DEPARTMENT OF ENERGY

10 CFR Part 430

[Docket No. EERE–2009–BT–TP–0019]

RIN 1904–AC03

Energy Conservation Program for Certain Consumer Appliances: Test Procedures for Battery Chargers and External Power Supplies

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

ACTION: Final rule.

SUMMARY: The U.S. Department of Energy (DOE) is amending its test procedures for battery chargers and external power supplies. In particular, DOE is inserting a new active mode energy consumption test procedure for battery chargers, which is necessary to develop energy conservation standards for battery chargers as mandated by the Energy Independence and Security Act of 2007 (EISA 2007). DOE is also amending portions of its existing standby and off mode battery charger test procedure by decreasing the required testing time. Further, DOE is amending its active mode single-voltage external power supply test procedure to permit the testing of certain types of external power supplies. Finally, DOE is inserting a new procedure to address multiple-voltage external power supplies, which are not covered under the current single-voltage external power supply test procedure.

DATES: This rule is effective July 1, 2011. After November 28, 2011, manufacturers may not make any representation regarding battery charger or external power supply energy consumption or efficiency unless such battery charger or external power supply has been tested in accordance with the final rule provisions in appendix Y (for battery chargers) and appendix Z (for external power supplies).

ADDRESSES: You may review copies of all materials related to this rulemaking at the U.S. Department of Energy, Resource Room of the Building Technologies Program, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC, (202) 586–2945, between 9 a.m. and 4 p.m., Monday through Friday, except Federal Holidays. Please call Ms. Brenda Edwards at the above telephone number for additional information regarding visiting the Resource Room.

FOR FURTHER INFORMATION CONTACT: Mr. Victor Petrolati, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–2J, 1000 Independence Avenue, SW., Washington, DC 20585–0121. Telephone: (202) 586–4549. E-mail: *Victor.Petrolati@ee.doe.gov.*

For legal issues, contact Mr. Michael Kido, U.S. Department of Energy, Office of the General Counsel, GC–71, 1000 Independence Avenue, SW., Washington, DC 20585. Telephone: (202) 586–9507. E-mail: *Michael.Kido@hq.doe.gov.*

SUPPLEMENTARY INFORMATION:

I. Authority and Background

Title III of the Energy Policy and Conservation Act, 42 U.S.C. 6291, *et seq.* (EPCA or the Act), sets forth a variety of provisions designed to improve energy efficiency. Part A of Title III (42 U.S.C. 6291–6309) establishes the "Energy Conservation Program for Consumer Products Other Than Automobiles," which covers consumer products and certain commercial products (all of which are referred to below as "covered products"), including battery chargers and external power supplies.

Under EPCA, the overall energy conservation program for consumer products and commercial equipment consists essentially of the following parts: testing, labeling, and Federal energy conservation standards. The testing requirements consist of procedures that manufacturers of covered products must use to certify to the U.S. Department of Energy (DOE) that their products comply with the required energy conservation standards and to rate the efficiency of their products. These test procedures would also be used during enforcement-related testing when determining whether a given product complies with the relevant standards.

Today's final rule provides, among other things, a new active mode energy consumption test procedure for battery chargers, which is necessary to develop energy conservation standards for battery chargers as mandated by the Energy Independence and Security Act of 2007 (EISA 2007). Today's rule also modifies the existing procedure found in appendix Y to 10 CFR part 430, subpart B. In particular, the test procedure that DOE is adopting today provides a uniform method to test the energy efficiency of a battery charger, which is a necessary prerequisite to the setting of any energy conservation standard for these products. Consequently, DOE is promulgating today's rule in anticipation of the final rule that will set standards for battery chargers.

Additionally, today's rule introduces other changes to the procedures found in 10 CFR 430, subpart B, appendix Z, which covers the energy efficiency testing of an external power supply. In particular, the rule amends aspects of the current procedure when measuring the energy consumption of a Class A external power supply. A Class A external power supply is one that is: designed to convert line voltage AC input into lower voltage AC or DC output; able to convert to only 1 AC or DC output voltage at a time; sold with, or intended to be used with, a separate end-use product that constitutes the primary load; contained in a separate physical enclosure from the end-use product; is connected to the end-use product via a removable or hard-wired male/female electrical connection, cable, cord, or other wiring; and has nameplate output power that is less than or equal to 250 watts. See 42 U.S.C. 6291(36)(C). Today's rule also adds a procedure to facilitate testing of a multiple-voltage external power supply. The test procedure requires loading the multiple-voltage external power supply at five separate loading levels and requires that these five outputs be reported individually.

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of such test procedures. See generally 42 U.S.C. 6293. As part of these requirements, the procedures must be reasonably designed to measure the energy use, energy efficiency, or annual operating cost during a period that is representative of typical use and not be "unduly burdensome." (42 U.S.C. 6293(b)(3)) In addition, consistent with 42 U.S.C. 6293(b)(2) and Executive Order 12899, 58 FR 69681 (Dec. 30, 1993), if DOE determines that a test procedure amendment is warranted, it must publish proposed test procedures and offer the public an opportunity to present oral and written comments on them, with a comment period of not less than 75 days. Finally, in any rulemaking to amend a test procedure, DOE must determine "to what extent the proposed test procedure would alter the measured energy efficiency as determined under the existing test procedure." (42 U.S.C. 6293(e)(1)) If DOE determines that the amended test procedure would alter the measured efficiency of a covered product, DOE must amend the applicable energy conservation standard accordingly. (42 U.S.C. 6293(e)(2)) DOE discusses its consideration of the amendments to the test procedures for battery chargers and external power supplies in the section that follows.

DOE published a notice of proposed rulemaking (NOPR) on April 2, 2010 (75 FR 16958) in which it discussed in more detail many of the testing issues brought forward in the framework document and an accompanying public meeting to discuss the approach that DOE planned to use in setting energy conservation standards for battery chargers and external power supplies. See 74 FR 26816 (June 4, 2009) (discussing the framework document for battery chargers and external power supplies).[1] (The public meeting discussing the framework document was held on July 16, 2009. That meeting also included discussions related to test procedure issues. A related meeting to discuss the preliminary analysis DOE performed in examining standards for these products also generated some discussion related to test procedure issues.) DOE held a public meeting to discuss its test procedure NOPR on May 7, 2010, where it also received comments on the proposals set forth in the NOPR (hereafter referred to as the NOPR public meeting). A 75-day comment period as prescribed by EPCA was afforded to interested parties.

Battery chargers and external power supplies operate similarly in that they both take electricity from a power source, usually from a wall outlet, and convert it into a form that can be used either to power an application directly or to charge and maintain the energy in a battery. Specifically, they both take power at one voltage and current type, typically 120 volts alternating current (AC), and convert it to lower-voltage direct current (DC) power. Because these products operate in a similar manner, DOE is consolidating its evaluation of potential energy conservation standards for battery chargers and external power supplies together in a single rulemaking proceeding. Additional details related to the authority and background of this rulemaking can be found in section I of the NOPR. 75 FR 16958, 16959–16960.

II. Summary of the Final Rule

Today's final rule does two key things. First, it adopts new test procedures for the active mode of battery chargers and all modes of multiple-voltage external power supplies. Second, it modifies existing parts of the battery charger and external power supply test procedures (for example, the duration of the battery charger standby and off mode tests). In doing so, it amends both appendices Y and Z in multiple places. Furthermore, although DOE is retaining the current language of certain sections of appendices Y and Z, in selecting amendments for inclusion in today's final rule, DOE considered all aspects of the existing battery charger and external power supply test procedures. By examining these procedures in this comprehensive manner, this rulemaking satisfies the 7-year review requirement of 42 U.S.C. 6293(b). Subsequent amendments will, as needed, be made in a manner consistent with the schedule set out in that provision.

As explained in greater detail in this notice, the final rule makes the following specific changes to the current regulations:

(1) Inserts a new test procedure to measure the energy consumption of battery chargers in active mode to assist in the development of energy conservation standards;

(2) Amends the battery charger test procedure to decrease the testing time of battery chargers in standby and off modes;

(3) Amends the single-voltage external power supply test procedure to accommodate external power supplies with Universal Serial Bus (USB) outputs and other types of external power supplies that cannot be tested in accordance with the current test procedure; and

(4) Inserts a new test procedure for multiple-voltage external power supplies, a type of non-Class A external power supply that DOE evaluated in its non-Class A determination analysis and that will be covered under the energy conservation standard.

Table II.1 lists the sections of 10 CFR part 430 affected by the amendments in this rule. The left-hand column in the table cites the locations of the affected CFR provisions, while the right-hand column lists the changes.

[1] U.S. Department of Energy—Office of Energy Efficiency and Renewable Energy. Energy Conservation Program for Consumer Products *Energy Conservation Standards Rulemaking for Battery Chargers and External Power Supplies.* May 2009. Washington, DC. Available at: *http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/bceps_frameworkdocument.pdf.*

TABLE II.1—SUMMARY OF PROPOSED CHANGES AND AFFECTED SECTIONS OF 10 CFR PART 430

Existing Section in 10 CFR Part 430	Summary of modifications
Section 430.23 of Subpart B—Test procedures for the measurement of energy and water consumption.	• Modify '(aa) battery charger' to include energy consumption in active mode.
Appendix Y to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Battery Chargers.	• Renumber the existing sections to ease referencing and use by testing technicians.
1. Scope	• Limit scope to include only battery chargers intended for operation in the United States.
2. Definitions	• Add definitions for: ○ Active power or real power (P). ○ Ambient temperature. ○ Apparent power (S). ○ Batch charger. ○ Battery rest period. ○ C-rate. ○ Equalization. ○ Instructions or manufacturer's instructions. ○ Measured charge capacity. ○ Rated battery voltage. ○ Rated charge capacity. ○ Rated energy capacity. ○ Total harmonic distortion (THD). ○ Unit under test (UUT). • Remove definitions for: ○ Accumulated nonactive energy. ○ Energy ratio or nonactive energy ratio. • Modify definitions for: ○ Active mode. ○ Multi-port charger. ○ Multi-voltage à la carte charger. ○ Standby mode.
3. Test Apparatus and General Instructions	• Insert apparatus and instructions to measure energy consumption in active mode.
4. Test Measurement	• Insert procedures to measure energy consumption in active mode. • Modify 4(c) to change standby mode measurement time. • Modify 4(d) to change off mode measurement time.
Appendix Z to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of External Power Supplies.	
1. Scope	• No change.
2. Definitions	• Modify definition of active power.
3. Test Apparatus and General Instructions	• Modify 3(b) to accommodate multiple-voltage external power supplies.
4. Test Measurement	• Modify 4(a) to accommodate external power supplies that communicate with the load, perform current limiting, or have output power greater than 250 watts. • Modify 4(b) to accommodate multiple-voltage external power supplies.

In developing today's amendments, DOE considered comments received from interested parties in response to the standby and off mode test procedure, framework document, NOPR, and NOPR public meeting. Although a part of the standards rulemaking, DOE also considered comments to the framework document insofar as these comments had any bearing with respect to test procedure-related items. Numerous commenters sought to have DOE require testing in additional modes of operation in which products had not been tested under the current procedure, such as active or charge mode. DOE reviewed the existing test procedures for battery chargers and external power supplies and found that, with some modifications, they could be used as a basis for updating DOE's test procedures to address some of the limitations identified by commenters. These modifications are discussed in greater detail below.

Interested parties who commented on the NOPR consisted of manufacturers (Associate of Home Appliance Manufacturers (AHAM), Power Tool Institute (PTI), Euro-Pro, Phillips, Sony Electronics, Inc., Delta-Q Technologies Corp. and Wahl Clipper); an energy efficiency advocate (Appliance Standards Awareness Project (ASAP)); and utility companies (Pacific Gas and Electric (PG&E) and Southern California Edison).

DOE also examined whether the amendments to its test procedures would significantly change the measured energy consumption or efficiency of battery chargers or external power supplies. This question is particularly important for Class A external power supplies, which are subject to the EISA minimum efficiency standard that took effect on July 1, 2008. (42 U.S.C. 6295(u)(3)(A))

The amendments to the single-voltage external power supply test procedure, which is used to test compliance with Class A external power supply standards, affect the measured efficiency of external power supplies with USB outputs and external power supplies that communicate with their loads—which together comprise the subset of Class A external power supplies to which these amendments would apply. The term "communicating" with a load refers to an external power supply's ability to identify or otherwise exchange information with its load (*i.e.,* the end-use product to which it is connected). This technique is used to tailor the operation of the external power supply to the needs of the load as well as to prevent the possibility of the supply being used with incompatible loads, which could damage the product. While most external power supplies provide power at a fixed output voltage regardless of what load is connected to their outputs, some external power supplies will only provide power once they have "communicated" with the load and identified it as the intended load.

The remaining amendments included in today's final rule have the following impacts on measured energy consumption or efficiency:

(1) The battery charger active mode test procedure amendment changes the measured energy consumption of battery chargers by eliminating the nonactive energy ratio metric and replacing it with a new metric that measures energy consumption in active mode;

(2) The standby and off mode test procedure amendment changes the measured energy consumption of battery chargers or external power supplies when operating in these modes; and

(3) The multiple-voltage external power supply amendment inserts a new test procedure for these products.

The procedure being adopted today will be used to help DOE in establishing the energy conservation standards for these products through a separate rulemaking that is currently underway.

A. Battery Charger Active Mode Test Procedure

Prior to this final rule, the DOE battery charger test procedure, first created by the EPACT 2005 En Masse final rule (71 FR 71340 (December 8, 2006)) and amended by the standby and off mode test procedure final rule (74 FR 13318 (March 27, 2009)), did not measure battery charger energy consumption in all modes. Instead, it excluded the energy consumed by the battery charger while charging a battery (*i.e.* active mode energy consumption). The procedure measured energy consumption only in standby (or no battery) and off modes (*i.e.* inactive mode energy consumption). DOE had adopted this earlier approach because the timing of the rulemaking did not permit an addition of an active mode test procedure at that time. 71 FR 71340, 71360.

The battery charger active mode test procedure in today's final rule removes the inactive mode calculation. This calculation, found in section 4(a) of appendix Y, is a composite of different operational modes that, under the changes introduced by today's final rule, are to be measured separately.

The final rule also makes three additional key changes to the battery charger test procedure. First, it adds an active mode measurement to section 4(b) to account for the energy consumed by a battery charger while it is charging a battery. Second, it amends the scope, definitions, and test apparatus and general instructions (sections 1, 2, and 3) to address the changes brought about by the introduction of the new active mode test procedure. Third, it reorganizes the battery charger sections to enhance their readability and ease of use to help reduce the prospect of differing interpretations while conducting the test.

The active mode amendment that DOE is adopting today is based in large part on the battery charger system test procedure already adopted by the California Energy Commission (CEC).[2] DOE, however, has modified that procedure to help decrease the overall testing burden faced by manufacturers when testing these products and by increasing the procedure's clarity. Examples of how DOE has accomplished these goals include modifying the procedure to use terms consistent with other DOE rulemakings and dividing more complex procedures into simpler, discrete steps for testing technicians to follow. These changes are discussed further in section III.B.

B. Review of Battery Charger and External Power Supply Standby Mode and Off Mode Test Procedures

DOE addressed the EPCA requirements to prescribe definitions and test procedures for measuring the energy consumption of external power supplies and battery chargers in standby and off modes (42 U.S.C. 6298(gg)(A) and (B)) in its March 27, 2009, test procedure final rule. That final rule incorporated standby and off mode measurements as well as updated definitions into appendices Y and Z. 74 FR 13318.

In today's final rule, DOE amends the battery charger test procedure by requiring the use of a 30-minute warm-up period followed by a 10-minute measurement period. Previously, the DOE test procedure required a 1-hour measurement period. This amendment harmonizes DOE's standby and off mode measurement requirement for battery chargers with the requirement contained in section IV of part 1 of the CEC battery charger test procedure. DOE is harmonizing its procedure with the CEC battery charger test procedure to produce a less burdensome procedure while preserving testing accuracy. No changes are being made to the standby and off mode test procedures for external power supplies. Detailed discussion of the changes can be found in section III.C.

C. Review of Single-Voltage External Power Supply Test Procedure

DOE is amending the test procedure for single-voltage external power supplies to accommodate several classes of external power supplies that cannot be tested in a representative or repeatable manner under the current test procedure. These external power supplies include those devices that (1) communicate with their loads through USB and other protocols (*e.g.* I2C and TCP/IP),[3] (2) limit their output current below the maximum current listed on their nameplates, and (3) have output power in excess of 250 watts. In its NOPR, DOE presented a general outline for a possible test method for these products, but stated that because these types of external power supplies did not exist in significant numbers in the market, DOE was unable to analyze them in depth and develop a testing approach using the single-voltage external power supply procedure. 75 FR 16958, 16962. DOE received generally supportive comments on its proposals for dealing with the three different external power supply types, especially those proposals regarding external power supplies that communicate with their loads. The test procedure revisions adopted in this final rule are described in greater detail in section III.D.

D. Multiple-Voltage External Power Supply Test Procedure

Pursuant to 42 U.S.C. 6295(u)(1)(E)(i)(I), DOE performed a determination analysis and concluded that those external power supplies equipped with multiple simultaneous output voltages were appropriate candidates for separate energy conservation standards. 75 FR 16958, 16974. Because DOE was unaware of any procedure that could be used to measure the energy consumption of these devices, DOE sought to develop such a procedure by modifying the

[2] Ecos Consulting, Electric Power Research Institute (EPRI) Solutions, Southern California Edison (SCE). *Energy Efficiency Battery Charger System Test Procedure.* Version 2.2. November 12, 2008. *http://www.energy.ca.gov/appliances/2008rulemaking/2008-AAER-1B/2008-11-19_BATTERY_CHARGER_SYSTEM_TEST_PROCEDURE.PDF.*

[3] Devices of this type include cellular telephones and portable media players such as MP3 players.

procedures currently used by the CEC when measuring the energy consumption of single-voltage external power supplies [4] and internal power supplies.[5] 73 FR 48054, 48058 (August 15, 2008). DOE looked to the CEC's test procedure as the starting point for creating a multiple voltage external power supply procedure because of the aforementioned positive determination. DOE also believed that the CEC test procedure was the most accurate and appropriate of all the test procedures it examined and that adopting the CEC test procedure would allow DOE to maintain consistency with DOE's single-voltage external power supply test procedure, which was also based on a CEC test procedure. DOE's 73 FR 48064.

In today's final rule, DOE is adopting a test procedure generally consistent with both its earlier approach from its August 2008 proposal to address multiple-voltage external power supplies within the context of its standby mode test procedure and its more recent proposal. See 73 FR 48054, 48064 and 75 FR 16958, 16974. Although DOE had initially considered the adoption of a multiple-voltage external power supply procedure as part of its August 2008 NOPR, it declined to include such a procedure in the March 2009 final rule because of the substantial number of issues raised by commenters and the limited time provided by EISA 2007 to fully consider all of these concerns. 74 FR 13322. These concerns have since been resolved in light of additional comments, data, and information developed as part of today's final rule.

Incorporating this amendment into the external power supply test procedure will enable DOE to evaluate power consumption for multiple-voltage external power supplies in all modes of operation: active, standby (or no-load), and off. A detailed discussion of DOE's test procedure for multiple-voltage external power supplies can be found in section III.E.

[4] Calwell, C., Foster, S., and Reeder, T. *Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies,* August 11, 2004, previously incorporated by reference into appendix Y. Ecos Consulting for the California Energy Commission; Sacramento, CA. *http://www.energystar.gov/ia/partners/prod_development/downloads/power_supplies/EPSupplyEffic_TestMethod_0804.pdf.*

[5] Mansoor, A., *et al.* and May-Ostendorp, P., *et al. Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc Power Supplies, Rev. 6.4.3.* October 22, 2009. EPRI and Ecos Consulting for the California Energy Commission; Sacramento, CA. *http://efficientpowersupplies.epri.com/pages/Latest_Protocol/Generalized_Internal_Power_Supply_Efficiency_Test_Protocol_R6.4.3.pdf.*

III. Discussion

Commenters raised a variety of issues related to DOE's proposal. These issues are addressed in greater detail in the sections that follow.

A. Effective Date for the Amended Test Procedures

The April 2010 proposal provided for an effective date of 30 days after publication of the final rule. That notice also indicated that the amendments to the battery charger and non-Class A external power supply test procedures would be required to be used once DOE sets standards for these particular products. 75 FR 16958, 16963.

Commenters voiced concerns with the 30-day effective date set forth in the test procedure NOPR. AHAM and PTI specifically asked for clarification on the language regarding the effective date. (AHAM, Pub. Mtg. Tran., No. 2 at p. 220; PTI, Pub. Mtg. Tran., No. 2 at p. 236) AHAM specifically voiced that clarification is important to prevent the need for relabeling products and avoiding possible conflicts with applicable State and ENERGY STAR specifications. (AHAM, Pub. Mtg. Tran., No. 2 at p. 223)

In addition to clarity, commenters requested more time to comply. Euro-Pro commented that it is difficult to re-label products, update all associated paperwork and advertisements, and sell the product in the marketplace within 30 days. (Euro-Pro, Pub. Mtg. Tran., No. 2 at p. 224) Euro-Pro further commented that it is difficult to comply with the new test procedure, whether given 30 or 180 days, and that DOE should provide a calendar date by which the procedure would go into effect. (Euro-Pro, Pub. Mtg. Tran., No. 2 at p. 233) Finally, AHAM urged DOE to make the test procedure effective, including the ENERGY STAR test procedure, when the standard becomes effective, to avoid confusion and issues with non-conformance. (AHAM, No. 10 at p. 4)

Commenters indicated that providing a lead time of 30 days would be insufficient to transition to a new test procedure. DOE notes that, any representations of energy use or efficiency made by a manufacturer must be based on the test procedure established by DOE. Manufacturers have 180 days from the establishment of that procedure to ensure that any such representations are based on that DOE-established test procedure. 42 U.S.C. 6293(c)(2)

Currently, there are no energy conservation standards for battery chargers and non-Class A external power supplies. To clarify the timing of the test procedure requirements that DOE is adopting today, DOE is amending the regulatory text to address this issue. Because of the 180-day requirement, as a practical matter, manufacturers have a full six months to adjust to the new procedure before having to make representations based on that procedure. Manufacturers would need to use the new procedure for battery chargers and non-Class A external power supplies once the this date for making representations is reached. Any written representations, such as those prescribed by the Federal Trade Commission in accordance with 42 U.S.C. 6294, would need to be made consistent with the test procedure as amended by today's final rule. Accordingly, although today's rule becomes effective 30 days after publication in the **Federal Register**, manufacturers have 180 days from the publication of today's final rule to use the test procedure for any written representation of energy efficiency or use. And since such requirements are not likely to be established until after DOE sets energy efficiency standards for these products in mid- to-late 2011, manufacturers will have considerable time to adjust to the new procedure before they are required to use this procedure to certify compliance with those new standards. (Given that today's rule does not prescribe any substantive changes that would affect the measured energy efficiency or use of Class A external power supplies, DOE does not anticipate any difficulties for manufacturers who are certifying these products.)

Finally, interested parties asked DOE to clarify how products that cannot be tested can be sold in the United States. (ASAP, No. 11 at p. 12; SCE, No. 13 at p. 12; PG&E, No. 12 at p. 12) They commented that DOE should disallow the sale of products that cannot be tested by the test procedure, but wanted to ensure that a product that must be tested under the procedure does not provide a path for manufacturers to avoid the energy conservation standard requirements. (ASAP, No. 11 at p. 12; SCE, No. 13 at p. 12; PG&E, No. 12 at p. 12) DOE acknowledges the interested parties' concerns and clarifies that, in general, products that cannot be tested in accordance with the DOE test procedure will not be permitted to be sold in the United States. However, a process is available to permit manufacturer to seek a waiver from the test procedure in special circumstances. As part of this process, an alternative test procedure must be provided by the manufacturer seeking the waiver in order to provide a means to measure the energy use or efficiency of that product. See 10 CFR 431.27 (detailing requirements for obtaining a waiver from the required test procedure).

B. Battery Charger Active Mode Test Procedure

Prior to today's final rule, the battery charger test procedure consisted of four parts: (1) Scope, (2) definitions, (3) test apparatus and general instructions, and (4) test measurement. The test measurement section included four subparts to address the measurement of four separate energy consumption modes—inactive mode,[6] active mode, standby mode, and off-mode. Inactive mode energy consumption is measured for purposes of evaluating battery charger performance under the voluntary ENERGY STAR testing program.[7]

During the standby and off mode test procedure rulemaking from 2008, numerous interested parties commented that the current DOE test procedure is insufficient for the development of energy conservation standards because it does not measure energy consumption during active (*i.e.,* charging) mode. Many of these interested parties also recommended that DOE adopt the optional battery charger test procedure then under consideration in draft form at the CEC. As mentioned in the standby and off mode test procedure final rule, 74 FR 13318, DOE was unable to act on these comments, as it had not contemplated the inclusion of any active mode changes in the standby and off mode test procedure NOPR and there was insufficient time to consider this option in light of the statutory deadline for that rulemaking. 73 FR 48054 (August 15, 2008).

1. Incorporation of the CEC Test Procedure

On December 3, 2008, CEC adopted version 2.2 of the test procedure developed by Ecos Consulting, EPRI Solutions, and Southern California Edison (SCE), as an optional test procedure for the measurement of battery charger energy consumption during charging (active), maintenance, no-battery (standby), and off modes. The test procedure was incorporated by reference into section 1604(w) of title 20 of the California Code of Regulations,[8] alongside the DOE test procedure from appendix Y. Details of the CEC test procedure can be found in section III.1 of the NOPR. 75 FR 16964. *See also* 20 Cal. Code 1604(w) (referring to the 2008 DOE test procedure and the California test method for battery chargers).

In both the framework document and NOPR, DOE stated its intention to amend the battery charger test procedure in appendix Y to include an active mode measurement. See 74 FR 26818 and 75 FR 16958. Commenters supported the active mode measurement, and encouraged DOE to adopt the CEC test procedure in this regard. At the NOPR public meeting and in written comments, AHAM generally supported the proposed test procedure based on the CEC procedure and noted that its inclusion of an active mode energy measurement made it an improvement over the procedure already in place. (AHAM, Pub. Mtg. Tran., No. 2 at p. 25; No. 10 at p. 2) AHAM further commented that the CEC test procedure provides a good method for testing active mode. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 65–66) PTI agreed with DOE's decision to incorporate elements from the CEC test procedure into the NOPR. (PTI, Pub. Mtg. Tran., No. 2 at pp. 249–250) PG&E was supportive of DOE adopting an active mode that largely follows the CEC test procedure because that procedure, in PG&E's view, is a solid base for performing battery charger testing. (PG&E, Pub. Mtg. Tran., No. 2 at p. 14) PG&E, Delta-Q and AHAM also supported DOE's decision to drop the inactive mode procedure in favor of an active mode one. (PG&E, Pub. Mtg. Tran., No. 2 at pp. 51–52; AHAM, Pub. Mtg. Tran., No. 2 at p. 47; Delta-Q, No. 5 at p. 2)

As described in section III.B of the NOPR, DOE examined three other procedures that are used world-wide to measure battery charger energy consumption—the EPA-developed procedure used for ENERGY STAR-qualification, Canadian Standards Association (CSA) C381.2, and the CEC test procedure on which DOE based its proposal. 75 FR 16964. After examining these procedures and conducting tests using them, DOE decided that the CEC test procedure provided all of the necessary outputs with reasonably good accuracy and minimal variability. The EPA-developed procedure and the CSA test procedure both lacked a method for measuring active mode energy consumption, a measurement that DOE and interested parties believe is necessary to establish meaningful energy conservation standards. Therefore, for these reasons, and in light of the general support that interested parties gave to the prospect of incorporating a CEC-based test procedure, DOE is basing its battery charger test procedure on the methodology of the CEC procedure but with some modifications to help increase its clarity and repeatability, and minimize the testing burden. (Battery Charger Test Data, No. 18.3) These modifications are outlined in the following sections.

2. Scope

a. Battery Chargers Versus External Power Supplies

As discussed in the NOPR, the battery charger test procedure applies to: "battery chargers operating at either DC or United States AC line voltage (120V at 60Hz)." 75 FR 16958, 16979. In written and verbal comments, interested parties noted that the proposed battery charger test procedure did not clearly explain how DOE would distinguish a battery charger from an external power supply for purposes of testing requirements.

AHAM expressed numerous concerns regarding the proposal's scope. In its view, the procedure should have a scope that clearly outlines what the test procedure covers. (AHAM, Pub. Mtg. Tran., No. 2 at p. 42) AHAM also asserted that any differences between the scope of coverage of the DOE and CEC test procedures stemming from the treatment of the battery charger's wall adapter (*i.e.,* whether it is tested separately as an external power supply or as part of the battery charger) may cause problems once the DOE test procedure for battery chargers becomes effective. Manufacturers may not know which procedure to use with their particular product since the DOE and CEC definitions of battery chargers and external power supplies differ. As a result, in its view, manufacturers will be unsure how to test and label their products. (AHAM, Pub. Mtg. Tran., No. 2 at p. 228) As an example, AHAM argued that non-Class A, motor-operated or detachable battery external power supplies that use charge control circuitry should be viewed as part of a battery charging system and be tested as part of the overall battery charger. (AHAM, Pub. Mtg. Tran., No. 2 at p. 37) It also suggested that to avoid confusion and allow for greater accuracy, DOE

[6] The inactive mode energy consumption measurement consists of the energy measured over 36 hours while the battery charger is in maintenance mode, followed by 12 hours in standby (no-battery) mode, with the possibility of abbreviating the measurement to 6 hours and 1 hour, respectively under certain conditions.

[7] Environmental Protection Agency (EPA). *Test Methodology for Determining the Energy Performance of Battery Charging Systems.* December 2005. *Washington, DC. http://www.energystar.gov/ia/partners/prod_development/downloads/Battery_Chargers_Test_Method.pdf.*

[8] California Energy Commission (CEC), "2009 Appliance Efficiency Regulations," August 2009.

should specify that the battery charger test procedure should be the only test procedure used to test battery chargers and all parts of battery chargers.

DOE notes that the approach suggested by AHAM would eliminate the possibility of regulating external power supplies packaged with battery chargers under the external power supplies standard. (AHAM, No. 10 at p. 4) This approach, however, also contains some inherent problems. Because an external power supply can provide power to one or more parts of an application simultaneously, limiting the procedure in the manner suggested by AHAM would similarly limit DOE's ability to capture certain aspects of the energy consumption characteristics of these products. For certain products, such as a power tool, the external power supply might only provide power to the battery charger. However, for products such as laptops, the external power supply might simultaneously provide power to the battery charger and other functions, such as the screen and processor. If DOE were to follow AHAM's suggestion, it would be unable to capture the potential energy savings from the external power supply to parts of an application other than the battery charger.

AHAM also stated that it is difficult to comment on the test procedure without knowing how energy standards will apply to these products and believed it would be inappropriate to separate the testing of any portions of the battery recharging circuit as part of the test procedure. (AHAM, No. 10 at p. 2)

Separately, AHAM asserted that, in its view, DOE has not clearly explained how the battery charger test procedure schedule integrates with the test procedure for Class A or non-Class A external power supply devices, or any combination thereof. (AHAM, Pub. Mtg. Tran., No. 2 at p. 27) AHAM also stated that manufacturers are currently "required to report their energy usage to California to indicate by a Roman numeral ('IV' or 'V') the level of external power supply that the wall adapter may utilize." In its view, DOE has not yet clarified how a wall adapter would be treated—*i.e.,* as a separate and distinct Non-Class-A external power supply or as part of a battery charger—manufacturers would not know which energy conservation standard would apply. (AHAM, No. 10 at p. 4) Finally, AHAM commented that as a result of a recent memorandum of understanding (MOU) reached between DOE and EPA, ENERGY STAR may be obligated to use the DOE test procedure if it is available. (AHAM, Pub. Mtg. Tran., No. 2 at p. 236) [9]

Wahl recommended that DOE should have one test procedure and regulation for an individual product. Products should be classified as an external power supply or as a battery charger and regulated to one standard or the other but not both. (Wahl Clipper, No. 9, at p. 1)

DOE acknowledges that interested parties have a number of concerns about the scope of the battery charger test procedure. DOE will address these issues and explain its approach in greater detail concerning how to delineate which products are battery chargers and which are external power supplies in the standards rulemaking.

b. Input Voltage and Frequency

As proposed in the NOPR, the scope of the DOE test procedure encompasses products that use DC or AC input voltages of 115 volts (V) at 60 hertz (Hz). 75 FR 16958, 16965. This scope differs from that of the CEC test procedure, which requires, when possible, the testing of units that accept AC line-voltage input at two voltage and frequency combinations: 115 V at 60 Hz and 230 V at 50 Hz. At the NOPR public meeting, commenters expressed different opinions concerning the rulemaking's scope.

Delta-Q, AHAM, and Sony believed that the scope should be limited to cover only products that use DC or AC 115 V at 60 Hz. (Delta-Q, No. 5 at p. 1; Sony, No. 6 at p. 1; AHAM, No. 10 at p. 8) Delta-Q cautioned "against some overlap with any solar industry standards that may apply to battery chargers operating with DC input." (Delta-Q, No. 5 at p. 1) Sony further supported DOE's proposal by stating that limiting testing to a single input voltage would reduce test costs and time and would be consistent with the external power supply test procedure. (Sony, No. 6 at p. 2)

Alternatively, ASAP, PG&E and SCE encouraged DOE to allow for input voltages higher than 115 V, such as 230 V at 60 Hz, because there are some high-power consumer battery chargers that operate at 230 to 240 V at 60 Hz. These chargers include charger/inverter units that connect between the electrical grid and the battery of many consumer photovoltaic (PV) and wind energy systems, as well as rapid chargers for lead acid batteries. (ASAP, No. 11 at pp. 1–2; PG&E, No. 12 at pp. 1–2; SCE, No. 13 at pp. 1–2) These commenters indicated that power at 230 V is available in most U.S. households, and products that use this higher voltage may become more prevalent as the Federal government provides tax incentives for residential PV systems that employ these higher output voltage devices. (ASAP, No. 11 at p. 2; PG&E, No. 12 at p. 2; SCE, No. 13 at p. 2) To account for testing at either input voltage and frequency combination, ASAP, PG&E, and SCE urged DOE to adopt language indicating that if the unit under test (UUT) is intended (*i.e.,* designed) for operation on AC line voltage-input of 110 V to 125 V 60 Hz, it shall be tested at 115 V at 60 Hz. Similarly, these commenters added that if the UUT is not intended for operation at 110 V to 125 V at 60 Hz, but is intended for operation at 220 to 240 V at 60 Hz, it should be tested at 230 V at 60 Hz. In the case of a UUT that is designed for operation on AC line-voltage input but cannot be operated at either of these voltages, this unit should not be tested under the procedure. See generally, ASAP, No. 11 at p. 2; PG&E, No. 12 at p. 2; SCE, No. 13 at p. 2.

Further, these commenters argued that when testing products of the same voltage at both 50 and 60 Hz, switch mode power supplies showed negligible difference in power consumption, and products with line-frequency transformers showed higher power consumption at 50 Hz. (ASAP, No. 11 at p. 2; PG&E, No. 12 at p. 2; SCE, No. 13 at p. 2) In their view, if DOE included higher voltage products in its scope, DOE could assume that if a product tested at 230 V at 50 Hz demonstrates compliance, it would also comply at 230 V at 60 Hz because at 50 Hz, it would be, presumably, consuming more power. Therefore, DOE could accept a test result at 230 V at 50 Hz as a substitute for 230 V at 60 Hz. (ASAP, No. 11 at p. 2; PG&E, No. 12 at p. 2; SCE, No. 13 at p. 2) However, these commenters provided no data in support of these claims.

Although some interested parties were concerned with the scope of the battery charger test procedure, DOE is retaining the scope as it was presented in its NOPR. DOE acknowledges that consumer products operate at different voltage and frequency combinations. However, DOE has not encountered consumer products that operate only at input voltages other than 115 V throughout this rulemaking process. Commenters provided no evidence of such products being available. For this reason, DOE believes that, to the extent that any such products exist, these products comprise, at most, an extremely small portion of the battery

[9] 2009 EPA–DOE Memorandum of Understanding: *http://www.energystar.gov/index.cfm?c=partners.mou.*

charger market. Consequently, DOE has decided at this time not to require the use of a separate voltage in addition to 115 V. DOE does not anticipate that its decision to exclude them from this rulemaking will have a significant impact on the annual energy consumption of battery chargers as a whole. However, DOE may revisit this decision in subsequent rulemakings.

c. DC Input Battery Chargers

In this rulemaking, DOE covers both AC- (as discussed, above) and DC-input battery chargers. In its comments, AHAM questioned whether DOE has the authority to regulate DC-input battery chargers, particularly within the context of those devices that have automotive-related applications—and how the proposed regulation of such products relates to the need for reducing power demanded from utilities. (AHAM, No. 10 at p. 5) AHAM added that if this approach relates to battery charging energy consumption from other electronics sources (*i.e.* charging a cell phone from a laptop computer), it suggested that DOE explain how it will segregate the energy from the functions of the laptop to the battery charger. (AHAM, No. 10 at p. 5) AHAM also stated that DOE should not focus on DC input battery chargers, but rather focus only on non-Class A power supplies and AC input battery chargers. (AHAM, No. 10 at p. 5)

Additionally, in response to the preliminary analysis for the corresponding battery charger and external power supply energy conservation standards rulemaking, DOE received other comments regarding in-vehicle chargers.[10] CEA and Motorola both stated that DOE's test procedure should clarify its stance regarding in-vehicle chargers while also recommending that such chargers be dropped from the scope of coverage for both the test procedure and the energy conservation standards rulemakings. (CEA, No. 48 at p. 3 and Motorola, No. 50 at pp. 2–3) Motorola commented that the CEC test procedure does not have a clear stance for in-vehicle electronics because the stated scope of the test procedure excludes battery chargers that do not connect to the utility grid, yet there are stipulations for testing devices that connect to cigarette outlets in automotive equipment and USB ports. (Motorola, No. 50 at pp. 2–3). CEA commented that the "stated scope of the DOE test procedure clearly excludes in-vehicle 'DC-in, DC-out' battery charging systems which are not connected to the utility grid. However, there are instructions in the test method for testing these types of battery charging systems." (CEA, No. 48 at p. 3)

Under EPCA, DOE has the authority to cover a wide variety of consumer products, excluding those consumer products "designed solely for use in recreational vehicles and other mobile equipment". 42 U.S.C. 6292(a). In DOE's view, this exclusion does not apply to any of the DC-input devices that would likely be affected by the procedure being promulgated today. While some of these products may be designed to work in conjunction with certain mobile equipment, such as for the purpose of recharging the battery of a golf car, DOE has found that none of the products that were considered within the context of this rulemaking—or of any related standards rulemaking activities—involved products that were designed solely for use in recreational vehicles and other mobile equipment. For example, cell phone chargers that work with DC current (as would be available in a recreational vehicle) also come equipped (or are designed to work) with wall adapters. As a result, such devices are not "designed solely" for use in a recreational vehicle and other mobile equipment.

However, as a result of the aforementioned provision, DOE is modifying its procedure for determining how a product should be tested. If a manufacturer packages its product with a wall adapter or the manufacturer recommends or sells a wall adapter for use with its product, the battery charger shall be tested with that wall adapter. If this is not the case and the product, such as a GPS device, only works with a DC input through either a car charger or a USB port, that device will be tested with the 5 V DC input that corresponds to the USB port configuration.

Consistent with this view, DOE plans to proceed with the scope proposed in the NOPR, which includes testing DC-input battery chargers. While EPCA specifies the input voltage that applies to an external power supply as part of that product's statutory definition, it does not place similar limitations with respect to the input voltage of battery chargers that DOE may regulate. Further, while many DC-input battery chargers may be designed to work with a recreational vehicle or other mobile equipment, these chargers are not "designed solely for use" in these applications since many, if not all, of these chargers are designed to work in conjunction with wall adapters, USB ports, or through other electrical connections to obtain AC mains power. In light of the absence of any specific language that would otherwise prevent DOE from regulating battery chargers that operate with a DC-input, and the fact that these devices are not designed exclusively for use in recreational vehicles or other mobile equipment, DOE believes it has the authority to regulate such products. Whether DOE opts to regulate these products is a decision based on whether energy conservation standards for these products achieve the maximum energy savings, are technologically feasible, and are economically justified. See 42 U.S.C. 6295(o)(2). As part of the energy conservation standards setting process, DOE plans to separately evaluate those DC-input battery chargers and determine whether it is technically and economically feasible to set standards for them in a manner consistent with the applicable statutory requirements.

d. High-Power Battery Chargers

DOE sought comment on how it should address the treatment of high-power battery chargers. In comments, Delta-Q expressed concern with the approach contained in the current version of appendix Y, which tests all battery chargers in the same manner, irrespective of the amount of power they use. Delta-Q stated that they are very concerned about how the test procedure would measure the energy use of higher power (750–1500W) chargers on larger (>200Ah) batteries, because the potential variability in the batteries is greater than in smaller batteries. This greater variability can impact the entire system and the calculated energy efficiency. To address this issue, Delta-Q suggested the use of an electronic load to simulate a battery pack, a standard battery make/model with a certain age range or excluding batteries above a certain size from the test procedure (Delta-Q, No. 5 at p. 1).

As proposed in the NOPR, today's final rule specifies that both the battery charger and its battery shall be new products of the type and condition that would be sold to a customer (*i.e.* end-user). 75 FR 16958, 16981. DOE is aware of the potential benefit that exists from using a battery simulator and testing with an electronic load, namely, decreased variability in test results for large lead-acid batteries. However, DOE is unaware of any existing test procedures that rely on this particular method, but is aware of test procedures for battery chargers that require testing with the physical batteries that are associated with the charger being tested. The fact that there are no currently

[10] The comments listed in this paragraph come from administrative record for the parallel rulemaking on energy conservation standards for battery chargers and external power supplies. The reference docket number is EERE–2008–BT–STD–0005 (RIN: 1904–AB57).

recognized standard test procedures that rely on simulators suggests that testing with physical batteries rather than simulators is not only preferable but an appropriate and acceptable means to accurately test battery chargers, including those products that charge extremely large batteries (*i.e.* those used in forklifts or golf cars).

Additionally, because DOE is unaware of test procedures that use battery simulators, DOE would need to develop such procedures on its own, which would require considerably more testing and analysis and potentially involve additional uncertainty given the absence of any currently existing protocols. Potential concerns include determining how such a device would be used in a test procedure and how representative such a device would be of an actual battery, as well as other considerations, all of which would need to be vetted publicly. DOE is confident that today's final rule will result in repeatable test results for all battery chargers, including those that use large batteries, because of the requirements that are being added when selecting a battery to test and from DOE's experience testing various battery chargers. (Battery Charger Test Data, No. 18.3) As a result, the procedure will permit performance comparisons across all battery charger types with respect to energy usage. Upon the receipt of further information, DOE may consider using a battery simulator in a future revision to the test procedure. In the absence of this information, however, DOE is opting to incorporate its proposed method into the battery charger test procedure—*i.e.* specifying that high-powered battery chargers be tested using the same method as used to test all battery chargers; that is, by using the associated battery.

e. Consumer Motive Equipment

The CEC test procedure includes two parts: part 1 covers the energy consumption of consumer products with input power under 2 kilowatts, whereas part 2 covers the energy consumption of larger industrial chargers, which are generally larger in size and capacity. Briefly, part 1 measures the input energy to the battery charger when recharging a battery that had previously been conditioned (if necessary). Part 2 requires this same measurement but includes charger output energy measurements and tests the charger with the battery at three different depths-of-discharge. The NOPR provided a more detailed discussion of these parts. See 75 FR 16958, 16964–66 (section III.B.1 and section III.B.2).

DOE proposed testing all battery chargers, including large battery chargers for golf cars and other consumer motive equipment, according to part 1 of the CEC test procedure. PG&E, ASAP, and SCE agreed with DOE's approach for testing the battery chargers used with golf cars and other consumer motive equipment. (ASAP, No. 11 at p. 2; PG&E, No. 12 at p. 2; SCE, No. 13 at p. 2) PG&E informed DOE that golf cars can be satisfactorily tested under either part 1 or part 2 of the CEC test procedure. (PG&E, Pub. Mtg. Tran., No. 2 at p. 76) ASAP, PG&E and SCE informed DOE that the main drawback of using part 1 to test golf cars is that only the worst energy performers are identified under this approach. (ASAP, No. 11 at p. 2; PG&E, No. 12 at p. 2; SCE, No. 13 at p. 2) They suggested that when DOE revisits the test procedure, DOE should carefully consider the data on the efficiency of current golf car battery chargers, and consider amending the test procedure to use part 2 at that time. (ASAP, No. 11 at p. 2; PG&E, No. 12 at p. 2; SCE, No. 13 at p. 2)

Not all interested parties were supportive of using part 1 of the CEC test procedure to measure battery chargers for golf cars and other consumer motive equipment. In AHAM's view, DOE's proposal oversimplifies the issue because these products differ from other battery chargers in terms of battery chemistry, usage, and charging equipment. Because of these complexities, AHAM argued in favor of adopting a separate test procedure section for these products. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 74–75; AHAM, No. 10 at p. 5) Delta-Q reiterated this point but did not believe that there was any reason to exclude these 750–1000W size battery chargers from efficiency standards (Delta-Q, No. 5 at p. 1).

Contrary to the comments made by AHAM, there are similarities between battery chargers for golf cars and other consumer products, such as motorized wheelchairs, since they all require lead-acid batteries and use battery chargers with similar technologies. For more information on these products and their technical similarities, please refer to chapter 3 of DOE's preliminary technical support document for energy conservation standards for battery chargers and external power supplies. See *http://www1.eere.energy.gov/buildings/appliance_standards/residential/battery_external.html.*[11]

The technical similarities between these types of products allow them to be tested in a similar fashion. DOE has also considered PG&E's experience in developing the CEC test procedure on which DOE's proposal is largely based. In developing the CEC procedure, PG&E tested golf cars using the methods that are currently prescribed in both Part 1 and Part 2 of the CEC test procedure. DOE has given careful consideration to PG&E's statement that golf cars and other consumer motive equipment can be accurately tested under either part 1 or part 2 of the test procedure.

While DOE agrees with PG&E's overall assessment regarding the potential limitations applicable to part 1 of the CEC test, the additional testing requirements and complexity of part 2, which was intended for industrial applications, suggest that the adoption of part 2 for consumer products would constitute an unnecessary testing burden that would not be likely to increase the accuracy of the test results that would otherwise be gleaned from part 1. The test procedure provisions in part 2 may be necessary to accurately measure the energy efficiency of large industrial battery chargers but for golf cars and other types of consumer motive equipment (collectively, consumer motive equipment) that fall at the low-power end of the lead-acid battery charger range, the need for a specialized test procedure is not as clear. For example, part 2 requires a series of tests under various conditions to detect any differences in energy consumption. The greater comprehensiveness to this approach is better suited to high-power industrial chargers, which are already very efficient when compared to the consumer products that could be tested under part 2. Moreover, since consumer products that could be tested under part 2 have greater variations in efficiency than industrial chargers, requiring manufacturers to test these products using the simpler test method outlined in part 1 should generate sufficiently accurate results without imposing the greater burden that would likely be posed by requiring part 2. Therefore, in consideration of this situation, today's final rule specifies that part 1 be used for these products.

3. Definitions

DOE proposed to make a number of changes to the definitions in the battery charger test procedure contained in 10 CFR, subpart B, appendix Y. Specifically, DOE proposed to delete

[11] Chapter 3 of the technical support document contains the Market and technology Assessment, which includes additional details on all products that may be affected by DOE's energy conservation standards rulemaking effort. The docket number for this parallel rulemaking is EERE–2008–BT–STD–0005 (RIN: 1904–AB57).

two definitions from the current battery charger test procedure, modify four definitions, and add 15 new definitions to appendix Y. 75 FR 16966. After reviewing the comments submitted in response to this proposal, DOE has decided to apply certain terms used in the CEC procedure as part of the revised set of battery charger-related definitions. To implement these changes, DOE is amending section 2 of appendix Y by amending, deleting, and incorporating new definitions to make appendix Y consistent with the CEC procedure. DOE is also removing definitions used only in section 4(a) of appendix Y (inactive mode energy consumption measurement), which DOE is removing with today's final rule (see section 5.a of this final rule).

a. Deleting Existing Definitions

The specific changes in today's final rule consist of a series of deletions, amendments, and additions. These changes include removing the definitions of "accumulated nonactive energy" and "energy ratio or nonactive energy ratio" from the regulations, as they are relevant only to the nonactive mode measurement of the procedure. That portion of the procedure is being removed as part of this final rule. Details of these deletions can be found in section III.B.3.a of the NOPR. 75 FR 16958, 16966. Commenters did not oppose the proposed deletions.

DOE received comments suggesting the removal of two definitions from its current test procedure. ASAP, PG&E, and SCE recommended the removal of definitions of "detachable" and "integral" batteries, which are contained within the definition of "battery or battery pack" in the current DOE test procedure. These commenters argued that these particular definitions are not required when carrying out the test procedure and that their inclusion within the regulation could create confusion since some batteries are neither detachable nor integral. Commenters cited as an example products that use AA or AAA rechargeable batteries to power a device, but recharge those batteries in a device external to the product. They also added that some lead-acid batteries for automotive and marine applications may also not meet either definition. (ASAP, No. 11 at pp. 10–11; PG&E, No. 12 at pp. 10–11; SCE, No. 13 at pp. 10–11) These commenters further stated that the terms are only used for the battery selection process, and "[t]he key element is not whether the batteries are integral or detachable, but rather whether or not they are packaged with the charger and therefore constitute 'typical' batteries." (ASAP, No. 11 at p. 11; PG&E, No. 12 at p. 11; SCE, No. 13 at p. 11)

DOE's test procedure will continue to define detachable and integral batteries. Although commenters indicated that these terms are only used for the battery selection process, they are also used in the standby and off mode tests, which remain as part of the amended test procedure. Both of these tests require the disconnection of the battery from the end use product except in cases where an integral battery, which, by definition, cannot be disconnected from the end use product, is used. See 10 CFR part 430, subpart B, appendix Y. The continued use of these terms and their definitions helps provide clarity to these procedures.

b. Revising Existing Definitions

DOE had also proposed to modify the definitions of "active mode," "multi-port charger," "multi-voltage à la carte charger," and "standby mode" found in appendix Y. The proposed changes were minor and designed to clarify the wording of those definitions. DOE received no comments regarding these definitions in response to the NOPR. For "active mode" and "standby mode," DOE is clarifying that these terms can be used interchangeably with the terms "charge mode" and "no-battery mode" respectively. Additionally, the terms "multi-port charger" and "multi-voltage à la carte charger" are being revised to be consistent with the corresponding CEC definitions and are expanded to encompass a batch charger. Details of these proposed revisions can be found in section III.B.3.b. of the NOPR. 75 FR 16958, 16966.

c. Adding New Definitions

Finally, because DOE proposed adding procedures to measure energy consumption in active mode for a battery charger, DOE also proposed the inclusion of a number of new corresponding definitions. In particular, DOE proposed to add definitions for "active power or real power (P)," "ambient temperature," "apparent power (S)," "batch charger," "battery rest period," "rated energy capacity," "C-rate," "equalization," "instructions or manufacturer's instructions," "measured charge capacity," "rated battery voltage," "rated charge capacity," "total harmonic distortion (THD)," and "unit under test (UUT)." See 75 FR 16958, 16967.

Commenters provided feedback on DOE's proposed definitions for "instructions or manufacturer's instructions," "power factor," "rated charge capacity," and "total harmonic distortion," as discussed in the sections, below. No other comments were provided regarding the other proposed definitions.

Instructions or Manufacturer's Instructions

DOE proposed to define the term "manufacturer's instructions" as "the documentation packaged with the product in printed or electronic form and any information about the product listed on a Web site maintained by the manufacturer and accessible by the general public at the time of the test." 75 FR 16958, 16967. Commenters expressed concern with the proposed definition for manufacturer's instructions.

PG&E referred DOE to the CEC test procedure, which defines the term "manufacturing instructions" broadly to permit testing labs to use information that is unavailable to consumers. (PG&E, Pub. Mtg. Tran., No. 2 at p. 23) PG&E also supported DOE's decision to expand the definition of manufacturer instructions to include information provided on manufacturers' Web sites. However, it stated that service instructions should be included to enable manufacturers to provide information not generally available to consumers. Service instructions may include detailed information to technicians that explain how to disassemble the product to gain access to an integral battery or a battery that has protective circuitry. (PG&E, Pub. Mtg. Tran., No. 2 at pp. 246–247) PTI indicated that such information would not ordinarily be provided to consumers in light of the potential safety hazard posed by the disassembly of the product by an untrained individual. (PTI, Pub. Mtg. Tran., No. 2 at pp. 247). PTI supported the inclusion of service instructions as part of the definition so long as the testing is carried out by professional technicians and those detailed instructions do not become public. (PTI, Pub. Mtg. Tran., No. 2 at pp. 248–249) ASAP, PG&E, and SCE encouraged DOE "to expand the definition of 'manufacturer's instructions' to include both consumer instructions and service instructions." (ASAP, No. 11 at p. 3; PG&E, No. 12 at p. 3; SCE, No. 13 at p. 3) They recommended that DOE should take one of the following approaches: (1) utilize the original CEC language or (2) adopt alternative language in which DOE would define "manufacturer's service instructions to consumers" separately from "manufacturer's service instructions." By defining them separately, DOE can specify that only the consumer instructions should be used when setting up a product in preparation for the charge test, but either can be used to access the battery for the discharge test, since disassembly to reach the battery will never be needed for the charge test but may be necessary for the discharge test. (ASAP, No. 11 at p. 3; SCE, No. 13 at p. 3; PG&E, No. 12 at p. 3) Finally, AHAM commented that the test procedure should not encourage a test technician to open a sealed battery pack or compartment. (AHAM, No. 10 at p. 7)

PG&E and PTI both suggested that service instructions should be included in the definition of manufacturer instructions, and permit these documents to be used to perform testing, according to the CEC definition. The CEC defines that term to include "any service manuals or data sheets that the manufacturer offers for sale to independent service technicians, whether printed or in electronic form." [12]

After considering these comments, DOE has decided to modify its initial proposal and to adopt the CEC definition for manufacturer's instructions, which includes service instructions in its definition. DOE is taking this step to ensure that testing technicians have adequate information on how to access the battery. DOE will also specify that if service instructions are used to perform testing, it should clearly be stated in the certification report to avoid potential confusion if the particular product is subjected to verification testing. A copy of the instructions should be provided to DOE for verification purposes.

Power Factor and Crest Factor

DOE proposed to include definitions for both power factor and crest factor as part of the battery charger test procedure. 75 FR 16958, 16967. The term "power factor" denotes the ratio of the power consumed by a device relative to the power drawn by a device from mains. The term "crest factor" refers to the ratio of the instantaneous peak voltage relative to the root-mean-square value, measured when charging a device. These definitions are not currently used as part of the test procedure. DOE received comments both in favor and against these proposed definitions.

ASAP, PG&E and SCE supported DOE's inclusion of power factor and crest factor. In their view, the inclusion of these terms in the test procedure would broaden its scope and applicability. These commenters also believed that even though DOE may not be using these measurements and definitions within the context of the current rulemaking activities to set energy efficiency standards for battery chargers, their inclusion in this test procedure will allow other agencies, such as the U.S. Environmental Protection Agency (EPA), to reference this test procedure and develop future policies regarding energy efficiency related performance features. (ASAP, No. 11 at p. 13; PG&E, No. 12 at p. 13; SCE, No. 13 at p. 13)

AHAM disagreed with these proposed definitions as well as the proposed method by which to measure them. (AHAM, Pub. Mtg. Tran., No. 2 at p. 85; AHAM, No. 10 at p. 4) It argued that measuring power factor for the purpose of regulation represents a significant departure from most other DOE appliance energy efficiency standards. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 85–86; AHAM, No. 10 at pp. 4) AHAM continued, stating that the test procedure provides no method for taking a power factor measurement and that part of the problem is that the procedure lacks a definition of source impedance. The source impedance is an important factor because its definition affects the accurateness of the real world losses that would stem from power factor in a consumer product. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 86–87; AHAM, No. 10 at pp. 4–5) For consumer products, like those that use battery chargers covered by this rulemaking, the source impedance is an electrical description of the wiring within a house that has a direct impact on apparent power and thus, constitutes the power factor measured for a device. AHAM also suggested that DOE should conduct studies to establish the range of impedance and the possible impacts of power factor. (AHAM, No. 10 at pp. 4–5)

Additionally, PTI was concerned that DOE has not provided any details on how to measure power factor. PTI, like AHAM, argued that to obtain consistent and meaningful results, DOE must define the source impedance and provide a method for how the measurement is taken. (PTI, No. 8 at p. 3) PTI also stated that DOE should not include the power factor and crest factor test procedure measurements and definitions in its final rule. PTI also commented that including these definitions and measurement methods in the test procedure would imply that DOE has evaluated the merit of measuring power factor and crest factor, which it has not; therefore PTI believes that DOE should not define or require the measurement of power factor and crest factor. (PTI, No. 8 at p. 3)

In today's final rule, DOE has decided to drop its proposal regarding power factor and crest factor. At this time, DOE has not conducted an analysis on the benefits that could be gained from regulating power factor or crest factor for consumer products that use battery chargers and commenters offered no data in support of such an approach. Although DOE acknowledges that other agencies, such as EPA, may have an interest in using these measurements, DOE currently has no plans to incorporate either of them for compliance purposes. Accordingly, although DOE may revisit this issue at a later date, DOE is declining to incorporate power factor and crest factor into today's final rule.

Rated Charge Capacity

DOE proposed to define "rated charge capacity" in its regulations. Specifically, DOE proposed to define this term as "the capacity the manufacturer declares the battery can store under specified test conditions, usually given in ampere-hours (Ah) or milliampere-hours (mAh) and typically printed on the label of the battery itself * * * " 75 FR 16958, 16968. The proposed definition was consistent with the CEC test procedure's definition.[13]

DOE received a single response to this proposal. Sony recommended that DOE adopt the current CEC definition for rated charge capacity, which allows the option of using a rated charge capacity unit of either milliampere-hours (mAh) or ampere-hours (Ah). Sony opposed what it believed was a proposal by DOE to use only Ah. (Sony, No. 6 at p. 2) DOE notes that its proposed definition includes the use of both Ah and mAh. 75 FR 16958, 16980.

In light of the absence of any objections to its proposed approach, DOE will adopt its proposed definition for rated charge capacity.

Total Harmonic Distortion

In its NOPR, DOE defined "total harmonic distortion" as:

"the root-mean-square (RMS) value of an AC signal after the fundamental component is removed and inter-harmonic components are ignored, divided by the RMS value of the fundamental component." 75 FR 16980.

Responding to this proposal, AHAM suggested that DOE consider the language of International

[12] Pacific Gas and Electric, California Energy Commision-Pulic Interest Energy Research (PIER) Program, and Southern California Edison *Energy Efficiency Battery Charger System Test Procedure.* Version 2.2, November 12, 2008, page 6.

[13] Pacific Gas and Electric, California Energy Commision-Pulic Interest Energy Research (PIER) Program, and Southern California Edison *Energy Efficiency Battery Charger System Test Procedure.* Version 2.2, November 12, 2008, page 8.

Electrotechnical Commission (IEC) Standard 62301, section 1.1.1 "Supply voltage waveform" with respect to total harmonic distortion, but did not provide reasoning for this recommendation. (AHAM, No. 10 at p. 7)

DOE is adopting the proposed definition. DOE notes that this language is based on those definitions that are already in use by the Institute of Electrical and Electronics Engineers (IEEE) through standard 1515–2000—as well as DOE's own regulations for external power supplies. See 10 CFR part 430, subpart B, appendix Z. As a result, the industry already follows this definition. Adopting a different definition would conflict with DOE's intent to harmonize the approaches contained in the battery charger and external power supply test procedures, as well as with the industry standard currently in place. Therefore, DOE is adopting its proposed definition for this term.

4. Test Apparatus and General Instructions

a. Confidence Intervals

DOE proposed incorporating confidence qualifiers to the confidence intervals in its test procedure. The proposed confidence intervals were different from the CEC intervals in that they added a 95% confidence qualifier to the CEC intervals. As a result DOE's proposal provided for a margin of ≤ 2% at the 95% confidence level for active power measurements of 0.5 W or greater and a margin of ≤ 0.01 W at the 95% confidence level for active power measurements of 0.5 W or less.

AHAM supported adding the 95% confidence qualifier to the confidence intervals, stating that it is "an important addition to the standard." (AHAM, Pub. Mtg. Tran., No. 2 at p. 91) PTI left the use of a confidence level for error analysis to DOE by stating that "[s]ince the Department alone is aware of their intention with respect to future use of the data provided by the test procedure, they should evaluate, through an error analysis, the impact of the error in the test data, particularly in the case of battery capacity." (PTI, No. 8 at p. 3) AHAM recommended that DOE consider the IEC 62301 Second Edition FDIS document for methods of dealing with uncertainty, specifically for measurements under 1 watt. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 91–92; AHAM, No. 10 at p. 6) AHAM also suggested that the Department consider the language in section 4.2 "Measuring equipment" of the Canadian Standards Association's (CSA) test method for battery chargers for confidence limits. (AHAM, No. 10 at p. 6) Additionally, AHAM recommended that DOE add a requirement that laboratories publish the error analysis for their automated equipment because manufacturers may obtain different results than verification laboratories as a result of different sampling rates and instrument accuracy. (AHAM, No. 10 at pp. 5–6)

PTI also supported DOE's proposal, noting that DOE was correct to address the uncertainty of the measurements rather than the equipment, as the test equipment may not be able to deliver the same uncertainty with different UUTs. (PTI, No. 8 at p. 4) PTI recommended that DOE include requirements that test laboratories, particularly in the case of verification testing, provide a suitable error analysis that demonstrates that they have met the uncertainty requirements of the test procedure. (PTI, No. 8 at p. 4) PTI also stated that DOE should establish overall error requirements rather than only equipment requirements because elements other than equipment introduce error. (PTI, Pub. Mtg. Tran., No. 2 at pp. 95–96)

PTI added that DOE should consider the sampling rate and sampling interval during the measurement of the energy use of a charger that performs pulse charging—which is when a unit that sends periodic bursts of current to the battery rather than a continual stream of current—because these factors will affect the overall uncertainty of the measurement (PTI, Pub. Mtg. Tran., No. 2 at p. 94).

After taking into account these comments, which generally expressed support for DOE's proposed inclusion of the specified confidence intervals into the test procedure, DOE decided to adopt its proposed approach. Regarding these specific intervals and the various recommendations offered by AHAM, DOE notes that its proposal matches the requirements set out in IEC 62301 and, although the language is not identical to what appears in the CSA test method, its requirements are similar. As for PTI's concerns with respect to pulse charging, DOE is not persuaded that any extra consideration or change is needed. By specifying a 95% confidence level for the measurement, the technician must ensure that the sampling rate is fast enough to capture any pulses in order to maintain the specified statistical accuracy of his measurement. Thus, the requirements that DOE is incorporating are aligned with the commenters' recommendations. They also will result in a more robust and repeatable test procedure because all results must be expressed with a high level of confidence, which will permit less variance in the measurements recorded for a tested device.

b. Test Laboratory Temperature

DOE proposed raising the ambient temperature during testing from 20 degrees to 25 degrees plus or minus 5 degrees Celsius in its NOPR. DOE proposed this change because it believed 25 degrees Celsius was more easily achievable across diverse climates and more typical of testing environments. 75 FR 16968–69. Several commenters responded to this aspect of the proposal.

PG&E recommended leaving the temperature range as it was. The basis for the CEC temperature range, which has already gained industry acceptance, stems from the applicable IEC standards for batteries. If DOE were to alter the temperature range, it would need to conduct additional testing to verify that the end-of-discharge voltages are still appropriate at the high end of the range of temperatures because the higher temperatures will have unknown effects on the chemistries of batteries. (PG&E, Pub. Mtg. Tran., No. 2 at p. 97). AHAM agreed with PG&E and, in its view, raising the ambient temperature during testing would be acceptable only if DOE had first considered the end-of-discharge voltages when making the change. (AHAM, Pub. Mtg. Tran., No. 2 at p. 98) ASAP, PG&E, and SCE urged DOE to adopt the industry standard room temperature of 15 to 25 degrees Celsius. (ASAP, No. 11 at p. 3; PG&E, No. 12 at p. 3; SCE, No. 13 at p. 3). These commenters noted that the 15 to 25 degrees Celsius temperature range is the industry standard and because the chemical reactions taking place in batteries are temperature sensitive and the end-of-discharge voltages are based on this range, DOE should not change the temperature range. Altering the temperature range could have unintended and unknown consequences on the end-of-discharge voltage. It is possible that changing the temperature range could increase or decrease the end-of-discharge voltage, so doing so would require testing to determine if the end-of-discharge voltages for various battery chemistries are still appropriate at the higher temperature range. (ASAP, No. 11 at p. 3; PG&E, No. 12 at p. 3; SCE, No. 13 at p. 3)

AHAM alternatively recommended in its written comments that DOE consider incorporating the IEC 62301 requirement that "[t]he ambient temperature shall be maintained at (23±5)° C through the test." (AHAM, No. 10 at p. 7) Although this was a departure from its statements at the NOPR public meeting, AHAM stated that it believed this value had support in the International Standards community and would be very attainable. (AHAM, No. 10 at p. 7)

After evaluating the comments received on this issue, DOE has decided not to increase the temperature range and to continue requiring an ambient temperature of 20 degrees plus or minus 5 degrees Celsius. This approach is consistent with the CEC test procedure. The lower temperature range is widely accepted and currently used by the industry. Adopting this approach, based on information presented to DOE, should not impose a new burden on manufacturers to alter their testing laboratories since the appropriate operating temperature range remains the same. Additionally, this temperature range, which served as the basis for the development of the end-of-discharge voltages specified, ensures that consistency and the validity of those voltages is maintained. For these reasons, DOE is incorporating this range into the final rule. DOE notes that while AHAM suggested DOE consider the IEC 62301 range of 23 degrees plus or minus 5 degrees Celsius, all other commenters—including AHAM—indicated that a departure from the original temperature range, 20 degrees plus or minus 5 degrees Celsius has the potential to invalidate the end-of-discharge voltages that have been established for the various battery chemistries used in battery chargers. Accordingly, DOE is opting not to make such a change and will harmonize its test procedure with other industry standards to the extent feasible to help ensure the validity of all measured end-of-discharge voltages.

c. Charge Rate Selection

DOE proposed to require that when testing a battery charger equipped with user controls that enable the user to select from two or more charge rates that the test be conducted using the fastest charge rate that is recommended by the manufacturer for everyday use. 75 FR 16958, 16969. Commenters had varying opinions on this approach.

Delta-Q "mildly disagreed" with DOE's proposal for selecting the charge rate for testing, as a charger could be significantly less efficient at lower power levels, but they did not provide data or other support for their reasoning. (Delta-Q, No. 5 at p. 1) Alternatively, ASAP, PG&E, and SCE supported DOE's proposed approach. (ASAP, No. 11 at p. 10; PG&E, No. 12 at p. 10; SCE, No. 13 at p. 10) No other pertinent comments were submitted on this issue.

In light of these comments, and the absence of any supporting data or information that would support Delta Q's assertion that a charger would operate less efficiently at lower power levels, DOE is adopting its proposed approach. DOE believes that, given a choice, users are more likely to opt for the fastest charge that does not impact the battery's long-term health, as evidenced by the popularity of successively faster chargers in the market. (Battery Charger Test Data, No. 18.3) DOE presented this view during the NOPR public meeting and received no comments disputing this view. Consequently, DOE is requiring that testing occur at the fastest charge rate that is recommended by the manufacturer for everyday use. Doing so will reduce the test procedure burden on manufacturers while producing representative measurements of energy use.

d. Battery Selection

DOE proposed to require testing with a battery or combination of batteries, depending on the charger type—*i.e.* multi-voltage, multi-port, or multi-capacity. This approach is consistent with the CEC test procedure. 75 FR 16958, 16969. For those battery chargers that come either with no batteries or multiple batteries, DOE also sought comment on an alternative approach that would require the testing of only the configuration of batteries most commonly used with the device, but no comments or data were received on this approach. 75 FR 16969, 16979.

AHAM commented that if the manufacturer recommends a battery for use with the product, the Department should consider using only that battery, and not any others, for measuring energy consumption during testing. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 112–113) ASAP, PG&E, and SCE supported DOE's proposal to test the battery charger with only the typical battery configuration but suggested a change to improve the repeatability of the battery selection process. (ASAP, No. 11 at p. 10; PG&E, No. 12 at p. 10; SCE, No. 13 at p. 10) Specifically, these commenters suggested changing section 4.3 (3) of appendix Y to be more restrictive than the proposed "any [battery] suitable for use with the charger"-approach set forth in the NOPR. These commenters suggested that DOE's test procedure recommend searching within brand name batteries that are readily available in the region where the product is sold or being tested. (ASAP, No. 11 at p. 10; PG&E, No. 12 at p. 10; SCE, No. 13 at p. 10)

DOE is incorporating its proposed approach because it received no comments suggesting alternative approaches that would allow a battery charger to be tested with a single battery that would generate a result that is "a representative average use cycle." See 42 U.S.C. 6293(b)(3). Under this approach, if the battery is packaged with the charger, then the charger is tested with only this battery. Alternatively, if the charger is not packaged with a battery, and is multi-port, multi-capacity, or multi-voltage in configuration, testing with a single battery, as recommended by interested parties, may not be a representative average use cycle and more than one test is needed to accurately assess the average use of that product. Although DOE's proposed approach can require up to three tests, which is potentially burdensome, it ensures that the test procedure fulfills this statutory requirement. See 42 U.S.C. 6293(b)(3). This approach should also enable DOE to account for all possible battery combinations that can be used in the charger rather than just the most typical configurations.

In response to the preliminary analysis for energy conservation standards for battery chargers and external power supplies, DOE received related comments. Motorola commented that the CEC test procedure, upon which DOE based its test procedure, is not completely clear in defining how to select batteries for testing and that DOE should clearly define how to select batteries for testing. They added that DOE should define the terms "lowest voltage" and "highest voltage." (Motorola, No. 50 at p. 2) [14]

As mentioned, DOE is incorporating its proposed approach for selecting batteries with which a technician should test a unit under test. Although the procedure does not define the terms "highest voltage" and "lowest voltage," DOE believes that these terms clearly refer to the rated battery voltage because that is the pertinent information that manufacturers will provide when they package or recommend batteries to use with their devices. The other voltages that Motorola references in its comment (*e.g.* desired end-of-discharge battery voltage) are voltages that must be monitored after the testing has commenced and are not pertinent for selecting batteries to test. Accordingly, DOE is declining to define these particular terms at this time.

[14] The comments listed in this paragraph come from administrative record for the parallel rulemaking on energy conservation standards for battery chargers and external power supplies. The reference docket number is EERE–2008–BT–STD–0005 (RIN: 1904–AB57).

e. Non-Battery Charging Functions

DOE proposed to implement a procedure for testing battery chargers with non-battery charging functions that would be consistent with the CEC approach. The CEC method requires the tester to turn off any user-controlled functions and disconnect all auxiliary electrical connections to the battery charger. 75 FR 16958, 16969.

Commenters had mixed views regarding non-battery charging functions. PG&E, Delta-Q, ASAP and SCE agreed with DOE's approach. PG&E stated that it agreed that the test procedure should not provide any energy allowances for battery chargers with extra functionality and agreed that any such functionality should be turned off during testing. (PG&E, Pub. Mtg. Tran., No. 2 at p. 15) Delta-Q agreed with DOE's approach for non-battery charging functions. (Delta-Q, No. 5 at p. 2) ASAP, PG&E, and SCE stated that testing conducted for the development of the CEC test procedure found that turning off or disconnecting additional functions is the only approach that results in accurate measurements of standby power while providing a means to compare the energy consumption of products with and without additional functionality against each other. (ASAP, No. 11 at p. 3; PG&E, No. 12 at pp. 3–4; SCE, No. 13 at p. 4) Sony asked for clarification on how the additional functionality section in the proposal would pertain to video products (Sony, No. 6 at p. 2).

In contrast, PTI commented that since battery charging is often secondary to the main function of the product, requiring the non-battery charging functionality to be turned off during testing would be inconsistent with the general approach of trying to satisfy the user's requirements. (PTI, Pub. Mtg. Tran., No. 2 at p. 119) In response, PG&E offered a solution to manufacturers and stated that manufacturers could design additional functionality into their products to ensure that the additional functionality will not consume enough power to prevent a battery charger from meeting any energy conservation standards that DOE might set. (PG&E, Pub. Mtg. Tran., No. 2 at p. 120)

PTI suggested an alternative method to account for non-battery charging functions. It suggested conducting the battery charger test with and without the battery; the difference between the two measurements would be the energy used to charge the battery. Although this method excludes the standby component, PTI believed that the error associated with its exclusion is less significant than the error that would result from treating all of the products as if they were augmented battery chargers. (PTI, Pub. Mtg. Tran., No. 2 at pp. 123–124)

When developing its test procedure, DOE considered how to isolate the energy consumption of the battery charging circuitry in cases where the charger is embedded inside another product that provides additional functionality, such as video products and notebook computers. The test procedure must ensure that measurement of energy use for these types of products accounts for the energy used by this additional functionality. DOE believes that its proposed method is best suited to capture these measurements compared with the other methods suggested by commenters because it does not discount power consumption in other modes of operation, as the suggested approach by PTI would do.

The method in this final rule is consistent with that of the generally accepted CEC test procedure, which applies equally to all products, including video products. By requiring that any switches controlling the additional functionality be turned off, and any auxiliary cables or connections be disconnected, this method provides manufacturers with a cue to shut down the additional functionality. As a result, only the battery charging portion of the battery charger is measured during testing. DOE notes that if a manufacturer does not equip its product with a switch to shut off non-battery charger functions, it may continue to do so. During testing, the energy consumption of these functions would still be calculated as part of a given product's total energy consumption. For this reason, DOE believes that it is likely that manufacturers of these types of products, in order to continue to maintain the added functionality, would be encouraged to minimize the energy consumed by these non-battery charger functions when designing their products.

f. Battery Chargers With Protective Circuitry

DOE proposed to incorporate text from the CEC test procedure related to protective circuitry. 75 FR 16958, 16982. Incorporating this change would allow technicians to accurately measure the discharge energy of a battery without including energy from the protective circuitry. This measurement is important for the test procedure because it is equivalent to the useful, or non-lost, energy consumed during a charge cycle. The text was proposed for incorporation as part of DOE's overall adoption of the CEC test procedure. DOE did not propose to change the language of the CEC test procedure pertaining to protective circuitry in its NOPR. However, commenters provided feedback on the language in the CEC test procedure, stating that it contained an error.

Commenters asserted that the language that DOE proposed to incorporate from the CEC-based test procedure contained an error that the CEC has not yet corrected. These commenters recommended that DOE adopt the language that the CEC had apparently intended to use in its procedure when testing battery chargers equipped with protective circuitry, rather than the language that CEC ultimately adopted.[15] In the view of these commenters, the procedure should have stated that when protective circuitry is present, the technician should take the measurement at the leads of the battery cells after the protective circuitry rather than at the terminals of the test battery to ensure that the energy consumption of the protective circuitry is accurately measured. (PG&E, Pub. Mtg. Tran., No. 2 at p. 23, 181–184) ASAP, PG&E and SCE also recommended incorporating language that matched the language that CEC had intended to incorporate into its test procedure. (ASAP, No. 11 at p. 11; PG&E, No. 12 at p. 11; SCE, No. 13 at p. 11) PTI also agreed with the suggested revision. (PTI, Pub. Mtg. Tran., No. 2 at p. 184) ASAP, PG&E and SCE indicated that their collective belief is that CEC will adopt the corrected language in their next test procedure revision, although this revision has yet to occur. (ASAP, No. 11 at p. 11; PG&E, No. 12 at p. 11; SCE, No. 13 at p. 11) PG&E and SCE are two of the primary consulting firms that helped develop the CEC test procedure. DOE received no comments opposing the revision recommended by ASAP, PG&E, and SCE. Additionally, commenters mentioned how the new methodology will increase safety in the test labs because technicians will not be required to dismantle battery packs and create connections between the battery and its protective circuitry. (ASAP, No. 11 at p.

[15] The language adopted in the CEC test procedure states: "Some products may include protective circuitry between the battery cells and the remainder of the device. In some cases, it is possible that the test battery cannot be discharged without activating protective control circuitry. If the manufacturer provides a description for accessing connections at the output of the protective circuitry, the energy measurements shall be made at the terminals of the test battery, so as not to include energy used by the protective control circuitry." See part 1, section II.F of CEC test procedure.

11; PG&E, No. 12 at p. 11; SCE, No. 13 at p. 11)

In light of the new information presented by PG&E regarding the CEC test procedure and the noted safety benefits, DOE is altering its proposal to incorporate language that will require testing to occur at the output of the protective circuitry, rather than at the test battery terminals. As noted, the primary benefit of this approach is increased safety within the testing laboratory. The protective circuitry that is used in battery chargers is usually found in cases where a battery charger works with a lithium-ion chemistry battery. Due to their chemistry, these batteries can be unstable, which is why the protective circuitry is used. Consequently, DOE believes it is prudent that such circuitry should be used, and not dismantled, when measurements are taken for this test procedure.

g. Charge Capacity of Batteries With No Rating

The battery charger test procedure currently requires the use of a battery capacity rating in order to determine the rate at which the discharge test is performed. This section describes how DOE decided to address batteries that have no rating. DOE proposed a method for determining the capacity of batteries with no ratings. That method was an iterative process requiring the use of an initial 0.5 amp (A) trial current (hereafter referred to as the 0.5 A test method). 75 FR 16970. The proposed process would require that the user iteratively adjust the initial 0.5 A, until he or she reaches a discharge current that could discharge that battery at a 0.2 C rate ("C rate" refers to the amount of time in hours it would take to discharge the battery relative to its capacity), which corresponds to an approximately 5-hour discharge. DOE proposed that so long as the battery was discharged within 4.5 to 5.5 hours, or an hour-long window of time, the result of the discharge test could be accepted as valid. 75 FR 16983. Commenters had mixed opinions on both the time frame acceptance window and the 0.5 A test method. These comments are addressed below.

Acceptance Window

An acceptance window is the time frame in which a measurement of battery energy can be taken and considered appropriate for the UUT. It is critical for testing purposes because it ensures consistency and repeatability. Commenters generally urged DOE to decrease its acceptance window to a range of 4.5 to 5 hours, which would decrease the proposed acceptance window of 1-hour down to 30 minutes. (ASAP, No. 11 at p. 4; PG&E, No. 12 at p. 4; SCE, No. 13 at p. 4) PG&E claimed that the proposed 1 hour window causes unacceptable errors and recommended a half-hour maximum window to decrease the likelihood of measurement errors. (PG&E, No. 2 at p. 20) It explained that a half-hour time window for the discharge time of unrated batteries introduces a 2-percent error in the energy use measurement, while a 1-hour time window introduces an error of about 4 to 5 percent. However, a 15-minute time window would, in its view, be preferable. (PG&E, No. 2 at p. 106; ASAP, No. 11 at p. 6; PG&E, No. 12 at p. 6; SCE, No. 13 at p. 6) Manufacturers provided no comments regarding the proposed time window.

Commenters agreed that a shorter acceptance window of 4.5 to 5 hours is more appropriate than the 4- to 5-hour time window that DOE proposed. DOE believes that a 15-minute window would be unduly burdensome since it reduces the originally proposed time period by one-fourth and will require more iterations to accomplish. DOE recognizes, however, the merit of using a shorter acceptance window and is adjusting this element in its procedure to cover a 30-minute window as suggested by the commenters. The tighter acceptance window will produce more precise results than what the proposed 1-hour window would have yielded and will not be unduly burdensome to perform.

Method for Determining the Capacity of Batteries With No Rating

As mentioned above, DOE proposed using the 0.5 A test method to determine the capacity of batteries with no ratings as a method to achieve a current that would discharge the battery within the time acceptance window. Properly discharging a battery is necessary to ensure that the useful energy that was transferred from the battery charger to the battery is accurately measured and not misconstrued as lost energy. However, commenters were generally critical of DOE's proposal.

ASAP, PG&E, and SCE strongly encouraged DOE to remove its proposed instructions for determining the discharge current for batteries without capacity labels. (ASAP, No. 11 at p. 4; PG&E, No. 12 at p. 4; SCE, No. 13 at p. 4) They commented that for batteries with no rated capacity, the 0.5 A initial trial current is not always appropriate. Specifically, in their view, a current of 0.5 A works well primarily for batteries with capacities from about 0.5 Ah to 4 Ah. However, for products that cannot accept currents of 0.5 A (*i.e.* smaller batteries with lower capacities, such as those used with Bluetooth headset batteries) or that have large capacities (*i.e.* batteries with capacities in the range of 35 to 50 Ah, such as those used with electric scooters), a 0.5 A current would either not be possible or require an amount of time well in excess of the 5 hour maximum proposed by DOE—potentially, multiple days in duration. (PG&E, No. 2 at p. 20; ASAP, No. 11 at p. 7; PG&E, No. 12 at p. 7; SCE, No. 13 at p. 7) PTI also stated that it believed the 0.5 A starting current may be inappropriate and they believed that better results may come from trial and error as is suggested in the CEC test procedure. (PTI, Pub. Mtg. Tran., No. 2 at p. 102) ASAP, PG&E, and SCE added that DOE's proposed method does not always produce repeatable results, particularly when the results of the protocol for determining discharge time push the discharge time near the boundaries of the acceptance discharge time window. (ASAP, No. 11 at p. 4; PG&E, No. 12 at p. 4; SCE, No. 13 at p. 4)

ASAP, PG&E, and SCE proposed an alternative to the 0.5 A test method. Their method bases the initial discharge current on battery weight. (ASAP, No. 11 at pp.18–19; PG&E, No. 12 at pp. 18–19; SCE, No. 13 at pp. 18–19) ASAP, PG&E, and SCE suggested that if DOE considers it necessary to include instructions regarding the determination of the capacity of unrated batteries, DOE should consider adding the following steps:

1. Pick an initial trial current which is deliberately too low. A reasonable step is to weigh or measure the battery and divide the number of cells to obtain grams per cell or cm^3 per cell.

2. Be sure the battery is fully charged and discharged at the current selected in step 1 for up to 2 hours. If the end-of-discharge voltage is reached before 2 hours, stop the discharge and go to step 5. If not, after 2 hours of discharge go to step 3.

3. Double the current.

4. Discharge the battery at the new current for up to 1 hour. If the end of discharge voltage is reached before 1 hour, stop the discharge and go to step 5. If not, after 1 hour of discharge, repeat steps 3 and 4.

5. For the first discharge, compute the total charge capacity as the sum of the capacities of each step to discharge. For each step, the partial capacity is the product of the current and the time for which that current was drawn. (The total charge is defined as the integral of

the current over time.) Call this [value the] total charge capacity Q_0.

6. The last discharge current is called I_0 and let T_m be the center of the acceptable time window, (perhaps 4.75 hours). Calculate the next trial current as:

$I_1=(Q_0/T_m) * (1.0 + 0.2 * 1n (I_0 * T_m/Q_0))$

where ln() is the natural logarithm function.

7. Discharge at this current I_1 until the end-of-discharge voltage is reached. Call the time required for this discharge T_1. If T_1 is within the acceptable window, use I_1 as the discharge current. If not, continue with step 8.

8. Compute the next trial current I_2:

a. $I_2=(I_1*T_1/T_m) * (1.0 + 0.2 * 1n (T_m/T_1))$

b. Repeat step 7.

(ASAP, No. 11 at pp. 18–19; PG&E, No. 12 at pp. 18–19;; SCE, No. 13 at pp. 18–19;)

Adopting such a method would address the concern raised by Delta-Q, who requested that a provision be included for batteries with no rated capacity that allows (1) a larger starting current and (2) current steps to be estimated based on the battery size and weight. (Delta-Q, No. 5 at p. 2)

ASAP, PG&E, and SCE added that the instructions in DOE's proposal, or any instructions generally, would not improve the repeatability or accuracy of the CEC method to select a discharge current, but would instead complicate the details of the test method and limit the flexibility of test labs and manufacturers to determine their own discharge rate by requiring that they obtain that rate using the specific DOE instructions. (ASAP, No. 11 at p. 4; PG&E, No. 12 at p. 4; SCE, No. 13 at p. 4) ASAP, PG&E, and SCE urged DOE to not require steps to determine discharge current and instead to require only that the discharge current satisfy the time acceptance window. (ASAP, No. 11 at p. 5; PG&E, No. 12 at p. 5; SCE, No. 13 at p. 5)

After carefully considering all of the comments, DOE is modifying the approach it proposed. In particular, DOE will incorporate a specific time acceptance window but not specify at this time the method for manufacturers to follow when discharging an unrated battery. By adopting this new approach, the measured efficiency of the battery charger will not be affected because technicians will have the freedom to rely on their expertise and will not be required to use a method that may be inappropriate for very large or very small batteries contained within a battery charger. DOE is declining to incorporate the suggested battery weight method offered by ASAP, PG&E, and SCE. In evaluating this method, which included conducting actual tests using this suggested approach, DOE found that it took many iterations—as many as eight in some cases—to obtain the proper discharge current. (Battery Charger Test Data, No. 18.3) DOE believes that sufficiently accurate testing can occur because the test procedure requires that the discharge test be completed within a half an hour acceptance window. This requirement will ensure that technicians discharge their battery at a rate close to the 0.5 C-rate that is required when the charge capacity of the battery is known.

Battery Capacity Listings

The final comment pertaining to unrated batteries related to the manner in which manufacturers communicate to end users and technicians the charge capacity specifications of a battery. DOE had proposed that the technician refer to a manufacturer's instructions to obtain a rated charge capacity. 75 FR 16982. Subsequently, AHAM commented that Web pages are an effective way to allow the manufacturer to communicate this information. (AHAM, No. 2 at p. 126) DOE notes that its proposal already permits manufacturers to communicate the specifications in this manner because its definition of "instructions or manufacturer's instructions" includes Web page information. 75 FR 16958, 16980. Accordingly, in the absence of any objections to its proposal, DOE is adopting its proposed approach to refer technicians to manufacturer's instructions for information regarding battery capacity.

h. Battery Conditioning

DOE proposed to require conditioning of the battery by performing two charges and two discharges, resulting in two conditioning cycles. Battery conditioning is the process by which the battery is cycled several times prior to testing in order to permit the battery to reach its specified capacity. DOE proposed these conditioning cycles to prepare the battery for testing while ending on a discharge of the battery. This step was necessary within the context of the proposed testing order. The proposal reversed the testing order from the one currently prescribed under the CEC testing provisions. 75 FR 16958, 16971.

Responding to this proposal, ASAP, PG&E, and SCE collectively recommended that DOE require three cycles of battery conditioning to maintain repeatability. (ASAP, No. 11 at p. 8; PG&E, No. 12 at p. 8; SCE, No. 13 at p. 8) Although nickel-based batteries (*e.g.* NiCd or NiMH) can take between 5 and 100 cycles to "develop their full capacity," these commenters pointed out that interested parties reached a consensus during the CEC rulemaking that 3 cycles is an acceptable compromise between accuracy and repeatability. (PG&E, Pub. Mtg. Tran., No. 2 at p. 22; ASAP, No. 11 at p. 8; PG&E, No. 12 at p. 8; SCE, No. 13 at p. 8) In golf cars and similarly-sized applications with large battery packs, Delta-Q noted that testing for several cycles could take several weeks if different manufacturers and models are considered. (Delta-Q, No. 5 at p. 2)

The CEC test procedure requires that the batteries requiring conditioning be prepared by performing three charges and two discharges. DOE proposed to remove the final preparatory charge and replace it with a measured charge as would have been required by the proposed reversed testing order. However, because of the concerns raised by commenters in response to DOE's proposal, and the potential risk identified by the commenters that such an approach may decrease the accuracy of the test, DOE is dropping its proposed testing order and is adding a final preparatory charge as suggested by interested parties. Although PG&E, ASAP, and SCE commented that some nickel-based batteries need 5 to 100 cycles to develop their full capacity, they also stated that the three cycles specified in the CEC method was an acceptable compromise between accuracy and repeatability. Other commenters did not dispute the sufficiency of using three cycles.

A battery must be stable during testing to ensure the repeatability of measurements related to capacity. Because the battery becomes more stable as additional charge-discharge cycles are performed, more than one cycle must be used. Adopting a requirement that provides for three cycles should be sufficient to ensure the stability of the battery because most battery chemistries will reach a relatively steady state at this point and three tests will not impose an excessive testing burden. Accordingly, DOE is adopting a three cycle approach to ensure battery stability is achieved during testing.

Additionally, DOE is incorporating a conditioning section into the test procedure, as requested by ASAP, PG&E, SCE, and Sony. Commenters had noted that the proposed regulatory text did not include a section regarding battery conditioning. (ASAP, No. 11 at p. 8; PG&E, No. 13 at p. 8; SCE, No. 12 at p. 8; Sony, No. 6 at p. 2). To address this issue, DOE is incorporating a conditioning section that is consistent with the approach followed by the CEC. This new requirement will be inserted into 5.3 of amended appendix Y of subpart B of part 430 and will help ensure the completeness of the test procedure.

i. Rest Period

DOE proposed to permit a rest period for both charged and discharged batteries from 1 to 24 hours. 75 FR 16958, 16984. A rest period is the period between the preparation of a battery and the battery discharge test. It also includes the period between the battery discharge test and the charge and maintenance mode tests. 75 FR 16958, 16967. A rest period is required to enable the battery to return to the ambient temperature, which is a necessary prerequisite to ensure consistent testing conditions. This proposal differed from the rest period in the CEC test procedure, which prescribes a period of 1 to 4 hours for charged batteries and 1 to 24 hours for discharged batteries. See III.C and III.E of part 1 of the CEC test procedure.

ASAP, PG&E, and SCE asserted that the proposed rest period "is inconsistent with the CEC-adopted test procedure as well as industry standards." (ASAP, No. 11 at p. 14; PG&E, No. 12 at p. 14; SCE, No. 13 at p. 14) The interested parties further commented that "regardless of the test order, the rest periods should be 1 to 4 hours for charged batteries and 1 to 24 hours for discharged batteries." The shorter rest period for charged batteries would minimize the self-discharge effect that occurs in NiCd and NiMH batteries. (ASAP, No. 11 at p. 14; PG&E, No. 12 at p. 14; SCE, No. 13 at p. 14)

In this final rule, DOE is adopting the language from the CEC test procedure, in part to maintain consistency with industry testing protocols. Providing a shorter rest period for charged batteries also ensures that certain types of batteries (such as the NiCd and NiMH batteries discussed above) do not self-discharge, making the test results more consistent. Incorporating a 1 to 4 hour rest period for charged batteries will help harmonize the DOE test procedure with these widely accepted industry standards, as well as minimize the possibility of self-discharging of batteries with NiCd or NiMH chemistries.

Additionally, in its NOPR, DOE also proposed that "for batteries with flooded cells, the electrolyte temperature shall be less than 33 degrees Celsius before charging." 75 FR 16958, 16984. DOE had intended to adopt the language from the CEC test procedure, which specifies an under 30 degree Celsius requirement. No comments were received regarding this issue. In this final rule, DOE is incorporating the corrected temperature requirement, which is consistent with that retained in the CEC test procedure. See part 1, sections II.C and II.E of the CEC test procedure.

5. Test Measurement

a. Removing Inactive Mode Energy Consumption Test Apparatus and Measurement

DOE proposed removing its inactive mode energy consumption test. 75 FR 16958, 16970. The inactive mode energy consumption measurement in section 4(a) of appendix Y prior to today's final rule prescribed a method for calculating a nonactive energy ratio. Both industry and non-industry commenters responded to this proposed change.

PG&E, Delta-Q and AHAM supported DOE's proposal to drop its inactive mode procedure and to replace it with one that measures active mode energy consumption. (PG&E, Pub. Mtg. Tran., No. 2 at p. 51; AHAM, Pub. Mtg. Tran., No. 2 at p. 47; Delta-Q, No. 5 at p. 2) However, PTI did not agree with removing the nonactive mode metric because, in its view, the removal of this metric would remove an aggregate measure of the energy use of the product in a variety of modes. (PTI, No. 8 at p. 1) Commenters also raised concerns related to usage profiles, noting in particular that they are necessary to determine how a product is truly used and what energy savings potential actually exists. (AHAM, Pub. Mtg. Tran., No. 2 at p. 48, PTI, Pub. Mtg. Tran., No. 2 at p. 49) (Usage profiles are assumptions, based on a variety of sources, including manufacturers, surveys, and other publicly available data, about the amount of time products spend in each mode of operation. These assumptions represent the manner and frequency with which a product is used. Usage profiles are valuable in that they help show how a product is used, which can be helpful in determining its energy consumption during typical consumer usage in all modes of operation.)

Performing the inactive mode test procedure requires integrating the input power of the battery charger in maintenance mode and no battery mode. That value is divided by the battery energy measured during discharge, resulting in a nonactive energy ratio. However, today's final rule incorporates an active mode test, which will, collectively, with the other portions of the amended test procedure, result in a battery charger test procedure that measures battery charger energy in all four modes (*i.e.,* active, maintenance, standby, and off). Consequently, there is no need for the continued use of a nonactive mode metric since the energy that was previously captured by this metric will be captured by these other modes. As for concerns about aggregation and usage profiles, DOE notes that it will address these issues in greater detail in the related standards rulemaking that is currently underway. See 75 FR 56021 (Sept. 15, 2010).

b. Charge Test Duration

Charge test duration issues involved two primary areas. First, commenters provided feedback on DOE's proposal to shorten the procedure for certain products. Second, commenters also provided feedback on DOE's proposal to have indicators to help provide some means for a tester to determine the appropriate duration of a test. These issues are discussed in greater detail below.

Shortened Test Procedure

In the NOPR, DOE considered permitting a shortened test procedure for those products that stabilized (*i.e.* reached steady-state in maintenance mode) in less than 24 hours. This approach would have modified the procedure contained in the CEC test procedure. See part 1, section II.E of the CEC test procedure. Shortening the active mode test by terminating it once the charger has entered steady state operation could result in decreased testing time and decreased burden on manufacturers. DOE proposed this approach to reduce the testing burden faced by at least some manufacturers from the 24-hour charge test. 75 FR 16958, 16970.

PG&E stated that the 24-hour test is not more burdensome than the proposed shortened test. Under the longer 24-hour test, technicians would be able to leave the test setup over night and begin a new test the next day, which is likely to be the same even if the test is shortened. (PG&E, Pub. Mtg. Tran., No. 2 at pp. 167–168) PTI commented that while it may be convenient for DOE to offer a shortened test procedure, the full test procedure will need to be used for verification purposes. (PTI, Pub. Mtg. Tran., No. 2 at p. 162) ASAP, PG&E, and SCE argued that a 24-hour active and maintenance mode test is the shortest permissible period that should be employed because it will allow the technician to see additional shifts in battery charger behavior that may have otherwise been missed because the charger entered a steady-state that was not necessarily maintenance mode early on during the test period. (ASAP, No. 11

at p. 7; PG&E, No. 12 at p. 7; SCE, No. 13 at p. 7)

Alternatively, some interested parties supported the shortened test method approach. AHAM argued that the shortened test is acceptable if the test record shows that it was used, and manufacturers understand that the 24-hour test will be used for verification. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 169–170) AHAM further stated that if a manufacturer knows that the shortened test procedure will accurately test their product, it should be able to use it so long as the manufacturer clearly states in the test record that it was used. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 164–165) For manufacturers with products that have short charge times, the shortened test can provide value by enabling a tester to complete multiple testing cycles within a normal testing day. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 168–169) AHAM noted that if the shortened test procedure yields the same results as the 24-hour test procedure, manufacturers should be permitted to use that procedure so long as the 24-hour test procedure will be used for verification purposes. (AHAM, No. 10 at pp. 6–7) AHAM emphasized that it is crucial that the test procedures be accurate, and that there be no opportunity for a certifying laboratory to conduct a test one way, and a verifying laboratory to conduct it a different way, with the two laboratories obtaining different results. (AHAM, Pub. Mtg. Tran., No. 2 at p. 26) Delta-Q, in general, agreed with the proposed shortened test procedure. It noted that more advanced chargers may be programmed to pass the shortened test by inhibiting any energy-consuming modes for the duration of the test. (Delta-Q, No. 11 at p. 2). Sony opposed the 24-hour charge test duration, stating that it is neither cost effective nor efficient. It suggested adding the following statement: "If the battery charger has an indicator to show that the battery is fully charged, [the discharge] test can begin as soon as the indicator shows that the battery is fully charged." Alternatively, Sony recommended that DOE shorten the charge test duration from 24 hours to 12 hours. (Sony, No. 6 at p. 2)

DOE is dropping its initial proposal for a shortened test period.

As indicated by the submitted comments, manufacturers were wary of the proposal since it could cause issues with verification testing of products. In particular, not all battery chargers behave the same way in maintenance mode. Some chargers may "wake up" and have periods of high input current to top off the battery's charge level if the battery has self-discharged after sitting without being used for an extended period of time. Measuring the energy consumption of products employing this type of feature under these conditions could miss these "wake up" periods if a shortened test duration is used. When DOE conducted testing according to the shortened test procedure, it also found that it can be difficult to determine when the product reaches steady state, which serves as the point at which the test should end. (Battery Charger Test Data, No. 18.3) Furthermore, adopting the shortened test procedure could lead to complications due to the necessity of reconciling two differing measurement results. Therefore, to ensure there are no potential discrepancies or confusion, and in light of the reliability and accuracy of a test with a longer duration, DOE is declining to incorporate a shortened test procedure in this final rule.

Indicators

DOE proposed to have indicators, if present, to serve as a means to help determine the length of the charge test. DOE proposed this approach because it is consistent with the CEC test procedure (see section II.E of part 1 of the CEC test procedure) and provides a clear means for technicians to determine when the battery has been fully charged. In using this approach, DOE proposed that if the indicator shows that the battery is fully charged after 19 hours of charging, the test shall terminate once 24 hours have elapsed. Conversely, if the full-charge indicator does not indicate that a full charge has been reached after 19 hours of charging, the test shall continue up until 5 hours after the indicator has illuminated or otherwise indicates that the battery has been fully charged. 75 FR 16958, 16983.

ASAP, PG&E, and SCE commented that charger indicator lights are not reliable and consistent sources of information about the state of charge of the battery. They added, though, that these lights are useful for general guidance on the state of charge for the purpose of determining a charger's active mode test length. (ASAP, No. 11 at p. 13; PG&E, No. 12 at p. 13; SCE, No. 13 at p. 13) Despite their collective objection to DOE's proposed approach, these interested parties did not suggest changing the proposed test duration selection process. (ASAP, No. 11 at p. 13; PG&E, No. 12 at p. 13; SCE, No. 13 at p. 13)

After considering these comments, DOE is adopting its proposed approach to permit the use of indicators to help determine a battery's state of charge. DOE notes that a testing technician is not restricted to the use of indicator lights, but may rely on any indicator that is a part of the UUT that would help in determining a battery's state of charge. DOE believes that indicators are sufficiently informative to determine the charge test duration of a battery because, as commenters conceded, they are useful in providing information regarding the general state of a battery's charge. Because the charge and maintenance mode test will not be shortened, DOE believes that the information conveyed by an indicator about the general state of a battery's charge is all that is necessary for the purposes of testing. Furthermore, the vast majority of battery chargers currently available on the market will likely finish charging well before the 19 hour mark that must be met in order to complete the test within 24 hours. (Battery Charger Test Data, No. 18.3) Therefore, up-to-the-minute precision regarding when the battery has reached its full charge state is not necessary for the vast majority of products. This change will not only provide testers with a straight-forward guide when determining a battery's state of charge, but will also help to ensure consistency with the established CEC test procedure that the industry is already following.

c. Testing Order

The CEC test procedure requires that the test be conducted by performing first a preparatory discharge followed by a measured charge and then a measured discharge. See section III of part 1 of the CEC test procedure. DOE proposed to reverse this testing order by requiring a preparatory charge first, followed by a measured discharge and measured charge. 75 FR 16971. As explained below, interested parties generally opposed this proposed approach.

PG&E stated that if DOE adopts its proposal to reverse the CEC testing order, the procedure will not accurately measure the energy consumption of battery chargers that take longer than 24 hours to charge. If the battery is discharged completely during the 5 hour discharge test, and then is not fully charged within 24 hours, the test does not account for a complete "round-trip" (*i.e.,* a complete charge-discharge or discharge-charge cycle). PG&E recommended that DOE either prove a round-trip has been accomplished under its proposed approach or adopt the CEC method. (PG&E, Pub. Mtg. Tran., No. 2 at pp. 16–18; PG&E, Pub. Mtg. Tran., No. 2 at pp. 135–136)

PG&E further stated that reversing the testing order creates a loophole that can encourage manufacturers to make slow charging products that will appear more efficient than they actually are since the reversed testing order will account for a full discharge but only a partial charge for these products. PG&E encouraged DOE to ensure that its final procedure includes a valid method to measure the energy consumption of battery chargers that take longer than 24 hours to charge. (PG&E, Pub. Mtg. Tran., No. 2 at pp. 140–141; PG&E, Pub. Mtg. Tran., No. 2 at pp. 143–144). ASAP objected to reversing the charge/discharge order detailed in the CEC procedure. (ASAP, No. 11 at p. 8; PG&E, No. 12 at p. 8; SCE, No. 13 at p. 8) ASAP, PG&E, and SCE added that the reversed testing order was found to give inaccurate and inconsistent results for a significant number of products that were tested. (ASAP, No. 11 at p. 8; PG&E, No. 12 at p. 8; SCE, No. 13 at p. 8) In their view, the reversed testing order does not accurately test batteries that take longer than 24 hours to charge, which includes batteries used with emergency systems (*e.g.* computer uninterruptible power supplies, security systems, exit lighting, and other power backup applications), small automotive type chargers, and many universal chargers for C-size of D-size batteries. (ASAP, No. 11 at p. 8; PG&E, No. 12 at p. 8; SCE, No. 13 at p. 8) These commenters also contended that retaining the proposed reversed CEC testing order may create an incentive for manufacturers to redesign their products to charge for longer periods of time rather than making the product more efficient, since the test procedure will record a full discharge, and only a partial charge. (ASAP, No. 11 at p. 9; PG&E, No. 12 at p. 9; SCE, No. 13 at p. 9) By doing so, manufacturers could inflate the efficiency of their products and effectively circumvent any energy conservation standards that DOE may establish.

Similarly, AHAM commented that if reversing the testing cycle causes errors with accuracy, the Department should consider alternatives. (AHAM, Pub. Mtg. Tran., No. 2 at p. 139) However, AHAM also commented that DOE's proposal to reverse the CEC testing order will result in some time savings without any loss of accuracy. (AHAM, No. 10 at p. 5) Delta-Q expressed support for incorporating a reversed order from the CEC procedure and noted that it follows this reversed-order approach when conducting all battery cycle test measurements. (Delta-Q, No. 5 at p. 2).

Euro-Pro made an alternative suggestion, requesting that DOE consider modifying its proposal to permit the tester to monitor the battery voltage either during charging or at the end of the charge, and terminate the test when the battery is discharged, regardless of the time needed for a complete discharge to occur. (Euro-Pro, Pub. Mtg. Tran., No. 2 at pp. 142–143)

Sony sought clarification on whether the proposed reversing of the CEC test procedure would impact the testing duration or burden. (Sony, No. 6 at p. 2)

DOE made its proposal to allow the preparatory step to be a charge rather than a discharge. By permitting this step, preparation could be conducted within the UUT, rather than using a battery analyzer, which would in turn reduce the amount of required testing equipment time that a manufacturer would need to allocate while testing. DOE had believed that following this approach would reduce the overall testing burden without impacting accuracy. 75 FR 16958, 16971.

However, after considering the comments submitted on this issue, DOE recognizes the merits of the concerns expressed by interested parties that the proposed test procedure may not capture a full round-trip for some battery chargers. Completing a full round trip is critical to accurately measuring the energy consumption of a battery charger because it prevents the possibility of obtaining results that suggest that more energy came out of the battery then went into the battery, a physical impossibility with a full charge and discharge. As mentioned above, commenters indicated that this problem may be prevalent with numerous products such as an uninterruptible power supply or universal battery charger that takes longer than 24 hours to charge its battery. (ASAP, No. 11 at p. 8; PG&E, No. 12 at p. 8; SCE, No. 13 at p. 8) Furthermore, the potential measurement error caused by the proposed change could be exploited by some manufacturers as a loophole, which could occur if the 5-hour discharge test recovered all energy from the battery and the subsequent charge test captured only the energy flowing into the battery during the first 24 hours. Under this scenario, the test would capture only a portion of the energy consumed by the charger. Finally, DOE believes that preserving the proposed testing order while adding steps to ensure that a battery is not overcharged, like the steps suggested by Euro-Pro, would increase test procedure complexity and burden since it would require a technician to continuously monitor the battery for 24 hours or longer to determine when the battery has reached a fully charged state. For these reasons, DOE is modifying the approach presented in its proposal and adopting the order prescribed in the CEC test procedure—*i.e.* preparatory discharge, measured charge, measured discharge.

d. End-of-Discharge Voltages

DOE proposed end-of-discharge voltages for both popular and novel battery chemistries. 75 FR 16958, 16984. In its notice, DOE proposed that the test procedure incorporate an end-of-discharge voltage of 2.5 volts per battery cell. DOE made this proposal in order to provide guidance on the recommended voltage to stop the discharging process to avoid damaging the battery. Responses to this aspect of the proposal were mixed.

ASAP, PG&E and SCE offered support for "DOE's effort to include battery charger systems with novel chemistries in the test procedure," as well as "DOE's effort to identify batteries that are in the lab now and might become commercialized over the coming years." (ASAP, No. 11 at p. 9; PG&E, No. 12 at p. 9; SCE, No. 13 at p. 9)

On the other hand, AHAM commented that the proposed end-of-discharge voltages were not consistent with manufacturer specifications, noting in particular that most lithium ion battery manufacturers do not recommend discharging below 3.0 volts per cell. (AHAM, Pub. Mtg. Tran., No. 2 at p. 147) AHAM further stated that some manufacturers do not design the battery with protective circuitry and discharging to too low of a level will damage the battery. (AHAM, Pub. Mtg. Tran., No. 2 at p. 151) Euro-Pro agreed with AHAM and noted that some products stop operating after a certain amount of time and do not reach the end-of-discharge voltage level. (Euro-Pro, Pub. Mtg. Tran., No. 2 at p. 150) PTI's main concern was that if the test is terminated at a predetermined voltage, even if that predetermined voltage is set by surrounding circuitry, as long as the battery is returned back to that same voltage, this method would complete a round trip. (PTI, Pub. Mtg. Tran., No. 2 sheet at p. 181)

On the issue of novel battery chemistries, commenters stated that because the test procedure would likely be reviewed on a seven-year cycle, DOE should have an approach to address those battery cells that had not been previously contemplated. (PTI, Pub. Mtg. Tran., No. 2 at p. 152) PTI urged DOE to consider accepting "cell manufacturer published values for recommended cutoff voltages" and "permitting future chemistries to be considered under the test procedure without having to revise it." (PTI, Pub. Mtg. Tran., No. 2 at p. 154). AHAM also commented that the proposed end-of-discharge voltages only apply to units without electronic cycle termination and that new battery chemistries were not included as part of the end-of-discharge table. AHAM asserted that DOE's proposed end-of-discharge voltage table should only be used as a guide and that testing should use the manufacturer's stated end-of-discharge values, which usually stem from recommendations received from the battery manufacturer. Alternatively, AHAM also suggested that relevant IEC cell standards could be used as a reference. For example, it asserted that DOE should allow manufacturers to place battery capacity information on their Web sites, specification sheets, or instructions shipped with the product. In AHAM's view, this flexibility would help better handle situations where new battery chemistries are introduced and appropriate end-of-discharge voltages are not known, without which, damage could be done to the battery during testing. (AHAM, No. 10 at p. 6; AHAM, Pub. Mtg. Tran., No. 2 at p. 156)

In today's final rule, DOE is opting to maintain its end-of-discharge voltage table as proposed in the NOPR. 75 FR 16984. DOE believes that it is prudent to have a consistent cut-off voltage across chemistries because this voltage will affect the amount of energy that is measured coming out of the battery. This energy represents a fundamental measurement and key output of the test procedure. Given the outlined approach, deferring to a manufacturer's stated end-of-discharge values that are provided on an individual product basis may not provide this type of consistency. Accordingly, today's final rule adopts the end of discharge voltages from the CEC test procedure, since they are widely accepted and already in use by the industry. In addition to the chemistries listed in the CEC table, DOE specified end-of-discharge voltages for two novel chemistries (Nanophosphate Lithium Ion and Silver Zinc). DOE is aware of the existence of these particular chemistries and their potential for more widespread use. DOE is including these two chemistries to ensure that its test procedure can adequately address products that employ batteries that rely on these chemistries.

With respect to discharging, AHAM and Euro-Pro commented that manufacturers often do not discharge their products to the IEC specified end-of-discharge voltage, which were used in the proposed test procedure. AHAM further commented that the test procedure should allow manufacturers to specify their own end-of discharge voltages during testing.

DOE believes that adopting this approach would lead to inconsistent testing between similar batteries, since manufacturers will be more likely to specify different voltages of batteries that are of similar make and chemistry. Because of the potential problems that could result from having inconsistent testing methods between similar batteries, such as measuring vastly different amounts of energy coming from similar batteries, DOE is declining to adopt the particular measures suggested by AHAM.

DOE notes, however, that some batteries, particularly those using the more unstable lithium-ion chemistry (compared to nickel-based batteries), should not be discharged past a certain voltage for safety reasons. (Discharging of these types of batteries beyond a certain point may result in the risk of fire.) For most products using these types of batteries, manufacturers will provide protection circuitry within the lithium-ion battery pack that will stop the discharge at a safe voltage, regardless of the end-of-discharge voltage, to ensure a safe discharge. DOE is aware that since these mechanisms are bypassed during the test procedure, an overly low end-of-discharge voltage could present a safety risk in this case.

AHAM commented that most manufacturers do not recommend discharging lithium batteries below 3.0 V. It identified Sony and Black & Decker as examples of manufacturers who make this recommendation. However, DOE has consulted with subject matter experts regarding this issue who believe that lithium-ion batteries will not experience safety issues if discharged to the end-of-discharge voltage of 2.5 V. (Comment pertaining to batteries being used as a part of the test equipment to test a charger, No. 18.1) While conducting tests on lithium-ion batteries over the years, including the tests done for the Department, DOE's subject matter expert has not experienced any safety issues when discharging lithium-ion batteries to 2.5 V. (Battery Charger Test Data, No. 18.3) Additionally, AHAM did not provide any data to support its claim. Consequently, DOE will adopt the 2.5 V end-of-discharge voltage, consistent with that proposed in its NOPR, in this final rule. This end-of-discharge voltage is accepted in industry and should not create any appreciable testing burden for manufacturers.

e. E24 Measurement

DOE proposed measuring only the energy consumed during the first 24 hours of charging, even if the test lasts longer than 24 hours. 75 FR 16958, 16984. DOE proposed this approach because it believed that most products could be charged within the 24-hour time period, and for those products that took longer to charge, most of the energy consumption would likely have been accounted for within the first 24 hours. However, most commenters opposed this approach. PG&E commented that the proposal only accounts for the energy used during the first 24 hours of charging, which does not capture a full round-trip for batteries with charge times that exceed 24 hours. (PG&E, Pub. Mtg. Tran., No. 2 at p. 22; PG&E, Pub. Mtg. Tran., No. 2 at p. 144) Instead, PG&E strongly urged DOE to modify its test procedure to be consistent with the CEC procedure by including (1) total charger input energy (Charge and Maintenance Energy) accumulated over the entire duration of the test, reported in watt-hours (Wh) and (2) total time duration of the charging test (at least 24 hours)." (ASAP, No. 11 at pp. 12–13; PG&E, No. 12 at pp. 12–13; SCE, No. 13 at pp. 12–13) ASAP, PG&E, and SCE supported this view by commenting that batteries that take longer than 24 hours to charge will not reach a fully charged state during the 24-hour charge test, which will result in energy use measurements that significantly underestimate the energy required to charge the battery and can result in inflated efficiency levels exceeding 100 percent. (ASAP, No. 11 at p. 9; PG&E, No. 12 at p. 9; SCE, No. 13 at p. 9)

AHAM supported the proposed E_{24} measurement. (AHAM, No. 10 at p. 5) No other comments were received on this issue.

DOE's proposed test method would have required measuring a full discharge and the energy consumed during the first 24 hours of the charge. As interested parties noted, if the test procedure only accounts for the energy to charge the battery over the first 24 hours, it would not capture a full "round-trip" for those battery chargers taking longer than 24 hours to charge.

Even though the most common products that require more than 24 hours to charge do not account for a large portion of shipments, these products will not be accurately tested and may result in reporting efficiencies greater than 100 percent if the measurement period is only 24 hours. While DOE acknowledges that varying the test duration may create a less than uniform approach as well as a potentially increased testing burden, the need to obtain accurate results is critical to ensure the viability of not only the procedure that DOE adopts for all manufacturers to use, but also to help ensure the integrity of whatever energy conservation standards that DOE may set for these products. Therefore, to make certain that accurate results are obtained, DOE is modifying its proposal by requiring that the full round-trip be accounted during testing and that the measurements are taken over the entire duration of the charge test, even if that time period exceeds 24 hours.

C. Review of Battery Charger and External Power Supply Standby and Off Mode Test Procedures

1. Battery Charger Test Procedure Off Mode Definition

DOE sought comments on the existing standby and off mode test procedures for battery chargers. 75 FR 16958, 16962. Section 2.k. of appendix Y defines off mode as: "The condition, applicable only to units with manual on-off switches, in which the battery charger is (1) connected to the main electricity supply; (2) is not connected to the battery; and (3) all manual on-off switches are turned off."

DOE received comments with regard to this proposed definition and how it applies to integral batteries in the off mode test procedure. PG&E suggested that the off-mode definition should be rewritten to allow off mode to be measured even if the battery is internal and cannot be removed. (PG&E, Pub. Mtg. Tran., No. 2 at pp. 23–24) PG&E added that a large number of battery chargers can have an off mode even if the battery is still connected, noting that battery chargers can be equipped with an on/off switch. ASAP, PG&E, and SCE cited a computer UPS as an example of a such charger in which the battery is not usually removed, but is equipped with an on-off switch. (ASAP, No. 11 at p. 13; PG&E, No. 12 at p. 13; SCE, No. 13 at p. 13) PG&E added that the off mode of these types of chargers should be tested even if the battery cannot be disconnected. (PG&E, Pub. Mtg. Tran., No. 2 at p. 188) Therefore, ASAP, PG&E, and SCE all recommended that off mode be tested for all battery chargers with an on-off switch. (ASAP, No. 11 at p. 13; PG&E, No. 12 at p. 13; SCE, No. 13 at p. 13).

Section 310 of EISA 2007 defined "off mode" as "the condition in which an energy-using product–(I) is connected to a main power source; and (II) is not providing any standby or active mode function." (42 U.S.C. 6295 (gg)(1)(A)(ii)) For the purposes of this test procedure, the "energy-using product" is the battery charger itself and not the end-use product into which that battery charger is integrated. This distinction is important to note because on-off switches are frequently used for the end-use product and not the battery charger. Therefore, to be completely unambiguous and ensure that only off mode power for the battery charger. and not the end-use product, is being measured, DOE believes it is necessary that the battery must be detachable from the end-use product. By removing the battery from the battery charger, the technician can be certain that any power consumed by the battery charger is not attributable to any standby or active mode function that the battery charger may have otherwise still been providing despite turning off the end-use product. Consequently, DOE is declining to expand its definition of off mode to encompass products with non-detachable batteries.

2. Test Duration

DOE proposed to shorten the current warm-up period from one hour to 30 minutes used in the standby and off mode test procedures. Compare 10 CFR part 430, subpart B, appendix Y, sec. (c)(1) with 75 FR 16985 (proposed sections 5.11 and 5.12). Additionally, DOE proposed to have this 30-minute warm-up period followed by a 10-minute measurement period. DOE proposed this approach, in part, to help harmonize DOE's standby and off mode measurement procedures with sections IV.B and IV.C in part 1 of the CEC test procedure and to reduce testing burden while maintaining accuracy. 75 FR 16958, 16962.

Commenters had varying opinions on the issue. Delta-Q "mildly agreed" with the proposed changes to standby and off mode duration and believed that there would be no significant impact from the proposed change. (Delta-Q, No. 5 at p. 2) Alternatively, AHAM suggested that the warm-up period should last an hour to maintain the accuracy of the data. (AHAM, No. 10 at p. 7)

As stated in the NOPR, abbreviating the measurement period from 1 hour to 10 minutes will not affect the accuracy of the test because the amended test procedures would retain a 30-minute warm up period. Variations in component efficiency due to temperature are the most common reason for changes in battery charger energy consumption in standby and off modes, and the 30-minute warm-up period will remain sufficient to permit the input power of most battery chargers to stabilize. 75 FR 16958, 16962. DOE recognizes that further instabilities (pulses) in energy consumption in standby and off modes may be caused by periodic operation of certain battery charger functions, as when a battery charger occasionally checks its output for the presence of the battery. In general, there is always a potential for a time-limited test procedure to fail to capture a behavior occurring at an arbitrary time. DOE has conducted numerous tests to analyze this issue and has not encountered any cases where the product does not stabilize within the allotted 30-minute time period. (Battery Charger Standby Tests, No. 18.2) Accordingly, DOE believes that the 30-minute warm-up period is sufficient for testing battery chargers and is adopting its proposed approach in today's final rule.

D. Review of the Single-Voltage External Power Supply Test Procedure

1. External Power Supplies That Communicate With Their Loads

DOE requested comments on testing external power supplies that communicate with their loads, specifically with regard to allowing manufacturers to supply test jigs (*i.e.,* physical connection adapters to permit testers to help identify which electrical leads to use when taking a measurement) to properly measure these products. 75 FR 16973 and 16979. ASAP, PG&E, and SCE recommended that DOE create a standard test jig for external power supplies that communicate with their loads via USB protocol and that manufacturers supply test jigs for non-standard protocols. (ASAP, No. 11 at p. 14; PG&E, No. 12 at p. 14; SCE, No. 13 at p. 14) They also recommended that for proprietary or custom communication protocols, manufacturers should submit an external power supply test jig so that the product can be tested and will not be exempt from the standard because it cannot be tested. In their view, if the jig is not supplied, the efficiency value should be zero, and the external power supply would not meet the standard. (ASAP, No. 11 at p. 14; PG&E, No. 12 at p. 14; SCE, No. 13 at p. 14). Alternatively, Sony recommended excluding USBs from the external power supply test procedure because including them would result in additional burden and increased testing costs to manufacturers. (Sony, No. 6 at p. 2).

DOE notes that to the extent that a particular product cannot be tested under the prescribed procedure, a manufacturer would be able to seek a test procedure waiver in order to be able to test and rate that product. See 10 CFR 430.27. Without such a rating, a manufacturer would be unable to sell that product in the United States. 42 U.S.C. 6302(a)(5). With respect to the final rule DOE is adopting today, the test procedure will permit manufacturers to supply test jigs that can accurately measure the energy consumption of their external power supplies. It is DOE's understanding that these jigs are straightforward adapters that would allow technicians to determine which output connectors from the external power supply are providing output power. These jigs would also allow the technician to simulate normal operating conditions if any communication with the device is necessary. DOE does not believe that the allowance of such devices will lead to gaming of the test procedure because the jig should be a simple, non-powered device. This approach is preferable to the approach suggested by Sony because it avoids the exclusion of products from coverage. This approach will also ensure that DOE obtains accurate and consistent test results and allows products to be tested that otherwise might have required waivers.

2. External Power Supplies With Output Current Limiting

DOE sought comment regarding the treatment of external power supplies with an output current limiting capability. "Output current limiting" is a mode of operation where an external power supply significantly lowers its output voltage once an internal output limit has been exceeded. These external power supplies cannot be loaded at 100 percent of rated nameplate output current. 75 FR 16958, 16962.

PTI offered two recommendations on this issue. First, it recommended that DOE require that the measurement be made and recorded at a 100 percent load. (PTI, Pub. Mtg. Tran., No. 2 at p. 196) Second, PTI recommended that if the external power supply cannot be loaded at the 100 percent load point then it should not be tested at that load point. (PTI, Pub. Mtg. Tran., No. 2 at p. 204) PTI did not offer an appropriate load point under that scenario. ASAP, PG&E and SCE recommended that DOE alter its proposal and require testing of external power supplies with lower than expected output current limiting levels at three standard load points (25, 50, and 75 percent) and include an option to modify the 100 percent load point to 95 percent. These commenters believe that the 95 percent option will account for some manufacturer variation that might exist because of current limiting circuitry that is occasionally present in external power supplies to prevent a short circuit. (ASAP, No. 11 at p. 15; PG&E, No. 12 at p. 15; SCE, No. 13 at p. 15)

SAP, PG&E and SCE recommended that the following approach should be used (ASAP, No. 11 at p. 15; SCE, No. 13 at p. 15; PG&E, No. 12 at p. 15):

(1) After the warm-up, load the product at 100 percent of rated output current.

(2) If the external power supply will not supply 100 percent of the nameplate output current (assumed because of the current limiting function), then the external power supply shall be tested at 95 percent rated output current.

(3) If the external power supply supplies current at 95 percent rated output current, then the efficiency at the 100 percent loading point shall be recorded as the efficiency at the 95 percent loading point to permit some variation.

(4) If the external power supply will not supply 100 percent or 95 percent of the rated output current, then the efficiency measured at 100 percent shall be recorded as 0.

(5) Move on to other loading points (75, 50, and 25) in the procedure. If the external power supply cannot supply current at the other loading points, they should all be marked 0.

PTI commented that external power supplies that do not reach 100 percent load are likely designed to ensure that they are not affected by the early cutoff of the wall adapter. They likely only make excursions at those current levels on a transitory basis. (PTI, Pub. Mtg. Tran., No. 2 at p. 203) PTI added that it is possible that wall adapters that are unable to meet 100 percent of nameplate output power had charge control and were not external power supplies. (PTI, Pub. Mtg. Tran., No. 2 at. 199) Alternatively, AHAM informed DOE that some external power supplies will not reach 100 percent because the manufacturer rates them higher to reach a maximum value for temperature purposes such that the product will never reach the value under the worst situations. (AHAM, Pub. Mtg. Tran., No. 2 at p. 201) AHAM further commented that nameplate ratings are not used for energy efficiency purposes, but for safety certification. (AHAM, Pub. Mtg. Tran., No. 2 at pp. 200–201)

If an external power supply cannot sustain output current at 100 percent load during testing, then it will not operate at 100 percent load with its associated application. Incorporating the 100 percent loading point into the metric for these units would be inconsistent with how they are used in consumer environments. Therefore, DOE is not requiring an efficiency measurement at that loading point as part of the average efficiency metric. Instead, the average efficiency of products that cannot maintain 100 percent output load will be the average of the efficiencies at 25 percent, 50 percent, and 75 percent of full load only. Appropriate changes to section 4(a)(i) of appendix Z to subpart B of part 430 have been made for today's final rule.

3. High-Power External Power Supplies

As mentioned above, the current external power supply test procedure in appendix Z requires the nameplate output current to be used to calculate the loading points for efficiency measurements. See section 4(a)(i) of Appendix Z to subpart B of part 430 (referencing CEC's "Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power supplies"). DOE sought comments on what should be done in those instances where a manufacturer lists more than one maximum output power for a given high-power external power supply. In particular, DOE sought comment on whether it should modify the definition of "output power" to specify that the continuous output current should be used when more than one maximum output is provided.

ASAP, PG&E, and SCE recommended that DOE test both intermittent and continuous load conditions for high power external power supplies. They commented that when ham radios (amateur wireless radios) are transmitting, the higher (intermittent) rating is more applicable, and when the radio is receiving, the lower (continuous) rating is more applicable. They believe that the intermittent portion of the external power supply may be used from 20 percent to 50 percent of the time, which, in their view, constitutes a significant portion of operating time. (ASAP, No. 11 at p. 16; PG&E, No. 12 at p. 16; SCE, No. 13 at p. 16)

DOE notes that testing a high-power external power supply at its advertised intermittent output power would be inconsistent with its typical use, since the external power supply test procedure requires operating the external power supply at full load for 30 minutes, whereas the high-power external power supply only operates at intermittent output power for substantially shorter periods of time. Further, DOE believes that operating the external power supply for 30 minutes at its intermittent output power might damage the external power supply due to overheating, because the external power supply is only designed to operate at the higher level for brief intermittent intervals. Therefore, in the case where more than one output current is listed, DOE is requiring that the external power supply be tested at only the continuous loading conditions.

4. Active Power

DOE proposed to incorporate a definition for battery charger "active power" into section 2 of appendix Y. 75 FR 16958, 16973. This definition would provide that "active power" as meaning "the average power consumed by a unit." Id. at 16980. DOE proposed this definition because of related proposals to measure the power consumption of a battery charger during active mode. DOE did not receive any comments on the definition it proposed in its NOPR. Therefore, in the absence of any comments, and to ensure the viability and completeness of the active mode procedure, DOE is incorporating its proposed definition into its regulations.

E. Multiple-Voltage External Power Supply Test Procedure

In 2008, DOE first proposed a test procedure for multiple-voltage external power supplies as part of its NOPR test procedure for standby and off modes for single-voltage external power supplies. See 73 FR 48054. That proposal detailed an approach that would have required measuring efficiency levels at no-load, 25 percent, 50 percent, 75 percent, and 100 percent of nameplate output, but result in a single average efficiency measurement. Id. at 48082. In 2009, DOE finalized its test procedure for standby and off modes, but in light of substantial concerns raised by commenters, it did not incorporate a procedure to accommodate multiple-voltage external power supplies. See 74 FR 13318, 13322. DOE re-proposed the incorporation of a multiple-voltage external power supply procedure as part of this rulemaking proposal. This more recent proposal specified an approach that would require measurements at each loading point. 75 FR 16958, 16974.

PG&E supported the creation of a separate multi-voltage external power supply test procedure so long as it would not impact the current single-voltage external power supply test procedure already in use. (PG&E, No. 2 at p. 15) ASAP, SCE, and PG&E also accepted DOE's proposed measurement and reporting method for multiple-voltage output external power supplies, but encouraged DOE to evenly weight the 25-percent, 50-percent, 75-percent, and 100-percent loading conditions in any forthcoming standards. (ASAP, No. 11 at p. 16; SCE, No. 13 at p. 16; PG&E, No. 12 at p. 16)

AHAM objected to DOE's proposal to report five efficiency metrics for external power supplies without aggregating them. (AHAM, No. 2 at p. 211) AHAM further commented "* * * 'a test procedure for covered products should measure energy efficiency,' " and that this action is inconsistent with the direction of section 323 of EPCA. (AHAM, No. 2 at p. 219). AHAM also commented that it may make more sense to measure multiple-voltage external power supplies at values representative of typical loading rather than 25, 50, 75, and 100 percent of full load. (AHAM, No. 2 at pp. 212–213)

Although AHAM expressed concern over the multiple-voltage test procedure, outputting separate metrics creates a method similar to that for battery chargers. Adopting an approach that parallels the battery charger method is preferable because of the similar nature of these two products and the potential variation of use from consumer to consumer that can be expected. Again, as with the battery charger test procedure (see section III.B.5.a), DOE may combine them for purposes of determining compliance with any energy conservation standard that may be set.

F. Test Procedure Amendments Not Incorporated in this Final Rule

1. Incorporating Usage Profiles

DOE proposed to amend the battery charger test procedure to measure energy consumption in each mode, which would more readily permit comparisons between a greater number of test results. 75 FR 16958, 16974.

PG&E supported this approach and stated that DOE is moving in the right direction by outputting multiple measures rather than a single one because this allows the different usage of products to be taken into account. (PG&E, Pub. Mtg. Tran., No. 2 at p. 51). PG&E also commented that having multiple outputs may create a test procedure that can easily be harmonized across jurisdictions. (PG&E, Pub. Mtg. Tran., No. 2 at pp. 14–15) Similarly, ASAP, PG&E, and SCE supported DOE's approach. (ASAP, No. 11 at p. 13; PG&E, No. 12 at p. 13; SCE, No. 13 at p. 13)

Other commenters preferred that the test procedure combine all measurements into a single metric. AHAM stated that DOE should integrate energy consumption from active, maintenance, and no-battery mode through usage factors required by law. (AHAM, Pub. Mtg. Tran., No. 2 at p. 48) AHAM also supported incorporating usage profiles, stating that having one value will help a consumer to choose between product A and product B based on energy efficiency. (AHAM, Pub. Mtg. Tran., No. 2 at p. 56) AHAM commented that "it is incumbent upon DOE to make available an aggregate energy use number of the energy use or energy efficiency of a battery charger that is ' * * * representative of typical use.' " (AHAM, No. 10 at p. 3) AHAM noted that, in reference to the periodic (seven-year) review of a given test procedure that DOE must conduct in accordance with 42 U.S.C. 6293(b), the procedure should include usage factors in order to improve the current procedure and to allow the test procedure to stand for seven more years. (AHAM, No. 10 at p. 3) "All energy from active, maintenance, and no-battery modes should have factors of usage applied to them and then aggregated to arrive at one value." (AHAM, No. 10 at p. 3)

PTI commented that the disaggregated data do not represent the typical use of the product as accurately as a combined metric would. (PTI, Pub. Mtg. Tran., No. 2 at p. 48) PTI preferred that the test procedure result in a metric that tells the consumer something about the overall efficiency of the product, because, when it becomes effective, representations of energy use based on other test procedures will become invalid. (PTI, Pub. Mtg. Tran., No. 2 at p. 50) PTI commented that "[w]hile active mode must be included in the test procedure, it should be included in a manner that generates a proportioned, aggregated value, consistent with the philosophy expressed in the existing test procedure, and [be] in line with the Department's obligation to produce a procedure that reflects typical use." (PTI, No. 8 at p. 2) PTI further stated that an aggregation "will not reflect every particular user, but would rather represent an average of use. This [approach] would not be consistent with the requirement to have the test procedure reflect 'typical' use." (PTI, No. 8 at p. 2) PTI suggested that DOE should "have a series of ratios, by product category, that can be used to aggregate the quantities in the proposed test procedure." (PTI, No. 8 at p. 2) "By DOE issuing the current [proposed] test procedure as a national test, it permits entities to use a test procedure in a manner that does not reflect typical use or DOE's intent." (PTI, No. 8 at p. 2)

Phillips stated that the "only way for the test procedure to be representative of typical use is to have the test procedure utilize use patterns of representative classes of battery chargers." (Phillips, No. 7 at p. 2) Phillips also commented that it is essential that the test procedure require the typical energy use factors established by the Department for particular categories of products. (Phillips, No. 7 at p. 2) Phillips supported "AHAM's position to have the test procedure aggregate energy use data." (Phillips, No. 7 at p. 3) According to Phillips, the ENERGY STAR specifications for battery charger do not require measuring output energy use in each mode, which it believes demonstrates that these measurements are not of significant interest to consumers. (Phillips, No. 7 at p. 3)

Wahl Clipper stated that the test procedure should measure the energy consumption of products representative of typical use. This measurement, in its view, should be an aggregated number of the active, standby, and maintenance modes, which is representative of the typical use for that product category. (Wahl Clipper, No. 9, at p. 1)

AHAM cited other test procedures and commented that for a number of appliances, the usage factors are in the test procedure such that they output one metric. Usage factors are used in this way in test procedures for washing machines and refrigeration cycling, and are being proposed for clothes dryers. (AHAM, Pub. Mtg. Tran., No. 2 at p. 58) AHAM specifically cited the clothes washer test procedure, from which a single MEF (modified energy factor) value is derived that is based on choices of cycles and percentage of wash loads going to a dryer. The standard is then set against the MEF value. (AHAM, No. 10 at p. 3)

PTI stated that the test procedure should indicate that it is intended to be used with usage profiles in the standard to ensure that the data are not misused. (PTI, Pub. Mtg. Tran., No. 2 at p. 172) Phillips suggested that the battery charger usage profiles should either be in the test procedure or the test procedure should include a reference explaining that the usage factors are in the standard. (Phillips, Pub. Mtg. Tran., No. 2 at p. 240) PTI added that DOE should "indicate clearly that the test procedure is only intended to be used with the suggested ratios and shall not be used until they become available. As soon as the ratios are developed, DOE should update its test procedure and reissue it with the ratios incorporated." (PTI, No. 8 at p. 2)

Commenters also expressed a variety of views regarding the disseminating of product usage information. PG&E commented that consumers know how they use their products. If the test procedure outputs a separate metric for each mode, consumers will know which number they should check when comparing energy consumption levels among products. (PG&E, Pub. Mtg. Tran., No. 2 at p. 54) AHAM was concerned that consumers may not know how their products are used and argued that DOE should give the consumer a single value representing a product's average, or approximate average, usage pattern. (AHAM, Pub. Mtg. Tran., No. 2 at p. 55) Usage factors applied against an aggregated value will give the consumer accurate information on how the product is used. (AHAM, Pub. Mtg. Tran., No. 2 at p. 53) PG&E similarly stated that manufacturers may not be able to give accurate estimates of how much time their product spends in each mode annually. (PG&E, Pub. Mtg. Tran., No. 2 at p. 54) An aggregation based on calculated averages does not, in its view, help the consumer determine what amount of energy their particular usage pattern will consume. (PG&E, Pub. Mtg. Tran., No. 2 at p. 54) AHAM emphasized that consumers need a single piece of information on energy efficiency so that products can be compared. (AHAM, No. 10 at p. 3)

Phillips cited section 6 of the draft technical report that accompanied the battery charger and external power supply framework document and described the usage of its own products. Phillips generally supported the approach taken by DOE to examine usage patterns. It noted, in reference to its own products (notably, electric shavers), that there cannot be a meaningful energy reduction for products that "have limited usage patterns [that spend] most, if not close to all of their time in unplugged mode." (Phillips, No. 7 at p. 2)

DOE notes that the relevant statute permits DOE to promulgate a test procedure that either produces measurements of energy use or efficiency (neither of which would require usage profile data) or the estimated annual operating cost of a product (which would require usage profile data). Specifically, test procedures should "be reasonably designed to produce test results which measure energy efficiency, energy use, water use (in the case of showerheads, faucets, water closets, or urinals), or estimated annual operating cost of a covered product under a representative average use cycle or period of use * * *" 42 U.S.C. 6293(b)(3) The procedure DOE is promulgating today satisfies this requirement by producing a measurement of energy usage. Accordingly, energy usage profiles, as suggested by some commenters, are unnecessary for DOE to use in developing this test procedure.

2. Measuring Charger Output Energy

During the framework document public meeting, DOE suggested the possible approach of including a procedure that would require measuring the charger output energy rather than the battery output energy in order to calculate the total energy consumed by the battery charger during charging[16] (Pub. Mtg. Tr., No. 14 at pp. 162–164). (DOE believed at the time that measuring energy consumption at the charger output, thereby bypassing the battery, could remove some of the variability from the measurement. Commenters were unified in opposition to this change and it was not proposed in the NOPR. During the NOPR public meeting, AHAM agreed with DOE's decision to drop this approach. (AHAM, No. 10 at p. 7)

3. Alternative Depth-of-Discharge Measurement

In its NOPR, DOE discussed the possibility of requiring that battery chargers be tested with batteries at the 100 percent depth-of-discharge level. 75 FR 16958, 16975. DOE proposed this approach in response to comments that critiqued the initial approach DOE had considered using, which DOE described during the framework document public meeting (Pub. Mtg. Tr., No. 14 at pp. 162–164).[17] During that stage, DOE discussed the possibility of testing battery chargers with batteries at 40 percent depth-of-discharge, meaning that they would contain a 60 percent charge. Commenters opposed this earlier approach because it would unnecessarily complicate the test procedure and be an assumption of typical use that would be hard to substantiate. 75 FR 16958, 16975. See also Pub. Mtg. Tr., No. 14 at pp. 195–196, 199–200, 201, 206; PG&E *et al.,* No. 20 at p. 16.[18]

AHAM agreed with DOE's removal of the 40 percent depth-of-discharge measurement, saying that DOE should not require measurements at multiple depths of discharge. (AHAM, No. 2 at p. 175; AHAM, No. 10 at p. 7)

Alternatively, Euro-Pro noted that if batteries are only measured at 100

[16] A notation in the form "Pub. Mtg. Tr., No. 14 at pp. 162–164" identifies DOE's explanation of this issue during the July 16, 2009, framework document public meeting. This explanation and comments received were recorded in the public meeting transcript in the docket of the BC and EPS energy conservation standards rulemaking (Docket No. EERE–2008–BT– STD–0005, RIN 1904–AB57), maintained in the Resource Room of the Building Technologies Program and available at *http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/bceps_standards_meeting_transcript.pdf.*

[17] U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy. Energy Conservation Program for Consumer Products *Energy Conservation Standards Rulemaking for Battery Chargers and External Power Supplies.* May 2009. Washington, DC. Available at: *http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/bceps_frameworkdocument.pdf.*

[18] *See id.*

percent depth-of-discharge, the energy use of batteries with protective circuitry that prevents them from reaching that depth may not be able to be accurately measured. (Euro-Pro, No. 2 at p. 177) They also commented that products that will not permit a 100-percent depth-of-discharge level when being used by consumers may achieve better energy use ratings than they deserve. This is because they will never be able to reach a 100-percent depth-of-discharge level, yet the test procedure will test them at this level. As a result, the test will measure the presence of more energy to be recovered from the battery than can be used by the consumer. (Euro-Pro, Pub. Mtg. Tran., No. 2 at p. 179)

DOE acknowledges the comments from interested parties. DOE believes that by following the outlined test procedure, including the preparatory discharge step, products will not inadvertently achieve better energy use ratings than what they are capable of achieving when in actual use in the field. The UUT will be taken from a known state of discharge, charged, and then discharged back to the known state, which ensures that a product's energy consumption will be appropriate for its design and capabilities. By following this procedure, it should be physically impossible to get more energy out of the battery during the measured discharge than what was put in during the measured charge and maintenance mode test. Therefore, as discussed in the NOPR, DOE will not incorporate testing at alternative levels of depths-of-discharge. Requiring testing at only 100 percent depth-of-discharge also promotes consistent testing across products, making it easy to compare products and reducing the testing burden on manufacturers.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

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

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.,* as amended by the Small Business Regulatory Enforcement Fairness Act of 1996) requires preparation of an initial regulatory flexibility analysis for any rule that, by law, must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. A regulatory flexibility analysis examines the impact of the rule on small entities and considers alternative ways of reducing negative effects. Also, 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 impact of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE made its procedures and policies available on the Office of the General Counsel's Web site at *http://www.gc.doe.gov.*

DOE identified producers of products covered by this rulemaking that have manufacturing facilities located within the United States and could be considered small entities by searching the SBA Web site to identify manufacturers within the applicable NAICS code. After examining this information, DOE ascertained that many of the companies that manufacture these products are large multinational corporations with more than 500 employees. DOE also identified some small businesses that could potentially be manufacturers of covered products. DOE notes that with respect to battery charger and multiple-voltage external power supply manufacturers, there are currently no standards in place for these products for manufacturers to meet. Accordingly, manufacturers are under no obligation to use these procedures until DOE prescribes standards for them. As for the changes to the single-voltage external power supply procedure, these proposed amendments will reduce the overall burden to manufacturers and provide a means to test more complex devices.

After reviewing its proposal, DOE had tentatively concluded that two aspects of the proposal may result in some increased testing burden for manufacturers generally: the revision of the battery charger test procedure to include a test for battery chargers operating in active mode and the addition of a test procedure for multiple-voltage external power supplies.

DOE anticipates, however, that adding an active mode battery charger test procedure will not be likely to cause a significant burden to small manufacturers because the steps in the active mode test procedure that DOE is promulgating in this rule already exist in the current DOE test procedure. The additional step that this rule will require will be the recording of certain values during one of those steps. Additionally, this rule is based largely on procedures already implemented by the State of California that are already followed by the industry. By basing its rule on these established procedures, DOE anticipates little, if any, incremental increase in testing cost or burden from this rulemaking. Manufacturers are familiar with the steps detailed in the procedure being adopted today and should already have the necessary equipment to conduct these tests.

Similarly, the addition of a multiple-voltage external power supply test procedure will not have a significant impact on small businesses since these devices are manufactured almost exclusively by businesses that exceed the small business size threshold for this category. Further, the multiple-voltage external power supply test procedure being adopted today is nearly identical to the single-voltage external power supply procedure already in place that manufacturers must follow. This procedure was not noted by interested parties as being burdensome by small businesses.

In addition to the relatively modest changes introduced by today's rule to the existing test procedure that manufacturers are already using, manufacturers will only be required to test products that are subject to energy conservation standards. Currently, there are no standards in place for battery chargers or multiple-voltage external power supplies. Until energy conservation standards are adopted, no entities, small or large, would be required to comply with the proposed battery charger and external power supply test procedures. As a result, in light of all of the above factors, DOE believes that today's rule would not have a "significant economic impact on a substantial number of small entities."

The amendments discussed in this final rule affecting Class A external power supplies, which are covered by statutorily-set standards, do not significantly change the existing test procedure used to measure the energy output of these devices. DOE does not expect these amendments to impose a significant new testing and compliance burden. Therefore, these amendments also would be unlikely to have significant impact on a substantial number of small entities.

Accordingly, DOE has not prepared a regulatory flexibility analysis for this rulemaking. DOE has provided its certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act

Manufacturers of battery chargers and external power supplies must certify to DOE that their products comply with any applicable energy conservation standard. In certifying compliance, manufacturers must test their equipment according to the applicable DOE test procedure, including any amendments adopted for that test procedure. DOE has adopted regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including battery chargers and external power supplies. 76 FR 12442 (March 7, 2011). The collection-of-information requirement for the certification and recordkeeping has been approved by OMB under control number 1910–1400. The public reporting burden for the certification is estimated to average 20 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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

D. Review Under the National Environmental Policy Act

In this final rule, DOE amends its test procedures for battery chargers and external power supplies. These amendments will enable manufacturers to test the energy consumption of battery chargers while charging batteries and reduce the amount of testing time during standby and off mode testing. The amendments also provide a method by which to test those external power supplies that are equipped with USB outputs as well as those power supplies that are of the multi-voltage type. These amendments, where applicable, will also be used to develop and implement future energy conservation standards for battery chargers and external power supplies. After carefully considering the nature and impacts of this rule, DOE has determined that this final rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321, *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, this rule amends an existing rule without changing its environmental effect, and, therefore, is covered by the categorical exclusion contained in 10 CFR part 1021, subpart D, paragraph A5. The exclusion applies because this rule establishes revisions to existing test procedures that will not affect the amount, quality, or distribution of energy usage, and, therefore, will not result in any environmental impacts. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, "Federalism," 64 FR 43255 (August 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this rule and has determined that it will not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of state regulations as to energy conservation for the products that are the subject of today's 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

With respect to 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 rule meets the relevant standards of Executive Order 12988.

G. Review Under Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) (Pub. L. 104–4) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. For proposed regulatory actions likely to result in a rule that may cause expenditures by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish estimates of the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) UMRA also requires Federal agencies to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate." In addition, UMRA requires an agency plan for giving notice and opportunity for timely input to small governments that may be affected before establishing a requirement that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. (This policy is also available at *http://www.gc.doe.gov*). Today's 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 proposed rule that may affect family well-being. Today's rule will not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is unnecessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

Pursuant to Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (March 15, 1988), DOE has determined that this rule will not result in any takings that might require compensation under the Fifth Amendment to the United States Constitution.

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (Pub. L. 106–554; 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). DOE has reviewed today's 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 promulgates or is expected to lead to promulgation of a final rule, and that: (1) Is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use if the regulation is implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use. Today's regulatory action is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy. 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, *et seq.*), DOE must comply with section 32 of the Federal Energy Administration Act of 1974 (Pub. L. 93–275), as amended by the Federal Energy Administration Authorization Act of 1977 (Pub. L. 95–70). (15 U.S.C. 788) Section 32 provides that, where a proposed rule authorizes or requires use of commercial standards, the rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Federal Trade Commission (FTC) about the effect of the commercial or industry standards on competition.

DOE has evaluated these revised standards, which are based on testing protocols developed and adopted by the State of California. The specific sections from the CEC procedure that today's rule incorporates into the test procedure are from Part 1 of the test procedure, with some modifications for clarity. After examining the public record related to the promulgation of these requirements by the CEC, DOE believes that these procedures were developed in a manner that fully provided for public participation, comment, and review from all interested parties. Additionally, DOE has consulted with the Attorney General and the Chairman of the FTC concerning the affect on competition of requiring manufacturers to use the test methods contained in these standards, and neither objected to the incorporation of these standards.

M. Congressional Notification

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

V. Approval of the Office of the Secretary

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

List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Reporting and recordkeeping requirements.

Issued in Washington, DC, on May 3, 2011.

Kathleen B. Hogan,

Deputy Assistant Secretary for Energy Efficiency, Office of Technology Development, Energy Efficiency and Renewable Energy.

For the reasons stated in the preamble, DOE amends 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.

■ 2. In § 430.23 revise paragraph (aa) to read as follows:

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

* * * * *

(aa) *Battery Chargers.* Upon the effective date of any energy conservation standard for battery chargers governing active and maintenance mode energy consumption, the 24-hour energy consumption of a battery charger in active and maintenance modes, expressed in watt-hours, and the power consumption of a battery charger in maintenance mode, expressed in watts, shall be measured in accordance with section 5.10 of appendix Y of this subpart. The power consumption of a battery charger in standby mode and off mode, expressed in watts, shall be measured in accordance with sections 5.11 and 5.12, respectively, of appendix Y of this subpart.

* * * * *

■ 3. Appendix Y to Subpart B of Part 430 is revised to read as follows:

Appendix Y to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Battery Chargers

The provisions of this appendix are effective on the compliance date of any energy conservation standard for battery chargers.

1. Scope

This appendix covers the test requirements used to measure battery charger energy consumption for battery chargers operating at either DC or United States AC line voltage (115V at 60Hz).

2. Definitions

The following definitions are for the purposes of explaining the terminology associated with the test method for measuring battery charger energy consumption.[1]

2.1. *Active mode* or *charge mode* is the state in which the battery charger system is connected to the main electricity supply, and the battery charger is delivering current, equalizing the cells, and performing other one-time or limited-time functions in order to bring the battery to a fully charged state.

2.2. *Active power* or *real power* (P) means the average power consumed by a unit. For a two terminal device with current and voltage waveforms i(t) and v(t), which are periodic with period T, the real or active power P is:

$$P = \frac{1}{T}\int_0^T v(t)i(t)dt$$

2.3. *Ambient temperature* is the temperature of the ambient air immediately surrounding the unit under test.

2.4. *Apparent power* (S) is the product of root-mean-square (RMS) voltage and RMS current in volt-amperes (VA).

2.5. *Batch charger* is a battery charger that charges two or more identical batteries simultaneously in a series, parallel, series-parallel, or parallel-series configuration. A batch charger does not have separate voltage or current regulation, nor does it have any separate indicators for each battery in the batch. When testing a batch charger, the term "battery" is understood to mean, collectively, all the batteries in the batch that are charged together. A charger can be both a batch charger and a multi-port charger or multi-voltage charger.

2.6. *Battery* or *battery pack* is an assembly of one or more rechargeable cells and any integral protective circuitry intended to provide electrical energy to a consumer product, and may be in one of the following forms: (a) Detachable battery (a battery that is contained in a separate enclosure from the consumer product and is intended to be removed or disconnected from the consumer product for recharging); or (b) integral battery (a battery that is contained within the consumer product and is not removed from the consumer product for charging purposes). The word "intended" in this context refers to the whether a battery has been designed in such a way as to permit its removal or disconnection from its associated consumer product.

2.7. *Battery energy* is the energy, in watt-hours, delivered by the battery under the specified discharge conditions in the test procedure.

2.8. *Battery maintenance mode* or *maintenance mode* is the mode of operation when the battery charger is connected to the main electricity supply and the battery is fully charged, but is still connected to the charger.

2.9. *Battery rest period* is a period of time between discharge and charge or between charge and discharge, during which the battery is resting in an open-circuit state in ambient air.

2.10. *C-rate* is the rate of charge or discharge, calculated by dividing the charge or discharge current by the rated charge capacity of the battery.

2.11. *Cradle* is an electrical interface between an integral battery product and the rest of the battery charger designed to hold the product between uses.

2.12. *Equalization* is a process whereby a battery is overcharged, beyond what would be considered "normal" charge return, so that cells can be balanced, electrolyte mixed, and plate sulfation removed.

2.13. *Instructions* or *manufacturer's instructions* means the documentation packaged with a product in printed or electronic form and any information about the product listed on a Web site maintained by the manufacturer and accessible by the general public at the time of the test. It also includes any information on the packaging or on the product itself. "Instructions" also includes any service manuals or data sheets that the manufacturer offers to independent service technicians, whether printed or in electronic form.

2.14. *Measured charge capacity* of a battery is the product of the discharge current in amperes and the time in decimal hours required to reach the specified end-of-discharge voltage.

2.15. *Manual on-off switch* is a switch activated by the user to control power reaching the battery charger. This term does not apply to any mechanical, optical, or electronic switches that automatically disconnect mains power from the battery charger when a battery is removed from a cradle or charging base, or for products with non-detachable batteries that control power to the product itself.

2.16. *Multi-port charger* means a battery charger that charges two or more batteries (which may be identical or different) simultaneously. The batteries are not connected in series or in parallel but with each port having separate voltage and/or current regulation. If the charger has status indicators, each port has its own indicator(s). A charger can be both a batch charger and a multi-port charger if it is capable of charging two or more batches of batteries simultaneously and each batch has separate regulation and/or indicator(s).

2.17. *Multi-voltage charger* is a battery charger that, by design, can charge a variety of batteries (or batches of batteries, if also a batch charger) that are of different rated battery voltages. A multi-voltage charger can also be a multi-port charger if it can charge two or more batteries simultaneously with independent voltage and/or current regulation.

2.18. *Off mode* is the condition, applicable only to units with manual on-off switches, in which the battery charger:

(1) Is connected to the main electricity supply;

(2) Is not connected to the battery; and

(3) All manual on-off switches are turned off.

2.19. *Rated battery voltage* is specified by the manufacturer and typically printed on the label of the battery itself. If there are multiple batteries that are connected in series, the rated battery voltage of the batteries is the total voltage of the series configuration—that is, the rated voltage of each battery multiplied by the number of batteries connected in series. Connecting multiple batteries in parallel does not affect the rated battery voltage.

2.20. *Rated charge capacity* is the capacity claimed by a manufacturer, on a label or in instructions, the battery can store under specified test conditions, usually given in ampere-hours (Ah) or milliampere-hours (mAh) and typically printed on the label of the battery itself. If there are multiple batteries that are connected in parallel, the rated charge capacity of the batteries is the total charge capacity of the parallel configuration, that is, the rated charge capacity of each battery multiplied by the number of batteries connected in parallel. Connecting multiple batteries in series does not affect the rated charge capacity.

2.21. *Rated energy capacity* means the product (in watt-hours) of the rated battery voltage and the rated charge capacity.

2.22. *Standby mode* or *no-battery mode* means the condition in which:

(1) The battery charger is connected to the main electricity supply;

(2) The battery is not connected to the charger; and

(3) For battery chargers with manual on-off switches, all such switches are turned on.

2.23. *Total harmonic distortion* (THD), expressed as a percent, is the root mean square (RMS) value of an AC signal after the fundamental component is removed and interharmonic components are ignored, divided by the RMS value of the fundamental component.

2.24. *Unit under test* (UUT) in this appendix refers to the combination of the battery charger and battery being tested.

3. Standard Test Conditions

3.1. General

The values that may be measured or calculated during the conduct of this test procedure have been summarized for easy reference in Table 3.1.

[1] For clarity on any other terminology used in the test method, please refer to IEEE Standard 1515–2000.

TABLE 3.1— LIST OF MEASURED OR CALCULATED VALUES

Name of measured or calculated value	Reference	Value
1. Duration of the charge and maintenance mode test	Section 5.2	
2. Battery Discharge Energy	Section 4.6	
3. Initial time and power (W) of the input current of connected battery	Section 5.8	
4. Active and Maintenance Mode Energy Consumption	Section 5.8	
5. Maintenance Mode Power	Section 5.9	
6. 24 Hour Energy Consumption	Section 5.10	
7. Standby Mode Power	Section 5.11	
8. Off Mode Power	Section 5.12	

3.2. Verifying Accuracy and Precision of Measuring Equipment

a. Measurements of active power of 0.5 W or greater shall be made with an uncertainty of ≤ 2 percent at the 95 percent confidence level. Measurements of active power of less than 0.5 W shall be made with an uncertainty of ≤ 0.01 W at the 95 percent confidence level. The power measurement instrument shall, as applicable, have a resolution of:

(1) 0.01 W or better for measurements up to 10 W;

(2) 0.1 W or better for measurements of 10 to 100 W; or

(3) 1 W or better for measurements over 100 W.

b. Measurements of energy (Wh) shall be made with an uncertainty of ≤ 2 percent at the 95 percent confidence level. Measurements of voltage and current shall be made with an uncertainty of ≤ 1 percent at the 95 percent confidence level. Measurements of temperature shall be made with an uncertainty of ≤ 2 °C at the 95 percent confidence level.

c. All equipment used to conduct the tests must be selected and calibrated to ensure that measurements will meet the above uncertainty requirements. For suggestions on measuring low power levels, see IEC 62301, (Reference for guidance only, see § 430.4) especially Section 5.3.2 and Annexes B and D.

3.3. Setting Up the Test Room

All tests, battery conditioning, and battery rest periods shall be carried out in a room with an air speed immediately surrounding the UUT of ≤ 0.5 m/s. The ambient temperature shall be maintained at 20 °C ± 5 °C throughout the test. There shall be no intentional cooling of the UUT such as by use of separately powered fans, air conditioners, or heat sinks. The UUT shall be conditioned, rested, and tested on a thermally non-conductive surface. When not undergoing active testing, batteries shall be stored at 20 °C ± 5 °C.

3.4. Verifying the UUT's Input Voltage and Input Frequency

a. If the UUT is intended for operation on AC line-voltage input in the United States, it shall be tested at 115 V at 60 Hz. If the UUT is intended for operation on AC line-voltage input but cannot be operated at 115 V at 60 Hz, it shall not be tested.

b. If a charger is powered by a low-voltage DC or AC input, and the manufacturer packages the charger with a wall adapter, sells, or recommends an optional wall adapter capable of providing that low voltage input, then the charger shall be tested using that wall adapter and the input reference source shall be 115 V at 60 Hz. If the wall adapter cannot be operated with AC input voltage at 115 V at 60 Hz, the charger shall not be tested.

c. If the UUT is designed for operation only on DC input voltage and the provisions of paragraph 3.4 (b) above do not apply, it shall be tested with one of the following input voltages: 5.0 V DC for products drawing power from a computer USB port or the midpoint of the rated input voltage range for all other products. The input voltage shall be within ± 1 percent of the above specified voltage.

d. If the input voltage is AC, the input frequency shall be within ± 1 percent of the specified frequency. The THD of the input voltage shall be ≤ 2 percent, up to and including the 13th harmonic. The crest factor of the input voltage shall be between 1.34 and 1.49.

e. If the input voltage is DC, the AC ripple voltage (RMS) shall be:

(1) ≤ 0.2 V for DC voltages up to 10 V; or

(2) ≤ 2 percent of the DC voltage for DC voltages over 10 V.

Unit Under Test Setup Requirements

4.1. General Setup

a. The battery charger system shall be prepared and set up in accordance with the manufacturer's instructions, except where those instructions conflict with the requirements of this test procedure. If no instructions are given, then factory or "default" settings shall be used, or where there are no indications of such settings, the UUT shall be tested in the condition as it would be supplied to an end user.

b. If the battery charger has user controls to select from two or more charge rates (such as regular or fast charge) or different charge currents, the test shall be conducted at the fastest charge rate that is recommended by the manufacturer for everyday use, or, failing any explicit recommendation, the factory-default charge rate. If the charger has user controls for selecting special charge cycles that are recommended only for occasional use to preserve battery health, such as equalization charge, removing memory, or battery conditioning, these modes are not required to be tested. The settings of the controls shall be listed in the report for each test.

4.2. Selection and Treatment of the Battery Charger

The UUT, including the battery charger and its associated battery, shall be new products of the type and condition that would be sold to a customer. If the battery is lead-acid chemistry and the battery is to be stored for more than 24 hours between its initial acquisition and testing, the battery shall be charged before such storage.

4.3. Selection of Batteries To Use for Testing

a. For chargers with integral batteries, the battery packaged with the charger shall be used for testing. For chargers with detachable batteries, the battery or batteries to be used for testing will vary depending on whether there are any batteries packaged with the battery charger.

(1) If batteries are packaged with the charger, batteries for testing shall be selected from the batteries packaged with the battery charger, according to the procedure in section 4.3.b.

(2) If no batteries are packaged with the charger, but the instructions specify or recommend batteries for use with the charger, batteries for testing shall be selected from those recommended or specified in the instructions, according to the procedure in section 4.3.b.

(3) If no batteries are packaged with the charger and the instructions do not specify or recommend batteries for use with the charger, batteries for testing shall be selected from any that are suitable for use with the charger, according to the procedure in section 4.3.b.

b. From the detachable batteries specified above, the technician shall use Table 4.1 to select the batteries to be used for testing depending on the type of charger being tested. Each row in the table represents a mutually exclusive charger type. The technician shall find the single applicable row for the UUT, and test according to those requirements.

c. A charger is considered as:

(1) Single-capacity if all associated batteries have the same rated charge capacity (see definition) and, if it is a batch charger, all configurations of the batteries have the same rated charge capacity.

(2) Multi-capacity if there are associated batteries or configurations of batteries that have different rated charge capacities.

d. The selected battery or batteries will be referred to as the "test battery" and will be used through the remainder of this test procedure.

TABLE 4.1—BATTERY SELECTION FOR TESTING

Type of charger			Tests to perform	
Multi-voltage	Multi-port	Multi-capacity	Number of tests	Battery selection (from all configurations of all associated batteries)
No	No	No	1	Any associated battery.
No	No	Yes	2	Lowest charge capacity battery. Highest charge capacity battery.
No	Yes	Yes or No	2	Use only one port and use the minimum number of batteries with the lowest rated charge capacity that the charger can charge. Use all ports and use the maximum number of identical batteries of the highest rated charge capacity the charger can accommodate.
Yes	No	No	2	Lowest voltage battery. Highest voltage battery.
Yes	Yes to either or both		3	Of the batteries with the lowest voltage, use the one with the lowest charge capacity. Use only one port. Of the batteries with the highest voltage, use the one with the lowest charge capacity. Use only one port. Use all ports and use the battery or the configuration of batteries with the highest total rated energy capacity.

4.4. Limiting Other Non-Battery-Charger Functions

a. If the battery charger or product containing the battery charger does not have any additional functions unrelated to battery charging, this subsection may be skipped.

b. Any optional functions controlled by the user and not associated with the battery charging process (*e.g.,* the answering machine in a cordless telephone charging base) shall be switched off. If it is not possible to switch such functions off, they shall be set to their lowest power-consuming mode during the test.

c. If the battery charger takes any physically separate connectors or cables not required for battery charging but associated with its other functionality (such as phone lines, serial or USB connections, Ethernet, cable TV lines, *etc.*), these connectors or cables shall be left disconnected during the testing.

d. Any manual on-off switches specifically associated with the battery charging process shall be switched on for the duration of the charge, maintenance, and no-battery mode tests, and switched off for the off mode test.

4.5. Accessing the Battery for the Test

a. The technician may need to disassemble the end-use product or battery charger to gain access to the battery terminals for the Battery Discharge Energy Test in section 5.6. If the battery terminals are not clearly labeled, the technician shall use a voltmeter to identify the positive and negative terminals. These terminals will be the ones that give the largest voltage difference and are able to deliver significant current (0.2 C or 1/hr) into a load.

b. All conductors used for contacting the battery must be cleaned and burnished prior to connecting in order to decrease voltage drops and achieve consistent results.

c. Manufacturer's instructions for disassembly shall be followed, except those instructions that:

(1) Lead to any permanent alteration of the battery charger circuitry or function;

(2) Could alter the energy consumption of the battery charger compared to that experienced by a user during typical use, *e.g.,* due to changes in the airflow through the enclosure of the UUT; or

(3) Conflict requirements of this test procedure.

d. Care shall be taken by the technician during disassembly to follow appropriate safety precautions. If the functionality of the device or its safety features is compromised, the product shall be discarded after testing.

e. Some products may include protective circuitry between the battery cells and the remainder of the device. If the manufacturer provides a description for accessing the connections at the output of the protective circuitry, these connections shall be used to discharge the battery and measure the discharge energy. The energy consumed by the protective circuitry during discharge shall not be measured or credited as battery energy.

f. If the technician, despite diligent effort and use of the manufacturer's instructions, encounters any of the following conditions noted immediately below, the Battery Discharge Energy and the Charging and Maintenance Mode Energy shall be reported as "Not Applicable":

(1) Inability to access the battery terminals;

(2) Access to the battery terminals destroys charger functionality; or

(3) Inability to draw current from the test battery.

4.6. Determining Charge Capacity for Batteries With No Rating

If there is no rating for the battery charge capacity on the battery or in the instructions, then the technician shall determine a discharge current that meets the following requirements. The battery shall be fully charged and then discharged at this constant-current rate until it reaches the end-of-discharge voltage specified in Table 5.2. The discharge time must be not less than 4.5 hours nor more than 5 hours. In addition, the discharge test (Section 5.6) (which may not be starting with a fully-charged battery) shall reach the end-of-discharge voltage within 5 hours. The same discharge current shall be used for both the preparations step (Section 5.4) and the discharge test (Section 5.6). The test report shall include the discharge current used and the resulting discharge times for both a fully-charged battery and for the discharge test.

For this section, the battery is considered as "fully charged" when either (a) it has been charged by the UUT until an indicator on the UUT shows that the charge is complete, or (b) it has been charged by a battery analyzer at a current not greater than the discharge current until the battery analyzer indicates that the battery is fully charged.

When there is no capacity rating, a suitable discharge current must generally be determined by trial and error. Since the conditioning step does not require constant-current discharges, the trials themselves may also be counted as part of battery conditioning.

5. Test Measurement

The test sequence to measure the battery charger energy consumption is summarized in Table 5.1, and explained in detail below. Measurements shall be made under test conditions and with the equipment specified in Sections 3 and 4.

TABLE 5.1—TEST SEQUENCE

Step	Description	Data taken?	Equipment needed				
			Test battery	Charger	Battery analyzer or constant-current load	AC power meter	Thermometer (for flooded lead-acid battery chargers only)
1	Record general data on UUT; Section 5.1	Yes	X	X			
2	Determine test duration; Section 5.2	No					
3	Battery conditioning; Section 5.3	No	X	X	X		
4	Prepare battery for charge test; Section 5.4	No	X	X			
5	Battery rest period; Section 5.5	No	X				X
6	Conduct Charge Mode and Battery Maintenance Mode Test; Section 5.6.	Yes	X	X		X	
7	Battery Rest Period; Section 5.7	No	X				X
8	Battery Discharge Energy Test; Section 5.8	Yes	X		X		
9	Determining the Maintenance Mode Power; Section 5.9.	Yes	X	X		X	
10	Calculating the 24–Hour Energy Consumption; Section 5.10.	No					
11	Standby Mode Test; Section 5.11	Yes		X		X	
12	Off Mode Test; Section 5.12	Yes		X		X	

5.1. Recording General Data on the UUT

The technician shall record:

(1) The manufacturer and model of the battery charger;

(2) The presence and status of any additional functions unrelated to battery charging;

(3) The manufacturer, model, and number of batteries in the test battery;

(4) The rated battery voltage of the test battery;

(5) The rated charge capacity of the test battery; and

(6) The rated charge energy of the test battery.

(7) The settings of the controls, if battery charger has user controls to select from two or more charge rates

5.2. Determining the Duration of the Charge and Maintenance Mode Test

a. The charging and maintenance mode test, described in detail in section 5.8, shall be 24 hours in length or longer, as determined by the items below. Proceed in order until a test duration is determined.

(1) If the battery charger has an indicator to show that the battery is fully charged, that indicator shall be used as follows: If the indicator shows that the battery is charged after 19 hours of charging, the test shall be terminated at 24 hours. Conversely, if the full-charge indication is not yet present after 19 hours of charging, the test shall continue until 5 hours after the indication is present.

(2) If there is no indicator, but the manufacturer's instructions indicate that charging this battery or this capacity of battery should be complete within 19 hours, the test shall be for 24 hours. If the instructions indicate that charging may take longer than 19 hours, the test shall be run for the longest estimated charge time plus 5 hours.

(3) If there is no indicator and no time estimate in the instructions, but the charging current is stated on the charger or in the instructions, calculate the test duration as the longer of 24 hours or:

$$Duration = 1.4 \cdot \frac{RatedChargeCapacity\,(\mathrm{Ah})}{ChargeCurrent\,(\mathrm{A})} + 5\mathrm{h}$$

b. If none of the above applies, the duration of the test shall be 24 hours.

5.3. Battery Conditioning

a. No conditioning is to be done on lead-acid or lithium-ion batteries. The test technician shall proceed directly to battery preparation, section 5.4, when testing chargers for these batteries.

b. Products with integral batteries will have to be disassembled per the instructions in section 4.5, and the battery disconnected from the charger for discharging.

c. Batteries of other chemistries that have not been previously cycled are to be conditioned by performing two charges and two discharges, followed by a charge, as below. No data need be recorded during battery conditioning.

(1) The test battery shall be fully charged for the duration specified in section 5.2 or longer using the UUT.

(2) The test battery shall then be fully discharged using either:

(i) A battery analyzer at a rate not to exceed 1 C, until its average cell voltage under load reaches the end-of-discharge voltage specified in Table 5.2 for the relevant battery chemistry; or

(ii) The UUT, until the UUT ceases operation due to low battery voltage.

(3) The test battery shall again be fully charged as in step c.(1) of this section.

(4) The test battery shall again be fully discharged as per step c.(2) of this section.

(5) The test battery shall be again fully charged as in step c.(1) of this section.

d. Batteries of chemistries other than lead-acid or lithium-ion that are known to have been through at least two previous full charge/discharge cycles shall only be charged once per step c.(5), of this section.

5.4. Preparing the Battery for Charge Testing

Following any conditioning prior to beginning the battery charge test (section 5.6), the test battery shall be fully discharged for the duration specified in section 5.2 or longer using a battery analyzer.

5.5. Resting the Battery

The test battery shall be rested between preparation and the battery charge test. The rest period shall be at least one hour and not exceed 24 hours. For batteries with flooded cells, the electrolyte temperature shall be less than 30 °C before charging, even if the rest period must be extended longer than 24 hours.

5.6. Testing Charge Mode and Battery Maintenance Mode

a. The Charge and Battery Maintenance Mode test measures the energy consumed during charge mode and some time spent in the maintenance mode of the UUT. Functions required for battery conditioning that happen only with some user-selected switch or other control shall not be included in this measurement. (The technician shall manually turn off any battery conditioning cycle or setting.) Regularly occurring battery conditioning or maintenance functions that are not controlled by the user will, by default, be incorporated into this measurement.

b. During the measurement period, input power values to the UUT shall be recorded at least once every minute.

(1) If possible, the technician shall set the data logging system to record the average power during the sample interval. The total energy is computed as the sum of power samples (in watts) multiplied by the sample interval (in hours).

(2) If this setting is not possible, then the power analyzer shall be set to integrate or accumulate the input power over the measurement period and this result shall be used as the total energy.

c. The technician shall follow these steps:

(1) Ensure that the user-controllable device functionality not associated with battery charging and any battery conditioning cycle or setting are turned off, as instructed in section 4.4;

(2) Ensure that the test battery used in this test has been conditioned, prepared, discharged, and rested as described in sections 5.3 through 5.7;

(3) Connect the data logging equipment to the battery charger;

(4) Record the start time of the measurement period, and begin logging the input power;

(5) Connect the test battery to the battery charger within 3 minutes of beginning logging. For integral battery products, connect the product to a cradle or wall adapter within 3 minutes of beginning logging;

(6) After the test battery is connected, record the initial time and power (W) of the input current to the UUT. These measurements shall be taken within the first 10 minutes of active charging;

(7) Record the input power for the duration of the "Charging and Maintenance Mode Test" period, as determined by section 5.2. The actual time that power is connected to the UUT shall be within ±5 minutes of the specified period; and

(8) Disconnect power to the UUT, terminate data logging, and record the final time.

5.7. Resting the Battery

The test battery shall be rested between charging and discharging. The rest period shall be at least 1 hour and not more than 4 hours, with an exception for flooded cells. For batteries with flooded cells, the electrolyte temperature shall be less than 30 °C before charging, even if the rest period must be extended beyond 4 hours.

5.8. Battery Discharge Energy Test

a. If multiple batteries were charged simultaneously, the discharge energy is the sum of the discharge energies of all the batteries.

(1) For a multi-port charger, batteries that were charged in separate ports shall be discharged independently.

(2) For a batch charger, batteries that were charged as a group may be discharged individually, as a group, or in sub-groups connected in series and/or parallel. The position of each battery with respect to the other batteries need not be maintained.

b. During discharge, the battery voltage and discharge current shall be sampled and recorded at least once per minute. The values recorded may be average or instantaneous values.

c. For this test, the technician shall follow these steps:

(1) Ensure that the test battery has been charged by the UUT and rested according to the procedures above.

(2) Set the battery analyzer for a constant discharge current of 0.2 °C and the end-of-discharge voltage in Table 5.2 for the relevant battery chemistry.

(3) Connect the test battery to the analyzer and begin recording the voltage, current, and wattage, if available from the battery analyzer. When the end-of-discharge voltage is reached or the UUT circuitry terminates the discharge, the test battery shall be returned to an open-circuit condition. If current continues to be drawn from the test battery after the end-of-discharge condition is first reached, this additional energy is not to be counted in the battery discharge energy.

d. If not available from the battery analyzer, the battery discharge energy (in watt-hours) is calculated by multiplying the voltage (in volts), current (in amperes), and sample period (in hours) for each sample, and then summing over all sample periods until the end-of-discharge voltage is reached.

5.9. Determining the Maintenance Mode Power

After the measurement period is complete, the technician shall determine the average maintenance mode power consumption by examining the power-versus-time data from the charge and maintenance test and:

(1) If the maintenance mode power is cyclic or shows periodic pulses, compute the average power over a time period that spans a whole number of cycles and includes at least the last 4 hours.

(2) Otherwise, calculate the average power value over the last 4 hours.

5.10. Determining the 24-Hour Energy Consumption

The accumulated energy or the average input power, integrated over the test period from the charge and maintenance mode test, shall be used to calculate 24-hour energy consumption.

TABLE 5.2—REQUIRED BATTERY DISCHARGE RATES AND END-OF-DISCHARGE BATTERY VOLTAGES

Battery chemistry	Discharge rate *C*	End-of-discharge voltage *volts per cell*
Valve-Regulated Lead Acid (VRLA)	0.2	1.75
Flooded Lead Acid	0.2	1.70
Nickel Cadmium (NiCd)	0.2	1.0
Nickel Metal Hydride (NiMH)	0.2	1.0
Lithium Ion (Li-Ion)	0.2	2.5
Lithium Polymer	0.2	2.5
Rechargeable Alkaline	0.2	0.9
Nanophosphate Lithium Ion	0.2	2.0
Silver Zinc	0.2	1.2

5.11. Standby Mode Energy Consumption Measurement

The standby mode measurement depends on the configuration of the battery charger, as follows.

a. Conduct a measurement of standby power consumption while the battery charger is connected to the power source. Disconnect the battery from the charger, allow the charger to operate for at least 30 minutes, and record the power (*i.e.,* watts) consumed as the time series integral of the power consumed over a 10-minute test period, divided by the period of measurement. If the battery charger has manual on-off switches, all must be turned on for the duration of the standby mode test.

b. Standby mode may also apply to products with integral batteries. If the product uses a cradle and/or adapter for power conversion and charging, then "disconnecting the battery from the charger" will require disconnection of the end-use product, which contains the batteries. The other enclosures of the battery charging system will remain connected to the main electricity supply, and standby mode power consumption will equal that of the cradle and/or adapter alone.

c. If the product is powered through a detachable AC power cord and contains integrated power conversion and charging circuitry, then only the cord will remain connected to mains, and standby mode power consumption will equal that of the AC power cord (*i.e.,* zero watts).

d. Finally, if the product contains integrated power conversion and charging circuitry but is powered through a non-detachable AC power cord or plug blades, then no part of the system will remain connected to mains, and standby mode measurement is not applicable.

5.12. Off Mode Energy Consumption Measurement

The off mode measurement depends on the configuration of the battery charger, as follows.

a. If the battery charger has manual on-off switches, record a measurement of off mode energy consumption while the battery charger is connected to the power source. Remove the battery from the charger, allow the charger to operate for at least 30 minutes, and record the power (*i.e.,* watts) consumed as the time series integral of the power consumed over a 10-minute test period, divided by the period of measurement, with all manual on-off switches turned off. If the battery charger does not have manual on-off switches, record that the off mode measurement is not applicable to this product.

b. Off mode may also apply to products with integral batteries. If the product uses a cradle and/or adapter for power conversion and charging, then "disconnecting the battery from the charger" will require disconnection of the end-use product, which contains the batteries. The other enclosures of the battery charging system will remain connected to the main electricity supply, and off mode power consumption will equal that of the cradle and/or adapter alone.

c. If the product is powered through a detachable AC power cord and contains integrated power conversion and charging circuitry, then only the cord will remain connected to mains, and off mode power consumption will equal that of the AC power cord (*i.e.,* zero watts).

d. Finally, if the product contains integrated power conversion and charging circuitry but is powered through a non-detachable AC power cord or plug blades, then no part of the system will remain connected to mains, and off mode measurement is not applicable.

4. Amend Appendix Z to Subpart B of Part 430 by revising paragraphs 2(c), 3(b), 4(a)(i) and 4(b) to read as follows:

Appendix Z to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of External Power Supplies

* * * * *

2. * * *

c. *Active power (P)* (also *real power*) means the average power consumed by a unit. For a two terminal device with current and voltage waveforms i(t) and v(t) which are periodic with period T, the real or active power P is:

$$P = \frac{1}{T}\int_0^T v(t)i(t)dt$$

* * * * *

3. * * *

(b) Multiple-Voltage External Power Supply. Unless otherwise specified, measurements shall be made under test conditions and with equipment specified below.

(i) Verifying Accuracy and Precision of Measuring Equipment

(A) Measurements of power 0.5 W or greater shall be made with an uncertainty of ≤ 2 percent at the 95 percent confidence level. Measurements of power less than 0.5 W shall be made with an uncertainty of ≤ 0.01 W at the 95 percent confidence level. The power measurement instrument shall have a resolution of:

(1) 0.01 W or better for measurements up to 10 W;

(2) 0.1 W or better for measurements of 10 to 100 W; or

(3) 1 W or better for measurements over 100 W.

(B) Measurements of energy (Wh) shall be made with an uncertainty of ≤ 2 percent at the 95 percent confidence level. Measurements of voltage and current shall be made with an uncertainty of ≤ 1 percent at the 95 percent confidence level. Measurements of temperature shall be made with an uncertainty of ≤ 2 °C at the 95 percent confidence level.

(C) All equipment used to conduct the tests must be selected and calibrated to ensure that measurements will meet the above uncertainty requirements. For guidance on measuring low power levels, see IEC 62301, Section 5.3.2 and Annexes B and D (Reference for guidance only, see § 430.4).

(ii) Setting Up the Test Room

All tests shall be carried out in a room with an air speed immediately surrounding the UUT of ≤ 0.5 m/s. The ambient temperature shall be maintained at 20 °C ± 5 °C throughout the test. There shall be no intentional cooling of the UUT such as by use of separately powered fans, air conditioners, or heat sinks. The UUT shall be conditioned, rested, and tested on a thermally non-conductive surface. A readily available material such as Styrofoam will be sufficient.

(iii) Verifying the UUT's Input Voltage and Input Frequency

(A) If the UUT is intended for operation on AC line-voltage input in the United States, it shall be tested at 115 V at 60 Hz. If the UUT is intended for operation on AC line-voltage input but cannot be operated at 115 V at 60 Hz, it shall not be tested. The input voltage shall be within ± 1 percent of the above specified voltage.

(B) If the input voltage is AC, the input frequency shall be within ± 1 percent of the specified frequency. The THD of the input voltage shall be ≤ 2 percent, up to and including the 13th harmonic. The crest factor of the input voltage shall be between 1.34 and 1.49.

4. * * *

(a) * * *

(i) Standby Mode and Active Mode Measurement—The measurement of standby mode (also no-load mode) energy consumption and active mode efficiency shall conform to the requirements specified in section 5, "Measurement Approach" of the CEC's "Test Method for Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies," August 11, 2004, (incorporated by reference, see § 430.3). Switch-selectable single-voltage external power supplies shall be tested twice—once at the highest nameplate output voltage and once at the lowest.

(A) If the product has more than two output wires, including those that are necessary for controlling the product, the manufacturer shall supply a connection diagram or test fixture that will allow the testing laboratory to put the unit under test into active mode.

(B) For those external power supplies that cannot sustain output at 100 percent loading condition, this efficiency metric shall not be included. For these external power supplies, the average efficiency is the average of the efficiencies measured at 25 percent, 50 percent, and 75 percent of maximum load.

(C) In the case where the external power supply lists both an instantaneous and continuous output current, it shall be tested at the continuous condition only.

* * * * *

(b) Multiple-Voltage External Power Supply—Power supplies must be tested with the output cord packaged with the unit for sale to the consumer, as it is considered part of the unit under test. There are two options for connecting metering equipment to the output of this type of power supply: cut the cord immediately adjacent to the output connector or attach leads and measure the efficiency from the output connector itself. If the power supply is attached directly to the product that it is powering, cut the cord immediately adjacent to the powered product and connect output measurement probes at that point. The tests should be conducted on the sets of output wires that constitute the output busses. If the product has additional wires, these should be left electrically disconnected unless they are necessary for controlling the product. In this case, the manufacturer shall supply a connection diagram or test fixture that will allow the testing laboratory to put the unit under test into active mode.

(i) Standby-Mode and Active-Mode Measurement—The measurement of the multiple-voltage external power supply standby mode (also no-load-mode) energy consumption and active-mode efficiency shall be as follows:

(A) Loading conditions and testing sequence. (1) If the unit under test has on-off switches, all switches shall be placed in the "on" position. Loading criteria for multiple-voltage external power supplies shall be based on nameplate output current and not on nameplate output power because output voltage might not remain constant.

(2) The unit under test shall operate at 100 percent of nameplate current output for at least 30 minutes immediately before conducting efficiency measurements.

(3) After this warm-up period, the technician shall monitor AC input power for a period of 5 minutes to assess the stability of the unit under test. If the power level does not drift by more than 1 percent from the maximum value observed, the unit under test can be considered stable and measurements can be recorded at the end of the 5-minute

period. Measurements at subsequent loading conditions, listed in Table 1, can then be conducted under the same 5-minute stability guidelines. Only one warm-up period of 30 minutes is required for each unit under test at the beginning of the test procedure.

(4) If AC input power is not stable over a 5-minute period, the technician shall follow the guidelines established by IEC Standard 62301 for measuring average power or accumulated energy over time for both input and output. (Reference for guidance only, see § 430.4).

(5) The unit under test shall be tested at the loading conditions listed in Table 1, derated per the proportional allocation method presented in the following section.

TABLE 1—LOADING CONDITIONS FOR UNIT UNDER TEST

Loading Condition 1	100% of Derated Nameplate Output Current ± 2%.
Loading Condition 2	75% of Derated Nameplate Output Current ± 2%.
Loading Condition 3	50% of Derated Nameplate Output Current ± 2%.
Loading Condition 4	25% of Derated Nameplate Output Current ± 2%.
Loading Condition 5	0%.

(6) Input and output power measurements shall be conducted in sequence from Loading Condition 1 to Loading Condition 4, as indicated in Table 1. For Loading Condition 5, the unit under test shall be placed in no-load mode, any additional signal connections to the unit under test shall be disconnected, and input power shall be measured.

(B) Proportional allocation method for loading multiple-voltage external power supplies. For power supplies with multiple voltage busses, defining consistent loading criteria is difficult because each bus has its own nameplate output current. The sum of the power dissipated by each bus loaded to its nameplate output current may exceed the overall nameplate output power of the power supply. The following proportional allocation method must be used to provide consistent loading conditions for multiple-voltage external power supplies. For additional explanation, please refer to section 6.1.1 of the California Energy Commission's "Proposed Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc Power Supplies Revision 6.2," November 2007.

(1) Consider a multiple-voltage power supply with *N* output busses, and nameplate output voltages $V_{I,}$ * * *, V_N, corresponding output current ratings $I_{I,}$ * * *, I_N, and a nameplate output power *P.* Calculate the derating factor *D* by dividing the power supply nameplate output power *P* by the sum of the nameplate output powers of the individual output busses, equal to the product of bus nameplate output voltage and current I_iV_i, as follows:

$$D = \frac{P}{\sum_{i=1}^{N} V_i I_i},$$

(2) If $D \geq 1$, then loading every bus to its nameplate output current does not exceed the overall nameplate output power for the power supply. In this case, each output bus will simply be loaded to the percentages of its nameplate output current listed in Table 1. However, if $D < 1$, it is an indication that loading each bus to its nameplate output current will exceed the overall nameplate output power for the power supply. In this case, and at each loading condition, each output bus will be loaded to the appropriate percentage of its nameplate output current listed in Table 1, multiplied by the derating factor *D.*

(C) Minimum output current requirements. Depending on their application, some multiple-voltage power supplies may require a minimum output current for each output bus of the power supply for correct operation. In these cases, ensure that the load current for each output at Loading Condition 4 in Table 1 is greater than the minimum output current requirement. Thus, if the test method's calculated load current for a given voltage bus is smaller than the minimum output current requirement, the minimum output current must be used to load the bus. This load current shall be properly recorded in any test report.

(D) Test loads. Active loads such as electronic loads or passive loads such as rheostats used for efficiency testing of the unit under test shall be able to maintain the required current loading set point for each output voltage within an accuracy of ± 0.5 percent. If electronic load banks are used, their settings should be adjusted such that they provide a constant current load to the unit under test.

(E) Efficiency calculation. Efficiency shall be calculated by dividing the measured active output power of the unit under test at a given loading condition by the active AC input power measured at that loading condition. Efficiency shall be calculated at each Loading Condition (1, 2, 3, and 4, in Table 1) and be recorded separately.

(F) Power consumption calculation. Power consumption of the unit under test at Loading Conditions 1, 2, 3, and 4 is the difference between the active output power at that Loading Condition and the active AC input power at that Loading Condition. The power consumption of Loading Condition 5 (no-load) is equal to the AC active input power at that Loading Condition.

(ii) Off Mode Measurement—If the multiple-voltage external power supply unit under test incorporates any on-off switches, the unit under test shall be placed in off mode and its power consumption in off mode measured and recorded. The measurement of the off mode energy consumption shall conform to the requirements specified in paragraph (4)(b)(i) of this appendix. Note that the only loading condition that will be measured for off mode is "Loading Condition 5" in paragraph (A), "Loading conditions and testing sequence", except that all manual on-off switches shall be placed in the off position for the measurement.

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