ENERGY STAR® Program Requirements for Battery Charging Systems

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the manufacture and labeling of ENERGY STAR qualified products. The ENERGY STAR Partner must adhere to the following partner commitments:

Qualifying Products

1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for battery charging systems (BCSs). A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
2. Obtain certification of ENERGY STAR qualification from a Certification Body recognized by EPA for battery charging systems prior to associating the ENERGY STAR name or mark with any product. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform battery charging system product testing.

Using the ENERGY STAR Name and Marks

3. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at www.energystar.gov/logouse.
4. Use the ENERGY STAR name and marks only in association with qualified products. Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale.
5. Provide clear and consistent labeling of ENERGY STAR qualified battery charging systems.

    5.1. Partner shall adhere to the following product-specific commitments regarding use of the ENERGY STAR BCS graphic for qualified products:

        5.1.1. Partner must clearly display the ENERGY STAR BCS graphic on the Partner's website where information about end-use products with ENERGY STAR qualified BCS is displayed. Partner must comply with the ENERGY STAR Web Linking Policy, which can be found at www.energystar.gov/partners;

        5.1.2. Partner must also use the ENERGY STAR BCS graphic in one of the following ways:

            1) On the outside of end-use product packaging, preferably on the front face; or

            2) On a package insert included with end-use product packaging.

            EPA will consider alternative labeling proposals on a case-by-case basis.

        5.1.3. It is also recommended that the ENERGY STAR BCS graphic appear in end-use product literature (e.g., user manuals, specification sheets) and in advertising/promotional materials.

        5.1.4. Partner is prohibited from affixing the BCS graphic directly to an associated end-use product or to the battery charging system itself. However, the BCS graphic may be displayed on a cord tag that is fastened to a BCS cord.

Verifying Ongoing Product Qualification

6. Participate in third-party verification testing through a Certification Body recognized by EPA for battery charging systems.
7. Comply with tests that EPA/DOE may conduct at its discretion on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.

Providing Information to EPA

8. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:

    8.1. Partner must submit the total number of ENERGY STAR qualified battery charging systems shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).

    8.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.

    8.3. Partner must submit unit shipment data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

    Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. Any information used will be masked by EPA so as to protect the confidentiality of the Partner;

9. Report to EPA any attempts by laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
10. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Performance for Special Distinction

In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures, and should keep EPA informed on the progress of these efforts:

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.
- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.

- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, communicate, and/or promote Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.
- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.
- Join EPA's Climate Leaders Partnership to inventory and reduce greenhouse gas emissions. Through participation, companies create a credible record of their accomplishments and receive EPA recognition as corporate environmental leaders. For more information on Climate Leaders, visit www.epa.gov/climateleaders.
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel-based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.

ENERGY STAR® Program Requirements
Product Specification for Battery Charging Systems

Eligibility Criteria
Draft Version 1.1

Following is the Version 1.1 ENERGY STAR Product Specification for Battery Charging Systems. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1 DEFINITIONS

A) Product Types and Components:

1) Battery (Battery Pack): An assembly of one or more rechargeable cells intended to provide electrical energy to an end-use product. This definition does not include primary (e.g., alkaline) cells. Batteries may be in one of the following forms:

a) Detachable Battery: A battery contained in a separate enclosure from the end-use product and intended to be removed or disconnected from the end-use product for charging.

b) Integral Battery: A battery contained within the end-use product and not intended to be removed from the end-use product for charging. This definition includes batteries that are intended to be removed from the end-use product for disposal or recycling purposes only.

2) Battery Charger: A device intended to replenish the charge in a rechargeable battery. A battery charger connects to the mains at the power input and connects to the battery at the output. The charger may be comprised of multiple components, in more than one enclosure, and may be fully or partially contained in the Battery Operated End-use Product.

a) A La Carte Charger: A battery charger that is individually packaged without batteries. Batteries that the a la carte charger is designed to charge should be listed on the packaging, battery, and/or in printed or electronic user information materials. A la carte chargers may have multi-voltage or multi-port capability.

b) Multi-Voltage Charger: A battery charger that, by design, may charge a variety of batteries that have different Nominal Battery Voltages.

c) Multi-Port Charger: A battery charger that, by design, is capable of simultaneously charging two or more batteries. Multi-port chargers may have multi-voltage capability.

d) Stand-Alone Charger: A battery charger that, by design, charges separable batteries that are disconnected from the Battery Operated End-use Product.

e) Batch Charger: A multi-port charger, such as a universal AA battery charger, that charges batteries in batches (i.e., groups of batteries charged in series). For the purposes of this specification, each of these batches shall be treated as a discrete battery pack.[1]

1 For example, a AA Nickel Metal Hydride charger with four ports may charge in two batches, with the batches connected in parallel. Each batch, in this case, would be treated as a single 2.4V battery pack. Charging four AA batteries in this system would be considered, for the purposes of this specification, as a multi-port charger charging two 2.4V batteries in parallel.

3) Battery Charging System: A combination of a Battery Charger and a detachable or integral Battery that is designed to power a Battery Operated End-use Product.

B) Device Types:

1) Battery Operated End-use Product: A cordless product or appliance fully powered by the battery at least part of the time.

2) Cord/Cordless: A product or appliance designed to operate on battery power or directly from the mains with a discharged battery.

3) Inductive Coupling: A system in which power is transferred between windings in two separate enclosures through magnetic induction rather than metal-to-metal contact. Inductive coupling is typically used in small household appliances, such as cordless toothbrushes and shavers.

C) Operational Modes:

1) Active Mode: The condition in which the battery is receiving the main charge, equalizing cells, and performing other one-time or limited-time functions necessary for bringing the battery to the fully charged state.

2) Battery Maintenance Mode: The condition in which the battery has been fully charged but is still connected to the charger, and the charger is connected to the power source. This mode may persist for an indefinite period of time.

3) Standby (No-Load) Mode: The lowest power consumption mode which cannot be switched off (influenced) by the user and that may persist for an indefinite time when an appliance is connected to the main electricity supply and used in accordance with the manufacturer's instructions. Note: The standby mode is usually a non-operational mode when compared to the intended use of the appliance's primary function.[2] For the purposes of this specification, standby mode is the condition in which:

a) no battery is present in the charger, or, where the battery is integral to a product, the product is not attached to the charger,

b) the charger is connected to mains, and

c) any manual power switches are switched on.

D) Test/Measurement Terminology:

1) Accumulated Nonactive Energy (Ea): The energy, in watt-hours (Wh), consumed by the battery charger in battery maintenance and standby modes of operation over a defined period of time. For the purposes of this specification, a standard 48-hour period is used for evaluation, consisting of 36 hours of maintenance mode operation followed by 12 hours of standby mode operation.

2) Nominal Battery Capacity: The quantity of charge, measured in ampere-hours (Ah), provided by a battery during discharge under specified conditions. Nominal Battery Capacity is typically listed on battery packaging.

2 This definition is consistent with IEC 62301: Household Electrical Appliances – Measurement of Standby Power.

3) Battery Energy (Eb): The energy, in watt-hours (Wh), that may be delivered by the battery under specified discharge conditions. For the purposes of this specification, battery energy is measured at a constant current discharge rate of 0.2 C, beginning with a fully charged battery and ending at the manufacturer specified cutoff voltage.

4) Nameplate Input Power: The nameplate input power is either (a) the input power marked on the nameplate (watts), or (b) where only nameplate input voltage and current ranges are provided, the highest value achieved by multiplying a nameplate input voltage limit and its corresponding current limit (Volt-Amperes).

5) Nominal Battery Energy: The product of Nominal Battery Capacity and Nominal Battery Voltage.

6) Nominal Battery Voltage: Industry standard cell voltage multiplied by the number of cells in the battery pack. Nominal Battery Voltage is typically listed on battery packaging.

7) Energy Ratio (ER): The ratio of accumulated nonactive energy (Ea) divided by battery energy (Eb).

8) Product Family: A group of product models that are (1) made by the same manufacturer, (2) subject to the same ENERGY STAR qualification criteria, and (3) of a common basic design. Product models within a family differ from each other according to one or more characteristics or features that either (1) have no impact on product performance with regard to ENERGY STAR qualification criteria, or (2) are specified herein as acceptable variations within a product family. For Battery Charging Systems, acceptable variations within a product family include:

   a) Color

   b) Housing

2 SCOPE

2.1 Included Products

2.1.1 The following products are eligible for ENERGY STAR qualification under this specification, with the exception of products listed in Section 2.2:

1. Battery Charging Systems packaged with portable, rechargeable products (e.g., small home appliances, personal care products, power tools, flashlights, and floor care products) whose principal output is (1) mechanical motion, (2) light, (3) movement of air, or (4) production of heat.

2. Stand-alone Battery Chargers sold with products that use a detachable battery (e.g., some digital camera and camcorder designs); and

3. Battery Charging Systems intended to replace standard sized primary alkaline cells, including: AAA, AA, C, D, 9-volt, etc. (i.e., universal battery chargers).

2.2 Excluded Products

2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for qualification under this specification. The list of specifications currently in effect can be found at www.energystar.gov/products.

2.2.2 The following products are not eligible for qualification under this specification:

1. Battery Charging Systems with Inductive Coupling;

2. Battery Charging Systems with Nameplate Input Power less than 2 watts or greater than 300 watts;

3. Battery Charging Systems with Nominal Battery Voltage greater than or equal to 42 volts;

4. Battery Charging Systems that continuously draw power to support functionality beyond a clock or state of charge indicator (e.g., embedded radios, GFI AC outlets, shaver cleaning stations, etc.) that is unrelated to charging the battery or operating the Battery Operated End-use Product; and

5. Battery Charging Systems intended for primary cell chemistries (e.g., alkaline “dry” cells) and not for rechargeable battery chemistries (e.g., nickel cadmium, lead acid, lithium ion, and nickel metal hydride).

3 QUALIFICATION CRITERIA

3.1 Significant Digits and Rounding

3.1.1 All calculations shall be carried out with actual measured or observed values. Only the final result of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using exact values without any benefit from further rounding.

3.2 Nonactive Energy Ratio Requirements for Non-Multi-Voltage, Non-Multi-Port Chargers

3.2.1 The Nonactive Energy Ratio (ER), as calculated per Equation 1, shall be less than or equal to the Maximum Nonactive Energy Ratio Requirement (ER_{MAX}), as specified in Table 1, where V_B is the Nominal Battery Voltage.

Equation 1: Nonactive Energy Ratio Calculation for Non-Multi-Voltage, Non-Multi-Port Chargers

$$ER = \frac{E_M + E_S}{E_B},$$

Where:

- *ER is the nonactive energy ratio.*
- *E_M is the maintenance mode energy, measured in the test method.*
- *E_S is the standby mode energy, measured in the test method.*
- *E_B is the battery energy, measured in the test method.*

Table 1: Maximum Nonactive Energy Ratio Requirements (ER_{MAX})

Rated Battery Voltage, V_B (V)	Maximum Nonactive Energy Ratio Requirement (ER_{MAX})		Rated Battery Voltage, V_B (V)	Maximum Nonactive Energy Ratio Requirement (ER_{MAX})
$V_B \leq 1.2$	20.0		$12.0 < V_B \leq 13.2$	5.1
$1.2 < V_B \leq 2.4$	16.9		$13.2 < V_B \leq 14.4$	4.5
$2.4 < V_B \leq 3.6$	13.7		$14.4 < V_B \leq 15.6$	4.3
$3.6 < V_B \leq 4.8$	11.6		$15.6 < V_B \leq 16.8$	4.2
$4.8 < V_B \leq 6.0$	9.6		$16.8 < V_B \leq 18.0$	3.8
$6.0 < V_B \leq 7.2$	7.5		$18.0 < V_B \leq 19.2$	3.6
$7.2 < V_B \leq 8.4$	7.0		$19.2 < V_B \leq 20.4$	3.5
$8.4 < V_B \leq 9.6$	6.5		$20.4 < V_B \leq 21.6$	3.3
$9.6 < V_B \leq 10.8$	6.1		$21.6 < V_B \leq 22.8$	3.2
$10.8 < V_B \leq 12.0$	5.6		$V_B > 22.8$	3.0

3.3 Nonactive Energy Ratio Requirements for Multi-Voltage Chargers

3.3.1 The Nonactive Energy Ratio (ER), as calculated per Equation 2, shall be less than or equal to the Maximum Nonactive Energy Ratio Requirement (ER_{MAX}), as specified in Table 1, where V_B is the average of the Nominal Battery Voltages of the batteries used for the tests.

Equation 2: Energy Ratio Calculation for Multi-Voltage Chargers

$$ER = \frac{\sum_{i=1}^{n}\left(E_{Mi} + E_{Si}\right)}{\sum_{i=1}^{n} E_{Bi}},$$

Where:

- *ER is the nonactive energy ratio.*
- *E_{Mi} is the maintenance mode energy with the i^{th} battery installed, measured in the test method.*
- *E_{Si} is the standby mode energy for the i^{th} test, measured in the test method.*
- *E_{Bi} is the battery energy for the i^{th} battery tested, measured in the test method.*
- *n is the number of tests of a particular unit with different sets of batteries, and greater than or equal to 3.*
- *$\sum$ is the summation function.*

3.4 Nonactive Energy Ratio Requirements for Multi-Port Chargers

3.4.1 The Nonactive Energy Ratio (ER), as calculated per Equation 3, shall be less than or equal to the Maximum Nonactive Energy Ratio Requirement (ER_{MAX}), as specified in Table 1, where:

1. For batteries charged in parallel, V_B is equal to the Nominal Battery Voltage of a single identical battery pack; and

2. For batteries charged in series, V_B is equal to the sum of the Nominal Battery Voltage of all battery packs installed for testing.

Equation 3: Energy Ratio Calculation for Multi Port Chargers

$$ER = \frac{E_M + E_S}{\sum_{i=1}^{m} E_{Bi}},$$

Where:

- *ER is the nonactive energy ratio.*
- *E_M is the maintenance mode energy, measured in the test method.*
- *E_S is the standby mode energy, measured in the test method.*
- *E_{Bi} is the battery energy for the i^{th} battery tested, measured in the test method.*
- *m is the number of batteries installed in the charger during the test (the maximum number the charger can accommodate)*
- *$\sum$ is the summation function.*

3.5 Nonactive Energy Ratio Requirements for Multi-Voltage, Multi-Port Chargers

3.5.1 The Nonactive Energy Ratio (ER), as calculated per Equation 4, shall be less than or equal to the Maximum Nonactive Energy Ratio Requirement (ER_{MAX}), as specified in Table 1, where:

1. For batteries charged in parallel, V_B is equal to the average of the *single-pack* Nominal Battery Voltages of the batteries in each batch installed for testing; and

2. For batteries charged in series, V_B is equal to the average of the summed Nominal Battery Voltages of each batch of batteries installed for testing.

Equation 4: Energy Ratio Calculation for Multi-Voltage, Multi-Port Chargers

$$ER = \frac{\sum_{i=1}^{n}\left(E_{Mi} + E_{Si}\right)}{\sum_{i=1}^{n\times m} E_{Bi}},$$

Where:

- *ER is the nonactive energy ratio.*
- *E_{Mi} is the maintenance mode energy with the i^{th} battery installed, measured in the test method.*
- *E_{Si} is the standby mode energy for the i^{th} test, measured in the test method.*
- *E_{Bi} is the battery energy for the i^{th} battery tested, measured in the test method.*
- *n is the number of tests of a particular unit with different sets of batteries, and greater than or equal to 3.*
- *m is the number of batteries installed in the charger during each test (the maximum number the charger can accommodate)*

3.6 Safety Requirements

3.6.1 Battery Charging Systems shall comply with applicable local product safety requirements in the market(s) in which the product is to be sold.

4 TESTING REQUIREMENTS

4.1 Test Methods

4.1.1 When testing Battery Charging Systems, the test methods identified in Table 2 shall be used to determine ENERGY STAR qualification:

Table 2: Test Methods for ENERGY STAR Qualification

Product Type	Test Method
All	ENERGY STAR Test Method for Battery Charging Systems, Rev. Aug-2010
	IEC Standard 61951-1: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 1: Nickel-cadmium. Ed. 2.1. January 2006.
	IEC Standard 61951-2: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 2: Nickel-metal hydride. Ed. 2.0. April 2003.
	IEC Standard 61960: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications. Ed. 1.0. December 2003.

4.2 Number of Units Required for Test

4.2.1 Representative Models shall be selected for testing per the following requirements:

i. For qualification of an individual product model, a product configuration equivalent to that which is intended to be marketed and labeled as ENERGY STAR is considered the Representative Model;

ii. For qualification of a product family, any product configuration within the family may be considered the Representative Model.

4.2.2 Testing shall be conducted on three randomly chosen units of the same Representative Model.

4.2.3 All tested units shall meet ENERGY STAR qualification requirements

4.3 International Market Qualification

4.3.1 Products shall be tested for qualification at the relevant input voltage/frequency combination for each market in which they will be sold and promoted as ENERGY STAR.

5 EFFECTIVE DATE

5.1.1 Effective Date: The Version 1.1 ENERGY STAR Battery Charging System specification shall take effect on the dates specified in Table 3. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on its date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

5.1.2 Future Specification Revisions: EPA reserves the right to change this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that the ENERGY STAR qualification is not automatically granted for the life of a product model.

Table 3: Specification Effective Date

Effective Date
January 1, 2006

ENERGY STAR® Program Requirements
Product Specification for
Battery Charging Systems

Test Method

1 OVERVIEW

The following test method shall be used for determining compliance with requirements in the ENERGY STAR Eligibility Criteria for Battery Charging Systems.

2 APPLICABILITY

The following test method is applicable to all products eligible for qualification under the ENERGY STAR Eligibility Criteria for Battery Charging Systems. In the event of dispute/verification, the full test method shall be used to measure maintenance mode energy and standby mode energy, per Section 6.2.

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions contained in the ENERGY STAR Eligibility Criteria for Battery Charging Systems

A) C-Rate: C-rate is a charge or discharge current normalized to battery capacity. A charge or discharge rate of one C draws a capacity equal to the battery capacity in one hour. For example, a rate of C/2 for a 1.2 amp-hour battery is 0.6 amps, a one C rate is 1.2 amps, and a 2C rate is 2.4 amps.

B) End-of-Discharge Voltage: The specified closed circuit voltage at which discharge of a battery is terminated.

4 STANDARD TESTING CONDITIONS

A) Supply Requirements: The requirements in Table 1 shall apply to the power source from which the unit under test (UUT) derives its operating energy for the test.

Table 1: Input Power Requirements

Market	Voltage	Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency	Frequency Tolerance
North America, Taiwan	115 Vac	+/- 1.0 %	2.0 %	60 Hz	+/- 1.0 %
Europe, Australia, New Zealand	230 Vac	+/- 1.0 %	2.0 %	50 Hz	+/- 1.0 %
China	220 Vac	+/- 1.0 %	2.0 %	50 Hz	+/- 1.0 %
Japan	100 Vac	+/- 1.0 %	2.0 %	50 Hz and 60 Hz	+/- 1.0 %

B) Ambient Requirements: The following requirements apply to the room or immediate environment in which the testing is conducted.

1) Air speed shall be less than 0.5 m/s.

2) Ambient temperature shall be maintained at 20 °C ± 5 °C.

C) Measurement and Instrumentation Requirements:

1) Precision measurement of energy consumption shall be made with a precision equal to the greater of 0.1 Watt-hour or 1% of full-scale measurement.

5 UUT REQUIREMENTS

A) Both the UUT and the associated batteries shall be new products, representative of the type and condition of product that a consumer would purchase in a retail setting.

B) Battery Conditioning: The batteries shall have experienced no more than 5 complete charge/discharge cycles prior to testing. These cycles are optional and must be completed according to the charge (Section 6.2) and discharge (Section 6.3) procedures outlined in this test method.

C) Battery Selection: All products shall be tested as packaged for sale, except as specified below.

1) Multi-voltage chargers shall be tested using at least three currently produced batteries identified/listed as usable with the unit.

a) The charger shall be tested using batteries with both the highest and lowest nominal battery energy (watt-hours) that are manufactured for use with the UUT.

b) If the multi-voltage charger is also packaged for sale with end-use products using batteries, it shall be tested with the specific charger and battery combination.

c) Each unit in the sample required by the ENERGY STAR Eligibility Criteria for Battery Charging Systems shall be evaluated using the full set of tests.

2) Multi-port chargers shall be tested with the maximum number of identical batteries the charger can accommodate. These shall be treated as a single battery throughout the test.

a) If the multi-port charger is also multi-voltage, it shall be tested using the multi-voltage method, above, except the maximum number of identical batteries the charger can accommodate shall be used for each test (i.e., the UUT must be tested with three full sets of identical batteries, including batteries with both highest and lowest battery energies).

6 DETERMINING BCS ENERGY RATIO

6.1 UUT Preparation

A) Abbreviated test methodology: The abbreviated test method, described for each mode tested, below, may be conducted where:

1) The UUT's energy consumption in both maintenance and standby modes does not vary significantly over time.

2) All maintenance and standby functions occur at the same magnitude and frequency for as long as the device remains in that mode.

3) Products utilizing a current pulse to maintain charge are not precluded from using the abbreviated method, so long as the magnitude and frequency of the pulse remain constant indefinitely while in both maintenance and standby modes.

4) Those wishing to use the abbreviated test must submit a written statement indicating that the UUT qualifies for the abbreviated test methodology and include this documentation with the test report.

B) Battery Voltage: Record the rated voltage of the battery or batteries used for the test, V_B.

C) Testing shall commence with a fully discharged battery, consistent with end of discharge voltages specified in Table 2.

Table 2: End of Discharge Voltage by Chemistry

Battery Chemistry	End of Discharge Voltage
Nickel-based (NiCD/NiMh)	1.0V/cell (IEC 61951)
Lead Acid (all types)	1.75V/cell
All Others	Follow manufacturer specifications

6.2 Measuring Non-active Energy

A) Charge the battery with the UUT for the period specified by the UUT manufacturer as the time needed to fully charge the battery under test.

1) All limited time functions used to deliver the primary charge to the battery, including cell equalization, are to be excluded from the measurement of battery maintenance mode.

2) If these events are known to occur for a time period beyond the manufacturer specified charge time, the battery is to be left in place until all such functions are complete.

3) In cases where no charge time is specified, the batteries is to be charged for a period of at least 24 hours.

B) If the UUT is disconnected from the power source following charging (e.g., to move it from a charging station to a metering station), then

1) The time that the UUT spends disconnected from the AC mains between charging and measuring of battery maintenance mode energy shall be less than or equal to 1 hour.

2) The UUT and battery must be connected to the AC mains for a period greater than or equal to 15 minutes prior to the start of the maintenance mode measurement.

C) Begin power measurement.

D) Maintenance Mode:

1) Testing shall proceed according to one of the following methods:

a) Full Test - Continue measurement for a period of 36 hours (+/- 1 minute). Energy use may be measured as a time series integral of power or as an accumulated watt-hour total.

b) Abbreviated Method - Measure energy consumption for at least 6 hours. Energy use may be measured as a time series integral of power or as an accumulated watt-hour total, but shall be extrapolated to 36 hours.

2) Record the Maintenance Mode Energy (E_M).

E) Standby Mode:

1) Remove battery from charger and continue measurement of standby power using one of the following options:

a) Full Test: Measure energy used for 12 hours (+/- 1 minute). Energy use may be measured as a time series integral of power or as an accumulated watt-hour total.

b) Abbreviated Method: Measure energy used for a period of not less than 1 hour. Energy use may be measured as a time series integral of power or as an accumulated watt-hour total, but shall be extrapolated to 12 hours.

2) Record the Standby Mode Energy, (E_S).

Note: For some types of cord/cordless products, the charging circuitry is contained within the device itself and the only detachable part of the system is an AC power cord. For such Battery Operated End-use Products, the standby power/energy is zero, since the product/charger will draw no power when the battery is not being either charged or maintained. This does not apply to cradle products with a separable cord, as the cradle or wall adapter may still draw some power when the device/battery is removed.

6.3 Measuring Battery Energy

A) Unless otherwise specified herein, measurement of battery energy shall be conducted under the conditions specified in:

1) IEC 61951-11 for nickel cadmium cells,

2) IEC 61951-22 for nickel metal hydride cells or

3) IEC 619603 for lithium cells.

4) For other cell chemistries, measurement of battery energy shall be conducted under the conditions specified in an equivalent, industry-accepted standard. In this case, the test procedure used shall be reported.

B) The battery energy shall be measured as follows:

1) The battery shall be charged, according to Section 6.2 of this test methodology. After charging and the completion of any maintenance mode measurement, the battery shall be stored in an ambient temperature of 20 °C ± 5 °C for a period of 1 to 4 hours, inclusive.

2) The battery shall then be discharged in an ambient temperature of 20 °C ± 5 °C at a rate of 0.2C, where C is the rated Ampere-hour capacity of the battery. The test shall continue until the battery pack reaches its end of discharge voltage, according to Table 2.

3) During this period, voltage shall be logged, integrated at the end of discharge, and multiplied by the discharge rate to obtain the measured battery energy, (E_B).

C) The test may be repeated a maximum of 5 times, as in IEC 61951, with the best result being chosen as the final measured energy value.

7 ACKNOWLEDGEMENTS

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1 International Electrotechnical Commission (IEC). “IEC Standard 61951-1: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 1: Nickel-cadmium.” Ed. 2.1. January 2006.

2 IEC. “IEC Standard 61951-2: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 2: Nickel-metal hydride.” Ed. 2.0. April 2003.

3 IEC. “IEC Standard 61960: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications.” Ed. 1.0. December 2003.