DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE–2021–BT–TP–0023]

RIN 1904–AF18

Energy Conservation Program: Test Procedures for Cooking Products

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

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

SUMMARY: The U.S. Department of Energy (''DOE'') proposes to establish a test procedure for a category of cooking products, *i.e.,* conventional cooking tops, under a proposed new appendix. The proposed test procedure would adopt the latest version of the relevant industry standard with modifications to adapt the test method to gas cooking tops, offer an optional method for burden reduction, normalize the energy use of each test cycle, include measurement of standby mode and off mode energy use, update certain test conditions, and provide certain clarifying language. This NOPR also proposes to retitle the existing cooking products test procedure for microwave ovens only. DOE is seeking comment from interested parties on the proposal.

DATES: DOE will accept comments, data, and information regarding this proposal no later than January 3, 2022. See section V, ''Public Participation,'' for details. DOE will hold a webinar on Wednesday, December 15, 2021, from 1:00 p.m. to 5:00 p.m. See section V, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants. If no participants register for the webinar, it will be cancelled.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov.* Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2021–BT–TP–0023, by any of the following methods:

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

2. *Email:* to *CookingProducts2021TP0023@ee.doe.gov.* Include docket number EERE–2021–BT–TP–0023 in the subject line of the message.

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

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

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

The docket web page can be found at *www.regulations.gov/docket/EERE-2021-BT-TP-0023.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section V for information on how to submit comments through *www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT:

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

SUPPLEMENTARY INFORMATION: DOE proposes to maintain previously approved incorporations by reference and incorporate by reference the following industry standard into 10 CFR part 430:

International Electrotechnical Commission (''IEC'') Standard 62301 (''IEC 62301''), ''Household electrical appliances—Measurement of standby power'' (first edition, June 2005).

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

International Electrotechnical Commission Standard 60350–2:2017, (''IEC 60350–2:2017''), ''Household electric cooking appliances Part 2: Hobs—Methods for measuring performance.''

Copies of IEC 62301 First Edition, IEC 62301 Second Edition and IEC 60350–2:2017 can be obtained from the International Electrotechnical Commission at 25 W 43rd Street, 4th Floor, New York, NY 10036, or by going to *webstore.ansi.org.*

See section IV.M of this document for further discussion of these standards.

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I. Authority and Background

Kitchen ranges and ovens are included in the list of ''covered products'' for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6292(a)(10)) DOE's regulations at title 10 of the Code of Federal Regulations (''CFR'') 430.2 include definitions for ''cooking products,'' [1] which cover cooking appliances that use gas, electricity, or microwave energy as the source of heat; as well as specific categories of cooking products, including conventional cooking tops, conventional ovens, microwave ovens, and other cooking products. DOE's energy conservation standards and test procedure for cooking products are currently prescribed at 10 CFR 430.32(j) and 10 CFR part 430 subpart B appendix I (''appendix I''). Currently only microwave oven test procedures are specified in appendix I. DOE is proposing to create a new test procedure at 10 CFR part 430 subpart B appendix I1 (''appendix I1'') that would establish a conventional cooking top test procedure. The following sections discuss DOE's authority to establish a test procedure for conventional cooking tops and relevant background information regarding DOE's consideration of a test procedure for this product.

A. Authority

The Energy Policy and Conservation Act, as amended (''EPCA''),[2] 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 [3] 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 cooking products, and specifically conventional cooking tops, the subject of this document. (42 U.S.C. 6292(a)(10))

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

DOE follows an early assessment review process to conduct a more focused analysis that would allow DOE to determine, based on statutory criteria, whether an amended test procedure is warranted. 10 CFR part 430, subpart C, appendix A section 8(a).

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 be reasonably designed to produce test results which measure energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle or period of use and not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

In addition, EPCA requires that DOE amend its test procedures for all covered products to integrate measures of standby mode and off mode energy consumption. (42 U.S.C. 6295(gg)(2)(A)) Standby mode and off mode energy consumption must be incorporated into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product unless the current test procedures already account for and incorporate standby and off mode energy consumption or such integration is technically infeasible. If an integrated test procedure is

[1] DOE established the regulatory term ''cooking products'' in lieu of the statutory term ''kitchen ranges and ovens'' (42 U.S.C. 6292(a)(10)) having determined that the latter is obsolete and does accurately describe the products considered, which include microwave ovens, conventional ranges, cooktops, and ovens. 63 FR 48038, 48052 (Sep. 8, 1998).

[2] 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).

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

technically infeasible, DOE must prescribe a separate standby mode and off mode energy use test procedure for the covered product, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)(ii)) Any such amendment must consider the most current versions of the International Electrotechnical Commission (''IEC'') Standard 62301 [4] and IEC Standard 62087 [5] as applicable. (42 U.S.C. 6295(gg)(2)(A))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered product, including cooking products, to determine whether an amended test procedure would more accurately or fully comply with the requirements for the test procedure 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** a proposed test procedure and afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such procedure. 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 procedure.

DOE is publishing this NOPR in satisfaction of the statutory authority specified in EPCA. (42 U.S.C. 6293(b)(1)(A)) DOE determined that it was not necessary to do an early assessment request for information prior to initiating this NOPR, as the requirement in 10 CFR part 430, subpart C, appendix A, section 8(a) to do an early assessment applies only when DOE is considering amending a test procedure, not establishing one. In this NOPR, DOE is proposing to establish a new test procedure for conventional cooking tops. Establishing performance-based test procedures for conventional cooking tops is necessary prior to establishing performance-based energy conservation standards for conventional cooking tops, which DOE is required to evaluate under EPCA. Thus, an early assessment as to whether to move forward with a proposal to establish a test procedure for conventional cooking tops is not necessary. Additionally, in the case of conventional cooking tops, DOE has established a detailed administrative record in previous dockets relating to test procedures for conventional cooking tops, which included expansive product testing, data from that testing, detailed test set up requirements, stakeholder input, and robust public comment. This NOPR builds off of that prior work on developing a test procedure for conventional cooking tops, which also obviates the need for an early assessment for this rulemaking.

B. Background

As stated, DOE's existing test procedure for cooking products appears at 10 CFR part 430, subpart B, appendix I (''Uniform Test Method for Measuring the Energy Consumption of Cooking Products''). The current Federal test procedure provides for the testing of standby power of microwave ovens, but currently there is not a Federal test procedure applicable to conventional cooking tops.

DOE originally established test procedures for cooking products in a final rule published in the **Federal Register** on May 10, 1978 (''May 1978 Final Rule''). 43 FR 20108, 20120–20128. In the years following, DOE amended the test procedure for conventional cooking tops on several occasions. Those amendments included the adoption of standby and off mode provisions in a final rule published on October 31, 2012 (77 FR 65942, the ''October 2012 Final Rule'') that satisfied the EPCA requirement that DOE include measures of standby mode and off mode power in its test procedures for residential products, if technically feasible. (42 U.S.C. 6295(gg)(2)(A))

In a final rule published December 16, 2016 (''December 2016 Final Rule''), DOE amended 10 CFR part 430 to incorporate by reference, for use in the conventional cooking tops test procedure, the relevant sections of Committee for Electrotechnical Standardization (''CENELEC'') Standard 60350–2:2013, ''Household electric appliances—Part 2: Hobs—Method for measuring performance'' (''EN 60350–2:2013''), which uses a water-heating test method to measure the energy consumption of electric cooking tops, and extended the water-heating test method specified in EN 60350–2:2013 to gas cooking tops. 81 FR 91418.

On August 18, 2020, DOE published a final rule (''August 2020 Final Rule'') withdrawing the test procedure for conventional cooking tops. 85 FR 50757. DOE initiated the rulemaking for the August 2020 Final Rule in response to a petition for rulemaking submitted by the Association of Home Appliance Manufacturers (''AHAM'') in which AHAM asserted that the then-current test procedure for gas cooking tops was not representative, and, for both gas and electric cooking tops, had such a high level of variation that it did not produce accurate results for certification and enforcement purposes and did not assist consumers in making purchasing decisions based on energy efficiency (''AHAM petition''). 85 FR 50757, 50760; see also 80 FR 17944 (Apr. 25, 2018).

At the time of the AHAM petition, the Federal test procedure for cooking tops measured the integrated annual energy consumption of both gas and electric cooking tops based on EN 60350–2:2013.[6] See, appendix I of 10 CFR part 430 subpart B edition revised as of January 1, 2020.

DOE withdrew the test procedure for conventional cooking tops based on test data submitted by outside parties. 85 FR 50757, 50760. Although not all of the test results submitted by outside parties were from testing that completely followed the DOE test procedure, these data indicated that the test procedure for conventional cooking tops yielded inconsistent results. *Id.* DOE's test data for electric cooking tops from testing conducted as a single laboratory showed small variations. Lab-to-lab test results submitted by AHAM showed high levels of variation for gas and electric cooking tops. 85 FR 50757, 50763. DOE determined that the inconsistency in results of such testing showed the results to be unreliable, and at that time DOE determined it unduly burdensome to leave that test procedure in place and require cooking top tests be conducted

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

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

[6] The EN 60350–2:2013 test method was based on the same test methods in the draft version of IEC 60350–2 Second Edition, at the time of publication of the final rule adopting EN 60350–2:2013. Based on the few comments received during the development of the draft, DOE stated in the December 2016 Final Rule that it expected the IEC procedure, once finalized, would retain the same basic test method as contained in EN 60350–2:2013, and incorporated EN 60350–2:2013 by reference in appendix I. 81 FR 91418, 91421 (Dec. 16, 2016).

using that test method without further study to resolve those inconsistencies. 85 FR 50757, 50760.

In January 2020, DOE initiated a round robin test program to further investigate the water-heating approach and the issues raised in the AHAM petition. This testing was on-going as of the August 2020 Final Rule and its results are discussed in section III of this NOPR. Following the August 2020 Final Rule, DOE initiated an additional round robin test program that is on-going at this time.

II. Synopsis of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to establish a new test procedure at 10 CFR part 430, subpart B, appendix I1, ''Uniform Test Method for the Measuring the Energy Consumption of Conventional Cooking Products.'' For use in appendix I1, DOE would also amend 10 CFR part 430 to incorporate by reference the current version of the applicable industry standard—IEC 60350–2 (Edition 2.0 2017–08), ''Household electric cooking appliances—Part 2: Hobs—Methods for measuring performance'' (''IEC 60350–2:2017''). Appendix I1 would:

(1) Reduce the test burden and improve the repeatability and reproducibility of IEC 60350–2:2017 by:

(a) Simplifying the test vessel selection process for electrical cooking tops;

(b) Modifying the room temperature, product temperature, and starting water temperature requirements;

(c) Providing an optional method for determining the initial power setting to be used for measuring energy consumption of cooking tops during the simmering period, based on a draft updated version of IEC 60350–2;

(d) Providing criteria for determination of the simmering setting during energy testing; and

(e) Normalizing the per-cycle energy use to account for the water temperature at the end of the simmering period;

(2) Apply IEC 60350–2:2017 to the measurement of gas cooking tops by including:

(a) Specifications for gas supply instrumentation and test conditions;

(b) Test vessel selection based on nominal heat input rate;

(c) Adjustment methods and specifications for the maximum heat input rate; and

(d) Target power density for the optional potential simmering setting pre-selection test;

(3) Provide additional specifications, including:

(a) Definitions for operating modes, product configurations, test settings, and instrumentation;

(b) Test conditions, including electrical supply characteristics and water load mass tolerance;

(c) Instructions for product installation according to product configuration; and

(d) Instructions for determining power settings for multi-ring cooking zones and cooking zones with infinite power settings and rotating knobs;

(4) Provide means for measuring cooking top annual energy use in standby mode and off mode by:

(a) Applying IEC 62301 (First Edition 2005–06), ''Household electrical appliances—Measurement of standby power'' (''IEC 62301 First Edition'') and IEC 62301 (Edition 2.0 2011–01), ''Household electrical appliances—Measurement of standby power'' (''IEC 62301 Second Edition'');

(b) Defining the number of hours spent in combined low-power mode; and

(c) Defining the allocation of combined low-power mode hours to the conventional cooking top component of a combined cooking product; and

(5) Define the integrated annual energy use metric by specifying the representative water load mass and the number of annual cooking top cycles.

DOE is also proposing to add calculations of annual energy consumption and estimated annual operating cost to 10 CFR 430.23(i); and rename the test procedure at 10 CFR part 430, subpart B, appendix I (''appendix I'') to ''Uniform Test Method for Measuring the Energy Consumption of Microwave Ovens.'' Table II.1 summarizes DOE's proposed changes for the cooking tops test procedure compared to the current industry test procedure, as well as the reasons for the proposed provisions. DOE's proposed reorganization of appendix I is summarized in Table II.2.

TABLE II.1—SUMMARY OF CHANGES IN PROPOSED TEST PROCEDURE FOR CONVENTIONAL COOKING PRODUCTS RELATIVE TO THE INDUSTRY TEST PROCEDURE INCORPORATED BY REFERENCE

IEC 60350–2:2017 test procedure	Proposed test procedure	Attribution
Addresses only electric cooking tops	Addresses both electric and gas cooking tops, including new provisions specific to gas test conditions, instrumentation, and test conduct.	Include all covered cooking tops.
Includes an incomplete list of definitions	Includes definitions of operating modes, product configurations, power settings, and specialty cooking zone.	Improve readability of test procedure.
Installation instructions specify only that the cooking product is to be installed in accordance with manufacturer instructions.	Provides additional detail for the installation instructions, by product configuration, as well as definitions of those configurations.	Improve readability of test procedure.
Does not include provisions for measuring standby mode and off mode energy.	Incorporates provisions of IEC 62301 to measure standby mode and off mode power and calculate annual combined low-power mode energy.	EPCA requirement.
Specifies a room and product temperature of 23 ± 2 °C	Specifies a room and product temperature of 25 ± 5 °C. Specifies that the temperature must be stable, defines stable temperature, and specifies how to measure the product temperature.	Decrease test burden.
Specifies a starting water temperature of 15 ± 0.5 °C	Specifies a starting water temperature of 25 ± 0.5 °C	Decrease test burden.
Specifies complex requirements for determining test vessel sizes for cooking tops with 4 or more cooking zones, requiring that the set of vessels comprise at least 3 of 4 defined cookware size categories.	Requires the use of the cookware that is closest in size to the heating element diameter, without consideration of cookware size categories.	Improve readability of test procedure and decrease test burden.
Does not include a tolerance on the mass of the water load.	Specifies a 0.5g tolerance on the mass of the water load.	Improve repeatability and reproducibility.
Requires the measurement of all power settings spanning the lowest available through the identified Energy Test Cycle setting.	Offers the option of a ''potential simmering setting pre-selection'' test to reduce number of test cycles needed to identify the Energy Test Cycle. Further offers the option of starting testing at a known potential simmering setting.	Decrease test burden.

TABLE II.1—SUMMARY OF CHANGES IN PROPOSED TEST PROCEDURE FOR CONVENTIONAL COOKING PRODUCTS RELATIVE TO THE INDUSTRY TEST PROCEDURE INCORPORATED BY REFERENCE—Continued

IEC 60350–2:2017 test procedure	Proposed test procedure	Attribution
The measured energy consumption of the simmering period is not normalized to account for a final water temperature above the nominal 90 °C.	The energy consumption of the simmering period is normalized to represent a final water temperature of exactly 90 °C.	Improve representativeness of test results.
Uses a 1000g water load to normalize energy consumption.	Uses a 2853g water load to normalize energy consumption.	Improve representativeness of test results.
Does not calculate annual energy use	Calculates annual energy use based on 418 cooking cycles per year and 31 minutes per cycle.	Provide a representative measure of annual energy consumption

TABLE II.2—SUMMARY OF CHANGES IN PROPOSED TEST PROCEDURE FOR MICROWAVE OVENS RELATIVE TO CURRENT TEST PROCEDURE

Current DOE test procedure	Proposed test procedure	Attribution
Appendix I title covers all cooking products, but includes test procedures only for microwave ovens.	Appendix I title refers only to microwave ovens	Improve readability of test procedure.

DOE has tentatively determined that the proposed test procedure described in section III of this NOPR would, if made final, produce measurements of energy use that are representative of an average use cycle and not be unduly burdensome to conduct. Discussion of DOE's proposed actions are addressed in detail in section III of this NOPR. Additionally, DOE provides initial estimates of the cost of testing for industry in section III.L of this document. DOE notes that there are currently no performance-based energy conservation standards prescribed for conventional cooking tops. Manufacturers would not be required to conduct the proposed test procedure, if made final, until such time as compliance is required with any future applicable standards that are established, unless manufacturers voluntarily choose to make representations as to the energy use or energy efficiency of a conventional cooking top.

III. Discussion

In this NOPR, DOE is proposing to establish a new test procedure for conventional cooking tops in a proposed new appendix I1. The proposed test procedure is based primarily on an industry standard for measuring the energy consumption of electric cooking tops, IEC 60350–2:2017, with certain adjustments and clarifications as discussed in the following sections of this document. Whereas IEC 60350–2:2017 applies only to electric cooking tops, the proposed methodology is extended to gas cooking tops by means of additional instrumentation and test setup provisions to allow for testing of this heating technology.

DOE is also proposing to rename existing appendix I to ''Uniform Test Method for Measuring the Energy Consumption of Microwave Ovens'' to clarify that it applies only to microwave ovens.

A. Scope of Applicability

This rulemaking applies to conventional cooking tops, a category of cooking products which are household cooking appliances consisting of a horizontal surface containing one or more surface units that utilize a gas flame, electric resistance heating, or electric inductive heating. 10 CFR 430.2. A conventional cooking top includes any conventional cooking top component of a combined cooking product. 10 CFR 430.2.

As discussed in section I.A of this document, DOE has the authority to establish and amend test procedures for covered products. EPCA identifies kitchen ranges and ovens as a covered product. (42 U.S.C. 6292(a)(10)) In a final rule published on September 8, 1998 (63 FR 48038), DOE amended its regulations in certain places to substitute the term ''kitchen ranges and ovens'' with ''cooking products.'' DOE regulations currently define ''cooking products'' as consumer products that are used as the major household cooking appliances. Cooking products are designed to cook or heat different types of food by one or more of the following sources of heat: Gas, electricity, or microwave energy. Each product may consist of a horizontal cooking top containing one or more surface units and/or one or more heating compartments. 10 CFR 430.2.

Certain residential household cooking appliances combine a conventional cooking product component with other appliance functionality, which may or may not perform a cooking-related function. Examples of such ''combined cooking products'' include a conventional range, which combines a conventional cooking top and one or more conventional ovens; a microwave/conventional cooking top, which combines a microwave oven and a conventional cooking top; a microwave/conventional oven, which combines a microwave oven and a conventional oven; and a microwave/conventional range, which combines a microwave oven and a conventional oven in separate compartments and a conventional cooking top. Because combined cooking products may consist of multiple classes of cooking products, any established energy conservation standard applies to each individual component of the combined cooking product. As determined in the December 2016 Final Rule, DOE proposes in this NOPR that the cooking top test procedures would apply to the individual conventional cooking top portion of a combined cooking product. *See* 81 FR 91418, 91423.

As discussed in the December 2016 Final Rule, DOE observed that for combined cooking products, the annual combined low-power mode energy consumption can only be measured for the combined cooking product and not the individual components. 81 FR 91418, 91423 (Dec. 16, 2016). As discussed in section III.H.3 of this document, DOE is proposing similar methods to those adopted in the December 2016 Final Rule to calculate the integrated annual energy consumption of the conventional cooking top component separately by allocating a portion of the combined low-power mode energy consumption

measured for the combined cooking product to the conventional cooking top component using the estimated annual cooking hours for the given components comprising the combined cooking product.

B. Incorporation by Reference of IEC 60350–2:2017 for Measuring Energy Consumption

1. Water-Heating Test Methodology

As discussed previously, DOE is proposing to create a new appendix I1 that would generally adopt the test procedure in IEC 60350–2:2017, which is an industry test procedure that measures the energy consumption of a cooking top using a water-heating method. In the IEC 60350–2:2017 test method, each heating element is tested individually by heating a specified water load in a standardized test vessel at the maximum power setting until the temperature of the water, including any overshoot after reducing the input power, reaches 90 °C (*i.e.,* the ''heat-up period'').[7] At that time, the power is reduced to a lower setting so that the water temperature remains as close to 90 °C as possible, without dropping below that temperature threshold, for a 20-minute period (*i.e.,* the ''simmering period''). Energy consumption is measured over the entire duration of the initial heat-up period and 20-minute simmering period, which together comprise the Energy Test Cycle for that heating element. The energy consumption for each heating element is normalized by the weight of the tested water load and averaged among all tested heating elements to obtain an average energy consumption value for the cooking top, as discussed in section III.H.1 of this NOPR.

Both DOE's proposed new appendix I1 and IEC 60350–2:2017 on which it is based are similar to the approach used in the earlier DOE test procedure as established in the December 2016 Final Rule, which incorporated certain provisions from EN 60350–2:2013. A more detailed comparison of IEC 60350–2:2017 and EN 60350–2:2013 is provided in section III.B.2 of this NOPR.

As discussed in the NOPR preceding the December 2016 Final Rule, published on June 10, 2015 (''June 2015 NOPR''), manufacturers that produce and sell products in Europe supported the use of a water-heating test method and harmonization with IEC Standard 60350–2 [8] for measuring the energy consumption of electric cooking tops. 80 FR 33030, 33039–33040. Efficiency advocates also supported a water-heating test method to produce a measure of cooking efficiency for conventional cooking tops. *Id.*

In January 2020, DOE commenced an initial round robin test program to further investigate the suitability of the water-heating approach in the then-current version of appendix I and to evaluate issues raised in the AHAM petition. Ten cooking top units were tested according to the then-current version of appendix I at three third-party certified laboratories [9] as well as one non-certified laboratory [10] to investigate the repeatability and reproducibility of the test procedure. Each laboratory conducted three tests of each unit [11] to measure the annual energy consumption (excluding combined low-power mode energy), yielding a coefficient of variation (''COV'') that can be used to assess the repeatability of results. The averages between the laboratories were also compared to determine a COV of reproducibility. The results of this initial round robin testing are shown in Table III.1 and Table III.2.

TABLE III.1—SUMMARY OF INITIAL ROUND ROBIN TESTING: AVERAGE ANNUAL ENERGY USE

Unit No.	Type	Average annual energy use				
		Certified laboratory A	Certified laboratory B	Certified laboratory C [12]	Laboratory D	Overall average
1	Electric-Coil	108.3 kWh	107.4 kWh	n/a	101.9 kWh	105.9 kWh
2	Electric-Smooth (Radiant)	102.0 kWh	105.9 kWh	n/a	101.6 kWh**	103.2 kWh
3	Electric-Smooth (Radiant)	106.9 kWh	107.7 kWh	105.9 kWh*	102.9 kWh**	105.8 kWh
4	Electric-Smooth (Induction)	98.1 kWh	98.6 kWh	101.6 kWh**	101.0 kWh	99.8 kWh
5	Electric-Smooth (Induction)	97.7 kWh	98.3 kWh	99.8 kWh*	101.8 kWh**	98.4 kWh
6	Gas	565 kBtu	648 kBtu	629 kBtu**	n/a	614 kBtu
7	Gas	724 kBtu	899 kBtu	789 kBtu	n/a	804 kBtu
8	Gas	841 kBtu	913 kBtu	n/a	n/a	877 kBtu
9	Gas	866 kBtu	937 kBtu	950 kBtu	n/a	918 kBtu
10	Gas	869 kBtu	948 kBtu	997 kBtu	n/a	938 kBtu

* Only one valid test cycle, see footnote 11.
** Only two valid test cycles, see footnote 11.
''n/a'' represents units that were not tested at the laboratory in question.

[7] See discussion of the turndown temperature in sections III.B.2.a and III.E.5 of this NOPR.

[8] At the time of the June 2015 NOPR, the second edition of the IEC Standard 60350–2 was still in draft form. The second edition published in August 2017.

[9] Three of the ten cooking tops were tested at two of the three third-party certified laboratories, whereas the remaining seven were tested at all three third-party certified laboratories.

[10] Only the five electric cooking tops were tested at the non-certified laboratory.

[11] After reviewing data from Laboratory C and Laboratory D, DOE has determined that not all tests were conducted according to the now-withdrawn Appendix I test procedure. These tests were removed from consideration, leaving some elements with only one or two valid tests, instead of three. In these cases, Annual Energy Use values were calculated using only the valid tests on each element. Annual Energy Use values that are based on fewer than three valid tests are marked with an asterisk in Table III.1.

TABLE III.2—SUMMARY OF INITIAL ROUND ROBIN TESTING: COEFFICIENTS OF VARIATION ASSESSING REPEATABILITY AND REPRODUCIBILITY

Unit No.	Type	Repeatability COV				Reproducibility COV among certified laboratories (%)	Reproducibility COV among all laboratories (%)
		Certified lab A (%)	Certified lab B (%)	Certified lab C (%)	Lab D		
1	Electric-Coil	0.7	0.7	n/a	0.4	0.4	2.7
2	Electric-Smooth (Radiant)	0.4	1.5	n/a	** 0.3	1.9	1.9
3	Electric-Smooth (Radiant)	1.0	0.4	*	** 0.1	0.7	1.7
4	Electric-Smooth (Induction)	0.3	0.2	** 1.4	0.5	1.6	1.5
5	Electric-Smooth (Induction)	0.6	1.2	*	** 0.9	0.9	1.6
6	Gas	2.1	0.6	** 1.1	n/a	5.8	
7	Gas	1.3	3.7	1.6	n/a	8.9	
8	Gas	0.3	0.7	n/a	n/a	4.1	
9	Gas	1.1	1.4	2.3	n/a	4.0	
10	Gas	1.3	2.4	0.7	n/a	5.6	

* Only one valid test cycle, see footnote 11.
** Only two valid test cycles, see footnote 11.
''n/a'' represents units that were not tested at the laboratory in question.

These initial round robin test results showed repeatability and reproducibility COVs under 2 percent for electric cooking tops tested at the certified laboratories. A COV of 2 percent has previously been considered by some stakeholders to be an acceptable threshold for repeatability and reproducibility. (AHAM, EERE–2018–BT–TP–0004, No. 25 at p. 4) [13] As discussed, the test method employed (*i.e.,* the then-current DOE test procedure) relied generally on the methodology in EN 60350–2:2013. DOE also observed that, when extended to gas cooking tops, this test methodology provided results with repeatability COVs for gas cooking tops of 0.3–3.7 percent, and with reproducibility COVs ranging from 4.0 to 8.9 percent.

The results of the initial round robin test program were not available for consideration at the time of the August 2020 Final Rule. Since the August 2020 Final Rule, DOE has initiated further testing. In particular, DOE initiated a second round robin in May 2021 in response to changes to electric cooking tops on the market and to evaluate variability in testing gas cooking tops.

In response to AHAM's petition, Whirlpool submitted comments regarding the frequency of heating element cycling, stating that the introduction of a ''coil surface unit cooking oil ignition test'' to the 16th edition of the Underwriters Laboratory (''UL'') standard 858, ''Household Electric Ranges Standard for Safety'' (''UL 858'') resulted in manufacturers making design changes to electric-coil cooking tops that increased cycling frequency over shorter durations in order to maintain a constant temperature. (Whirlpool, EERE–2018–BT–TP–0004, No. 20 at pp. 2–3)

The 16th edition of UL 858 published on November 7, 2014. On June 18, 2015, UL issued a revision to UL 858 that added a new performance requirement for electric-coil cooking tops intended to address unattended cooking, the ''Abnormal Operation—Coil Surface Unit Cooking Oil Ignition Test.'' This revision had an effective date of April 4, 2019. Because the electric-coil cooking top in DOE's initial round robin testing was purchased prior to that effective date, DOE could not be certain whether that test unit contained design features that would meet the performance specifications in the updated UL 858. To address the lack of test data on electric-coil cooking tops that comply with the UL 858 safety standard, DOE included one electric-coil cooking top meeting the revised UL 858 safety standard in its second round robin, which is being conducted according to the test procedure proposed in this NOPR.

To address the reproducibility concerns with the prior gas cooking top test results, DOE is also testing four gas cooking tops, according to the test procedure proposed in this NOPR. As discussed in the following sections, several of the test procedure provisions proposed in this NOPR are intended to specifically reduce the testing variability for gas cooking tops. The second round robin test program is on-going at this time. Once complete, the results will be made available for comment and summarized for inclusion in the docket for this rulemaking.

DOE proposes to use a water-heating method, based primarily on IEC 60350–2:2017, to measure cooking top energy consumption, but with modifications to extend the test methodology to gas cooking tops and to reduce the variability of test results, as discussed in sections III.C through III.E of this NOPR.

2. IEC 60350–2:2017

After the publication of the December 2016 Final Rule, IEC issued the 2017 version of IEC 60350–2. This updated edition included informative methodology for significantly reducing testing burden during the determination of the simmering setting. This updated version retains substantively the same provisions for the water-heating methodology evaluated in the first round robin testing and provides the basis for the test procedure being evaluated in the second round robin testing, with certain modifications. DOE proposes in this NOPR to incorporate certain provisions of IEC 60350–2:2017 for measuring the energy consumption of cooking tops. DOE further proposes certain modifications and clarifications to the referenced sections of IEC 60350–2:2017. The relevant provisions of IEC 60350–2:2017 and the proposed modifications to the industry standard are discussed in the following sections.

[12] The gas data at Laboratory C was measured using a volumetric gas meter that must be read manually at the start and end of the test instead of recording measurements continuously during the test. In instances in which the start and end of the simmer period were not identified during the test conduct, two manually-recorded gas volume measurements at and near the end of the test were recorded and used later to interpolate the gas volume used during the Energy Test Cycle.

[13] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking regarding test procedures for conventional cooking tops. The references are arranged as follows: (commenter name, comment docket ID number, page of that document). (Docket No. EERE–2018–BT–TP–0004, which is maintained at *www.regulations.gov/docket/EERE-2018-BT-TP-0004*).

a. Temperature Averaging

In the December 2016 Final Rule, DOE discussed that the water temperature may occasionally oscillate slightly above and below 90 °C due to minor fluctuations (*i.e.,* ''noise'') in the temperature measurement. 81 FR 91418, 91430. These temperature oscillations may cause difficulty in determining when the 20-minute simmering period starts after the water temperature first reaches 90 °C. EN 60350–2:2013 did not contain provisions that addressed issues of temperature oscillations. In contrast, IEC 60350–2:2017 introduces the use of ''smoothened'' temperature measurements to minimize the effect of minor temperature oscillations in determining the water temperature. The smoothened water temperature is calculated as a 40-second moving-average over the period 20 seconds before to 20 seconds after each instantaneous temperature measurement.

DOE has evaluated the impact of implementing ''smoothened'' water temperature averaging on two aspects of the test procedure: (1) Validating that the water temperature at which the power setting is reduced during the energy test (*i.e.,* the ''turndown temperature'') was within a certain defined tolerance; and (2) the determination of the start of the 20-minute simmering period.

Regarding validation of the turndown temperature, Section 7.5.2.1 of IEC 60350–2:2017 provides a methodology for conducting a preliminary test to determine the water temperature at which the power setting will be reduced to the ''simmering setting'' during the subsequent energy test (*i.e.,* the ''target'' turndown temperature). Section 7.5.3 of IEC 60350–2:2017 specifies that while conducting the energy test, the water temperature when the power setting is reduced (*i.e.,* the ''measured'' turndown temperature) must be recorded. Section 7.5.4.1 of IEC 60350–2:2017 provides a methodology for validating that the measured turndown temperature was within a tolerance of +1 °C/ − 0.5 °C of the target turndown temperature. Section 7.5.4.1 requires that this validation be performed based on the smoothened water temperature (as described previously) rather than using the instantaneous measured water temperature.

DOE testing suggests that using the smoothened water temperature measurement, rather than the instantaneous water temperature measurement, to validate that the measured turndown temperature was within the specified tolerance of the target turndown temperature could introduce unnecessary test burden by invalidating test cycles that otherwise would have been valid if the instantaneous water temperature measurement had been used instead (as was previously required by EN 60350–2:2013). The potential for this to occur is highest for cooking top types that have particularly fast water temperature response times to changes in input power; *e.g.,* electric-smooth radiant and induction types. On such products, the rate at which the water temperature rises begins to quickly drop (*i.e.,* the temperature rise ''flattens'' out) within a few seconds after the power setting is turned down to the simmering setting. Because the smoothened water temperature calculation incorporates 20 seconds of forward-looking data into the average during which time the temperature curve is flattening out, the smoothened turndown temperature can be a few degrees lower than the instantaneous turndown temperature. This can result in a measured turndown temperature that is within the allowable tolerance of the target turndown temperature based on the instantaneous water temperature, but below the allowable tolerance when determined based on the smoothened average method (and thus invalid). On such products, using the instantaneous water temperature, rather than the smoothened water temperature, would provide a more accurate and representative validation that the measured turndown temperature was within the specified tolerance of the target turndown temperature.

To illustrate this, DOE conducted an analysis to evaluate the use of the smoothened water temperature to validate whether the measured turndown temperature was within the allowable tolerance of the target turndown temperature for test cycles that were deemed valid using the instantaneous water temperature. DOE used water temperature data from tests conducted according to the now-withdrawn DOE test procedure for cooking tops that was smoothened post-test for the purpose of this analysis. Table III.3 presents a summary of the percentage of test cycles previously validated with the instantaneous water temperature measurements that did not remain within the specified tolerance when evaluated based on the smoothened water temperature.

TABLE III.3—PERCENTAGE OF TEST CYCLES DEEMED VALID USING INSTANTANEOUS WATER TEMPERATURE THAT WOULD BE DEEMED INVALID USING SMOOTHENED WATER TEMPERATURE

Unit #	Type	Number of test cycles evaluated	Percent of invalid test cycles based on smoothened temperature (%)
1	Electric-Coil	48	0
2	Electric-Smooth (Radiant)	48	13
3	Electric-Smooth (Radiant)	60	5
4	Electric-Smooth (Induction)	48	52
5	Electric-Smooth (Induction)	48	27
6	Gas	48	0
7	Gas	48	0
8	Gas	45	0
9	Gas	48	0
10	Gas	48	1

As indicated in Table III.3, all four electric-smooth cooking tops exhibited test cycles for which the measured turndown temperature was within the allowable tolerance of the target turndown temperature based on the instantaneous water temperature, but below the allowable tolerance (and thus invalid) when determined based on the

smoothened water temperature. DOE has tentatively determined that the requirement in IEC 60350–2:2017 to use the smoothened water temperature measurement, rather than the instantaneous water temperature measurement, to validate that the measured turndown temperature was within the specified tolerance of the target turndown temperature may be unduly burdensome, particularly for electric-smooth radiant and induction cooking tops. Therefore, proposed new appendix I1 specifies that the instantaneous water temperature measurement (rather than the smoothened water temperature measurement) be used to validate that the measured turndown temperature was within +1 °C/ − 0.5 °C of the target turndown temperature.

DOE requests comment on its proposal to require that the instantaneous, rather than the smoothened, water temperature at which the power setting is reduced during the energy test be within +1 °C/ − 0.5 °C of the target turndown temperature.

Regarding the determination of the start of the 20-minute simmering period, DOE analyzed approaches for determining the start of the simmering period that account for water temperature fluctuations. Section 7.5.3 of IEC 60350–2:2017 specifies that the start of the 20-minute simmering period is when the water temperature first meets or exceeds 90 °C. The 2016 version of appendix I [14] allowed for a brief ''grace period'' after the water temperature initially reached 90 °C, during which temperature fluctuations below 90 °C for up to 20 seconds were permitted without changing the determination of whether the power setting under test met the requirements for a simmering setting (namely, maintaining the water temperature above 90 °C for 20 minutes). For this NOPR analysis, DOE analyzed test data from the initial January 2020 round robin test program and observed that none of the test cycles that had required such a ''grace period'' when evaluating the start of the simmering period using the instantaneous water temperature needed such an allowance when using the smoothened water temperature approach described in Section 7.5.4.1 of IEC 60350–2:2017; that is, for those test cycles, the smoothened water temperature did not drop below 90 °C after the initial time it reached that temperature. Therefore, DOE is proposing in proposed new appendix I1 to determine the start of the simmering period as defined in Sections 7.5.3 and 7.5.4.1 of IEC 60350–2:2017, using the smoothened water temperature and without further qualification (*i.e.,* not including any ''grace period''). DOE tentatively concludes that a grace period is unnecessary when relying on smoothened water temperature and such a provision could cause confusion regarding the start time of the 20-minute simmering period, which in turn could reduce repeatability and reproducibility of the test procedure.

DOE requests comment on its proposal to include the requirement to evaluate the start of the simmering period as the time that the 40-second ''smoothened'' average water temperature first meets or exceeds 90 °C.

To add further clarity, DOE is proposing to add a definition of ''smoothened water temperature'' to section 1 of proposed new appendix I1, which would specify that the averaged values be rounded to the nearest 0.1 °C, in accordance with the resolution requirements of IEC 60350–2:2017. DOE is proposing to define smoothened water temperature as ''the 40-second moving-average temperature as calculated in Section 7.5.4.1 of IEC 60350–2:2017, rounded to the nearest 0.1 degree Celsius.''

DOE requests comment on its proposed definition of smoothened water temperature as well as its proposal to require the smoothened water temperature be rounded to the nearest 0.1 °C.

Water Hardness

Section 7.1.Z6.1 of EN 60350–2:2013 and Section 7.6 of IEC 60350–2:2017 specify that the test water shall be potable, while Section 7.5.1 of IEC 60350–2:2017 further states that distilled water may be used to avoid lime sediment. Based on DOE's January 2020 round robin test results that showed high reproducibility among three certified test laboratories with different water supplies that were not subject to specific tolerances on water hardness (see Table III.2), DOE does not expect the use of distilled water to significantly affect the energy use of the cooking top in comparison to test results that would be obtained using water with a hardness within potable limits.[15] DOE has also tentatively determined that a reduction in lime sediment could extend the lifetime of the test vessels. Therefore, DOE proposes to allow the use of distilled water in proposed new appendix I1.

DOE requests comment on its proposal to allow the use of distilled water for testing in the proposed new appendix I1.

Cooking Top Preparation

Section 7.1.Z6.1 of EN 60350–2:2013 specifies that before the energy consumption measurement is conducted, the cooking top shall be operated for at least 10 minutes to ensure that residual water in the components is vaporized. (Residual water may accumulate in the components during the manufacturing process, shipping, or storage of a unit.) In the past, DOE received questions from test laboratories on how frequently this cooking top pre-test preparation should be conducted. Section 7.5.1 of IEC 60350–2:2017 includes a similar requirement and clarifies that this vaporization process need only be run once per tested unit. As DOE would expect that conducting the vaporization process once would be sufficient to eliminate residual water, DOE is proposing that the vaporization process need only be run once per tested unit by adopting the provision in IEC 60350–2:2017 in proposed new appendix I1.

DOE requests comment on its proposal to include the cooking top preparation requirements for water vaporization from IEC 60350–2:2017 in its proposed new appendix I1.

C. Modifications to IEC 60350–2:2017 Methodology To Reduce Testing Burden

1. Test Vessel Selection for Electric Cooking Tops

Section 5.6.1 of IEC 60350–2:2017 specifies a set of standardized cylindrical test vessels and respective lids of varying diameters, measured in millimeters (''mm'') that must be used for conducting the cooking top energy consumption tests. Table 3 in Section 5.6.1.5 of IEC 60350–2:2017 defines four ''standardized cookware categories [16]''

[14] The term ''the 2016 version of appendix I'' refers to the version of appendix I as finalized in the December 2016 Final Rule.

[15] While the United States does not regulate the water hardness of drinking water, the U.S. Environmental Protection Agency (''EPA'') has established non-mandatory Secondary Drinking Water Standards that provide limits on contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. These secondary standards specify a maximum limit of 500 milligrams/liter of total dissolved solids. The table of secondary standards is available at: *www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals#table.*

[16] The four categories are defined as A, B, C, and D. The vessel diameters associated with each category are as follows: Category A: 120 mm and 150 mm; Category B: 180 mm; Category C: 210 mm and 240 mm; and Category D: 270 mm, 300 mm, and 330 mm.

that are used to group test vessels by diameter range.

Sections 6.3 and 7.3 of IEC 60350–2:2017 specify a procedure to select the set of test vessels necessary to conduct testing for an electric cooking top. The process requires determining the number of cooking zones based on the number of controls that can be operated independently at the same time. For cooking tops without limitative markings, Annex A of IEC 60350–2:2017 defines the set of test vessels to be used for testing all of the cooking zones on the cooking top, based on the number of cooking zones.

For electric cooking tops with limitative markings (the most common), an initial test vessel selection is made based on matching the outermost diameter of the markings to the outer diameter of a corresponding test vessel, using Table 3 in Section 5.6.1.5 of IEC 60350–2:2017. IEC 60350–2:2017 specifies in Table 4 of Section 7.3 that for electric cooking tops with four or more controls, the set of test vessels used to test the cooking top must comprise at least three of the standardized cookware categories. If the initially selected test vessel set does not meet this criterion, a substitution must be made using the next best-fitting test vessel from one of the other standardized cookware categories. If a selected test vessel size is out of the range of the sizes allowed by the user manual, the closest compatible diameter is to be used.

DOE has tentatively determined through a market survey of electric cooking tops that the typical difference in diameter between the initial test vessel selection and the substituted test vessel is less than 30 mm, suggesting that the energy consumption using the substituted test vessel compared to using the test vessel whose diameter is closest to the heating element diameter will not substantially differ, and that any corresponding difference in measured energy consumption for the entire cooking top will be even more minimal. DOE has also observed through testing conducted in support of the December 2016 Final Rule that the complex test vessel selection process has, in some cases, resulted in electric cooking tops being tested with the wrong set of test vessels.

To reduce the burden of implementing the complex test vessel selection procedure and to thereby improve test procedure reproducibility, DOE is proposing to require much simpler test vessel selection criteria for proposed new appendix I1. Specifically, DOE proposes that for electric cooking tops with limitative markings, each cooking zone would be tested with the test vessel that most closely matches the outer diameter of the marking, from among the test vessels defined in Table 3 in Section 5.6.1.5 of IEC 60350–2:2017. Table A.1 in Annex A of IEC 60350–2:2017 would be used to determine the set of test vessels required for electric cooking tops without limitative markings, for which such matching of test vessel diameter to limitative marking diameter is not possible. To ensure that these approaches are properly implemented, DOE is additionally proposing to explicitly exclude the provisions from Section 7.3 of IEC 60350–2:2017 in proposed new appendix I1. DOE is further proposing that if a selected test vessel cannot be centered on the cooking zone due to interference with a structural component of the cooking top (for example, a raised outer border), the test vessel with the largest diameter that can be centered on the cooking zone be used instead. This process of vessel selection would reflect expected consumer practice of matching cookware to the size of a heating element (*i.e.,* cookware is placed on the burner that is the closest in size to the cookware).

DOE requests comment on its proposal to exclude the provisions from Section 7.3 of IEC 60350–2:2017 and instead require that each cooking zone be tested with the test vessel that most closely matches the outer diameter of the marking for electric cooking tops with limitative markings; and that Table A.1 of Annex A of IEC 60350–2:2017 be used to define the test vessels for electric cooking tops without limitative markings. DOE also requests comment on its proposal to substitute the largest test vessel that can be centered on the cooking zone in the case where a structural component of the cooking top interferes with the test vessel.

2. Temperature Specifications

a. Room Temperature

Section 5.1 of IEC 60350–2:2017 specifies an ambient room temperature of 23 ± 2 °C for the tests conducted under proposed new appendix I1. From discussions with cooking top manufacturers as part of a task force that AHAM assembled to update its cooking product test procedures,[17] DOE is aware that conducting energy testing on cooking tops in the same conditioned space that safety testing is conducted could significantly reduce testing burden. Section 40 of UL 858, a relevant safety standard for cooking tops, requires a room temperature of 25 ± 5 °C for certain safety testing that manufacturers are likely conducting.

The IEC ambient room temperature specifications (23 ± 2 °C) are within the range allowed by UL 858 (25 ± 5 °C). Based on its understanding of the primary heat transfer mechanisms to the water load (*i.e.,* by conduction to the test vessel for electric-coil and electric-smooth cooking tops other than induction type; by joule heating in the test vessel itself by induced eddy currents for electric-smooth induction cooking tops; and by convective heat transfer from the flames and conduction from the grates for gas cooking tops), DOE does not expect that the slightly different nominal value and larger tolerance on the ambient room temperature (corresponding to the range allowed by UL 858) would significantly impact the measured cooking top energy consumption. In consideration of this relatively minimal impact on testing results and the potential for significant reduction in test burden on manufacturers, DOE has tentatively determined that expanding the ambient temperature tolerance to match that used for safety testing (*i.e.,* 25 ± 5 °C) would be warranted and would not impact repeatability or reproducibility of the test procedure. To address concerns raised by manufacturers in the AHAM task force that test laboratories could consistently test at the extremes of the temperature tolerances, DOE is proposing to specify that the target ambient room temperature is the nominal midpoint of the temperature range. Therefore, DOE is proposing in proposed new appendix I1 to specify an ambient room temperature of 25 ± 5 °C, with a target temperature of 25 °C.

DOE requests comment on its proposal to specify an ambient room temperature of 25 ± 5 °C.

Product Temperature

Section 5.5 of IEC 60350–2:2017 specifies that the product shall be at the laboratory's ambient temperature at the beginning of each test, and that forced cooling may be used to assist in reducing the temperature from a prior test. This provision ensures a repeatable starting temperature of the cooking top prior to testing. A cooking top that is warmer or colder than the ambient temperature would consume a different amount of energy during testing. Section 5.5 of IEC 60350–2:2017 does not specify how to measure the temperature of the product prior to each test.

[17] The AHAM cooking product task force includes AHAM member manufacturers, a representative of the Appliance Standard Awareness Project, and DOE members and contractors. The task force's first meeting was in January 2021. The task force has been developing test procedures for electric and gas cooking tops.

DOE is proposing to require that the product temperature must be stable, which DOE is proposing to define as ''a temperature that does not vary by more than 1 °C over a 5-minute period.'' DOE is also proposing to specify that forced cooling must not be used during the period of time used to assess temperature stability.

DOE is further proposing to specify where to measure the temperature of the product. Prior to any active mode testing, the product temperature would be measured at the center of the cooking zone under test. Prior to the standby mode and off mode power test, the product temperature would be measured as the average of the temperature measured at the center of each cooking zone.

DOE requests comments on its proposal to require that the product temperature be stable, its proposed definition of a stable temperature, and its proposed methods for measuring the product temperature for active mode testing as well as standby mode and off mode power testing.

Initial Water Temperature

Section 7.5.1 of IEC 60350–2:2017 specifies an initial water temperature of 15 ± 0.5 °C, and that the test vessel should not be stored in a refrigerator to avoid the rims getting ''too cold.'' As part of conversations within the AHAM task force in which DOE has participated, manufacturers have expressed concerns regarding the test burden of maintaining a supply of water for test loads that is colder than the ambient temperature, especially when the test vessels cannot be placed in a refrigerator prior to testing.

As discussed, DOE is proposing to specify an ambient room temperature of 25 ± 5 °C. DOE expects that using an initial nominal temperature of 25 °C, rather than the currently specified 15 °C, would not impact the repeatability and reproducibility of the test procedure. Furthermore, DOE expects that an initial nominal temperature of 25 °C may more accurately represent an average temperature of food or water loads with which consumers would fill their cookware prior to the start of a cooking cycle. DOE surmises that consumers would be expected to fill cookware not only with refrigerated foods or water from the cold water supply (*i.e.,* food and water loads at 15 °C or lower), but also with water from the hot water supply and food items at room temperature (*i.e.,* food and water loads at 25 °C or higher).

DOE tentatively determines, however, that it is critical to maintain the tolerance of ± 0.5 °C on the initial water temperature as specified by IEC 60350–2:2017 so that the energy consumption during the initial heat-up phase to 90 °C is repeatable and reproducible. DOE has tentatively determined that it is not feasible to normalize the measured energy consumption to reflect different starting water temperatures due to the non-linearity of the water temperature curve during the initial portion of the test. As shown in Figure III.1, the rate of temperature rise of the water during the initial minutes of the test is significantly lower than during the remainder of the heat-up phase because in the initial minutes of the test, the cooking top itself and the test vessel are both heating up, such that a substantive portion of the input power is not transferred directly to the water load. The specific shape of the non-linear water temperature rise during this initial portion of the test is highly dependent on multiple factors, including heating technology, thermal mass of the cooking top, and, for gas cooking tops, the design of the burner system. DOE does not have sufficient data at this time to determine whether a single methodology for normalizing the energy use could be developed to accommodate the wide variety of cooktop heating technologies and designs. For these reasons, DOE proposes to maintain a tolerance of ± 0.5 °C on the initial water temperature as specified by IEC 60350–2:2017.

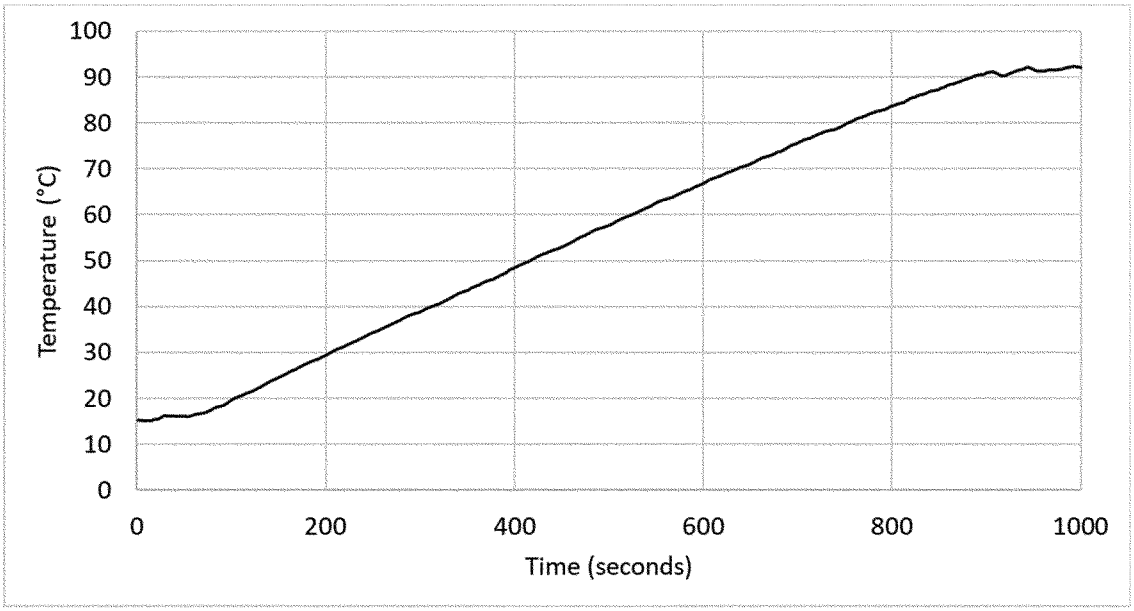

Figure III.1 Example Water Temperature During the Heat-up Period (Unit 7, Laboratory A)

In summary, DOE is proposing to specify in proposed new appendix I1 that the water must have an initial temperature of 25 ± 0.5 °C.

DOE requests comment on its proposal to specify an initial water temperature of 25 ± 0.5 °C.

3. Optional Potential Simmering Setting Pre-Selection Test

As discussed, DOE is proposing to adopt the water-heating methodology in IEC 60350–2:2017, which consists of measuring energy consumption during an initial heat-up period and a subsequent 20-minute simmering period, which together comprise the Energy Test Cycle. Conducting the IEC 60350–2:2017 test method requires the determination of the simmering setting by means of repeated test cycles, each with a successively higher input power setting after turndown, starting with the lowest input setting. This methodology can require a laboratory to conduct numerous test cycles before identifying the one in which the simmering period criteria are met.

In March of 2021, IEC released to its associated committee members a Final Draft International Standard (''IEC 60350–2:FDIS'') amendment to IEC 60350–2:2017, which was approved by the members in April 2021. Although an amended version of the IEC test method has not yet published, DOE is proposing to include several of the relevant changes into proposed new appendix I1. If IEC were to publish the amended version of the standard that includes these amendments prior to the publication of any final rule, DOE would consider incorporating by reference the updated version of the IEC test method instead of including each of these specific provisions in proposed new appendix I1.

Annex H of IEC 60350–2:FDIS provides an informative test method for determining the potential simmering setting (*i.e.,* the first setting used to conduct a simmering test in order to determine the simmering setting). Annex H states that, for electric cooking tops, empirical test data show that the power density of the minimum-above-threshold power setting (*i.e.,* simmering setting) is close to 0.8 watts per square centimeter (''W/cm^2'').[18] The method in Annex H provides a means to determine which power setting is closest to the target power density, and thus to more easily identify the first power setting that may be used for determining which power setting will be used for the Energy Test Cycle.

In response to manufacturer concerns regarding the test burden of IEC 60350–2:2017, DOE is proposing to include the procedure from Annex H of IEC 60350–2:FDIS in its proposed new appendix I1. In DOE's testing experience, using this ''pre-selection test'' can significantly reduce the test burden associated with determining the simmering setting to be used for the Energy Test Cycle. Although this would represent an additional procedure, performing the potential simmering setting pre-selection test can reduce the number of tests cycles necessary to determine the Energy Test Cycle from as many as 12 to as few as two; thus, the net overall testing time for a cooking top may be substantially shorter.[19]

Consistent with Annex H of IEC 60350–2:FDIS, DOE is proposing that during the potential simmering setting pre-selection test, the power density measurement be repeated for each successively higher power setting until the measured power density exceeds the specified threshold power density. Of the last two power settings tested (*i.e.,* the last one that results in a power density below the threshold and the first one that results in a power density above the threshold), the potential simmering setting would be the power setting that produces a power density closest to the threshold value. The closest power density may be higher or lower than the applicable threshold value.

DOE is further proposing to make the potential simmering setting pre-selection test optional. If the tester has prior knowledge of the unit's operation and has previously determined through a different method which power setting is the potential simmering setting, DOE proposes that the tester may use that setting as the initial power setting for the test cycles. Irrespective of the method used for determining the potential simmering setting, a valid test shall confirm whether the power setting under test meets the requirements of an Energy Test Cycle (see section III.C.4 of this NOPR). If a tester decides to use a different method to select the potential simmering setting, and chooses an incorrect power setting, the tester may then be required to conduct additional simmering tests until finding the power setting that meets the requirements of an Energy Test Cycle.

DOE requests comment on its proposal to include the potential simmering setting pre-selection test specified in Annex H of IEC 60350–2:FDIS as an optional test in proposed new appendix I1. DOE also requests comment on its proposal to allow that if the tester has prior knowledge of the unit's operation and has previously determined through a different method which power setting is the potential simmering setting, the tester may use that setting as the initial power setting for the test cycles.

4. Determination of the Simmering Setting

IEC 60350–2:FDIS adds a clause to Section 7.5.4.1 of IEC 60350–2:2017 stating that if the smoothened water temperature is measured to be below 90 °C during the simmering period, the energy consumption measurement shall be repeated with an increased power setting. The new clause also adds that if the smoothened water temperature is measured to be above 91 °C during the simmering period, the test cycle is repeated using next lower power setting and checked in order to guarantee that the lowest possible power setting that remains above 90 °C is identified for the Energy Test Cycle. DOE infers from this new clause that if the smoothened water temperature does not drop below 90 °C or rise above 91 °C during the simmering period, no additional testing is needed. This new clause provides clarity as to what setting is ''as close to 90 °C as possible,'' as required in Section 7.5.2.2 of IEC 60350–2:2017, and therefore improves the reproducibility of the simmering setting determination.

DOE is proposing to define the ''maximum-below-threshold power setting'' as ''the power setting on a conventional cooking top that is the highest power setting that results in smoothened water temperature data that does not meet the evaluation criteria specified in Section 7.5.4.1 of IEC 60350–2:2017;'' and to defined the ''minimum-above-threshold power setting'' as ''the power setting on a conventional cooking top that is the lowest power setting that results in smoothened water temperature data that meet the evaluation criteria specified in Section 7.5.4.1 of IEC 60350–2:2017. This power setting is also referred to as the simmering setting.''

DOE is proposing to include a flow chart in proposed new Appendix I1 that would require that any valid[20] simmering test conducted according to Section 7.5.2 of IEC 60350–2:2017 to be evaluated as follows:

(1) If the smoothened temperature does not exceed 91 °C or drop below 90 °C at any time in the 20-minute period

[18] The power density is defined as the average wattage of the power setting divided by the area of the cookware bottom.

[19] The potential simmering setting pre-selection tests takes 10 minutes per power setting tested (with no cool-down required between each test), whereas testing each setting as described in IEC 60350–2:2017 takes approximately 1 hour per power setting tested (including cool-down time between each test).

[20] DOE proposes to define a valid simmering test as one where the test conditions in section 2 of Appendix I1 are met and the measured water temperature at the time the power setting is reduced, Tc, must be within −0.5 °C and +1 °C of the target turndown temperature.

following t90,the power setting under test is considered to be the simmering setting, and no further evaluation or testing is required. The test is considered the Energy Test Cycle.[21]

(2) If the smoothened temperature exceeds 91 °C and does not drop below 90 °C at any time in the 20-minute period following t90, the power setting under test is considered to be above the threshold power setting. The simmering test is repeated using the next lower power setting, after allowing the product temperature to return to ambient conditions, until two consecutive power settings have been determined to be above the threshold power setting and below the threshold power setting, respectively. These power settings are considered to be the minimum-above-threshold power setting and the maximum-below-threshold power setting, respectively. The energy consumption representative of an Energy Test Cycle is calculated based on an interpolation of the energy use of both of these cycles, as discussed in section III.C.5 of this NOPR.

(3) If the smoothened temperature drops below 90 °C at any time in the 20-minute period following t90, the power setting under test is considered to be below the threshold power setting. The simmering test is repeated using the next higher power setting, after allowing the product temperature to return to ambient conditions, until two consecutive power settings have been determined to be above the threshold power setting and below the threshold power setting, respectively. These power settings are considered to be the minimum-above-threshold power setting and the maximum-below-threshold power setting, respectively. The energy consumption representative of an Energy Test Cycle is calculated based on an interpolation of the energy use of both of these cycles, as discussed in section III.C.5 of this NOPR.

DOE requests comment on its proposed definitions of the minimum-above-threshold power setting and the maximum-below-threshold power setting, and on its proposed methodology for determining the simmering setting.

5. Normalizing Per-Cycle Energy Use for the Final Water Temperature

As discussed, the test conduct can conclude with either a single Energy Test Cycle wherein the smoothened water temperature during the simmering period remains between 90 °C and 91 °C, or with a pair of cycles designated as the minimum-above-threshold cycle (wherein the smoothened water temperature during the simmering period remains above 90 °C, and for a portion of the time exceeds 91 °C) and the maximum-below-threshold cycle (wherein the smoothened water temperature during the simmering period does not remain above 90 °C). In IEC 60350–2:2017, energy use is calculated based on the minimum-above-threshold cycle, regardless of whether the smoothened water temperature exceeds 91 °C during the simmering period.

In conversations as part of the AHAM task force in which DOE has participated, some manufacturers have expressed concerns that a test cycle with a water temperature at the end of the simmering period that is above 91 °C may not be comparable to a test cycle with a water temperature at the end of the simmering period that is closer to 90 °C, particularly because there is no limit on how far above 91 °C the final water temperature may be (so long as the setting is the minimum-above-threshold cycle). This concern is particularly relevant to cooking tops with a small number of discrete power settings that result in relatively large differences in simmering temperature between each setting. In addition, repeatably identifying the minimum-above-threshold cycle is particularly challenging for cooking tops with continuous (*i.e.,* infinite) power settings.[22]

In order to reduce test burden on cooking tops with infinite power settings, and to provide comparable energy use for all cooking tops including those with discrete power settings, DOE is proposing to normalize the energy use of the minimum-above-threshold cycle to represent an Energy Test Cycle with a final water temperature of exactly 90 °C, using an interpolation of the energy use of the maximum-below-threshold cycle and the respective final smoothened water temperatures. DOE is proposing to not perform this normalization on test cycles where the smoothened water temperature during the simmering period does not exceed 91 °C, because IEC 60350–2:2017 does not require the next lowest power setting to be tested under these circumstances, and DOE has tentatively determined the extra test burden would not be warranted by the resulting small adjustment to the energy use.

DOE is further proposing that if the minimum-above-threshold power setting is the lowest available power setting on the heating element under test, or if the smoothened water temperature during the maximum-below-threshold power setting does not meet or exceed 90 °C during a 20-minute period following the time the power setting is reduced, a normalization calculation would not be possible. Under these circumstances, DOE proposes that the minimum-above-threshold power setting test is the Energy Test Cycle.

DOE is considering whether the smoothened final water temperature is the most appropriate measurement to perform this normalization and may consider using a different metric as the basis for normalization, such as the average temperature of the water during the 20-minute simmering period or the maximum smoothened water temperature during the 20-minute simmering period. DOE may also consider other methods of normalizing the energy use of a heating element to provide comparable energy use for all cooking tops including those with discrete power settings.

DOE requests comment on its proposal to normalize the energy use of the tested cycle if the smoothened water temperature exceeds 91 °C during the simmering period, to represent an Energy Test Cycle with a final water of 90 °C. DOE specifically requests comment on its proposal to use the smoothened final water temperature to perform this normalization and on whether a different normalization method would be more appropriate. DOE also requests comment on its proposal to not require the normalization when the smoothened water temperature remains between 90 °C and 91 °C during the simmering period, when the minimum-above-threshold power setting is the lowest available power setting on the heating element under test, or when the smoothened water temperature during the maximum-below-threshold power setting does not meet or exceed 90 °C during a 20-minute period following the time the power setting is reduced.

D. Extension of Methodology to Gas Cooking Tops

The IEC 60350–2:2017 test method is designed for testing the energy consumption of electric cooking tops. DOE extended this methodology to gas cooking tops in the December 2016 Final Rule, based on the incorporation of test provisions in the European Standard EN 30–2–1:1998, ''Domestic cooking appliances burning gas—Part 2–

[21] t90 is the start of the simmering period and is defined as the time at which the smoothened water temperature first meets or exceeds 90 °C.

[22] See section III.E.3 of this NOPR for further discussion of the proposed methodology for cooking tops with infinite power settings.

1: Rational use of energy—General'' (''EN 30–2–1''). After further consideration for this NOPR, similar to the prior DOE test procedure for gas cooking tops, DOE is proposing to include certain specifications for testing gas cooking tops based on EN 30–2–1, but with additional provisions to clarify testing requirements and improve the reproducibility of test results for gas cooking tops. Round robin testing of gas cooking tops, as presented in section III.B.1 of this NOPR and additional analysis described in the following sections suggest that a test procedure based on IEC 60350–2:2017 and EN 30–2–1, with modification as proposed in this NOPR, would provide test results with acceptable repeatability and reproducibility for gas cooking tops.

1. Gas Test Conditions

DOE is proposing that the supply pressure immediately ahead of all controls of the gas cooking top under test must be between 7 and 10 inches of water column for testing with natural gas, and between 11 and 13 inches of water column for testing with propane. DOE is further proposing to specify that the higher heating value of natural gas be approximately 1,025 British thermal units (''Btu'') per standard cubic foot, and that the higher heating value of propane be approximately 2,500 Btu per standard cubic foot. These values are consistent with industry standards, and other DOE test procedure for gas-fired appliances.

DOE is also proposing to define a standard cubic foot of gas as ''the quantity of gas that occupies 1 cubic foot when saturated with water vapor at a temperature of 60 °F and a pressure of 14.73 pounds per square inch (101.6 kPa).'' Standard cubic feet are used to measure the energy use of a gas appliance in a repeatable manner despite potential variation in the gas line conditions.

DOE requests comment on its proposed test conditions for gas cooking tops, and its proposed definition of a standard cubic foot of gas.

2. Gas Supply Instrumentation

DOE is proposing to specify in proposed new appendix I1 a gas meter for testing gas cooking tops using the same specifications as in the 2016 version of appendix I, which read as follows: The gas meter used for measuring gas consumption must have a resolution of 0.01 cubic foot or less and a maximum error no greater than 1 percent of the measured valued for any demand greater than 2.2 cubic feet per hour.

DOE is proposing to include in section 4.1.1.2.1 of proposed new appendix I1 the formula for the correction factor to standard temperature and pressure conditions, rather than reference the U.S. Bureau of Standards Circular C417, 1938, as was done in the 2016 version of appendix I. By providing this explicit formula, DOE expects to reduce the potential for confusion or miscalculations.

In order to measure the gas temperature and line pressure required for the calculation of the correction factor to standard temperature and pressure conditions, DOE is proposing to specify the instrumentation for measuring the gas temperature and line pressure. DOE is proposing to require that the instrument for measuring the gas line temperature must have a maximum error no greater than ±2 °F over the operating range and that the instrument for measuring the gas line pressure must have a maximum error no greater than 0.1 inches of water column. These requirements are consistent with the gas temperature and line pressure requirements from the test procedures at 10 CFR part 430, subpart B, appendices N and E, for furnaces and for water heaters, respectively.

DOE is proposing to require the use of a standard continuous flow calorimeter to measure the higher heating value of the gas, with an operating range of 750 to 3,500 Btu per cubic foot, a maximum error no greater than 0.2 percent of the actual heating value of the gas used in the test, an indicator readout maximum error no greater than 0.5 percent of the measured value within the operating range and a resolution of 0.2 percent of the full-scale reading of the indicator instrument. These requirements are consistent with the calorimeter requirements from the test procedure at 10 CFR part 430, subpart B, appendix D2, for gas clothes dryers.

The 2016 version of appendix I required that the heating value be measured with an unspecified instrument with a maximum error of 0.5 percent of the measured value and a resolution of 0.2 percent of the full scale reading. The heating value would then be corrected to standard temperature and pressure. 81 FR 91418, 91440. DOE is proposing the same error and resolution requirements for the instrumentation, but is proposing a different approach for determining the heating value because, after discussions with test laboratories and manufacturers, applying the gas correction factor to the heating value does not reflect common practice in the industry. Instead, DOE is proposing to calculate gas energy use as the product of the measured gas volume consumed (in cubic feet), a correction factor converting measured cubic feet of gas to standard cubic feet of gas, and the heating value of the gas (in Btu per standard cubic foot) in proposed new appendix I1. DOE is proposing to further specify that the heating value would be the higher heating value on a dry-basis of gas. It is DOE's understanding that this is the typical heating value used by the industry and third-party test laboratories.

DOE requests comment on its proposed instrumentation specifications for gas cooking tops, and any cost burden for manufacturers who may not already have the required instrumentation.

3. Test Vessel Selection for Gas Cooking Tops

In proposing to apply the test method in IEC 60350–2:2017 to gas cooking tops, DOE must define test vessels that are appropriate for each type of burner. The test vessels specified in Section 5.6.1 of IEC 60350–2:2017 are constructed from a 1-mm thick stainless steel sidewall welded to a 5-mm thick circular stainless steel base, with additional heat-resistant sealant applied.

The EN 30–2–1 test method, which is designed for use in gas cooking tops, specifies test vessels that differ in dimensions, material, and construction from those in IEC 60350–2:2017. Further, Table 1 of EN 30–2–1 defines the test vessel selection based on the nominal heat input rate (specified in kilowatts (''kW'') of each burner under test, as shown in Table III.4). These test vessels are fabricated from a single piece of aluminum, with a wall thickness between 1.5 and 1.8 mm. Because they are not made of a ferromagnetic material (such as stainless steel), the EN 30–2–1 test vessels could not be used for electric-smooth induction cooking tops.

TABLE III.4—TEST VESSEL SELECTION FOR GAS COOKING TOPS IN EN 30–2–1

Nominal heat input range (*kW*)	Test vessel diameter (*mm*)	Notes
between 1.16 and 1.64 inclusive	220	
between 1.65 and 1.98 inclusive	*240	
between 1.99 and 2.36 inclusive	*260	
between 2.37 and 4.2 inclusive	*260	Adjust the heat input rate of the burner to 2.36 kW ±2%.
greater than 4.2	*300	Adjust the heat input rate of the burner to 4.2 kW ±2%.

*If the indicated diameter is greater than the maximum diameter given in the instructions, conduct the test using the next lower diameter and adjust the heat input rate to the highest heat input of the allowable range for that test vessel size, ±2%.

To use a consistent set of test vessels for all types of gas and electric cooking tops, DOE is proposing in proposed new appendix I1 to specify the IEC 60350–2:2017 test vessel to be used for each gas burner,[23] based on heat input rate ranges equivalent to those in Table 1 of EN 30–2–1, although expressed in Btu per hour (''Btu/h''). The test vessel diameters in EN 30–2–1 do not exactly match those of the test vessels in IEC 60350–2:2017, but DOE selected the closest match possible, as shown in Table III.5. DOE also proposes to adjust the lower limit of one of the burner heat input rate ranges corresponding to the EN 260 mm test vessel (1.99–2.36 kW, equivalent to 6,800–8,050 Btu/h) and allocate some of its range to the IEC 240 mm test vessel to provide more evenly balanced ranges and avoid a significant mismatch between the heat input rate and test vessel sizes at the lower end of the heat input range. DOE is not proposing to include the notes included in EN 30–2–1, which require burners with nominal heat input rates greater than 8,050 Btu/h to be tested at heat input rates lower than their maximum rated value, which DOE preliminarily determines would not be representative of consumer use of such burners.

TABLE III.5—TEST VESSEL SELECTION FOR GAS COOKING TOPS IN PROPOSED NEW APPENDIX I1

Nominal gas burner input rate (*btu/h*)		EN 30–2–1 Test vessel diameter (*mm*)	IEC 60350–2:2017 Test vessel diameter (*mm*)	Water load mass (*g*)
Minimum (>)	Maximum (≤)			
	5,600	220	210	2,050
5,600	8,050	240 and 260	240	2,700
8,050	14,300	260	270	3,420
14,300		300	300	4,240

Similar to electric cooking tops, DOE is also proposing in proposed new appendix I1 that if a selected test vessel cannot be centered on the cooking zone due to interference with a structural component of the cooking top, the test vessel with the largest diameter that can be centered on the cooking zone be used.

DOE requests comment on its proposal to require the use of IEC test vessels for gas cooking tops and on its proposed method for selecting the test vessel size to use based on the gas burner's heat input rate.

4. Burner Heat Input Rate Adjustment

DOE recognizes that the 2016 version of appendix I did not include a tolerance on the regulator outlet pressure or specifications for the nominal heat input rate for burners on gas cooking tops. From review of the test results from its initial round robin testing, DOE has tentatively concluded that the lack of such provisions was likely a significant contributor to the greater reproducibility COV values observed for gas cooking tops in relation to those for electric cooking tops. To improve test procedure reproducibility, DOE is proposing in this NOPR to incorporate gas supply pressure and regulator outlet pressure requirements into proposed new appendix I1, as described further in the following discussion.

Other industry procedures for gas cooking tops include specifications for the heat input rate. For example, EN 30–2–1 specifies that prior to testing, each burner is adjusted to within 2 percent of its nominal heat input rate. Section 5.3.5 of the American National Standards Institute (''ANSI'') Standard Z21.1–2016, ''Household cooking gas appliances'' (''ANSI Z21.1'') requires that individual burners be adjusted to their Btu rating at normal inlet test pressure, and that when measured after 5 minutes of operation, the measured heat input rate must be within ±5 percent of the nameplate value.

Based on review of the maximum heat input rates and correlation with the resulting temperature rise in the water loads and energy use measured during the initial heat-up period, DOE has initially determined that the energy use measured using proposed new appendix I1 varies with the nominal heat input rate supplied to each burner on the cooking top. To achieve repeatable and reproducible results, the heat input rate must be specified within appropriate tolerances. To determine the appropriate tolerances, DOE analyzed 37 Energy Test Cycles conducted at multiple heat input rates on nine burners, from three different gas cooking tops.[24] For each burner, the measured energy use over each Energy Test Cycle, divided by the grams of water in the test load, referred to as the normalized per-burner energy use, was calculated in Btu

[23] As described previously, IEC 60350–2:2017 specifies test vessels in the following diameters: 120 mm, 150 mm, 180 mm, 210 mm, 240 mm, 270 mm, 300 mm, and 330 mm.

[24] DOE analyzed three burners with nameplate heat input rates of 18,000 Btu/h, three burners with nameplate heat input rates of 15,000 Btu/h, and three burners with nameplate heat input rates close to 5,000 Btu/h. Each burner was tested at four different set points, and one burner was tested at a fifth set point.

per gram (''Btu/g''). A linear curve fit was applied to the set of normalized per-burner energy use data versus measured heat input rate for each burner, and DOE calculated the value of the normalized per-burner energy use on the curve corresponding to the burner's nominal (*i.e.,* nameplate) heat input rate. For each of the nine burners, DOE then plotted the percent change in normalized per-burner energy use from the calculated value as a function of the percent change in the measured heat input rate from the nominal heat input rate, and again applied a linear curve fit to each data set. These graphs are shown in the Annex to this NOPR, which is available in the docket for this rulemaking.[25] Table III.4 presents the slopes of these nine curves, and based on these slopes, DOE calculated the percentage variation in normalized per-burner energy use for a ±2 percent variation (the EN 30–2–1 specification) and a ±5 percent variation (the ANSI Z21.1 specification) in heat input rate from nominal. Because each burner exhibits a different relationship between heat input rate and normalized per-burner energy use, identifying a single correction factor across all gas cooking tops may not be possible, further justifying the need to establish tolerances around the heat input rate. Among the burners in its test sample, DOE's analysis shows that a ±5-percent tolerance on the heat input rate of a burner resulted in a variation in per-burner energy use of as much as ±4.9 percent, whereas a ±2-percent tolerance on the heat input rate limited the variation in per-burner energy use in its test sample to ±2.0 percent.

TABLE III.6—GAS COOKING TOP INPUT RATE VARIATION INVESTIGATION

Unit No.	Burner location	Nameplate heat input rate (*Btu/h*)	Slope of best-fit line	Calculated variation in energy based on a ±2% variation in heat input rate (%)	Calculated variation in energy based on a ±5% variation in heat input rate (%)
12	FL	18,000	−0.67	±1.3	±3.4
13	FL	18,000	0.81	±1.6	±4.1
14	C	18,000	0.98	±2.0	±4.9
12	BL	15,000	0.51	±1.0	±2.5
13	BL	15,000	0.04	±0.1	±0.2
15	FR	15,000	0.63	±1.3	±3.2
12	BR	5,000	0.56	±1.1	±2.8
14	BR	5,500	0.06	±0.1	±0.3
15	BL	5,000	−0.24	±0.5	±1.2

Based on these results, DOE has tentatively determined that specifying a tolerance of ±5 percent from the nominal heat input rate may not produce repeatable and reproducible test results. Therefore, DOE is proposing to specify in proposed new appendix I1 that the measured heat input rate be within 2 percent of the nominal heat input rate as specified by the manufacturer.

DOE is proposing that the heat input rate be measured and adjusted for each burner of the cooking top before conducting testing on that burner. The measurement would be taken at the maximum heat input rate, with the properly sized test vessel and water load centered above the burner to be measured. If the measured average heat input rate of the burner is within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer, no adjustment of the heat input rate would be made for any testing of that burner.

DOE is proposing that if the measured average heat input rate of the burner is not within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer, the average heat input rate would be adjusted. For gas cooking tops with an adjustable internal pressure regulator, the pressure regulator would be adjusted such that the average heat input rate of the burner under test is within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer. For gas cooking tops with a non-adjustable internal pressure regulator or without an internal pressure regulator, the regulator would be removed or blocked in the open position, and the gas pressure ahead of all controls would be maintained at the nominal manifold pressure specified by the manufacturer. These proposed instructions are in accordance with provisions for burner adjustment in Section 5.3.3 of ANSI Z21.1. The gas supply pressure would then be adjusted such that the average heat input rate of the burner under test is within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer. In either case, the burner would be adjusted such that the air flow is sufficient to prevent a yellow flame or flame with yellow tips. Once the heat input rate has been set for a burner, it would not be adjusted during testing of that burner.

DOE requests comment on its proposal for adjusting the burner heat input rate to the nominal heat input rate as specified by the manufacturer, and to include a 2-percent tolerance on the heat input rate of each burner on a gas cooking top.

5. Target Power Density for Optional Potential Simmering Setting Pre-Selection Test

As discussed in section III.C.3 of this NOPR, Annex H of IEC 60350–2:FDIS provides a target power density for the potential simmering setting pre-selection test for electric cooking tops. In this NOPR, DOE is proposing to specify a separate target power density specific to gas cooking tops, which would be measured in Btu per hour divided by the area of the cookware bottom in square centimeters (''Btu/h·cm^2). To evaluate possible values for this target power density, DOE investigated test data from five gas cooking tops at Laboratory A, as shown in Table III.7, to develop a proposed target power density.

Among the five cooking tops, 22 individual burners were tested three times each, and four individual burners were tested two times each, for a total of 66 test cycles at the minimum-above-threshold power setting (Energy Test

[25] The docket web page can be found at *www.regulations.gov/docket/EERE-2021-BT-TP-0023.*

Cycles) and 66 test cycles at the maximum-below-threshold power setting. In reviewing the estimated corresponding power densities of both sets of energy test cycles, including the individual values and ranges of values for all burners, DOE preliminarily estimates that a target power density of 4.0 Btu/h·cm² would be appropriate. That is, in the majority of cases, the target power density falls between the power densities at the minimum-above-threshold power setting and maximum-below-threshold power setting. In such cases, the optional potential simmering setting pre-selection test would result in no more than two test cycles being conducted to obtain the Energy Test Cycle. DOE could consider specifying a different target power density for the potential simmering setting pre-selection test if additional data were to suggest that a different value would be more representative than the proposed value of 4.0 Btu/h·cm².

TABLE III.7—ESTIMATED POWER DENSITY FROM GAS COOKING TOP TESTS

Unit No.	Burner position	Power density of input setting used for the energy test (*Btu/h·cm²*)			Power density of input setting below the energy test (*Btu/h·cm²*)		
		Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
6	FL	4.3	3.8	5.5	3.2	2.8	3.5
	BL	4.4	4.2	4.4	3.8	2.7	3.2
	BR	6.2	3.9	5.1	3.7	3.0	3.6
	FR	4.5	4.6	4.7	2.7	3.0	3.6
7	FL	6.0	6.4	6.1	4.3	4.5	4.3
	BL	6.2	6.1	6.2	3.1	3.8	4.1
	BR	6.5	6.3	6.0	4.3	5.6	5.9
	FR	6.7	5.8	7.0	4.3	4.3	4.3
8	FL	6.5	6.1	6.3	4.0	4.0	3.9
	BL	6.3	7.1	5.7	4.2	4.0	4.1
	BR	5.4	5.4	5.8	3.2	3.2	3.2
	FR	8.4	7.4	9.2	5.1	4.2	4.1
9	FL	9.3	5.5	5.1	4.9	3.6	3.8
	BL	4.8	6.1	6.3	3.8	3.6	3.6
	BR	7.0	7.7	7.6	3.4	4.1	4.3
	FR	6.4	7.1	7.1	3.7	3.9	4.1
10	FL	5.9	5.9	5.8	2.9	3.0	3.0
	BL	11.6	10.8	11.2	4.7	4.5	4.4
	BC	5.3	4.9	5.4	2.9	2.9	2.9
	FC	7.1	5.8	7.2	4.0	3.8	3.6
	FR	10.7	10.8	5.3	3.9	4.6	2.6
	BR	7.3	7.1	6.1	3.0	2.9	3.0
Range		3.8–11.6			2.6–5.9		

DOE requests comment on its proposed target power density for gas cooking tops of 4.0 Btu/h·cm².

6. Product Temperature Measurement for Gas Cooking Tops

As discussed in section III.C.2.b of this NOPR, DOE is proposing to specify in proposed new appendix I1 that the temperature of the product must be measured at the center of the cooking zone under test prior to any active mode testing. DOE is proposing to specify that this requirement would also apply to gas burner adjustments. DOE is further proposing that for a conventional gas cooking top, the product temperature would be measured inside the burner body of the cooking zone under test, after temporarily removing the burner cap. Prior to the standby mode and off mode power test, the product temperature would be measured as the average of the temperature measured at the center of each cooking zone.

DOE requests comment on its proposal to require the product temperature of a gas cooking top be measured inside the burner body of the cooking zone under test, after temporarily removing the burner cap.

E. Definitions and Clarifications

As part of this NOPR, DOE is proposing to add certain definitions and clarifications to proposed new appendix I1 in addition to those already described.

1. Operating Modes

To clarify provisions relating to the various operating modes, DOE is proposing to add definitions of ''active mode,'' ''off mode,'' ''standby mode,'' ''inactive mode,'' and ''combined low-power mode'' to proposed new appendix I1. These definitions are identical to those that had been established in the 2016 version of appendix I.

DOE is proposing to define active mode as ''a mode in which the product is connected to a mains power source, has been activated, and is performing the main function of producing heat by means of a gas flame, electric resistance heating, or electric inductive heating.''

DOE is proposing to define off mode as ''any mode in which a product is connected to a mains power source and is not providing any active mode or standby 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.''

DOE is proposing to define standby mode as ''any mode in which a product is connected to a mains power source and offers one or more of the following user-oriented or protective functions which may persist for an indefinite time:

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

(2) Provision of continuous functions, including information or status displays (including clocks) or sensor-based functions. A timer is a continuous clock

function (which may or may not be associated with a display) that allows for regularly scheduled tasks and that operates on a continuous basis.''

DOE is proposing to define inactive mode as ''a standby mode that facilitates the activation of active mode by remote switch (including remote control), internal sensor, or timer, or that provides continuous status display.''

DOE is proposing to define combined low-power mode as ''the aggregate of available modes other than active mode, but including the delay start mode portion of active mode.''

DOE requests comment on its proposed definitions of ''active mode,'' ''off mode,'' ''standby mode,'' ''inactive mode,'' and ''combined low-power mode.''

2. Product Configuration and Installation Requirements

For additional clarity, DOE is proposing to add definitions of ''combined cooking product,'' ''freestanding,'' ''built-in,'' and ''drop-in'' to proposed new appendix I1 that were included in the 2016 version of appendix I, and installation instructions for each of these configurations.

DOE is proposing to define combined cooking product as ''a household cooking appliance that combines a cooking product with other appliance functionality, which may or may not include another cooking product. Combined cooking products include the following products: Conventional range, microwave/conventional cooking top, microwave/conventional oven, and microwave/conventional range.''

DOE is proposing that a conventional cooking top or combined cooking product be installed in accordance with the manufacturer's instructions. If the manufacturer's instructions specify that the product may be used in multiple installation conditions, the product would be installed according to the built-in configuration. DOE is proposing to require complete assembly of the product with all handles, knobs, guards, and similar components mounted in place; and that any electric resistance heaters, gas burners, and baffles be positioned in accordance with the manufacturer's instructions. DOE is proposing that if the product can communicate through a network (*e.g.,* Bluetooth® or internet connection), the network function be disabled, if it is possible to disable it by means provided in the manufacturer's user manual, for the duration of testing. If the network function cannot be disabled, or if means for disabling the function are not provided in the manufacturer's user manual, the product would be tested in the factory default setting or in the as-shipped condition. These proposals are consistent with comparable provisions in the supplemental NOPR that DOE published for its microwave oven test procedure on August 3, 2021 (86 FR 41759).

DOE is proposing to define freestanding as applying when ''the product is supported by the floor and is not specified in the manufacturer's instructions as able to be installed such that it is enclosed by surrounding cabinetry, walls, or other similar structures.'' DOE is proposing that a freestanding combined cooking product be installed with the back directly against, or as near as possible to, a vertical wall which extends at least 1 foot above the product and 1 foot beyond both sides of the product, and with no side walls.

DOE is proposing to define built-in as applying when ''the product is enclosed in surrounding cabinetry, walls, or other similar structures on at least three sides, and can be supported by surrounding cabinetry or the floor.'' DOE is proposing to define drop-in as applying when ''the product is supported by horizontal surface cabinetry.'' DOE is proposing that a drop-in or built-in combined cooking product be installed in a test enclosure in accordance with manufacturer's instructions.

DOE is proposing that a conventional cooking top be installed with the back directly against, or as near as possible to, a vertical wall which extends at least 1 foot above the product and 1 foot beyond both sides of the product.

DOE requests comment on its proposed definitions of product configurations and installation requirements.

3. Power Settings

DOE is proposing to clarify power setting selection by adding definitions of ''power setting,'' ''infinite power settings,'' ''multi-ring cooking zone,'' and ''maximum power setting'' in proposed new appendix I1, and by specifying which power settings are considered for each type of cooking zone.

DOE proposes to define power setting as ''a setting on a cooking zone control that offers a gas flame, electric resistance heating, or electric inductive heating.''

DOE proposes to define infinite power settings as ''a cooking zone control without discrete power settings, allowing for selection of any power setting below the maximum power setting.''

DOE proposes to define a multi-ring cooking zone as ''a cooking zone on a conventional cooking top with multiple concentric sizes of electric resistance heating elements or gas burner rings.''

DOE proposes to define maximum power setting as ''the maximum possible power setting if only one cookware item is used on the cooking zone or cooking area of a conventional cooking top, including any optional power boosting features. For conventional electric cooking tops with multi-ring cooking zones or cooking areas, the maximum power setting is the maximum power corresponding to the concentric heating element with the largest diameter, which may correspond to a power setting which may include one or more of the smaller concentric heating elements. For conventional gas cooking tops with multi-ring cooking zones, the maximum power is the maximum heat input rate when the maximum number of rings of the cooking zone are ignited.'' This definition is based on the definition of ''maximum power'' in Section 3.14 of IEC 60350–2:2017 which includes a note specifying that boost function should be considered in determining the maximum power setting.

DOE is also proposing to clarify in proposed new appendix I1 which power settings would be considered in the search for the simmering setting, based on its testing experience. On a multi-ring cooking zone on a conventional gas cooking top, all power settings would be considered, whether they ignite all rings of orifices or not. On a multi-ring cooking zone on a conventional electric cooking top, only power settings corresponding to the concentric heating element with the largest diameter would be considered, which may correspond to operation with one or more of the smaller concentric heating elements energized.

On a cooking zone with infinite power settings where the available range of rotation from maximum to minimum is more than 150 rotational degrees, power settings that are spaced by 10 rotational degrees would be evaluated. On a cooking zone with infinite power settings where the available range of rotation from maximum to minimum is less than or equal to 150 rotational degrees, power settings that are spaced by 5 rotational degrees would be evaluated. Based on its round robin testing and its own testing experience, DOE has tentatively determined that 5 or 10 rotational degrees, as appropriate, would provide sufficient granularity in determining the simmering setting. Given DOE's proposal, outlined in section III.C.5 of this NOPR, to normalize the energy use of the Energy Test Cycle to a value representative of

an energy test with a final water temperature of 90 °C, DOE has tentatively determined that testing more settings would be unduly burdensome.

DOE requests comment on its proposed definitions of ''power setting,'' ''infinite power settings,'' ''multi-ring cooking zone,'' and ''maximum power setting.'' DOE also requests comments on its proposal for the subset of power settings on each type of cooking zone that are considered as part of the identification of the simmering setting.

For cooking tops with rotating knobs for selecting the power setting, DOE is aware that the knob may yield different input power results for the same setting depending on the direction in which the knob is turned to reach that setting, due to hysteresis caused by potential backlash in the knob or valve. To avoid hysteresis and ensure consistent input power results for the same knob setting, DOE is proposing that the selection knob be turned in the direction from higher power to lower power to select the potential simmering setting for the test, and that if the appropriate setting is passed, the test must be repeated after allowing the product to return to ambient conditions. DOE has tentatively determined that this proposal would help obtain consistent input power for a given power setting, particularly on gas cooking tops, and thus improve repeatability and reproducibility of the test procedure.

DOE requests comment on its proposal that for cooking tops with rotating knobs for selecting the power setting, the selection knob always be turned in the direction from higher power to lower power to select the potential simmering setting for an energy test.

4. Specialty Cooking Zone

DOE is proposing to include a definition of a ''specialty cooking zone,'' including the clarification that such a cooking zone would not be tested under proposed new appendix I1. DOE is proposing to define a specialty cooking zone as ''any cooking zone that is designed for use only with non-circular cookware, such as bridge zones, warming plates, grills, and griddles. Specialty cooking zones are not tested under this appendix.''

DOE requests comments on its proposed definition of specialty cooking zone.

5. Target Turndown Temperature

DOE is proposing to include in the proposed new appendix I1 the formula for calculating the target turndown temperature after conducting the overshoot test,[26] because DOE testing experience has shown that referencing the definition of this value in IEC 60350–2:2017 (rather than providing the definition within the DOE test procedure) can lead to inadvertent errors in performing the calculation. The target turndown temperature is calculated as 93 °C minus the difference between the maximum measured temperature during the overshoot test, T_{max}, and the 20-second average temperature at the time the power is turned off during the overshoot test, T_{70}. Two common mistakes in calculating the target turndown temperature include using the target value of 70 °C rather than the measured T_{70} in the formula, and failing to round the target turndown temperature to the nearest degree Celsius. By including the formula for the target turndown temperature in the proposed new appendix I1, DOE aims to reduce the incidence of such errors.

DOE requests comments on its proposal to include the formula for the target turndown temperature in the proposed new appendix I1.

F. Test Conditions and Instrumentation

DOE is proposing to incorporate the test conditions and instrumentation requirements of IEC 60350–2:2017 into the proposed new appendix I1 with the following additions.

[26] The overshoot test is a test conducted before any simmering tests are initiated. The appropriate test vessel and water load are placed on the heating element or burner, which is turned to the maximum power setting. The power or heat input is shut off when the water temperature reaches 70 °C. The maximum water temperature reached after the power/heat input is shut off is used to calculate the nominal turndown temperature.

1. Electrical Supply

Section 5.2 of IEC 60350–2:2017 specifies that the electrical supply is required to be at ''the rated voltage with a relative tolerance of ±1%'' and ''the rated frequency ±1%.'' IEC 60350–2:2017 further specifies that the supply voltage and frequency shall be the nominal voltage and frequency of the country in which the appliance is intended to be used. DOE proposes to specify in the proposed new appendix I1 that the electrical supply for active mode testing be maintained at either 240 volts ±1 percent or 120 volts ±1 percent, according to the manufacturer's instructions, and at 60 Hz ± 1 percent, except for products which do not allow for a mains electrical supply.

DOE requests comment on its proposed electrical supply requirements for active mode testing.

2. Water Load Mass Tolerance

DOE is proposing to specify a tolerance on the water load mass in the proposed new appendix I1. Neither the 2016 version of appendix I nor IEC 60350–2:2017 includes a tolerance on the water load mass. DOE is proposing to specify a tolerance of ± 0.5 grams for each water load mass, to improve the repeatability, and reproducibility of the test procedure.

DOE requests comment on the proposed tolerance of ± 0.5 grams for each water load mass.

3. Test Vessel Flatness

In its petition, AHAM raised concerns about the impact of pan warpage on the repeatability and reproducibility of the test procedure. 83 FR 17944, 17958. For this NOPR, DOE investigated the issue of potential pan warpage over repeated test cycles. DOE conducted repeated testing trials on electric cooking tops, and measured each test vessels' flatness after every five tests. Figure III.2 shows the measured change in flatness (in mm) from the initial reading for the four test vessel sizes that were most frequently used during this testing.

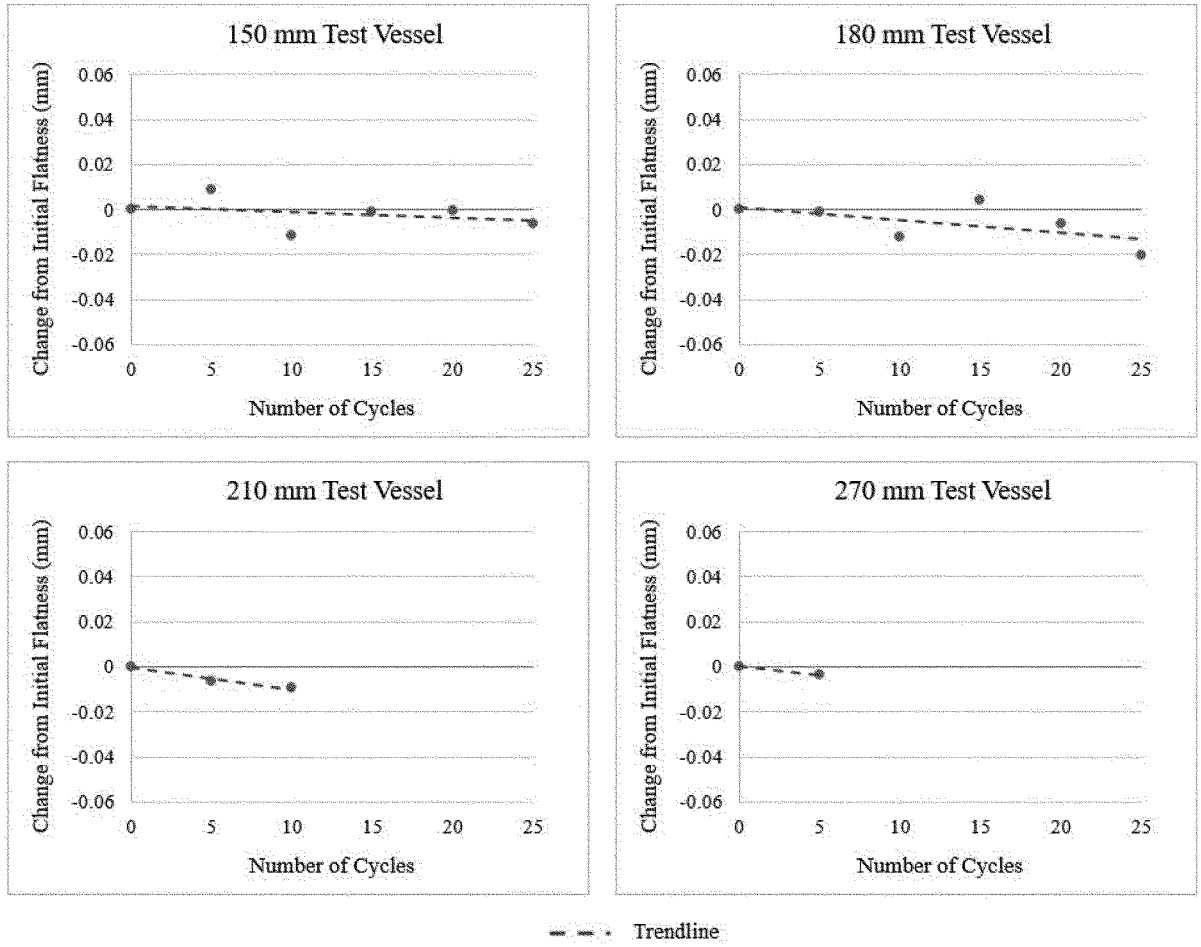

Figure III.2 Measurement of Test Vessel Flatness over Time

Figure III.2 shows there is some variation in the flatness measurement over time for each test vessel, but there is no consistent or substantive trend. Therefore, DOE has tentatively determined that pan warpage is not an issue for the test procedure.

DOE requests comment on its proposed determination that pan warpage does not affect repeatability and reproducibility of the test procedure.

G. Standby Mode and Off Mode Energy Consumption

1. Incorporation by Reference of IEC 62301

EPCA requires DOE to include the standby mode and off mode energy consumption in any energy consumption metric, if technically feasible. In the October 2012 Final Rule, DOE incorporated IEC Standard 62301 Edition 2.0, 2011–01, ''Household electrical appliances—Measurement of standby power'' (''IEC 62301 Second Edition'') for measuring the power in standby mode and off mode of conventional cooking products, including the provisions for the room ambient air temperature from Section 4, Paragraph 4.2 of IEC 62301 Second Edition, electrical supply voltage from Section 4, Paragraph 4.3.2 of IEC 62301 Second Edition, watt-meter from Section 4, Paragraph 4.4 of IEC 62301 Second Edition, portions of the installation and set-up from Section 5, Paragraph 5.2 of IEC 62301 Second Edition, and stabilization requirements from Section 5, Paragraph 5.1, Note 1 of IEC 62301 Second Edition. 77 FR 65942, 65948. DOE also specified that the measurement of standby mode and off mode power be made according to Section 5, Paragraph 5.3.2 of IEC 62301 Second Edition, except for conventional cooking products in which power varies as a function of the clock time displayed in standby mode (see section III.G.2 of this NOPR). This procedure is used by microwave ovens in the current version of appendix I. DOE is proposing to include the same procedure in the proposed new appendix I1 for conventional cooking tops.

DOE requests comment on its proposal to incorporate IEC 62301 Second Edition to provide the method for measuring standby mode and off mode power, except for conventional cooking products in which power varies as a function of the clock time displayed in standby mode.

2. Standby Power Measurement for Cooking Tops With Varying Power as a Function of Clock Time

In the October 2012 Final Rule, DOE determined that the measurement of standby mode and off mode power according to Section 5, Paragraph 5.3.2 of IEC 62301 Second Edition for conventional cooking products in which power varies as a function of the clock time displayed in standby mode would cause manufacturers to incur significant burden that would not be warranted by any potential improved accuracy of the test measurement. 77 FR 65942, 65948. Therefore, DOE implemented the following language in the 2012 version of appendix I: For units in which power varies as a function of displayed time in standby mode, clock time would be set to 3:23 at the end of the stabilization period specified in Section 5, Paragraph

5.3 of IEC Standard 62301 (First Edition, June 2005), ''Household electrical appliances—Measurement of standby power'' (''IEC 62301 First Edition''), and the average power approach described in Section 5, Paragraph 5.3.2(a) of IEC 62301 First Edition would be used, but with a single test period of 10 minutes +0/−2 sec after an additional stabilization period until the clock time reached 3:33. *Id.*

DOE subsequently implemented the same language for microwave ovens in appendix I as part of a final rule published on January 18, 2013. 78 FR 4015, 4020.

In this NOPR, DOE is proposing to incorporate in the proposed new appendix I1 the use of IEC 62301 First Edition for measuring the standby power of cooking tops in which the power consumption of the display varies as a function of the time displayed. DOE is also proposing to update the wording from the 2016 version of appendix I to provide additional direction regarding the two stabilization periods in response to a test laboratory's feedback. The updated language would read, ''For units in which power varies as a function of displayed time in standby mode, set the clock time to 3:23 at the end of an initial stabilization period, as specified in Section 5, Paragraph 5.3 of IEC 62301 First Edition. After an additional 10 minute stabilization period, measure the power use for a single test period of 10 minutes +0/−2 seconds that starts when the clock time first reads 3:33. Use the average power approach described in Section 5, Paragraph 5.3.2(a) of IEC 62301 First Edition.''

DOE requests comment on its proposal to incorporate IEC 62301 First Edition for measuring standby mode and off mode power for conventional cooking tops in which power varies as a function of the clock time displayed in standby mode.

H. Metrics

1. Annual Active Mode Energy Consumption

DOE is proposing to calculate cooking top annual active mode energy consumption as the average normalized per-cycle energy use across all tested cooking zones multiplied by the number of annual cycles. The per-cycle energy use would be normalized in two ways: First, by interpolating to represent a final water temperature of 90 °C, as described in section III.C.5 of this NOPR, and second, by scaling according to the ratio of a representative water load mass to the water mass used in the test.

To determine the representative water load mass for both electric and gas cooking tops, DOE reviewed the surface unit diameters and input rates for cooking tops (including those incorporated into combined cooking products) available on the market at the time of a supplemental NOPR that DOE published prior to the December 2016 Final Rule. 81 FR 57374, 57387 (Aug. 22, 2016). Using the methodology in IEC 60350–2 for selecting test vessel diameters and their corresponding water load masses, DOE determined that the market-weighted average water load mass for both electric and gas cooking top models available on the U.S. market was 2,853 g, and used that value in the December 2016 Final Rule. 81 FR 91418, 91437.

DOE is proposing to use the same representative water load mass for per-cycle energy use normalization of 2,853 g in the proposed new appendix I1.

DOE requests comment on its proposal to use a representative water load mass of 2,853 g in the proposed new appendix I1.

In the December 2016 Final Rule, DOE used data from the 2009 Residential Energy Consumption Survey (''RECS'') and a review of field energy consumption survey data of residential cooking from 2009 and 2010 to estimate 207.5 cycles per year for electric cooking tops and 214.5 cycles per year for gas cooking tops. 81 FR 91418, 91438. For this NOPR, DOE analyzed data available from more recent sources to determine an updated value of annual cooking top cycles.

DOE analyzed the 5,686 household responses from the 2015 RECS to estimate the number of annual cooking top cycles by installation configuration. The 2015 RECS asked respondents, geographically distributed in the United States, to provide the number of uses per week of their standalone cooking top and the cooking top portion of a combined cooking product (which included a cooking top with a conventional oven.) From these weekly frequency-of-use data, DOE calculated weighted-average annual cooking top cycles of 418. This value represents an average of both gas and electric cooking tops, as well as an average of both standalone cooking tops, and of the cooking top component of a combined cooking product. DOE has tentatively determined that a single value for both gas and electric cooking tops is most representative of consumer usage, as DOE is not aware of any reason for consumers of products with different energy sources to use their cooking products differently.

DOE reviewed data provided by AHAM through its task force, which summarized the cooking patterns of 3,508 consumers with connected cooking products, based on information collected via their network functions. Although specific geographical locations were not identified, AHAM indicated the sample of consumers represented a distribution of connected cooking product owners across the United States. This AHAM data set showed an average annual number of cooking top cycles of 365.

DOE also analyzed field-metered data from Pecan Street Inc.'s sample of 246 volunteer homes across four states (California, Texas, New York, and Colorado),[27] obtained over a varying number of years per household between 2012 and 2021, which showed a median of 437 annual cooking top cycles.

DOE is proposing to use the 2015 RECS value of 418 cycles per year for calculating annual active mode energy use. This value corresponds to the median of the three considered values and is based on the largest sample size and broadest distribution by geography and household characteristics.

DOE requests comment on its proposal to use a value of 418 annual cooking top cycles per year.

2. Combined Low-Power Mode Hours

The number of cooking top annual combined low-power mode hours is calculated as the number of hours in a year, 8,760, minus the number of annual active mode hours for the cooking top, which is typically equal to the number of annual cycles multiplied by cycle time. Additional calculations, as discussed below, are necessary for the cooking top component of a combined cooking product.

In a NOPR preceding the October 2012 Final Rule, DOE investigated the hours and energy consumption associated with each possible operating mode for conventional cooking tops, including inactive, Sabbath, off, and active modes. 75 FR 75290, 75310 (Dec. 2, 2010). ''Sabbath mode'' is defined as a mode in which the automatic shutoff is overridden to allow for warming of pre-cooked foods during such periods as the Jewish Sabbath. In its analysis leading up to the October 2012 Final Rule, DOE assigned the hours for which the cooking product is in Sabbath mode as active mode hours, because the energy use of those hours is similar to the energy use of the active mode. 75 FR 75290, 75311. DOE estimated each

[27] Information about Pecan Street Inc.'s data set is available at *www.pecanstreet.org/dataport/about/*.

household's oven spends an equivalent of 8.6 hours in Sabbath mode, based on the number of annual work-free hours and the percentage of U.S. households that observe kosher practices. *Id.* In that rule, DOE scaled the 8.6 hours according to the number of annual cooking cycles, the number of cooking products per household, and an assumption that a cooking top would only be used on the Sabbath a quarter of the time. *Id.*

In 2010, DOE estimated that the total number of cooking top cycles per year was 211 (see section III.H.1 of this NOPR), the average cycle time was 1 hour, and cooking tops spent 2.1 annual hours in Sabbath mode. *Id.* Therefore, in the October 2012 Final Rule, DOE specified that the number of annual active-mode hours was 213.2 and the number of annual combined low-power mode hours was 8,546.9. 77 FR 65942, 65994.

In the December 2016 Final Rule, DOE observed that for combined cooking products, the annual combined low-power mode energy consumption could be measured only for the combined cooking product and not the individual components. 81 FR 91418, 91423. DOE calculated the annual combined low-power mode of the conventional cooking top component of a combined cooking product separately by allocating a portion of the combined low-power mode energy consumption measured for the combined cooking product to the conventional cooking top component using the estimated annual cooking hours for the given components comprising the combined cooking product.

DOE is proposing for this NOPR to update the estimate of the annual combined low-power mode hours for standalone cooking tops and for the cooking top component of combined cooking products, using more recent estimates for the number of annual cooking top cycles and the representative cycle time. As discussed in section III.H.1 of this NOPR, DOE is proposing to use a value of 418 annual cooking top cycles for all cooking tops.

For representative average cooking top cycle time, DOE reviewed data provided by AHAM, which summarized the cooking patterns of 3,508 consumers with connected cooking products, based on information collected via their network functions. Although specific geographical locations were not identified, AHAM indicated the sample of consumers represented a distribution of connected cooking product owners across the United States. This AHAM data set showed an average cooking top cycle time of 18 minutes. DOE is concerned, however, that the usage patterns of consumers with connected cooking products, which are relatively higher-cost premium products, may not be representative of the usage patterns for all U.S. consumers.

DOE also analyzed the field-metered data from Pecan Street Inc.'s sample of 246 volunteer homes,[28] which showed a median cycle time of 31 minutes. The distribution of usage patterns among these homes may be representative of consumer habits in the United States as a whole because the metering was not limited to premium products which tend to be purchased by higher-income households.

DOE is proposing to calculate the number of cooking top annual active mode hours per installation configuration by multiplying the annual cycles estimated from the 2015 RECS by the 31-minute median cycle time, and then adding the appropriate number of Sabbath mode hours.[29] Using additional values, including the number of cooking tops per household, which was determined to be 1.02 using the 2015 RECS; the annual number of conventional oven cycles conducted per year on combined cooking products, which was determined to be 145 using the 2015 RECS; the number of microwave oven cycles per year, which was determined to be 627 using the 2015 RECS; the average cycle time for a conventional oven, which was assumed to be 1 hour; and the average cycle time for a microwave oven, which was assumed to be 6 minutes, the number of annual active mode hours for the overall cooking product could be estimated. By subtracting the resulting annual active mode hours from 8,760 annual hours, DOE proposes to estimate the annual combined low-power mode hours for the overall product by installation configuration. Finally, the percentages of combined lower-power mode hours assigned to the cooking top component were calculated by determining the proportion of overall active mode hours that are associated with the cooking top component of the combined cooking product. The results for DOE's proposed combined low-power mode usage factors and resulting cooking top annual combined low-power mode hours are shown in Table III.8.

TABLE III.8—COMBINED LOW-POWER MODE USAGE FACTORS

Product type	Overall product		Cooking top	
	Active mode hours per year	Combined low-power mode hours per year	Percentage of overall combined low-power mode hours allocated to the cooking top	Combined low-power mode hours per year
Standalone cooking top	216	8,544	100	8,544
Conventional range (cooking top + conventional oven)	368	8,392	60	5,004
Cooking top + microwave oven	279	8,481	77	6,560
Cooking top + conventional oven + microwave oven	431	8,329	51	4,228

DOE requests comment on its proposed usage factors and annual hours for cooking top combined low-power mode, as well as on any of the underlying assumptions.

3. Annual Combined Low-Power Mode Energy

DOE is proposing that the annual energy in combined low-power mode

[28] Information about Pecan Street Inc's data set is available at *www.pecanstreet.org/dataport/about/.*

[29] Given the value of 1.02 cooking tops per household determined using 2015 RECS, and using the same 25-percent assumption of the percent of time a cooking top is left on during the Sabbath (as opposed to a conventional oven), DOE assumed 2.2 hours per year in Sabbath mode for standalone cooking tops and for combined cooking products comprised of a microwave oven and a cooking top; and 8.8 hours per year in Sabbath mode for combined cooking products that include a conventional oven.

for a cooking top be calculated as the power consumption of the overall cooking product in standby and/or off mode (see sections III.G.1 and III.G.2 of this NOPR) multiplied by the number of annual combined low-power mode hours for the cooking top or cooking top component of a combined cooking product (see section III.H.2 of this NOPR). DOE is proposing, as it has done in the test procedures for other appliances which can have either an inactive (standby) mode, an off mode, or both, that the total number of cooking top annual combined low-power mode hours be allocated to each of inactive mode or off mode as illustrated in Table III.9.

TABLE III.9—ALLOCATION OF COOKING TOP COMBINED LOW-POWER MODE HOURS

Types of low-power mode(s) available	Allocation to inactive mode	Allocation to off mode
Both inactive and off mode	0.5	0.5
Inactive mode only	1	0
Off mode only	0	1

DOE requests comment on its proposed allocation of combined low-power mode hours.

4. Integrated Annual Energy Consumption

DOE is proposing to define the integrated annual energy consumption (''IAEC'') for each tested cooking top. For electric cooking tops, IAEC is defined in kilowatt-hours (''kWh'') per year and is equal to the sum of the annual active mode energy and the annual combined low-power mode energy. For gas cooking tops, IAEC is defined in kilo-British thermal units (''kBtu'') per year and is equal to the sum of the annual active mode gas energy consumption, the annual active mode electric energy consumption (converted into kBtu per year), and the annual combined low-power mode energy (converted into kBtu per year).

5. Annual Energy Consumption and Annual Cost

Section 430.23(i) of title 10 of the CFR lists the test procedures for the measurement of energy consumption of cooking products. As there are no current test procedures for conventional cooking tops, 10 CFR 430.23(i) currently contains provisions only for microwave ovens.

DOE is proposing to renumber the existing microwave oven paragraph as 10 CFR 430.23(i)(1) and to add new paragraphs (i)(2) through (i)(6) containing provisions for measuring the electrical energy consumption, gas energy consumption, and annual cost of conventional cooking tops.

New paragraph (i)(2) would provide the means of calculating the integrated annual energy consumption for either a conventional electric cooking top or a conventional gas cooking top, including any conventional cooking top component of a combined cooking product. The result would be rounded to the nearest 1 kWh per year for electric cooking tops, and to the nearest 1 kBtu per year for gas cooking tops.

New paragraph (i)(3) would provide the means of calculating the total annual gas energy consumption of a conventional gas cooking top, including any conventional cooking top component of a combined cooking product. The result would be rounded to the nearest 1 kBtu per year.

New paragraph (4) would provide the means of calculating the total annual electrical energy consumption for either a conventional electric cooking top or a conventional gas cooking top, including any conventional cooking top component of a combined cooking product. The result would be rounded to the nearest 1 kWh per year. The total annual electrical energy consumption of a conventional electric cooking top would equal the integrated annual energy consumption of the conventional electric cooking top, as determined in paragraph (i)(2).

New paragraph (i)(5) would provide the means of calculating the estimated annual operating cost corresponding to the energy consumption of a conventional cooking top, including any conventional cooking top component of a combined cooking product. The result would be rounded to the nearest dollar per year.

New paragraph (i)(6) would allow the definition of other useful measures of energy consumption for conventional cooking tops that the Secretary determines are likely to assist consumers in making purchasing decisions and that are derived from the application of appendix I1.

DOE requests comment on its proposed provisions for measuring annual energy consumption and estimated annual cost.

I. Alternate Proposals

DOE is aware of alternate approaches to the proposed cooking top test procedure that are currently being considered by stakeholders, such as those described in the subsections that follow. While in most cases DOE does not have data by which to evaluate such alternate approaches, DOE would consider the alternates discussed if sufficient data were available to evaluate whether such test procedures are reasonably designed to produce test results which measure energy use of conventional cooking tops during a representative average use cycle or period of use and are not be unduly burdensome to conduct. (*See* 42 U.S.C. 6293(b)(3))

1. Separate Boiling and Simmering Tests

DOE is aware that some manufacturers have indicated a preference for a test procedure that does not include a simmering portion. A test procedure that omits simmering would only capture the energy use associated with boiling and therefore would not be representative of an average energy use cycle, which DOE asserts would include a simmering period. Therefore, DOE has tentatively determined that a cooking top test procedure that does not include both a heat-up period and a simmering period would not produce test results that measure energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle or period of use, as required by EPCA. (42 U.S.C. 6293(b)(3))

However, DOE could consider separating the heat-up and the simmering portions of the test into two shorter test runs, which could each be subject to fewer failure conditions. For instance, DOE could consider a heat-up test that is similar to the overshoot test in IEC 60350–2:2017, but for which the power is turned off at 90 °C instead of 70 °C. If DOE were to consider this approach, the temperature overshoot by the water after the power is turned off could be used to normalize the energy used per degree of water heated. The test procedure could then require a separate test to measure the simmering

energy of a cooking top, for example by starting with already-simmering water at 90 °C and maintaining it at that temperature.

This approach could potentially reduce burden by reducing the overall time required to test each power setting.

DOE requests data on the test burden, repeatability, reproducibility, and representativeness of a test procedure that would separate the boiling and simmering tests.

2. Replacing the Simmering Test With a Simmering Usage Factor

Another approach could be to simplify the test procedure such that it requires only a single test per cooking zone. This test could entail a simple heat-up test at the maximum power setting until the water temperature reaches a threshold temperature, such as 90 °C or the target turndown temperature. A simmering usage factor could then be applied to the measured energy use in order to scale the energy of the heat-up only test to a value that is representative of typical consumer usage including a simmering phase.

An initial analysis of DOE test data suggests that for electric cooking tops, the simmering energy may be a consistent fraction of the heat-up energy for each heating technology type. However, for gas cooking tops, the potential simmering usage factor is more variable by individual cooking top and cooking zone. DOE test data for Laboratory A is presented in Table III.10.

TABLE III.10—SIMMERING ENERGY AS A FRACTION OF HEAT-UP ENERGY

Unit No.	Type	Potential simmering usage factor (average of 3 replications)						Average by cooking top	Average by technology
	Cooking zone No.:	1	2	3	4	5	6		
1	Electric-Coil	1.34	1.39	1.36	1.42			1.38	1.38
2	Electric-Smooth (Radiant)	1.34	1.36	1.32	1.38			1.35	1.35
3	Electric-Smooth (Radiant)	1.34	1.34	1.36	1.34	1.37		1.35	
4	Electric-Smooth (Induction)	1.47	1.45	1.41	1.38			1.43	1.41
5	Electric-Smooth (Induction)	1.40	1.38	1.42	1.38			1.40	
6	Gas	1.41	1.39	1.45	1.38			1.41	1.38
7	Gas	1.27	1.34	1.36	1.27			1.31	
10	Gas	1.33	1.63	1.29	1.37	1.50	1.38	1.41	

If DOE were to adopt a test procedure that uses a simmering usage factor, the usage factor would need to be based on test data and would need to be representative of a tested simmering period on multiple types of products. DOE has tentatively determined, based on the available data, that no such single simmering usage factor by heating technology can be defined, and is not proposing to pursue this approach at this time.

DOE requests data on the representativeness of a simmering usage factor across technology types.

3. Changing the Setting Used To Calculate Simmering Energy

IEC 60350–2:2017 defines the simmering setting according to the temperature characteristics of the water load at that power setting. As an alternative, DOE could consider defining the simmering setting according to the power supplied at each power setting. For instance, DOE could define the simmering setting as the lowest power setting that is at or above 25 percent of maximum power (or maximum heat input rate for gas cooking tops). This alternative approach could result in only a single simmering test being required.

To the extent that consumers choose a simmering power setting based on knob position (or setting number) rather than by directly or indirectly monitoring the temperature variation of the food or water in the cookware, this potential alternative could yield more representative results than the current proposal. DOE previously established a power-level-based test procedure as part of the October 2012 Final Rule. 77 FR 65942.

DOE requests data on the representativeness of a simmering setting based on a percentage of the maximum power setting.

4. Industry Test Procedures

DOE is aware that AHAM is developing test procedures for electric and gas cooking tops as part of its task force efforts. Although AHAM's test procedures have not been finalized at the time of publication of this NOPR, DOE understands the provisions in the draft test procedures as of September 1, 2021 to be substantially the same as those proposed in this NOPR. If AHAM were to finalize its test procedures ahead of the publication of any DOE test procedure final rule for conventional cooking tops, DOE could consider incorporating the AHAM procedure by reference, instead of using the language proposed in this NOPR, if the provisions are substantively the same as those proposed in this NOPR. If the finalized AHAM procedure were to contain significant differences from the procedures proposed in this NOPR, DOE would publish a supplemental proposal before proceeding to a final rule.

J. Representations

1. Sampling Plan

DOE is proposing to maintain the sampling plan requirements for cooking products in 10 CFR 429.23(a), which specify that for each basic model of cooking products a sample of sufficient size shall be randomly selected and tested to ensure that any represented value for which consumers would favor lower values shall be greater than or equal to the higher of the mean of the sample or the upper 97.5 percent confidence limit of the true mean divided by 1.05.

DOE seeks comment on the proposed method for establishing a sampling plan.

2. Convertible Cooking Appliances

DOE defines a convertible cooking appliance as any kitchen range and oven which is a household cooking appliance designed by the manufacturer to be changed in service from use with natural gas to use with LP-gas, and *vice versa,* by incorporating in the appliance convertible orifices for the main gas burners and a convertible gas pressure regulator. 10 CFR 430.2.

In the May 1978 Final Rule, DOE established a requirement for two estimated annual operating costs for convertible cooking appliances: An estimated annual operating cost reflecting testing with natural gas and a cost reflecting testing with propane. 43 FR 20108, 20110. DOE allowed manufacturers to use the amount of

energy consumed during the test with natural gas to determine the estimated annual operating cost of the appliance reflecting testing with propane. DOE provided this allowance based on test data that showed that conventional cooking products tested with propane yielded slightly higher efficiencies than the same products tested with natural gas. *Id.*

In the version of 10 CFR 430.23 finalized in the December 2016 Final Rule, convertible cooking tops were required to be tested using both natural gas and propane, although the version of appendix I finalized in that same rule listed the test gas as natural gas or propane. 81 FR 91418, 91488. DOE does not require testing both natural gas and propane for any other convertible appliances.

In this NOPR, DOE is proposing to specify that all gas cooking tops shall be tested using the default test gas (*i.e.,* the appropriate test gas given the as-shipped configuration of the cooking top) and is proposing to not require any convertible cooking top to be tested using both natural gas and propane.

DOE requests comment on its proposal to test all gas cooking tops using the default test gas, as defined by the as-shipped configuration of the unit.

Therefore, DOE is further proposing to delete the definition of convertible cooking appliance in 10 CFR 430.2, since such distinction would no longer be needed and may cause confusion.

DOE requests comment on its proposal to delete the definition of convertible cooking appliance from 10 CFR 430.2.

K. Reporting

DOE is not proposing to require reporting of cooking top energy use until such time as compliance is required with a performance-based energy conservation standard, should such a standard be established. DOE is proposing to add an introductory note to proposed new appendix I1 to that effect.

L. Test Procedure Costs

In this NOPR, DOE proposes to establish a new test procedure for conventional cooking tops in a new appendix I1. The test procedure proposed in this NOPR would adopt the latest version of the relevant industry standard with modifications to adapt the test method to gas cooking tops (including specifying gas supply tolerances), offer an optional method for burden reduction, normalize the energy use of each test cycle, include measurement of standby mode and off mode energy use, update certain test conditions, and provide certain clarifying language. If manufacturers voluntarily chose to make representations regarding the energy efficiency of conventional cooking tops, manufacturers would be required to test according to the DOE test procedure, if finalized.

DOE has initially determined that this proposal, if finalized, would result in added costs to conventional cooking top manufacturers, if manufacturers choose to make efficiency representations for the conventional cooking tops that they manufacture. Additionally, manufacturers would incur testing costs if DOE were to establish a performance-based energy conservation standard for conventional cooking tops.

To determine this potential cost to manufacturers, DOE first attempted to estimate the number of models that could be covered under these proposed test procedures. DOE used data from DOE's publicly available Compliance Certification Database (''CCD''),[30] California Energy Commission's (''CEC's'') Modernized Appliance Efficiency Database (''MAEDBS''),[31] Natural Resources Canada's publicly searchable database,[32] AHAM's member directory,[33] and individual catalog data from identified conventional cooking top manufacturers to estimate both the number of conventional cooking top manufacturers and the number of models potentially covered by the proposed test procedure. Based DOE's analysis, DOE identified approximately 45 manufacturers selling an estimated 1,606 unique basic models of conventional cooking tops covered by this proposed test procedure.

Based on an initial market assessment, DOE conservatively estimated that the largest seven manufacturers account for at least 75 percent of the conventional cooking tops sold in the United States. DOE assumed that these largest seven companies would test all their conventional cooking top models covered by this proposed test procedure at their in-house test facility (representing 1,205 basic models), while the remaining 25 percent would be tested at a third-party testing facility (representing 401 basic models). DOE assumed that the per-unit test costs differ between conducting testing at in-house test facilities versus testing at third-party test facilities. Table III.11 lists the estimated in-house and third-party test costs potentially incurred by manufacturers.

TABLE III.11—ESTIMATED NUMBER OF CONVENTIONAL COOKING TOP MODELS TESTED AND ASSOCIATED ONE-TIME PER-UNIT TEST COST

Type of test facility	Per-unit test cost	Number of models tested	Units tested per model	Total one-time testing cost
In-House Testing Facility	$729	1,205	2	$1,756,890
Third-Party Testing Facility	3,000	401	2	2,406,000
Total				4,162,890

[30] DOE currently requires manufacturers to certify that all conventional cooking product models using gas are not equipped with a standing pilot light. See *www.regulations.doe.gov/certification-data.* Last accessed on May 24, 2021.

[31] *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx.* Last accessed on May 24, 2021.

[32] *oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.welcome-bienvenue.* Last accessed on May 24, 2021.

[33] *www.aham.org/AHAM/AuxCurrentMembers.* Last accessed on May 24, 2021.

To estimate in-house testing cost, DOE estimated based on its testing experience that testing a single conventional cooking top unit to the proposed test procedure requires approximately 17.5 hours of a technician's time. Based on data from the Bureau of Labor Statistics' (''BLS's'') Occupational Employment and Wage Statistics, the mean hourly wage for mechanical engineering technologists and technicians is $29.27.[34] Additionally, DOE used data from BLS's Employer Costs for Employee Compensation to estimate the percent that wages comprise the total compensation for an employee. DOE estimates that wages make up 70.3 percent of the total compensation for private industry employees.[35] Therefore, DOE estimated that the total hourly compensation (including all fringe benefits) of a technician performing the testing is $41.64.[36] Using these labor rates and time estimates, DOE estimates that it would cost conventional cooking top manufacturers approximately $729 to conduct a single test on a conventional cooking top unit, if this test was conducted at an in-house test facility.

To estimate third-party laboratory costs, DOE received quotes from test laboratories on the price of conducting a similar conventional cooking top test procedure. DOE then averaged these prices to arrive at an estimate of what the manufacturers would have to spend to test their product using a third-party test laboratory. Using these quotes, DOE estimates that it would cost conventional cooking top manufacturers approximately $3,000 to conduct a single test on a conventional cooking top unit, if this test was conducted at a third-party laboratory test facility. Using this assumption, DOE estimates that it would cost conventional cooking top manufacturers approximately $1,458 per basic model, if tested at an in-house test facility and approximately $6,000 per basic model, if tested at a third-party laboratory test facility.

Based on these estimates, DOE estimated that conventional cooking top manufacturers would incur approximately $4.2 million[37] to initially test all conventional cooking top basic models that are currently on the market according to the test procedure proposed in this NOPR.

DOE requests comment on any aspect of the estimated initial testing costs associated with DOE's proposed test procedures.

DOE also estimated that conventional cooking top manufacturers would need to purchase test vessels in accordance with the test procedures proposed in this NOPR. DOE estimated that, on average, the largest seven manufacturers would purchase approximately 20 sets of test vessels each; while 19 manufacturers would purchase approximately two sets of testing vessels each; and the remaining 19 manufacturers would not purchase any testing vessels, as all the models manufactured by these manufacturers would be tested at a third-party testing facility. Based on these assumptions, DOE estimated that the entire conventional cooking top industry would purchase approximately 178 sets of test vessels to be able to conduct this proposed test procedure, if finalized.[38] DOE estimated that each set of test vessels would cost approximately $6,000. Therefore, DOE estimated that all conventional cooking top manufacturers would incur approximately $1.1 million to purchase the equipment necessary to conduct the test procedure proposed in this NOPR.[39]

In addition to these one-time testing costs to initially test all covered conventional cooking top basic models and the testing equipment needed to conduct the proposed test procedure, DOE assumed smaller annual recuring testing costs as conventional cooking top models are either newly introduced into the market or existing models are remodeled. DOE estimated that conventional cooking tops are redesigned approximately once every 3 years on average. Using this redesign cycle time-frame and the test costs and model count estimates previously stated, DOE estimated that conventional cooking top manufacturers would incur approximately $1.4 million every year to test these newly introduced or remodeled conventional cooking top models.[40]

DOE requests comment on any aspect of the estimated recurring testing costs associated with conventional cooking tops.

M. Compliance Date

EPCA prescribes that, if DOE establishes a new test procedure, all representations of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with that new test procedure, beginning 180 days after publication of such a test procedure final rule in the **Federal Register**. (42 U.S.C. 6293(c)(2))

If DOE were to publish a new test procedure for conventional cooking tops, 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.*)

As previously stated, currently no performance-based energy conservation standards are prescribed for conventional cooking tops. Were DOE to finalize the test procedure as proposed, manufacturers would not be required to test according to the DOE test procedure unless manufacturers voluntarily choose to make representations as to the energy efficiency or energy use of a conventional cooking top. Were DOE to establish energy conservation standards for conventional cooking tops, manufacturers would be required to test according to the finalized test procedure at such time as compliance would be required with the established standards.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

The Office of Management and Budget (''OMB'') has determined that this test procedure rulemaking does not constitute ''significant regulatory actions'' under section 3(f) of Executive Order (''E.O.'') 12866, Regulatory Planning and Review, 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive order by the Office of Information and Regulatory Affairs (''OIRA'') in OMB.

[34] DOE used the mean hourly wage of the ''17–3027 Mechanical Engineering Technologists and Technicians'' from the most recent BLS Occupational Employment and Wage Statistics (May 2020) to estimate the hourly wage rate of a technician assumed to perform this testing. *See www.bls.gov/oes/current/oes173027.htm.* Last accessed on May 26, 2021.

[35] DOE used the December 2020 ''Employer Costs for Employee Compensation'' to estimate that for ''Private Industry Workers,'' ''Wages and Salaries'' are 70.3 percent of the total employee compensation. See *www.bls.gov/news.release/archives/ecec_03182021.pdf.* Last accessed on May 26, 2021.

[36] $29.27 ÷ 0.703 = $41.64.

[37] In-House: $1,458 × 1,205 = $1,756,890. Third-Party: $6,000 × 401 = $2,406,000. Total: $1,756,890 + $2,406,000 = $4,162,890 (rounded to $4.2 million).

[38] (7 × 20) + (19 × 2) = 178.

[39] $6,000 × 178 = $1,068,000 (rounded to $1.1 million).

[40] DOE estimated that approximately 401 unique basic models would be tested at an in-house test facility and approximately 134 unique basic models would be tested at a third-party test facility each year. These estimates add up to approximately one-third of the total estimated number of unique basic models currently on the market.

B. Review Under the Regulatory Flexibility Act

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

1. Description of Reasons Why Action Is Being Considered

DOE is proposing to establish test procedures for conventional cooking tops. Establishing test procedures for conventional cooking tops assists DOE in fulfilling its statutory deadline for amending energy conservation standards for cooking products that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Additionally, establishing test procedures for conventional cooking tops, allows manufacturers to produce measurements of energy use that are representative of an average use cycle and uniform for all manufacturers.

2. Objectives of, and Legal Basis for, Rule

DOE has undertaken this rulemaking pursuant to 42 U.S.C. 6292(a)(10), which authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment, including the cooking products that are the subject of this rulemaking.

3. Description and Estimated Number of Small Entities Regulated

For manufacturers of conventional cooking tops, the Small Business Administration (''SBA'') has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. (*See* 13 CFR part 121.) The size standards are listed by North American Industry Classification System (''NAICS'') code and industry description and are available at *www.sba.gov/document/support—table-size-standards.* Manufacturing conventional cooking tops is classified under NAICS 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 reviewed the test procedures proposed in this NOPR under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. DOE used publicly available information to identify potential small businesses that manufacture conventional cooking tops. DOE used data from DOE's publicly available CCD,[41] CEC's MAEDBS,[42] Natural Resources Canada's publicly searchable database,[43] AHAM's member directory,[44] and manufacturers identified in previous DOE rulemakings to identify all potential manufacturers of conventional cooking tops sold in the United States. Once DOE created a list of potential manufacturers, DOE used market research tools (*e.g.,* D&B Hoover) to determine whether they met the SBA's definition of a small entity, based on the total number of employees for each company.

Based DOE's analysis, DOE identified 45 companies potentially selling conventional cooking tops covered by this proposed test procedure in the United States. DOE screened out companies that do not offer products impacted by this proposed rulemaking, do not meet the definition of a ''small business,'' or are foreign-owned and operated. Of these 45 conventional cooking top manufacturers, DOE identified up to 13 small businesses.

4. Description and Estimate of Compliance Requirements Including Differences in Cost, if Any, for Different Groups of Small Entities

As previously stated, DOE identified 13 small businesses potentially selling conventional cooking tops in the United States. Based on a review of publicly available model databases and individual company product catalogues, DOE estimated the number of conventional cooking tops covered by this test procedure proposal for each small business. DOE estimated the number of conventional cooking top models covered by this test procedure proposal for each small business ranges from four unique basic covered models to 93 unique basic covered models, depending on the specific small business. DOE conservatively estimated that all small businesses would have all their conventional cooking top models tested at a third-party testing facility.[45] As discussed in section III.L of this document, DOE estimated it would cost conventional cooking top manufacturers approximately $6,000 per unique basic model to be tested at a third-party test facility. Therefore, DOE estimated that a small business could incur anywhere from $24,000 to $558,000 if all their conventional cooking top models covered by this test procedure proposal were tested at a third-party test facility.[46] These costs represent the minimum and maximum one-time cost that a small business would incur to initially test all unique basic covered models.

Additionally, DOE used D&B Hoover to estimate the annual revenue for each potential small business. DOE used these annual revenue estimates in addition to the number of conventional cooking top models covered by this test procedure proposal to estimate the potential impact of initially testing all unique basic covered models on small businesses. These costs represent the initial one-time cost to test all unique basic covered models. DOE grouped these small businesses together based on the estimated annual revenue. Table IV.1 displays the one-time testing burden on potential small businesses.

[41] DOE currently requires manufacturers to certify that all conventional cooking product models using gas are not equipped with a standing pilot light. *See www.regulations.doe.gov/certification-data.* Last accessed on May 24, 2021.

[42] *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx.* Last accessed on May 24, 2021.

[43] *oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.welcome-bienvenue.* Last accessed on May 24, 2021.

[44] *www.aham.org/AHAM/AuxCurrentMembers.* Last accessed on May 24, 2021.

[45] DOE estimated a higher per-model testing cost when the test was conducted at a third-party testing facility versus if the test was conducted at an in-house testing facility.

[46] 4 models × $6,000 = $24,000. 93 models × $6,000 = $558,000.

TABLE IV.1—ESTIMATED ONE-TIME TESTING BURDEN ON SMALL BUSINESSES, BY ANNUAL REVENUE

Firm size (by annual revenue)	Number of small businesses	Average annual revenue	Average number of models	Average one-time testing cost	Testing cost as a percent of annual revenue
<$2,000,000	3	$1,196,667	5.7	$34,200	2.9
$2 million – $15 million	4	8,825,000	58.5	351,000	4.0
$15 million – $15 million	4	25,250,000	54.0	324,000	1.3
>$50 million	2	158,000,000	10.5	63,000	0.0

In section III.L of this document, DOE estimated that conventional cooking top manufacturers that conducted testing at in-house testing facilities would be required to purchase test vessels in accordance with the test procedures proposed in this NOPR. DOE assumed that all small businesses would conduct testing at a third-party test facility. Therefore, DOE did not estimate small businesses would incur any costs to purchase test vessels.

In addition to these one-time testing costs to initially test all covered conventional cooking top basic models, DOE assumed smaller annual recuring testing costs as conventional cooking top models are either newly introduced into the market or existing models are remodeled. DOE estimated that conventional cooking tops are redesigned approximately once every 3 years on average. Using this redesign cycle time-frame and the annual revenue estimates previously described, DOE estimated the potential impact of the annual recurring testing costs on small businesses. Table IV.2 displays the annual testing burden on potential small businesses.

TABLE IV.2—ESTIMATED ANNUAL TESTING BURDEN ON SMALL BUSINESSES, BY ANNUAL REVENUE

Firm size (by annual revenue)	Number of small businesses	Average annual revenue	Average number of models introduced annually	Average annual testing cost	Testing cost as a percent of annual revenue
<$2,000,000	3	$1,196,667	1.9	$11,400	1.0
$2 million – $15 million	4	8,825,000	19.5	117,000	1.3
$15 million – $50 million	4	25,250,000	18.0	108,000	0.4
>$50 million	2	158,000,000	3.5	21,000	0.0

5. Duplication, Overlap, and Conflict with Other Rules and Regulations

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the rule being considered today.

6. Significant Alternatives to the Rule

The discussion in the previous section analyzes impacts on small businesses that would result from DOE's proposed test procedure, if finalized. In reviewing alternatives to the proposed test procedure, DOE examined not establishing a performance-based test procedure for conventional cooking tops or establishing prescriptive-based test procedures for conventional cooking tops. While not establishing performance-based test procedures or establishing prescriptive-based test procedures for conventional cooking tops would reduce the burden on small businesses, DOE must use test procedures to determine whether the products comply with relevant standards promulgated under EPCA. (42 U.S.C. 6295(s)) Since establishing performance-based test procedures for conventional cooking tops is necessary prior to establishing performance-based energy conservation standards for conventional cooking tops, and DOE is required under EPCA to evaluate energy conservation standards for conventional cooking products, including cooking tops, DOE tentatively concludes that establishing performance-based test procedures, as proposed in this NOPR, supports DOE's authority to achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A))

DOE notes there currently are no energy conservation standards prescribed for conventional cooking tops. Therefore, manufacturers would not be required to conduct the proposed test procedure, if made final, until such time as compliance is required with energy conservation standards, should DOE establish such standards, unless manufacturers voluntarily chose to make representations as to the energy use or energy efficiency of a conventional cooking top.

Additional compliance flexibilities may be available through other means. EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8 million may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. (42 U.S.C. 6295(t)) Additionally, manufacturers subject to DOE's energy efficiency standards may apply to DOE's Office of Hearings and Appeals for exception relief under certain circumstances. Manufacturers should refer to 10 CFR part 430, subpart E, and 10 CFR part 1003 for additional details.

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of covered products 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. (*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.

There is currently no performance-based energy conservation standard for conventional cooking tops. As such, if finalized, the test procedure as proposed would not establish a reporting requirement.

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

D. Review Under the National Environmental Policy Act of 1969

In this proposed rule, DOE proposes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for conventional cooking tops. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment is consistent with activities identified in 10 CFR part 1021, Appendix A to Subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (Aug. 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 has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)). The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *www.energy.gov/gc/office-general-counsel.* DOE examined this proposed rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

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

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

I. Review Under Executive Order 12630

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

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 *note*) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

The proposed regulatory action to establish a test procedure for measuring the energy use of conventional cooking tops is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

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

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

The proposed test procedure for conventional cooking tops would incorporate testing methods contained in certain sections of the following commercial standards: IEC 60350–2:2017, IEC 62301 First Edition, and IEC 62301 Second Edition. DOE has evaluated these standards and is unable to conclude whether it fully complies with the requirements of section 32(b) of the FEAA (*i.e.,* whether it was developed in a manner that fully provides for public participation, comment, and review.) DOE will consult with both the Attorney General and the Chairman of the FTC concerning the impact of these test procedures on competition, prior to prescribing a final rule.

M. Description of Materials Incorporated by Reference

In this NOPR, DOE proposes to incorporate by reference sections of the test standard published by IEC, titled ''Household electric cooking appliances Part 2: Hobs—Methods for measuring performance,'' IEC 60350–2:2017. IEC 60350–2:2017 is an industry-accepted test procedure that measures conventional electric cooking top energy use, using a water heating approach. The test procedure proposed in this NOPR references various sections of IEC 60350–2:2017 that address test setup, instrumentation, test conduct, and calculations.

In this NOPR, DOE proposes to incorporate by reference sections of the test standard published by IEC, titled ''Household electrical appliances—Measurement of standby power,'' IEC 62301, both the First Edition from June 2005 and the Second Edition from January 2011. IEC 62301 is an industry-accepted test procedure that measures standby power in household appliances. The test procedure proposed in this NOPR references various sections of IEC 62301 that address test setup, instrumentation, and test conduct.

IEC 60350–2:2017, and both editions of IEC 62301 are readily available from the American National Standards Institute, 25 W 43rd Street, 4th Floor, New York, NY 10036, (212) 642–4900, or by going to *webstore.ansi.org.*

V. Public Participation

A. Participation in the Webinar

The time and date of the webinar are listed in the **DATES** section at the beginning of this document. If no participants register for the webinar, it will be cancelled. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *www.regulations.gov/docket/EERE-2021-BT-TP-0023.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule no later than the date provided in the **DATES** section at the beginning of this proposed rule.[47] Interested parties

[47] DOE has historically provided a 75-day comment period for test procedure NOPRs pursuant to the North American Free Trade Agreement, U.S.-Canada-Mexico (''NAFTA''), Dec. 17, 1992, 32 I.L.M. 289 (1993); the North American Free Trade Agreement Implementation Act, Public Law 103–182, 107 Stat. 2057 (1993) (codified as amended at 10 U.S.C.A. 2576) (1993) (''NAFTA Implementation Act''); and Executive Order 12889, ''Implementation of the North American Free Trade Agreement,'' 58 FR 69681 (Dec. 30, 1993). However, on July 1, 2020, the Agreement between the United States of America, the United Mexican States, and the United Canadian States (''USMCA''), Nov. 30, 2018, 134 Stat. 11 (*i.e.,* the successor to NAFTA), went into effect, and Congress's action in replacing NAFTA through the USMCA Implementation Act, 19 U.S.C. 4501 *et seq.* (2020), implies the repeal of E.O. 12889 and its 75-day comment period requirement for technical regulations. Thus, the controlling laws are EPCA and the USMCA Implementation Act. Consistent with EPCA's public comment period requirements for consumer products, the USMCA only requires a minimum comment period of 60

Continued

may submit comments using any of the methods described in the **ADDRESSES** section at the beginning of this document.

Submitting comments via www.regulations.gov. The *www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

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

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

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

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

Include contact information each time you submit comments, data, documents, and other information to DOE. No faxes will be accepted.

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

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

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: One copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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

C. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

(1) DOE requests comment on its proposal to require that the instantaneous, rather than the smoothened, water temperature at which the power setting is reduced during the energy test be within +1 °C/ − 0.5 °C of the target turndown temperature.

(2) DOE requests comment on its proposal to include the requirement to evaluate the start of the simmering period as the time that the 40-second ''smoothened'' average water temperature first meets or exceeds 90 °C.

(3) DOE requests comment on its proposed definition of smoothened water temperature as well as its proposal to require the smoothened water temperature be rounded to the nearest 0.1 °C.

(4) DOE requests comment on its proposal to allow the use of distilled water for testing in the proposed new appendix I1.

(5) DOE requests comment on its proposal to include the cooking top preparation requirements for water vaporization from IEC 60350–2:2017 in its proposed new appendix I1.

(6) DOE requests comment on its proposal to exclude the provisions from Section 7.3 of IEC 60350–2:2017 and instead require that each cooking zone be tested with the test vessel that most closely matches the outer diameter of the marking for electric cooking tops with limitative markings; and that Table A.1 of Annex A of IEC 60350–2:2017 be used to define the test vessels for electric cooking tops without limitative markings. DOE also requests comment on its proposal to substitute the largest test vessel that can be centered on the cooking zone in the case where a structural component of the cooking top interferes with the test vessel.

(7) DOE requests comment on its proposal to specify an ambient room temperature of 25 ±5 °C.

(8) DOE requests comments on its proposal to require that the product temperature be stable, its proposed definition of a stable temperature, and its proposed methods for measuring the product temperature for active mode testing as well as standby mode and off mode power testing.

(9) DOE requests comment on its proposal to specify an initial water temperature of 25 ±0.5 °C.

(10) DOE requests comment on its proposal to include the potential simmering setting pre-selection test specified in Annex H of IEC 60350–2:FDIS as an optional test in proposed new appendix I1. DOE also requests comment on its proposal to allow that if the tester has prior knowledge of the unit's operation and has previously determined through a different method which power setting is the potential simmering setting, the tester may use that setting as the initial power setting for the test cycles.

(11) DOE requests comment on its proposed definitions of the minimum-above-threshold power setting and the maximum-below-threshold power setting, and on its proposed methodology for determining the simmering setting.

(12) DOE requests comment on its proposal to normalize the energy use of the tested cycle if the smoothened water temperature exceeds 91 °C during the simmering period, to represent an Energy Test Cycle with a final water of 90 °C. DOE specifically requests comment on its proposal to use the smoothened final water temperature to perform this normalization and on whether a

days. Consequently, DOE now provides a 60-day public comment period for test procedure NOPRs.

different normalization method would be more appropriate. DOE also requests comment on its proposal to not require the normalization when the smoothened water temperature remains between 90 °C and 91 °C during the simmering period, when the minimum-above-threshold power setting is the lowest available power setting on the heating element under test, or when the smoothened water temperature during the maximum-below-threshold power setting does not meet or exceed 90 °C during a 20-minute period following the time the power setting is reduced.

(13) DOE requests comment on its proposed test conditions for gas cooking tops, and its proposed definition of a standard cubic foot of gas.

(14) DOE requests comment on its proposed instrumentation specifications for gas cooking tops, and any cost burden for manufacturers who may not already have the required instrumentation.

(15) DOE requests comment on its proposal to require the use of IEC test vessels for gas cooking tops and on its proposed method for selecting the test vessel size to use based on the gas burner's heat input rate.

(16) DOE requests comment on its proposal for adjusting the burner heat input rate to the nominal heat input rate as specified by the manufacturer, and to include a 2-percent tolerance on the heat input rate of each burner on a gas cooking top.

(17) DOE requests comment on its proposed target power density for gas cooking tops of 4.0 Btu/h·cm2.

(18) DOE requests comment on its proposal to require the product temperature of a gas cooking top be measured inside the burner body of the cooking zone under test, after temporarily removing the burner cap.

(19) DOE requests comment on its proposed definitions of ''active mode,'' ''off mode,'' ''standby mode,'' ''inactive mode,'' and ''combined low-power mode.''

(20) DOE requests comment on its proposed definitions of product configurations and installation requirements.

(21) DOE requests comment on its proposed definitions of ''power setting,'' ''infinite power settings,'' ''multi-ring cooking zone,'' and ''maximum power setting.'' DOE also requests comments on its proposal for the subset of power settings on each type of cooking zone that are considered as part of the identification of the simmering setting.

(22) DOE requests comment on its proposal that for cooking tops with rotating knobs for selecting the power setting, the selection knob always be turned in the direction from higher power to lower power to select the potential simmering setting for an energy test.

(23) DOE requests comments on its proposed definition of specialty cooking zone.

(24) DOE requests comments on its proposal to include the formula for the target turndown temperature in the proposed new appendix I1.

(25) DOE requests comment on its proposed electrical supply requirements for active mode testing.

(26) DOE requests comment on the proposed tolerance of ±0.5 grams for each water load mass.

(27) DOE requests comment on its proposed determination that pan warpage does not affect repeatability and reproducibility of the test procedure.

(28) DOE requests comment on its proposal to incorporate IEC 62301 Second Edition to provide the method for measuring standby mode and off mode power, except for conventional cooking products in which power varies as a function of the clock time displayed in standby mode.

(29) DOE requests comment on its proposal to incorporate IEC 62301 First Edition for measuring standby mode and off mode power for conventional cooking tops in which power varies as a function of the clock time displayed in standby mode.

(30) DOE requests comment on its proposal to use a representative water load mass of 2,853 g in the proposed new appendix I1.

(31) DOE requests comment on its proposal to use a value of 418 annual cooking top cycles per year.

(32) DOE requests comment on its proposed usage factors and annual hours for cooking top combined low-power mode, as well as on any of the underlying assumptions.

(33) DOE requests comment on its proposed allocation of combined low-power mode hours.

(34) DOE requests comment on its proposed provisions for measuring annual energy consumption and estimated annual cost.

(35) DOE requests data on the test burden, repeatability, reproducibility, and representativeness of a test procedure that would separate the boiling and simmering tests.

(36) DOE requests data on the representativeness of a simmering usage factor across technology types.

(37) DOE requests data on the representativeness of a simmering setting based on a percentage of the maximum power setting.

(38) DOE seeks comment on the proposed method for establishing a sampling plan.

(39) DOE requests comment on its proposal to test all gas cooking tops using the default test gas, as defined by the as-shipped configuration of the unit.

(40) DOE requests comment on its proposal to delete the definition of convertible cooking appliance from 10 CFR 430.2.

(41) DOE requests comment on any aspect of the estimated initial testing costs associated with DOE's proposed test procedures.

(42) DOE requests comment on any aspect of the estimated recurring testing costs associated with conventional cooking tops.

VI. Approval of the Office of the Secretary

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

List of Subjects in 10 CFR Part 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 October 21, 2021, by Kelly Speakes-Backman, Principal Deputy Assistant Secretary and Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on October 21, 2021.

Treena V. Garrett,

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

For the reasons stated in the preamble, DOE is proposing to amend part 430 of Chapter II of Title 10, Code of Federal Regulations as set forth below:

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

§ 430.2 [Amended]

■ 2. Section 430.2 is amended by removing the definition of ''Convertible cooking appliance.''

■ 3. Section 430.3 is amended by:

■ a. Redesignating paragraphs (o)(3) through (9) as paragraphs (o)(4) through (10);

■ b. Adding a new paragraph (o)(3); and

■ c. Revising newly redesignated paragraphs (o)(6) and (7).

The addition and revisions read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

(o) * * *

(3) IEC Standard 60350–2:2017, (''IEC 60350–2''), *Household electric cooking appliances Part 2: Hobs—Methods for*

measuring performance, (August 2017), IBR approved for appendix I1 to subpart B.

* * * * *

(6) International Electrotechnical Commission (IEC) Standard 62301 (''IEC 62301''), *Household electrical appliances—Measurement of standby power* (first edition, June 2005), IBR approved for appendices F, I, and I1 to subpart B.

(7) IEC 62301 (''IEC 62301''), *Household electrical appliances—Measurement of standby power,* (Edition 2.0, 2011–01), IBR approved for appendices C1, D1, D2, G, H, I, I1, J2, N, O, P, Q, X, X1, Y, Z, BB, and CC to subpart B.

* * * * *

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

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

* * * * *

(i) *Cooking products.* (1) Determine the standby power for microwave ovens, excluding any microwave oven component of a combined cooking product, according to section 3.2.3 of appendix I to this subpart. Round standby power to the nearest 0.1 watt.

(2)(i) The integrated annual energy consumption of a conventional electric cooking top, including any conventional cooking top component of a combined cooking product, is determined according to section 4.3.1 of appendix I1 to this subpart. Round the result to the nearest 1 kilowatt-hours (kWh) per year.

(ii) The integrated annual energy consumption of a conventional gas cooking top, including any conventional cooking top component of a combined cooking product, is determined according to section 4.3.2 of appendix I1 to this subpart. Round the result to the nearest 1 kilo-British thermal units (kBtu) per year.

(3) The total annual gas energy consumption of a conventional gas cooking top, including any conventional cooking top component of a combined cooking product, is determined according to section 4.1.2.2.1 of appendix I1 to this subpart. Round the result to the nearest 1 kBtu per year.

(4)(i) The total annual electrical energy consumption of a conventional electric cooking top, including any conventional cooking top component of a combined cooking product, is equal to the integrated annual energy consumption of the conventional electric cooking top, as determined in paragraph (i)(2)(i) of this section.

(ii) The total annual electrical energy consumption of a conventional gas cooking top, including any conventional cooking top component of a combined cooking product, is determined as the sum of the conventional gas cooking top annual active mode electrical energy consumption (E_{AGE}) as defined in section 4.1.2.2.2 of appendix I1 to this subpart, and the combined low-power mode energy consumption (E_{TLP}) as defined in section 4.1 of appendix I1 to this subpart. Round the result to the nearest 1 kWh per year.

(5) The estimated annual operating cost corresponding to the energy consumption of a conventional cooking top, including any conventional cooking top component of a combined cooking product, shall be the sum of the following products, rounded to the nearest dollar per year:

(i) The total annual electrical energy consumption for any electric energy usage, in kilowatt-hours (kWh) per year, as determined in accordance with paragraph (i)(4) of this section, times the representative average unit cost for electricity, in dollars per kWh, as provided pursuant to section 323(b)(2) of the Act; plus

(ii) The total annual gas energy consumption, in kBtu per year, as determined in accordance with paragraph (i)(3) of this section, times:

(A) For conventional gas cooking tops that operate with natural gas, the representative average unit cost for natural gas, in dollars per kBtu, as provided pursuant to section 323(b)(2) of the Act; or

(B) For conventional gas cooking tops that operate with LP-gas, the representative average unit cost for propane, in dollars per kBtu, as provided pursuant to section 323(b)(2) of the Act.

(6) Other useful measures of energy consumption for conventional cooking tops shall be the measures of energy consumption that the Secretary determines are likely to assist consumers in making purchasing decisions and that are derived from the application of appendix I1 to this subpart.

* * * * *

■ 5. Appendix I to Subpart B of Part 430 is amended by revising the heading to read as follows:

Appendix I to Subpart B of Part 430

Uniform Test Method for Measuring the Energy Consumption of Microwave Ovens

* * * * *

■ 6. Appendix I1 to subpart B of part 430 is added to read as follows:

Appendix I1 to Subpart B of Part 430

Uniform Test Method for Measuring the Energy Consumption of Conventional Cooking Products

Note: Any representation related to energy consumption of conventional cooking tops, including the conventional cooking top component of combined cooking products, made after [180 days after publication of the final rule in the **Federal Register**] must be based upon results generated under this test procedure. Upon the compliance date(s) of any energy conservation standard(s) for conventional cooking tops, including the conventional cooking top component of combined cooking products, use of the applicable provisions of this test procedure to demonstrate compliance with the energy conservation standard is required.

0. Incorporation by Reference

DOE incorporated by reference in § 430.3, the entire test standard for IEC 60350–2 (2017) ''Household electric cooking appliances—Part 2: Hobs—Methods for measuring performance;'' IEC 62301 ''Household electrical appliances—Measurement of standby power'' (first edition June 2005); and IEC 62301 ''Household electrical appliances—Measurement of standby power'' (Second Edition). However, only enumerated provisions of those documents are applicable to appendix I1, as follows. In cases in which there is a conflict, the language of the test procedure in this appendix takes precedence over the referenced test standards.

(1) IEC 60350–2 (2017)

(i) Section 5.1 as referenced in section 2.4.1 of this appendix;

(ii) Section 5.3 as referenced in sections 2.7.1.1, 2.7.3.1, 2.7.3.3, 2.7.3.4, 2.7.4, and 2.7.5 of this appendix;

(iii) Section 5.5 as referenced in section 2.5.1 of this appendix;

(iv) Section 5.6.1 as referenced in section 2.6.1 of this appendix;

(v) Section 5.6.1.5 as referenced in section 3.1.1.2 of this appendix;

(vi) Section 6.3 as referenced in section 3.1.1.1.1 of this appendix;

(vii) Section 6.3.1 as referenced in section 3.1.1.1.1 of this appendix;

(viii) Section 7.5.1 as referenced in section 2.6.2 of this appendix;

(ix) Section 7.5.2 as referenced in section 3.1.4.4 of this appendix;

(x) Section 7.5.2.1 as referenced in section 3.1.4.2 of this appendix;

(xi) Section 7.5.2.2 as referenced in section 3.1.4.4 of this appendix;

(xii) Section 7.5.4.1 as referenced in sections 1 and 3.1.4.5 of this appendix;

(xiii) Annex A as referenced in section 3.1.1.2 of this appendix;

(xiv) Annex B as referenced in sections 2.6.1 and 2.8.3 of this appendix; and

(xv) Annex C as referenced in section 3.1.4.1 of this appendix.

(2) IEC 62301 (First Edition)

(i) Paragraph 5.3 as referenced in section 3.2 of this appendix; and

(ii) Paragraph 5.3.2 as referenced in section 3.2 of this appendix.

(3) IEC 62301 (Second Edition)

(i) Paragraph 4.2 as referenced in section 2.4.2 of this appendix;

(ii) Paragraph 4.3.2 as referenced in section 2.2.1.1.2 of this appendix;

(iii) Paragraph 4.4 as referenced in section 2.7.1.2 of this appendix;

(iv) Paragraph 5.1 as referenced in section 3.2 of this appendix; and

(v) Paragraph 5.3.2 as referenced in section 3.2 of this appendix.

1. Definitions

The following definitions apply to the test procedures in this appendix, including the test procedures incorporated by reference:

Active mode means a mode in which the product is connected to a mains power source, has been activated, and is performing the main function of producing heat by means of a gas flame, electric resistance heating, or electric inductive heating.

Built-in means the product is enclosed in surrounding cabinetry, walls, or other similar structures on at least three sides, and can be supported by surrounding cabinetry or the floor.

Combined cooking product means a household cooking appliance that combines a cooking product with other appliance functionality, which may or may not include another cooking product. Combined cooking products include the following products: Conventional range, microwave/conventional cooking top, microwave/conventional oven, and microwave/conventional range.

Combined low-power mode means the aggregate of available modes other than active mode, but including the delay start mode portion of active mode.

Cooking area means an area on a conventional cooking top surface heated by an inducted magnetic field where cookware is placed for heating, where more than one cookware item can be used simultaneously and controlled separately from other cookware placed on the cooking area, and that is either—

(1) An area where no clear limitative markings for cookware are visible on the surface of the cooking top; or

(2) An area with limitative markings.

Cooking top control means a part of the conventional cooking top used to adjust the power and the temperature of the cooking zone or cooking area for one cookware item.

Cooking zone means a part of a conventional cooking top surface that is either a single electric resistance heating element, multiple concentric sizes of electric resistance heating elements, an inductive heating element, or a gas surface unit that is defined by limitative markings on the surface of the cooking top and can be controlled independently of any other cooking area or cooking zone.

Cycle finished mode means a standby mode in which a conventional cooking top provides continuous status display following operation in active mode.

Drop-in means the product is supported by horizontal surface cabinetry.

Freestanding means the product is supported by the floor and is not specified in the manufacturer's instructions as able to be installed such that it is enclosed by surrounding cabinetry, walls, or other similar structures.

IEC 60350–2:2017 means the test standard published by the International Electrotechnical Commission, titled ''Household electric cooking appliances—Part 2: Hobs—Methods for measuring performance,'' Publication 60350–2 (2017).

IEC 62301 (First Edition) means the test standard published by the International Electrotechnical Commission, titled ''Household electrical appliances—Measurement of standby power,'' Publication 62301 (First Edition 2005–06).

IEC 62301 (Second Edition) means the test standard published by the International Electrotechnical Commission, titled ''Household electrical appliances—Measurement of standby power,'' Publication 62301 (Edition 2.0 2011–01).

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.

Infinite power settings means a cooking zone control without discrete power settings, allowing for selection of any power setting below the maximum power setting.

Maximum-below-threshold power setting means the power setting on a conventional cooking top that is the highest power setting that results in smoothened water temperature data that does not meet the evaluation criteria specified in Section 7.5.4.1 of IEC 60350–2:2017.

Maximum power setting means the maximum possible power setting if only one cookware item is used on the cooking zone or cooking area of a conventional cooking top, including any optional power boosting features. For conventional electric cooking tops with multi-ring cooking zones or cooking areas, the maximum power setting is the maximum power corresponding to the concentric heating element with the largest diameter, which may correspond to a power setting which may include one or more of the smaller concentric heating elements. For conventional gas cooking tops with multi-ring cooking zones, the maximum power setting is the maximum heat input rate when the maximum number of rings of the cooking zone are ignited.

Minimum-above-threshold power setting means the power setting on a conventional cooking top that is the lowest power setting that results in smoothened water temperature data that meet the evaluation criteria specified in Section 7.5.4.1 of IEC 60350–2:2017. This power setting is also referred to as the simmering setting.

Multi-ring cooking zone means a cooking zone on a conventional cooking top with multiple concentric sizes of electric resistance heating elements or gas burner rings.

Off mode means any mode in which a product is connected to a mains power source and is not providing any active mode or standby 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.

Power setting means a setting on a cooking zone control that offers a gas flame, electric resistance heating, or electric inductive heating.

Smoothened water temperature means the 40-second moving-average temperature as calculated in Section 7.5.4.1 of IEC 60350–2:2017, rounded to the nearest 0.1 degree Celsius.

Specialty cooking zone means any cooking zone that is designed for use only with non-circular cookware, such as bridge zones, warming plates, grills, and griddles. Specialty cooking zones are not tested under this appendix.

Stable temperature means a temperature that does not vary by more than 1 °C over a 5-minute period.

Standard cubic foot of gas means the quantity of gas that occupies 1 cubic foot when saturated with water vapor at a temperature of 60 °F and a pressure of 14.73 pounds per square inch (30 inches of mercury or 101.6 kPa).

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

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

(2) Provision of continuous functions, including information or status displays (including clocks) or sensor-based functions. A timer is a continuous clock function (which may or may not be associated with a display) that allows for regularly scheduled tasks and that operates on a continuous basis.

Thermocouple means a device consisting of two dissimilar metals which are joined together and, with their associated wires, are used to measure temperature by means of electromotive force.

2. Test Conditions and Instrumentation

2.1 *Installation.* Install the conventional cooking top or combined cooking product in accordance with the manufacturer's instructions. If the manufacturer's instructions specify that the product may be used in multiple installation conditions, install the product according to the built-in configuration. Completely assemble the product with all handles, knobs, guards, and similar components mounted in place. Position any electric resistance heaters, gas burners, and baffles in accordance with the manufacturer's instructions. If the product can communicate through a network (*e.g.,* Bluetooth® or internet connection), disable the network function, if it is possible to disable it by means provided in the manufacturer's user manual, for the duration of testing. If the network function cannot be disabled, or if means for disabling the function are not provided in the manufacturer's user manual, the product shall be tested in the factory default setting or in the as-shipped condition.

2.1.1 *Freestanding combined cooking product.* Install a freestanding combined cooking product with the back directly against, or as near as possible to, a vertical wall which extends at least 1 foot above the product and 1 foot beyond both sides of the product, and with no side walls.

2.1.2 *Drop-in or built-in combined cooking product.* Install a drop-in or built-in

combined cooking product in a test enclosure in accordance with manufacturer's instructions.

2.1.3 *Conventional cooking top.* Install a conventional cooking top with the back directly against, or as near as possible to, a vertical wall which extends at least 1 foot above the product and 1 foot beyond both sides of the product.

2.2 *Energy supply.*

2.2.1 *Electrical supply.*

2.2.1.1 *Supply voltage.*

2.2.1.1.1 *Active mode supply voltage.* During active mode testing, maintain the electrical supply to the product at either 240 volts ±1 percent or 120 volts ±1 percent, according to the manufacturer's instructions, except for products which do not allow for a mains electrical supply.

2.2.1.1.2 *Standby mode and off mode supply voltage.* During standby mode and off mode testing, maintain the electrical supply to the product at either 240 volts ±1 percent, or 120 volts ±1 percent, according to the manufacturer's instructions. Maintain the electrical supply voltage waveform specified in Section 4, Paragraph 4.3.2 of IEC 62301 (Second Edition), disregarding the provisions regarding batteries and the determination, classification, and testing of relevant modes. If the power measuring instrument used for testing is unable to measure and record the total harmonic content during the test measurement period, total harmonic content may be measured and recorded immediately before and after the test measurement period.

2.2.1.2 *Supply frequency.* Maintain the electrical supply frequency for all tests at 60 hertz ±1 percent.

2.2.2 *Gas supply.*

2.2.2.1 *Natural gas.* Maintain the natural gas pressure immediately ahead of all controls of the unit under test at 7 to 10 inches of water column, except as specified in section 3.1.3 of this appendix. The natural gas supplied should have a higher heating value (dry-basis) of approximately 1,025 Btu per standard cubic foot. Obtain the higher heating value on a dry basis of gas, H_n, in Btu per standard cubic foot, for the natural gas to be used in the test either from measurements made by the manufacturer conducting the test using equipment that meets the requirements described in section 2.7.2.2 of this appendix or by the use of bottled natural gas whose gross heating value is certified to be at least as accurate a value that meets the requirements in section 2.7.2.2 of this appendix.

2.2.2.2 *Propane.* Maintain the propane pressure immediately ahead of all controls of the unit under test at 11 to 13 inches of water column, except as specified in section 3.1.3 of this appendix. The propane supplied should have a higher heating value (dry-basis) of approximately 2,500 Btu per standard cubic foot. Obtain the higher heating value on a dry basis of gas, H_p, in Btu per standard cubic foot, for the propane to be used in the test either from measurements made by the manufacturer conducting the test using equipment that meets the requirements described in section 2.7.2.2 of this appendix, or by the use of bottled propane whose gross heating value is certified to be at least as accurate a value that meets the requirements described in section 2.7.2.2 of this appendix.

2.3 *Air circulation.* Maintain air circulation in the room sufficient to secure a reasonably uniform temperature distribution, but do not cause a direct draft on the unit under test.

2.4 *Ambient room test conditions.*

2.4.1 *Active mode ambient conditions.* During active mode testing, maintain the ambient room air pressure specified in Section 5.1 of IEC 60350–2:2017, and maintain the ambient room air temperature at 25 ± 5 °C with a target temperature of 25 °C.

2.4.2 *Standby mode and off mode ambient conditions.* During standby mode and off mode testing, maintain the ambient room air temperature conditions specified in Section 4, Paragraph 4.2 of IEC 62301 (Second Edition).

2.5 *Product temperature.*

2.5.1 *Product temperature stability.* Prior to any testing, the product must achieve a stable temperature meeting the ambient room air temperature specified in section 2.4 of this appendix. For all conventional cooking tops, forced cooling may be used to assist in reducing the temperature of the product between tests, as specified in Section 5.5 of IEC 60350–2:2017. Forced cooling must not be used during the period of time used to assess temperature stability.

2.5.2 *Product temperature measurement.* Measure the product temperature in degrees Celsius using the equipment specified in section 2.7.3.3 of this appendix at the following locations.

2.5.2.1 Measure the product temperature at the center of the cooking zone under test for any gas burner adjustment in section 3.1.3 of this appendix and per-cooking zone energy consumption test in section 3.1.4 of this appendix, except that the product temperature measurement is not required for any potential simmering setting pre-selection test in section 3.1.4.3 of this appendix. For a conventional gas cooking top, the product temperature must be measured inside the burner body of the cooking zone under test, after temporarily removing the burner cap.

2.5.2.2 Measure the temperature at the center of each cooking zone for the standby mode and off mode power test in section 3.2 of this appendix. For a conventional gas cooking top, the temperature must be measured inside the burner body of each cooking zone, after temporarily removing the burner cap. Calculate the product temperature as the average of the temperatures at the center of each cooking zone.

2.6 *Test loads.*

2.6.1 *Test vessels.* The test vessels for active mode testing must meet the specifications in Section 5.6.1 and Annex B of IEC 60350–2:2017.

2.6.2 *Water load.* The water used to fill the test vessels for active mode testing must meet the specifications in Section 7.5.1 of IEC 60350–2:2017. The water temperature at the start of each test, except for the gas burner adjustment in section 3.1.3 of this appendix and the potential simmering setting pre-selection test in section 3.1.4.3 of this appendix, must have an initial temperature equal to 25 ± 0.5 °C.

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

2.7.1 *Electrical measurements.*

2.7.1.1 *Active mode watt-hour meter.* The watt-hour meter for measuring the active mode electrical energy consumption must have a resolution as specified in Table 1 of Section 5.3 of IEC 60350–2:2017. Measurements shall be made as specified in Table 2 of Section 5.3 of IEC 60350–2:2017.

2.7.1.2 *Standby mode and off mode watt meter.* The watt meter used to measure standby mode and off mode power must meet the specifications in Section 4, Paragraph 4.4 of IEC 62301 (Second Edition). If the power measuring instrument used for testing is unable to measure and record the crest factor, power factor, or maximum current ratio during the test measurement period, measure the crest factor, power factor, and maximum current ratio immediately before and after the test measurement period to determine whether these characteristics meet the specifications in Section 4, Paragraph 4.4 of IEC 62301 (Second Edition).

2.7.2 *Gas measurements.*

2.7.2.1 *Gas meter.* The gas meter used for measuring gas consumption must have a resolution of 0.01 cubic foot or less and a maximum error no greater than 1 percent of the measured valued for any demand greater than 2.2 cubic feet per hour.

2.7.2.2 *Standard continuous flow calorimeter.* The calorimeter must have an operating range of 750 to 3,500 Btu per cubic foot. The maximum error of the basic calorimeter must be no greater than 0.2 percent of the actual heating value of the gas used in the test. The indicator readout must have a maximum error no greater than 0.5 percent of the measured value within the operating range and a resolution of 0.2 percent of the full-scale reading of the indicator instrument.

2.7.2.3 *Gas line temperature.* The incoming gas temperature must be measured at the gas meter. The instrument for measuring the gas line temperature shall have a maximum error no greater than ±2 °F over the operating range.

2.7.2.4 *Gas line pressure.* The incoming gas pressure must be measured at the gas meter. The instrument for measuring the gas line pressure must have a maximum error no greater than 0.1 inches of water column.

2.7.3 *Temperature measurements.*

2.7.3.1 *Active mode ambient room temperature.* The room temperature indicating system must meet the specifications in Table 1 of Section 5.3 of IEC 60350–2:2017. Measurements shall be made as specified in Table 2 of Section 5.3 of IEC 60350–2:2017.

2.7.3.2 *Standby mode and off mode ambient room temperature.* The room temperature indicating system must have an error no greater than ±1 °F (±0.6 °C) over the range 65° to 90 °F (18 °C to 32 °C).

2.7.3.3 *Product temperature.* The temperature indicating system must have an error no greater than ±1 °F (±0.6 °C) over the range 65° to 90 °F (18 °C to 32 °C). Measurements shall be made as specified in Table 2 of Section 5.3 of IEC 60350–2:2017.

2.7.3.4 *Water temperature.* Measure the test vessel water temperature with a

thermocouple that meets the specifications in Table 1 of Section 5.3 of IEC 60350–2:2017. Measurements shall be made as specified in Table 2 of Section 5.3 of IEC 60350–2:2017.

2.7.4 *Room air pressure.* The room air pressure indicating system must meet the specifications in Table 1 of Section 5.3 of IEC 60350–2:2017.

2.7.5 *Water mass.* The scale used to measure the mass of the water load must meet the specifications in Table 1 of Section 5.3 of IEC 60350–2:2017.

2.8 *Power settings.*

2.8.1 On a multi-ring cooking zone on a conventional gas cooking top, all power settings are considered, whether they ignite all rings of orifices or not.

2.8.2 On a multi-ring cooking zone on a conventional electric cooking top, only power settings corresponding to the concentric heating element with the largest diameter are considered, which may correspond to operation with one or more of the smaller concentric heating elements energized.

2.8.3 On a cooking zone with infinite power settings where the available range of rotation from maximum to minimum is more than 150 rotational degrees, evaluate power settings that are spaced by 10 rotational degrees. On a cooking zone with infinite power settings where the available range of rotation from maximum to minimum is less than or equal to 150 rotational degrees, evaluate power settings that are spaced by 5 rotational degrees. Polar coordinate paper, as provided in Annex B of IEC 60350–2:2017 may be used to mark power settings.

3. Test Methods and Measurements

3.1. *Active mode.* Perform the following test methods for conventional cooking tops and the conventional cooking top component of a combined cooking product.

3.1.1 *Test vessel and water load selection.*

3.1.1.1 *Conventional electric cooking tops.*

3.1.1.1.1 For cooking areas with limitative markings, measure the diameter of each cooking zone, not including any specialty cooking zones as defined in section 1 of this appendix. The outer diameter of the cooking zone printed marking must be used for the measurement, as specified in Section 6.3 of IEC 60350–2:2017. For cooking areas without limitative markings, determine the number of cooking zones as specified in Section 6.3.1 of IEC 60350–2:2017.

3.1.1.1.2 Determine the test vessel diameter in millimeters (mm) and water load mass in grams (g) for each measured cooking zone, based on cooking zone size as specified in Table 3 in Section 5.6.1.5 of IEC 60350–2:2017 for cooking areas with limitative markings and in Annex A of IEC 60350–2:2017 for cooking areas without limitative markings. If a selected test vessel cannot be centered on the cooking zone due to interference with a structural component of the cooking top, the test vessel with the largest diameter that can be centered on the cooking zone shall be used. The allowable tolerance on the water load weight is ±0.5 g.

3.1.1.2 *Conventional gas cooking tops.*

3.1.1.2.1 Record the nominal heat input rate for each cooking zone, not including any specialty cooking zones as defined in section 1 of this appendix.

3.1.1.2.2 Determine the test vessel diameter in mm and water load mass in g for each measured cooking zone according to Table 3.1 of this appendix. If a selected test vessel cannot be centered on the cooking zone due to interference with a structural component of the cooking top, the test vessel with the largest diameter that can be centered on the cooking zone shall be used. The allowable tolerance on the water load weight is ±0.5 g.

TABLE 3.1—TEST VESSEL SELECTION FOR CONVENTIONAL GAS COOKING TOPS

Nominal gas burner input rate (Btu/h)		Test vessel diameter (mm)	Water load mass (g)
Minimum (>)	Maximum (≤)		
	5,600	210	2,050
5,600	8,050	240	2,700
8,050	14,300	270	3,420
14,300		300	4,240

3.1.2 *Unit Preparation.* Before the first measurement is taken, all cooking zones must be operated simultaneously for at least 10 minutes at maximum power. This step shall be conducted once per product.

3.1.3 *Gas burner adjustment.* Prior to active mode testing of each tested burner of a conventional gas cooking top, the burner average heat input rate must be adjusted, if necessary, to within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer. Prior to ignition and any adjustment of the burner heat input rate, the conventional cooking top must achieve the product temperature specified in section 2.5 of this appendix. Ignite and operate the gas burner under test with the test vessel and water mass specified in section 3.1.1 of this appendix. Measure the heat input rate of the gas burner under test starting 5 minutes after ignition. If the average input rate of the gas burner under test is within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer, no adjustment of the average heat input rate shall be made.

3.1.3.1 *Conventional gas cooking tops with an adjustable internal pressure regulator.* If the measured average heat input rate of the burner under test is not within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer, adjust the product's internal pressure regulator such that the average heat input rate of the burner under test is within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer. Adjust the burner with sufficient air flow to prevent a yellow flame or a flame with yellow tips. Complete section 3.1.4 of this appendix while maintaining the same gas pressure regulator adjustment.

3.1.3.2 *Conventional gas cooking tops with a non-adjustable internal pressure regulator or without an internal pressure regulator.* If the measured average heat input rate of the burner under test is not within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer, remove the product's internal pressure regulator, or block it in the open position, and initially maintain the gas pressure ahead of all controls of the unit under test approximately equal to the manufacturer's recommended manifold pressure. Adjust the gas supply pressure such that the average heat input rate of the burner under test is within 2 percent of the nominal heat input rate of the burner as specified by the manufacturer. Adjust the burner with sufficient air flow to prevent a yellow flame or a flame with yellow tips. Complete section 3.1.4 of this appendix while maintaining the same gas pressure regulator adjustment.

3.1.4 *Per-cooking zone energy consumption test.* Establish the test conditions set forth in section 2 of this appendix. Turn off the gas flow to the conventional oven(s), if so equipped. The product temperature must meet the specifications in section 2.5 of this appendix.

3.1.4.1 *Test vessel placement.* Position the test vessel with water load for the cooking zone under test, selected and prepared as specified in section 3.1.1 of this appendix, in the center of the cooking zone, and as specified in Annex C to IEC 60350–2:2017.

3.1.4.2 *Overshoot test.* Use the test methods set forth in Section 7.5.2.1 of IEC 60350–2:2017 to determine the target turndown temperature for each cooking zone, Tc_{target}, in degrees Celsius, as follows.

$$Tc_{target} = 93\ °C - (T_{max} - T_{70})$$

Where:

T_{max} is highest recorded temperature value, in degrees Celsius; and

T_{70} is the average recorded temperature between the time 10 seconds before the power is turned off and the time 10 seconds after the power is turned off.

If T_{70} is within the tolerance of 70 ± 0.5 °C, the target turndown temperature is the highest of 80 °C and the calculated Tc_{target}, rounded to the nearest integer. If T_{70} is

outside of the tolerance, the overshoot test is considered invalid and must be repeated after allowing the product to return to ambient conditions.

3.1.4.3 *Potential simmering setting pre-selection test.* The potential simmering setting for each cooking zone may be determined using the potential simmering setting pre-selecting test. If a potential simmering setting is already known, it may be used instead of completing sections 3.1.4.3.1 through 3.1.4.3.4 of this appendix.

3.1.4.3.1 Use the test vessel with water load for the cooking zone under test, selected, prepared, and positioned as specified in sections 3.1.1 and 3.1.4.1 of this appendix. The temperature of the conventional cooking top is not required to meet the specification for the product temperature in section 2.5 of this appendix for the potential simmering setting pre-selection test. Operate the cooking zone under test with the lowest available power setting. Measure the energy consumption for 10 minutes ±2 seconds.

3.1.4.3.2 Calculate the power density of the power setting, j, on a conventional electric cooking top, Qe_j, in watts per square centimeter, as:

$$Qe_j = \frac{6 \times E_j}{a}$$

Where:

a = the surface area of the test vessel bottom, in square centimeters; and

E_j = the electrical energy consumption during the 10-minute test, in Wh.

3.1.4.3.3 Calculate the power density of the power setting, j, on a conventional gas cooking top, Qg_j, in Btu/h per square centimeter, as:

$$Qg_j = \frac{6 \times \left(V_j \times CF \times H + Ee_j \times K_e\right)}{a}$$

Where:

a = the surface area of the test vessel bottom, in square centimeters;

V_j = the volume of gas consumed during the 10-minute test, in cubic feet;

CF = the gas correction factor to standard temperature and pressure, as calculated in section 4.1.1.2.1 of this appendix;

H = either H_n or H_p, the heating value of the gas used in the test as specified in sections 2.2.2.1 and 2.2.2.2 of this appendix, in Btu per standard cubic foot of gas;

Ee_j = the electrical energy consumption of the conventional gas cooking top during the 10-minute test, in Wh; and

K_e = 3.412 Btu/Wh, conversion factor of watt-hours to Btu.

3.1.4.3.4 Repeat the measurement for each successively higher power setting until Qe_j exceeds 0.8 W/cm² for conventional electric cooking tops or Qg_j exceeds 4.0 Btu/h·cm² for conventional gas cooking tops. For conventional cooking tops with rotating knobs for selecting the power setting, the selection knob shall be turned to the maximum power setting in between each test, to avoid hysteresis. The selection knob shall be turned in the direction from higher power to lower power to select the power setting for the test. If the appropriate power setting is passed, the selection knob shall be turned to the maximum power setting again before repeating the power setting selection. Of the last two power settings tested, the potential simmering setting is the power setting that produces a power density closest to 0.8 W/cm² for conventional electric cooking tops or 4.0 Btu/h·cm² for conventional gas cooking tops. The closest power density may be higher or lower than the applicable threshold value.

3.1.4.4 *Simmering test.* The product temperature must meet the specifications in section 2.5 of this appendix at the start of each simmering test. For each cooking zone, conduct the test method specified in Section 7.5.2 of IEC 60350–2:2017, using the potential simmering setting identified in section 3.1.4.3 of this appendix for the initial simmering setting used in Section 7.5.2.2 of IEC 60350–2:2017. For conventional cooking tops with rotating knobs for selecting the power setting, the selection knob shall be turned in the direction from higher power to lower power to select the potential simmering setting for the test, to avoid hysteresis. If the appropriate setting is passed, the test is considered invalid and must be repeated after allowing the product to return to ambient conditions.

3.1.4.5 *Evaluation of the simmering test.* Evaluate the test conducted under section 3.1.4.4 of this appendix as set forth in Section 7.5.4.1 of IEC 60350–2:2017 according to Figure 3.1.4.5 of this appendix. If the measured water temperature at the time the power setting is reduced, Tc, is not within –0.5 °C and +1 °C of the target turndown temperature, Tc_{target}, the test is considered invalid and must be repeated after allowing the product to return to ambient conditions.

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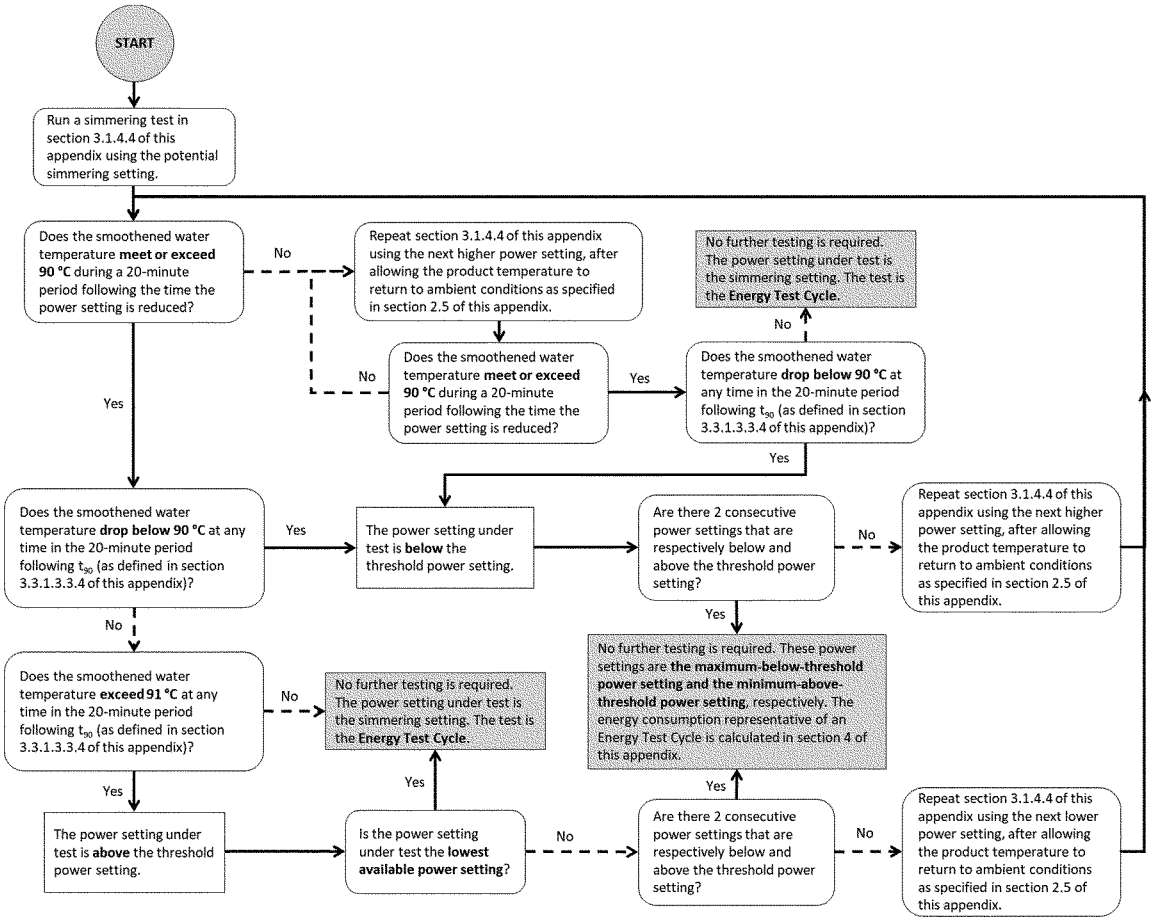
Figure 3.1.4.5 Evaluation of the Simmering Test



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3.2 *Standby mode and off mode power.* Establish the standby mode and off mode testing conditions set forth in section 2 of this appendix. For products that take some time to enter a stable state from a higher power state as discussed in Section 5, Paragraph 5.1, Note 1 of IEC 62301 (Second Edition), allow sufficient time for the product to reach the lower power state before proceeding with the test measurement. Follow the test procedure as specified in Section 5, Paragraph 5.3.2 of IEC 62301 (Second Edition) for testing in each possible mode as described in sections 3.2.1 and 3.2.2 of this appendix. For units in which power varies as a function of displayed time in standby mode, set the clock time to 3:23 at the end of an initial stabilization period, as specified in Section 5, Paragraph 5.3 of IEC 62301 (First Edition). After an additional 10 minute stabilization period, measure the power use for a single test period of 10 minutes +0/−2 seconds that starts when the clock time first reads 3:33. Use the average power approach described in Section 5, Paragraph 5.3.2(a) of IEC 62301 (First Edition).

3.2.1 If the product has an inactive mode, as defined in section 1 of this appendix, measure the average inactive mode power, P_{IA}, in watts.

3.2.2 If the product has an off mode, as defined in section 1 of this appendix, measure the average off mode power, P_{OM}, in watts.

3.3 *Recorded values.*

3.3.1 *Active mode.*

3.3.1.1 For a conventional gas cooking top tested with natural gas, record the natural gas higher heating value in Btu per standard cubic foot, H_n, as determined in section 2.2.2.1 of this appendix for the natural gas supply. For a conventional gas cooking top tested with propane, record the propane higher heating value in Btu per standard cubic foot, H_p, as determined in section 2.2.2.2 of this appendix for the propane supply.

3.3.1.2 Record the test room temperature in degrees Celsius and relative air pressure in hectopascals (hPa) during each test.

3.3.1.3 *Per-cooking zone energy consumption test.*

3.3.1.3.1 Record the product temperature in degrees Celsius, T_P, prior to the start of each overshoot test or simmering test, as determined in section 2.5 of this appendix.

3.3.1.3.2 *Overshoot test.* For each cooking zone, record the initial temperature of the water in degrees Celsius, T_i; the average water temperature between the time 10 seconds before the power is turned off and the time 10 seconds after the power is turned off in degrees Celsius, T_{70}; the highest recorded water temperature in degrees Celsius, T_{max}; and the target turndown temperature in degrees Celsius, Tc_{target}.

3.3.1.3.3 *Simmering test.* For each cooking zone, record the temperature of the water throughout the test, in degrees Celsius, and the values in sections 3.3.1.3.3.1 through 3.3.1.3.3.7 of this appendix for the Energy Test Cycle, if an Energy Test Cycle is measured in section 3.1.4.5 of this appendix, otherwise for both the maximum-below-threshold power setting and the minimum-above-threshold power setting. Because t_{90} may not be known until completion of the simmering test, water temperature, any electrical energy consumption, and any gas volumetric consumption measurements may be recorded for several minutes after the water temperature first reaches 90 °C to ensure that 20 minutes of the simmering period are recorded.

3.3.1.3.3.1 The power setting under test.

3.3.1.3.3.2 The initial temperature of the water, in degrees Celsius, T_i.

3.3.1.3.3.3 The time at which the power setting is reduced, to the nearest second, t_c and the water temperature when the power setting is reduced, in degrees Celsius, Tc.

3.3.1.3.3.4 The time at which the simmering period starts, to the nearest second, t_{90}, which is defined as the time at which the smoothened water temperature first meets or exceeds 90 °C.

3.3.1.3.3.5 The time, to the nearest second, at the end of a 20-minute simmering period following t_{90}, t_S and the smoothened water temperature at the end of the 20-minute simmering period, in degrees Celsius, T_S.

3.3.1.3.3.6 For a conventional electric cooking top, the electrical energy consumption from the start of the test to t_S, E, in watt-hours.

3.3.1.3.3.7 For a conventional gas cooking top, the volume of gas consumed from the start of the test to t_S, V, in cubic feet of gas; and any electrical energy consumption of the cooking top from the start of the test to t_S, E_e, in watt-hours.

3.3.2 *Standby mode and off mode.* Make measurements as specified in section 3.2 of this appendix. If the product is capable of operating in inactive mode, as defined in section 1 of this appendix, record the average inactive mode power, P_{IA}, in watts as specified in section 3.2.1 of this appendix. If the product is capable of operating in off mode, as defined in section 1 of this appendix, record the average off mode power, P_{OM}, in watts as specified in section 3.2.2 of this appendix.

4. Calculation of Derived Results From Test Measurements

4.1. Active mode energy consumption of conventional cooking tops and any conventional cooking top component of a combined cooking product.

4.1.1 Per-cycle active mode energy consumption of a conventional cooking top and any conventional cooking top component of a combined cooking product.

4.1.1.1 Conventional electric cooking top per-cycle active mode energy consumption.

4.1.1.1.1 Conventional electric cooking top per-cooking zone normalized active mode energy consumption. For each cooking zone, calculate the per-cooking zone normalized active mode energy consumption of a conventional electric cooking top, E, in watt-hours, using the following equation:

$E = E_{ETC}$

for cooking zones where an Energy Test Cycle was measured in section 3.1.4.5 of this appendix, and

$$E = E_{MAT} - \frac{E_{MAT} - E_{MBT}}{T_{S,MAT} - T_{S,MBT}} \times (T_{S,MAT} - 90)$$

for cooking zones where a minimum-above-threshold cycle and a maximum-below-threshold cycle were measured in section 3.1.4.5 of this appendix.

Where:

E_{ETC} = the electrical energy consumption of the Energy Test Cycle from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in watt-hours;

E_{MAT} = the electrical energy consumption of the minimum-above-threshold power setting from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in watt-hours;

E_{MBT} = the electrical energy consumption of the maximum-below-threshold power setting from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in watt-hours;

$T_{S,MAT}$ = the smoothened water temperature at the end of the minimum-above-threshold power setting test for the cooking zone, in degrees Celsius; and

$T_{S,MBT}$ = the smoothened water temperature at the end of the maximum-below-threshold power setting test for the cooking zone, in degrees Celsius.

4.1.1.1.2 Calculate the per-cycle active mode total energy consumption of a conventional electric cooking top, E_{CET}, in watt-hours, using the following equation:

$$E_{CET} = \frac{2853g}{n} \times \sum_{z=1}^{n} \frac{E_z}{m_z}$$

Where:

n = the total number of cooking zones tested on the conventional cooking top;

E_z = the normalized energy consumption representative of the Energy Test Cycle for each cooking zone, as calculated in section 4.1.1.1.1 of this appendix, in watt-hours; m_z is the mass of water used for each cooking zone, in grams; and

2853 = the representative water load mass, in grams.

4.1.1.2 Conventional gas cooking top per-cycle active mode energy consumption.

4.1.1.2.1 Gas correction factor to standard temperature and pressure. Calculate the gas correction factor to standard temperature and pressure, which converts between standard cubic feet and measured cubic feet of gas for a given set of test conditions:

$$CF = \frac{P_{gas} + P_{atm}}{P_{base}} \times \frac{T_{base}}{T_{gas}}$$

Where:

P_{gas} = the measured line gas gauge pressure, in inches of water;

P_{atm} = the measured atmospheric pressure, in inches of water;

P_{base} = 408.13 inches of water, the standard sea level air pressure;

T_{base} = 519.67 degrees Rankine (or 288.7 Kelvin); and

T_{gas} = the measured line gas temperature, in degrees Rankine (or Kelvin).

4.1.1.2.2 Conventional gas cooking top per-cooking zone normalized active mode gas consumption. For each cooking zone, calculate the per-cooking zone normalized active mode gas consumption of a conventional gas cooking top, V, in cubic feet, using the following equation:

$V = V_{ETC}$

for cooking zones where an Energy Test Cycle was measured in section 3.1.4.5 of this appendix, and

$$V = V_{MAT} - \frac{V_{MAT} - V_{MBT}}{T_{S,MAT} - T_{S,MBT}} \times (T_{S,MAT} - 90)$$

for cooking zones where a minimum-above-threshold cycle and a maximum-below-threshold cycle were measured in section 3.1.4.5 of this appendix.

Where:

V_{ETC} = the gas consumption of the Energy Test Cycle from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in cubic feet;

V_{MAT} = the gas consumption of the minimum-above-threshold power setting from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in cubic feet;

V_{MBT} = the gas consumption of the maximum-below-threshold power setting from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in cubic feet;

$T_{S,MAT}$ = the smoothened water temperature at the end of the minimum-above-threshold power setting test for the cooking zone, in degrees Celsius; and

$T_{S,MBT}$ = the smoothened water temperature at the end of the maximum-below-threshold power setting test for the cooking zone, in degrees Celsius.

4.1.1.2.3 Conventional gas cooking top per-cooking zone active mode normalized electrical energy consumption. For each cooking zone, calculate the per-cooking zone normalized active mode electrical energy consumption of a conventional gas cooking top, E_e, in watt-hours, using the following equation:

$E_e = E_{e,ETC}$

for cooking zones where an Energy Test Cycle was measured in section 3.1.4.5 of this appendix, and

$$E_e = E_{e,MAT} - \frac{E_{e,MAT} - E_{e,MBT}}{T_{S,MAT} - T_{S,MBT}} \times (T_{S,MAT} - 90)$$

for cooking zones where a minimum-above-threshold cycle and a maximum-below-threshold cycle were measured in section 3.1.4.5 of this appendix.

Where:

$E_{e,ETC}$ = the electrical energy consumption of the Energy Test Cycle from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in watt-hours;

$E_{e,MAT}$ = the electrical energy consumption of the minimum-above-threshold power setting from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in watt-hours;

$E_{e,MBT}$ = the electrical energy consumption of the maximum-below-threshold power setting from the start of the test to the end of the test for the cooking zone, as determined in section 3.1.4.5 of this appendix, in watt-hours;

$T_{S,MAT}$ = the smoothened water temperature at the end of the minimum-above-threshold power setting test for the cooking zone, in degrees Celsius; and

$T_{S,MBT}$ = the smoothened water temperature at the end of the maximum-below-threshold power setting test for the cooking zone, in degrees Celsius.

4.1.1.2.4 Conventional gas cooking top per-cycle active mode gas energy consumption. Calculate the per-cycle active mode gas energy consumption of a conventional gas cooking top, E_{CGG}, in Btu, using the following equation:

$$E_{CGG} = \frac{2853g}{n} \times \sum_{z=1}^{n} \frac{V_z \times CF \times H}{m_z}$$

Where:

n, m_z, and 2853 are defined in section 4.1.1.1.2 of this appendix;

V_z = the normalized gas consumption representative of the Energy Test Cycle for each cooking zone, as calculated in section 4.1.1.2.2 of this appendix, in cubic feet; and

CF = the gas correction factor to standard temperature and pressure, as calculated in section 4.1.1.2.1 of this appendix

H = either H_n or H_p, the heating value of the gas used in the test as specified in sections 2.2.2.1 and 2.2.2.2 of this appendix, expressed in Btu per standard cubic foot of gas.

4.1.1.2.5 Conventional gas cooking top per-cycle active mode electrical energy consumption. Calculate the per-cycle active mode electrical energy consumption of a conventional gas cooking top, E_{CGE}, in watt-hours, using the following equation:

$$E_{CGE} = \frac{2853g}{n} \times \sum_{z=1}^{n} \frac{E_{ez}}{m_z}$$

Where:

n, m_z, and 2853 are defined in section 4.1.1.1.2 of this appendix; and

E_{ez} = the normalized electrical energy consumption representative of the Energy Test Cycle for each cooking zone, as calculated in section 4.1.1.2.3 of this appendix, in watt-hours.

4.1.1.2.6 Conventional gas cooking top per-cycle active-mode total energy consumption. Calculate the per-cycle active mode total energy consumption of a conventional gas cooking top, E_{CGT}, in Btu, using the following equation:

$E_{CGT} = E_{CGG} + (E_{CGE} \times K_e)$

Where:

E_{CGG} = the per-cycle active mode gas energy consumption of a conventional gas cooking top as determined in section 4.1.1.2.4 of this appendix, in Btu;

E_{CGE} = the per-cycle active mode electrical energy consumption of a conventional gas cooking top as determined in section 4.1.1.2.5 of this appendix, in watt-hours; and K_e = 3.412 Btu/Wh, conversion factor of watt-hours to Btu.

4.1.2 Annual active mode energy consumption of a conventional cooking top and any conventional cooking top component of a combined cooking product.

4.1.2.1 Conventional electric cooking top annual active mode energy consumption. Calculate the annual active mode total energy consumption of a conventional electric cooking top, E_{AET}, in kilowatt-hours per year, using the following equation:

$E_{AET} = E_{CET} \times K \times N_C$

Where:

E_{CET} = the conventional electric cooking top per-cycle active mode total energy consumption, as determined in section 4.1.1.1.2 of this appendix, in watt-hours;

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours; and

N_C = 418 cooking cycles per year, the average number of cooking cycles per year normalized for duration of a cooking event estimated for conventional cooking tops.

4.1.2.2 Conventional gas cooking top annual active mode energy consumption.

4.1.2.2.1 Conventional gas cooking top annual active mode gas energy consumption. Calculate the annual active mode gas energy consumption of a conventional gas cooking top, E_{AGG}, in kBtu per year, using the following equation:

$E_{AGG} = E_{CGG} \times K \times N_C$

Where:

K and N_C are defined in section 4.1.2.1 of this appendix; and

E_{CGG} = the conventional gas cooking top per-cycle active mode gas energy consumption, as determined in section 4.1.1.2.4 of this appendix, in Btu.

4.1.2.2.2 Conventional gas cooking top annual active mode electrical energy consumption. Calculate the annual active mode electrical energy consumption of a conventional gas cooking top, E_{AGE}, in kilowatt-hours per year, using the following equation:

$E_{AGE} = E_{CGE} \times K \times N_C$

Where:

K and N_C are defined in section 4.1.2.1 of this appendix; and

E_{CGE} = the conventional gas cooking top per-cycle active mode electrical energy consumption, as determined in section 4.1.1.2.5 of this appendix, in watt-hours.

4.1.2.2.3 Conventional gas cooking top annual active mode total energy consumption. Calculate the annual active mode total energy consumption of a conventional gas cooking top, E_{AGT}, in kBtu per year, using the following equation:

$E_{AGT} = E_{AGG} + (E_{AGE} \times K_e)$

Where:

E_{AGG} = the conventional gas cooking top annual active mode gas energy consumption as determined in section 4.1.2.2.1 of this appendix, in kBtu per year;

E_{AGE} = the conventional gas cooking top annual active mode electrical energy consumption as determined in section 4.1.2.2.2 of this appendix, in kilowatt-hours per year; and

K_e is defined in section 4.1.1.2.6 of this appendix.

4.2 Annual combined low-power mode energy consumption of a conventional cooking top and any conventional cooking top component of a combined cooking product.

4.2.1 Conventional cooking top annual combined low-power mode energy consumption. Calculate the annual combined low-power mode energy consumption for a conventional cooking top, E_{TLP}, in kilowatt-hours per year, using the following equation:

$E_{TLP} = [(P_{IA} \times F_{IA}) + (P_{OM} \times F_{OM})] \times K \times S_T$

Where:

P_{IA} = inactive mode power, in watts, as measured in section 3.2.1 of this appendix;

P_{OM} = off mode power, in watts, as measured in section 3.2.2 of this appendix;

F_{IA} and F_{OM} are the portion of annual hours spent in inactive mode and off mode hours respectively, as defined in Table 4.2.1 of this appendix;

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours; and

S_T = 8,544, total number of inactive mode and off mode hours per year for a conventional cooking top.

TABLE 4.2.1—ANNUAL HOUR MULTIPLIERS

Types of low-power mode(s) available	F_{IA}	F_{OM}
Both inactive and off mode	0.5	0.5
Inactive mode only	1	0
Off mode only	0	1

4.2.2 Conventional cooking top component of a combined cooking product annual combined low-power mode energy consumption. Calculate the annual combined low-power mode energy consumption for the conventional cooking top component of a combined cooking product, E_{TLP}, in kilowatt-hours per year, using the following equation:

$E_{TLP} = [(P_{IA} \times F_{IA}) + (P_{OM} \times F_{OM})] \times K \times S_{TOT} \times H_C$

Where:

P_{IA}, P_{OM}, F_{IA}, F_{OM}, and K are defined in section 4.2.1 of this appendix;

S_{TOT} = the total number of inactive mode and off mode hours per year for a combined cooking product, as defined in Table 4.2.2 of this appendix; and

H_C = the percentage of hours per year assigned to the conventional cooking top component of a combined cooking product, as defined in Table 4.2.2 of this appendix.

TABLE 4.2.2—COMBINED COOKING PRODUCT USAGE FACTORS

Type of combined cooking product	S_{TOT}	H_C (%)
Cooking top and conventional oven (conventional range)	8,392	60
Cooking top and microwave oven	8,481	77
Cooking top, conventional oven, and microwave oven	8,329	51

4.3 Integrated annual energy consumption of a conventional cooking top and any conventional cooking top component of a combined cooking product.

4.3.1 Conventional electric cooking top integrated annual energy consumption. Calculate the integrated annual energy consumption, IAEC, of a conventional electric cooking top, in kilowatt-hours per year, using the following equation:

$IAEC = E_{AET} + E_{TLP}$

Where:

E_{AET} = the conventional electric cooking top annual active mode energy consumption, as determined in section 4.1.2.1 of this appendix; and

E_{TLP} = the annual combined low-power mode energy consumption of a conventional cooking top or any conventional cooking top component of a combined cooking product, as determined in section 4.2 of this appendix.

4.3.2 Conventional gas cooking top integrated annual energy consumption. Calculate the integrated annual energy consumption, IAEC, of a conventional gas cooking top, in kBtu per year, defined as:

$IAEC = E_{AGT} + (E_{TLP} \times K_e)$

Where:

E_{AGT} = the conventional gas cooking top annual active mode total energy consumption, as determined in section 4.1.2.2.3 of this appendix;

E_{TLP} = the annual combined low-power mode energy consumption of a conventional cooking top or any conventional cooking top component of a combined cooking product, as determined in section 4.2 of this appendix; and

K_e is defined in section 4.1.1.2.6 of this appendix.

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