appendix C2 to certify compliance with any amended standards prior to the applicable compliance date for those standards.

0. Incorporation by Reference

In § 430.3, DOE incorporated by reference the entire standard for AHAM DW–1–2020 and AHAM DW–2–2020; however, only enumerated provision of AHAM DW–1–2020, AHAM DW–2–2020, and IEC 62301 are applicable as follows:

0.1 AHAM DW–1–2020

(a) Sections 1.1 through 1.30 as referenced in section 1 of this appendix;

(b) Section 2.1 as referenced in sections 2 and 2.1 of this appendix;

(c) Sections 2.2 through 2.3.3, sections 2.5 through 2.7, sections 2.7.2 through 2.8, and section 2.11, as referenced in section 2 of this appendix;

(d) Section 2.4 as referenced in sections 2 and 2.2 of this appendix;

(e) Section 2.7.1 as referenced in sections 2 and 2.3 of this appendix;

(f) Section 2.9 as referenced in sections 2 and 2.4 of this appendix;

(g) Section 2.10 as referenced in sections 2 and 2.5 of this appendix;

(h) Sections 3.1 through 3.2 and sections 3.5 through 3.7 as referenced in section 3 of this appendix;

(i) Section 3.3 as referenced in sections 3 and 3.1 of this appendix;

(j) Section 3.4 as referenced in sections 3 and 3.2 of this appendix;

(k) Sections 4.1 through 4.1.2 and sections 4.1.4 through 4.2 as referenced in section 4 of this appendix;

(l) Section 4.1.4 as referenced in sections 4 and 4.1 of this appendix; and

(m) Section 5 as referenced in section 5 of this appendix.

0.2 AHAM DW–2–2020: Household Electric Dishwashers

(a) Section 3.4 as referenced in sections 2 and 2.3 of this appendix, and through reference to sections 1.5 and 1.22 of AHAM DW–1–2020 in section 1 of this appendix.

(b) Section 3.5 through reference to sections 1.5 and 1.22 of AHAM DW–1–2020 in section 1 of this appendix.

(c) Section 4.1 as referenced in section 2 of this appendix.

(d) Sections 5.3 through 5.8 as referenced in section 2 of this appendix, and through reference to sections 1.18, 1.19, and 1.20 of AHAM DW–1–2020 in section 1 of this appendix.

0.3 IEC 62301

(a) Sections 4.2, 4.3.2, and 5.2 as referenced in section 2 of this appendix; and

(b) Sections 5.1, note 1, and 5.3.2 as referenced in section 4 of this appendix.

1. Definitions

The definitions in sections 1.1 through 1.30 of AHAM DW–1–2020 apply to this test procedure, including the applicable provisions of AHAM DW–2–2020 as referenced in sections 1.5, 1.18, 1.19. 1.20, and 1.22 of AHAM DW–1–2020.

2. Testing Conditions

The testing conditions in sections 2.1 through 2.11 of AHAM DW–1–2020 apply to this test procedure, including the following provisions of:

(a) Sections 5.2, 4.3.2, and 4.2 of IEC 62301 as referenced in sections 2.1, 2.2.4, and 2.5.2 of AHAM DW–1–2020, respectively, and

(b) Sections 5.3 through 5.8 of AHAM DW–2–2020 as referenced in sections 2.6.3.1, 2.6.3.2, and 2.6.3.3 of AHAM DW–1–2020; section 3.4 of AHAM DW–2–2020, excluding the accompanying Note, as referenced in section 2.7.1 of AHAM DW–1–2020; section 5.4 of AHAM DW–2–2020 as referenced in section 2.7.4 of AHAM DW–1–2020; section 5.5 of AHAM DW–2–2020 as referenced in section 2.7.5 of AHAM DW–1–2020, and section 4.1 of AHAM DW–2–2020 as referenced in section 2.10.1 of AHAM DW–1–2020. Additionally, the following requirements are also applicable.

2.1 *Installation Requirements.*

The installation requirements described in section 2.1 of AHAM DW–1–2020 are applicable to all dishwashers, with the following additions:

2.1.1 *In-Sink Dishwashers.*

For in-sink dishwashers, the requirements pertaining to the rectangular enclosure for under-counter or under-sink dishwashers are not applicable. For such dishwashers, the rectangular enclosure must consist of a front, a back, two sides, and a bottom. The front, back, and sides of the enclosure must be brought into the closest contact with the appliance that the configuration of the dishwasher will allow. The height of the enclosure shall be as specified in the manufacturer's

instructions for installation height. If no instructions are provided, the enclosure height shall be 36 inches. The dishwasher must be installed from the top and mounted to the edges of the enclosure.

2.1.2 *Dishwashers without a Direct Water Line.*

Manually fill the built-in water reservoir to the full capacity reported by the manufacturer, using water at a temperature in accordance with section 2.3 of AHAM DW–1–2020.

2.2 *Water pressure.*

The water pressure requirements described in section 2.4 of AHAM DW–1–2020 are applicable to all dishwashers except dishwashers that do not have a direct water line.

2.3 *Test load items.*

The test load items described in section 2.7.1 of AHAM DW–1–2020 apply to this test procedure, including the applicable provisions of section 3.4 of AHAM DW–2–2020, as referenced in section 2.7.1 of AHAM DW–1–2020. The following test load items may be used in the alternative.

Dishware/glassware/flatware item	Primary source	Description	Primary No.	Alternate source	Alternate source No.
Dinner Plate	Corning Comcor®/Corelle®.	10 inch Dinner Plate	6003893		
Bread and Butter Plate	Corning Comcor®/Corelle®.	6.75 inch Bread & Butter.	6003887	Arzberg	8500217100 or 2000–00001–0217–1.
Fruit Bowl	Corning Comcor®/Corelle®.	10 oz. Dessert Bowl	6003899	Arzberg	3820513100.
Cup	Corning Comcor®/Corelle®.	8 oz. Ceramic Cup	6014162	Arzberg	1382–00001–4732.
Saucer	Corning Comcor®/Corelle®.	6 inch Saucer	6010972	Arzberg	1382–00001–4731.
Serving Bowl	Corning Comcor®/Corelle®.	1 qt. Serving Bowl	6003911		
Platter	Corning Comcor®/Corelle®.	9.5 inch Oval Platter	6011655		
Glass—Iced Tea	Libbey		551 HT		
Flatware—Knife	Oneida®—Accent		2619KPVF	WMF—Gastro 0800	12.0803.6047.
Flatware—Dinner Fork	Oneida®—Accent		2619FRSF	WMF—Signum 1900	12.1905.6040.
Flatware—Salad Fork	Oneida®—Accent		2619FSLF	WMF—Signum 1900	12.1964.6040.
Flatware—Teaspoon	Oneida®—Accent		2619STSF	WMF—Signum 1900	12.1910.6040.
Flatware—Serving Fork	Oneida®—Flight		2865FCM	WMF—Signum 1900	12.1902.6040.
Flatware—Serving Spoon.	Oneida®—Accent		2619STBF	WMF—Signum 1900	12.1904.6040.

2.4 *Preconditioning requirements.*

The preconditioning requirements described in section 2.9 of AHAM DW–1–2020 are applicable to all dishwashers. For dishwashers that do not have a direct water line, measurement of the prewash fill water volume, V_{pw}, if any, and measurement of the main wash fill water volume, V_{mw}, are not taken.

2.5 *Detergent.*

The detergent requirements described in section 2.10 of AHAM DW–1–2020 are applicable to all dishwashers. For any dishwasher that does not have a main wash detergent compartment and the manufacturer does not recommend a location to place the main wash detergent, determine the amount of main wash detergent (in grams) according to section 2.10 of AHAM DW–1–2020, or as specified below, and place the detergent directly into the dishwasher chamber.

Additionally, the following detergent and dosage may also be used for all dishwashers. Note that if the detergent specified in section 2.10 of AHAM DW–1–2020 is used, then the dosage requirements specified in section 2.10 of AHAM DW–1–2020 must be used. Alternately, if the detergent specified below is used, the dosage requirements specified below must be used.

Use Cascade with the Grease Fighting Power of Dawn powder as the detergent formulation. For all dishwashers other than water re-use system dishwashers determine the amount of detergent (in grams) to be added to the prewash compartment (if provided) or elsewhere in the dishwasher (if recommended by the manufacturer) and the main wash compartment according to sections 2.6.1 and 2.6.2 of this appendix.

2.5.1 *Detergent Dosing for Dishwashers other than Water Re-use System Dishwashers.*

2.5.1.1 *Prewash Detergent Dosing.* If the cycle setting for the test cycle includes prewash, determine the quantity of dry prewash detergent, D_{pw}, in grams (g) that results in 0.25 percent concentration by mass in the prewash fill water as:

$$D_{pw} = V_{pw} \times \rho \times k \times 0.25/100$$

Where,

V_{pw} = the prewash fill volume of water in gallons,

ρ = water density = 8.343 pounds (lb)/gallon for dishwashers to be tested at a nominal inlet water temperature of 50 °F (10 °C), 8.250 lb/gallon for dishwashers to be tested at a nominal inlet water temperature of 120 °F (49 °C), and 8.205 lb/gallon for dishwashers to be tested at a nominal inlet water temperature of 140 °F (60 °C), and

k = conversion factor from lb to g = 453.6 g/lb.

2.5.1.2 *Main Wash Detergent Dosing.* Determine the quantity of dry main wash detergent, D_{mw}, in grams (g) that results in 0.25 percent concentration by mass in the main wash fill water as:

$$D_{mw} = V_{mw} \times \rho \times k \times 0.25/100$$

Where,

V_{mw} = the main wash fill volume of water in gallons, and

ρ and k are defined in section 2.5.1.1 of this appendix.

For dishwashers that do not have a direct water line, the V_{mw} is equal to the manufacturer reported water capacity used in the main wash stage of the test cycle.

2.5.2 *Detergent Dosing for Water Re-use System Dishwashers.* Use the same detergent dosing requirement as specified in section 2.10.2 of AHAM DW–1–2020.

2.6 *Connected functionality.*

For dishwashers that can communicate through a network (*e.g.,* Bluetooth® or internet connection), disable all network functions that can be disabled by means provided in the manufacturer's user manual, for the

duration of testing. If network functions cannot be disabled by means provided in the manufacturer's user manual, conduct the standby power test with network function in the ''as-shipped'' condition.

3. Instrumentation

For this test procedure, the test instruments are to be calibrated annually according to the specifications in sections 3.1 through 3.7 of AHAM DW–1–2020, including the applicable provisions of IEC 62301 as referenced in section 3.6 of AHAM DW–1–2020. Additionally, the following requirements are also applicable.

3.1 *Water meter.*

The water meter requirements described in section 3.3 of AHAM DW–1–2020 are applicable to all dishwashers except dishwashers that do not have a direct water line. For such dishwashers these water meter conditions do not apply and water is added manually pursuant to section 2.1.1 of this appendix.

3.2 *Water pressure gauge.*

The water pressure gauge requirements described in section 3.4 of AHAM DW–1–2020 are applicable to all dishwashers except dishwashers that do not have a direct water line. For such dishwashers these water pressure gauge conditions do not apply and water is added manually pursuant to section 2.1.1 of this appendix.

4. Test Cycle and Measurements

The test cycle and measurement specifications in sections 4.1 through 4.2 of AHAM DW–1–2020 apply to this test procedure, including section 5.1, note 1, and section 5.3.2 of IEC 62301 as referenced in section 4.2 of AHAM DW–1–2020. Additionally, the following requirements are also applicable.

4.1 *Water consumption.*

The water consumption requirements described in section 4.1.4 of AHAM DW–1–2020 are applicable to all dishwashers except dishwashers that do not have a direct water line. For such dishwashers these water consumption measurement requirements do not apply and water consumption, V, is the value reported by the manufacturer.

5. Calculation of Derived Results From Test Measurements

The calculations in section 5.1 through 5.7 of AHAM DW–1–2020 apply to this test procedure. The following additional requirements are also applicable:

(a) In sections 5.1.3, 5.1.4, 5.1.5, 5.4.3, 5.4.4, 5.4.5, and 5.7 of AHAM DW–1–2020, use N = 215 cycles/year in place of N = 184 cycles/year.

(b) In section 5.7 of AHAM DW–1–2020, use S_{LP} = 8,465 for dishwashers that are not capable of operating in fan-only mode.

(c) For dishwashers that do not have a direct water line, water consumption is equal to the volume of water use in the test cycle, as specified by the manufacturer.

(d) In sections 5.6.1.3, 5.6.1.4, 5.6.2.3, and 5.6.2.4 of AHAM DW–1–2020, use (C/e) in place of K.

■ 7. Appendix C2 to subpart B of part 430 is added to read as follows:

Appendix C2 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Dishwashers

Note: Manufacturers must use the results of testing under this appendix C2 to determine compliance with any standards for dishwashers provided in § 430.32(f)(1) that are published after January 1, 2023. Representations related to energy or water consumption of dishwashers must be made in accordance with the appropriate appendix that applies (*i.e.,* appendix C1 or appendix C2) when determining compliance with the relevant standard. Manufacturers may also use appendix C2 to certify compliance with any amended standards prior to the applicable compliance date for those standards.

0. Incorporation by Reference

In § 430.3, DOE incorporated by reference the entire standard for AHAM DW–1–2020 and AHAM DW–2–2020; however, only enumerated provision of AHAM DW–1–2020, AHAM DW–2–2020, and IEC 62301 are applicable as follows:

0.1 AHAM DW–1–2020

(a) Sections 1.1 through 1.30 as referenced in section 1 of this appendix;

(b) Section 2.1 as referenced in sections 2 and 2.1 of this appendix;

(c) Sections 2.2 through 2.3.3, sections 2.5 and 2.7, sections 2.7.2 through 2.8, and section 2.11, as referenced in section 2 of this appendix;

(d) Section 2.4 as referenced in sections 2 and 2.2 of this appendix;

(e) Section 2.6.3 as referenced in sections 2 and 2.3 of this appendix;

(f) Section 2.7.1 as referenced in sections 2 and 2.4 of this appendix;

(g) Section 2.9 as referenced in sections 2 and 2.5 of this appendix;

(h) Section 2.10 as referenced in sections 2 and 2.6 of this appendix;

(i) Sections 3.1 through 3.2 and sections 3.5 through 3.7 as referenced in section 3 of this appendix;

(j) Section 3.3 as referenced in sections 3 and 3.1 of this appendix;

(k) Section 3.4 as referenced in sections 3 and 3.2 of this appendix;

(l) Section 4.1 as referenced in sections 4 and 4.1 of this appendix;

(m) Section 4.1.4 as referenced in sections 4 and 4.1.2 of this appendix; and

(n) Section 5 as referenced in section 5 of this appendix.

0.2 AHAM DW–2–2020

(a) Section 3.4 as referenced in sections 2 and 2.4 of this appendix, and through reference to sections 1.5 and 1.22 of AHAM DW–1–2020 in section 1 of this appendix.

(b) Section 3.5 through reference to sections 1.5 and 1.22 of AHAM DW–1–2020 in section 1 of this appendix.

(c) Section 4.1 as referenced in section 2 of this appendix.

(d) Sections 5.3 through 5.8 as referenced in section 2 of this appendix, and through reference to sections 1.18, 1.19 and 1.20 of AHAM DW–1–2020 in section 1 of this appendix.

(e) Section 5.10 as referenced in sections 2 and 2.8 of this appendix;

(f) Sections 5.10.1.1 as referenced in sections 4 and 4.2 of this appendix; and

(g) Section 5.12.3.1 as referenced in sections 5 and 5.1 of this appendix.

0.3 IEC 62301

(a) Sections 4.2, 4.3.2, and 5.2 as referenced in section 2 of this appendix; and

(b) Sections 5.1, note 1, and 5.3.2 as referenced in section 4 of this appendix.

1. Definitions

The definitions in sections 1.1 through 1.30 of AHAM DW–1–2020 apply to this test procedure, including the applicable provisions of AHAM DW–2–2020 as referenced in sections 1.5, 1.18, 1.19, 1.20, and 1.22 of AHAM DW–1–2020.

2. Testing Conditions

The testing conditions in Section 2.1 through 2.11 of AHAM DW–1–2020, except sections 2.6.1 and 2.6.2, and the testing conditions in section 5.10 of AHAM DW–2–2020 apply to this test procedure, including the following provisions of:

(a) Sections 5.2, 4.3.2, and 4.2 of IEC 62301 as referenced in sections 2.1, 2.2.4, and 2.5.2 of AHAM DW–1–2020, respectively, and

(b) Sections 5.3 through 5.8 of AHAM DW–2–2020 as referenced in sections 2.6.3.1, 2.6.3.2, and 2.6.3.3 of AHAM DW–1–2020; section 3.4 of AHAM DW–2–2020, excluding the accompanying Note, as referenced in section 2.7.1 of AHAM DW–1–2020; section 5.4 of AHAM DW–2–2020 as referenced in section 2.7.4 of AHAM DW–1–2020; section 5.5 of AHAM DW–2–2020 as

referenced in section 2.7.5 of AHAM DW–1–2020, and section 4.1 of AHAM DW–2–2020 as referenced in section 2.10.1 of AHAM DW–1–2020. Additionally, the following requirements are also applicable.

2.1 *Installation Requirements.*

The installation requirements described in section 2.1 of AHAM DW–1–2020 are applicable to all dishwashers, with the following additions:

2.1.1 *In-Sink Dishwashers.*

For in-sink dishwashers, the requirements pertaining to the rectangular enclosure for under-counter or under-sink dishwashers are not applicable. For such dishwashers, the rectangular enclosure must consist of a front, a back, two sides, and a bottom. The front, back, and sides of the enclosure must be brought into the closest contact with the appliance that the configuration of the dishwasher will allow. The height of the enclosure shall be as specified in the manufacturer's instructions for installation height. If no instructions are provided, the enclosure height shall be 36 inches. The dishwasher must be installed from the top and mounted to the edges of the enclosure.

2.1.2 *Dishwashers without a Direct Water Line.*

Manually fill the built-in water reservoir to the full capacity reported by the manufacturer, using water at a temperature in accordance with section 2.3 of AHAM DW–1–2020.

2.2 *Water pressure.*

The water pressure requirements described in section 2.4 of AHAM DW–1–2020 are applicable to all dishwashers except dishwashers that do not have a direct water line.

2.3 *Non-soil-sensing and soil-sensing dishwashers to be tested at a nominal inlet temperature of 50 °F, 120 °F, or 140 °F.*

The test load and soiling requirements for all non-soil-sensing and soil-sensing dishwashers shall be the same as those requirements specified in section 2.6.3 of AHAM DW–1–2020 for soil-sensing dishwashers. Additionally, both non-soil-sensing and soil-sensing compact dishwashers that have a capacity of less than four place settings shall be tested at the rated capacity of the dishwasher and the test load shall be soiled as follows at each soil load:

(a) Heavy soil load: soil two-thirds of the place settings, excluding flatware and serving pieces (rounded up to the nearest integer) or one place setting, whichever is greater;

(b) Medium soil load: soil one-quarter of the place settings, excluding flatware and serving pieces (rounded up to the nearest integer) or one place setting, whichever is smaller;

(c) Light soil load: soil one-quarter of the place settings, excluding flatware and serving pieces (rounded up to the nearest integer) or one place setting, whichever is smaller, using half the quantity of soils specified for one place setting.

2.4 *Test load items.*

The test load items described in section 2.7.1 of AHAM DW–1–2020 apply to this test procedure, including the applicable provisions of section 3.4 of AHAM DW–2–2020, as referenced in section 2.7.1 of AHAM DW–1–2020. The following test load items may be used in the alternative.

Dishware/glassware/flatware item	Primary source	Description	Primary No.	Alternate source	Alternate source No.
Dinner Plate	Corning Comcor®/Corelle®.	10 inch Dinner Plate	6003893		
Bread and Butter Plate	Corning Comcor®/Corelle®.	6.75 inch Bread & Butter.	6003887	Arzberg	8500217100 or 2000–00001–0217–1.
Fruit Bowl	Corning Comcor®/Corelle®.	10 oz. Dessert Bowl	6003899	Arzberg	3820513100.
Cup	Corning Comcor®/Corelle®.	8 oz. Ceramic Cup	6014162	Arzberg	1382–00001–4732.
Saucer	Corning Comcor®/Corelle®.	6 inch Saucer	6010972	Arzberg	1382–00001–4731.
Serving Bowl	Corning Comcor®/Corelle®.	1 qt. Serving Bowl	6003911		
Platter	Corning Comcor®/Corelle®.	9.5 inch Oval Platter	6011655		
Glass—Iced Tea	Libbey		551 HT		
Flatware—Knife	Oneida®—Accent		2619KPVF	WMF—Gastro 0800	12.0803.6047.
Flatware—Dinner Fork	Oneida®—Accent		2619FRSF	WMF—Signum 1900	12.1905.6040.
Flatware—Salad Fork	Oneida®—Accent		2619FSLF	WMF—Signum 1900	12.1964.6040.
Flatware—Teaspoon	Oneida®—Accent		2619STSF	WMF—Signum 1900	12.1910.6040.
Flatware—Serving Fork	Oneida®—Flight		2865FCM	WMF—Signum 1900	12.1902.6040.
Flatware—Serving Spoon.	Oneida®—Accent		2619STBF	WMF—Signum 1900	12.1904.6040.

2.5 *Preconditioning requirements.*

The preconditioning requirements described in section 2.9 of AHAM DW–1–2020 are applicable to all dishwashers except the measurement of the prewash fill water volume, V_{pw}, if any, and measurement of the main wash fill water volume, V_{mw}, are not required.

2.6 *Detergent.*

The detergent requirements described in section 2.10 of AHAM DW–1–2020 are applicable to all dishwashers. For any dishwasher that does not have a main wash detergent compartment and the manufacturer does not recommend a location to place the main wash detergent, place the detergent directly into the dishwasher chamber.

2.7 *Connected functionality.*

For dishwashers that can communicate through a network (*e.g.,* Bluetooth® or internet connection), disable all network functions that can be disabled by means provided in the manufacturer's user manual, for the duration of testing. If network functions cannot be disabled by means provided in the manufacturer's user manual, conduct the standby power test with network function in the ''as-shipped'' condition.

2.8 *Evaluation Room Lighting Conditions.*

The lighting setup in the evaluation room where the test load is scored shall be according to the requirements specified in section 5.10 of AHAM DW–2–2020.

3. Instrumentation

For this test procedure, the test instruments are to be calibrated annually according to the specifications in section 3.1 through 3.7 of AHAM DW–1–2020, including the applicable provisions of IEC 62301 as referenced in section 3.6 of AHAM DW–1–2020. Additionally, the following requirements are also applicable.

3.1 *Water meter.*

The water meter requirements described in section 3.3 of AHAM DW–1–2020 are applicable to all dishwashers except dishwashers that do not have a direct water line. For such dishwashers these water meter conditions do not apply and water is added manually pursuant to section 2.1.1 of this appendix.

3.2 *Water pressure gauge.*

The water pressure gauge requirements described in section 3.4 of AHAM DW–1–2020 are applicable to all dishwashers except dishwashers that do not have a direct water line. For such dishwashers these water pressure gauge conditions do not apply and water is added manually pursuant to section 2.1.1 of this appendix.

4. Test Cycle and Measurements

The test cycle and measurement specifications in sections 4.1 through 4.2 of AHAM DW–1–2020 and the scoring specifications in section 5.10.1.1 of AHAM DW–2–2020 apply to this test procedure, including section 5.1, note 1, and section 5.3.2 of IEC 62301 as referenced in section 4.2 of AHAM DW–1–2020. Additionally, the following requirements are also applicable.

4.1 *Active mode cycle.*

The active mode energy consumption measurement requirements described in section 4.1 of AHAM DW–1–2020 are applicable to all dishwashers. Additionally, the following requirements are also applicable:

(a) After the completion of each test cycle (sensor heavy response, sensor medium response, and sensor light response), the test load shall be scored according to section 4.2 of this appendix and its cleaning index calculated according to section 5.1 of this appendix.

(b) A test cycle is considered valid if its cleaning index is 70 or higher; otherwise, the test cycle is invalid and the data from that test run is discarded.

(c) For soil-sensing dishwashers, if the test cycle at any soil load is invalid, clean the dishwasher filter according to manufacturer's instructions and repeat the test at that soil load on the most energy-intensive cycle (determined as provided in section 4.1.1 of this appendix) that achieves a cleaning index of 70 or higher.

(d) For non-soil-sensing dishwashers, perform testing as described in section 4.1.a through 4.1.c of this appendix, except that, if a test cycle at a given soil load meets the cleaning index threshold criteria of 70 when tested on the normal cycle, no further testing is required for test cycles at lesser soil loads.

4.1.1 *Determination of most energy-intensive cycle.*

If the most energy-intensive cycle is not known and needs to be determined via testing, ensure the filter is cleaned as specified in the manufacturer's instructions and test each available cycle type, selecting the default cycle options for that cycle type. In the absence of manufacturer recommendations on washing and drying temperature options, the highest energy consumption options must be selected. Following the completion of each test cycle, the machine electrical energy consumption and water consumption shall be measured according to sections 4.1.1 and 4.1.4 of AHAM DW–1–2020, respectively. The total cycle energy consumption, E_{MEI}, of each tested cycle type shall be calculated according to section 5.2 of this appendix. The most energy-intensive cycle is the cycle type with the highest value of E_{MEI}.

For standard dishwashers, test each cycle with a clean load of eight place settings plus six serving pieces, as specified in section 2.7 of AHAM DW–1–2020. For compact dishwashers, test each cycle with a clean load of four place settings plus six serving pieces, as specified in section 2.7 of AHAM DW–1–2020. If the capacity of the dishwasher, as stated by the manufacturer, is less than four place settings, then the test load must be the stated capacity.

4.1.2 *Water consumption.*

The water consumption requirements described in section 4.1.4 of AHAM DW–1–2020 are applicable to all dishwashers except dishwashers that do not have a direct water line. For such dishwashers these water consumption measurement requirements do not apply and water consumption, V, is the value reported by the manufacturer.

4.2 *Scoring.*

Following the termination of an active mode test, each item in the test load shall be scored on a scale from 0 to 9 according to the instructions in section 5.10.1.1 of AHAM DW–2–2020.

5. Calculation of Derived Results From Test Measurements

The calculations in sections 5.1 through 5.7 of AHAM DW–1–2020 and section 5.12.3.1 of AHAM DW–2–2020 apply to this test procedure. The following additional requirements are also applicable:

(a) For both soil-sensing and non-soil-sensing dishwashers, use the equations specified for soil-sensing dishwashers.

(b) If a non-soil-sensing dishwasher is not tested at a certain soil load as specified in section 4.1.d of this appendix, use the energy and water consumption values of the preceding soil load when calculating the weighted average energy and water consumption values (*i.e.,* if the sensor medium response and sensor light response tests on the normal cycle are not conducted, use the values of the sensor heavy response test for all three soil loads; if only the sensor light response test is not conducted, use the values of the sensor medium response test for the sensor light response test).

(c) For dishwashers that do not have a direct water line, water consumption is equal to the volume of water use in the test cycle, as specified by the manufacturer.

(d) In sections 5.6.1.3, 5.6.1.4, 5.6.2.3, and 5.6.2.4 of AHAM DW–1–2020, use (C/e) in place of K.

5.1 *Cleaning Index.*

Determine the per-cycle cleaning index for each test cycle using the equation in section 5.12.3.1 of AHAM DW–2–2020.

5.2 *Calculation for determination of the most energy-intensive cycle type.*

The total cycle energy consumption for the determination of the most energy-intensive cycle specified in section 4.1.1 of this appendix is calculated for each tested cycle type as:

$$E_{MEI} = M + E_F - (E_D/2) + W$$

where,

M = per-cycle machine electrical energy consumption, expressed in kilowatt hours per cycle,

E_F = fan-only mode electrical energy consumption, if available on the tested cycle type, expressed in kilowatt hours per cycle,

E_D = drying energy consumed using the power-dry feature after the termination of the last rinse option of the tested cycle type, if available on the tested cycle type, expressed in kilowatt hours per cycle, and

W = water energy consumption and is defined as:

$V \times T \times K$, for dishwashers using electrically heated water, and

$V \times T \times C/e$, for dishwashers using gas-heated or oil-heated water.

Additionally,

V = water consumption in gallons per cycle,

T = nominal water heater temperature rise and is equal to 90 °F for dishwashers that operate with a nominal 140 °F inlet water temperature, and 70 °F for dishwashers

that operate with a nominal 120 °F inlet water temperature,

K = specific heat of water in kilowatt-hours per gallon per degree Fahrenheit = 0.0024,

C = specific heat of water in Btu's per gallon per degree Fahrenheit = 8.2, and

e = nominal gas or oil water heater recovery efficiency = 0.75.

■ 8. Section 430.32 is amended by revising paragraph (f) to read as follows:

§ 430.32 Energy and water conservation standards and their compliance dates.

* * * * *

(f) *Dishwashers.* (1) All dishwashers manufactured on or after May 30, 2013, shall meet the following standard—

(i) Standard size dishwashers shall not exceed 307 kwh/year and 5.0 gallons per cycle. Standard size dishwashers have a capacity equal to or greater than eight place settings plus six serving pieces as specified in AHAM DW–1–2020 (incorporated by reference, see § 430.3) using the test load specified in section 2.3 of appendix C1 or section 2.4 of appendix C2 in subpart B of this part, as applicable.

(ii) Compact size dishwashers shall not exceed 222 kwh/year and 3.5 gallons per cycle. Compact size dishwashers have a capacity less than eight place settings plus six serving pieces as specified in AHAM DW–1–2020 (incorporated by reference, see § 430.3) using the test load specified in section 2.3 of appendix C1 or section 2.4 of appendix C2 in subpart B of this part, as applicable.

(2) [Reserved]

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[FR Doc. 2022–27879 Filed 1–17–23; 8:45 am]

BILLING CODE 6450–01–P