ENERGY STAR® Program Requirements Product Specification for Uninterruptible Power Supplies (UPSs)

Eligibility Criteria Final Draft Version 1.0

Following is the Version 1.0 ENERGY STAR Product Specification for Uninterruptible Power Supplies (UPSs). A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the International Electrical Commission (IEC) standard IEC 62040-3[1].

For the purpose of this specification the following definitions apply:

A) Uninterruptible Power Supply (UPS): Combination of convertors, switches, and energy storage devices (such as batteries) constituting a power system for maintaining continuity of load power in case of input power failure.[2]

1) Power conversion mechanism:

a) Static UPS: UPS where solid-state power electronic components provide the output voltage.

b) Rotary UPS: UPS where one or more electrical rotating machines provide the output voltage.

i. Rotary UPS (RUPS) without Diesel: During a mains outage the load is supplied from an energy storage device.

ii. Diesel coupled rotary UPS (DRUPS): A Diesel engine controlled by the UPS can mechanically drive the horizontal generator of the UPS in case of a long mains outage. During short term mains outages or until the diesel engine is started the load is supplied from an energy storage device.

Note: Per stakeholder suggestion, EPA has added a subset of the Rotary UPS definition to describe the two major design variants in the scope of this specification.

2) Power Output:

a) Alternating Current (Ac)-output UPS: UPS that supplies power with a continuous flow of electric charge that periodically reverses direction.

b) Direct Current (Dc)-output UPS/Rectifier: UPS that supplies power with a continuous flow of electric charge that is unidirectional. Includes both individual rectifier units for dc applications and entire dc-output UPS frames or systems, consisting of rectifier modules, controllers, and any other supporting components.

Note: Dc-output UPSs are also known as rectifiers. A rectifier is a product that converts alternating current to direct current to supply a load and an energy storage mechanism. For the purposes of this document, the term “Dc-output UPS/Rectifier” is used because a “rectifier” may also refer to an Ac-output UPS component.

1 International Electrotechnical Commission (IEC). IEC standard 62040-3. “Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements.” Ed. 2.0

2 Input power failure occurs when voltage and frequency are outside rated steady-state and transient tolerance bands or when distortion or interruptions are outside the limits specified for the UPS.

B) Modular UPS: A UPS comprised of two or more single UPS units, sharing one or more common frames and a common energy storage system, whose outputs, in Normal Mode of operation, are connected to a common output bus contained entirely within the frame(s). The total quantity of single UPS units in a modular UPS equals "n + r" where n is the quantity of single UPS units required to support the load; r is the quantity of redundant UPS units. Modular UPSs may be used to provide redundancy, to scale capacity or both.

C) Redundancy: Addition of UPS units in a parallel UPS to enhance the continuity of load power, and classified as follows.

1) N + 0: UPS that cannot tolerate any failures while maintaining Normal Mode operation. No redundancy.

2) N + 1: Parallel UPS that can tolerate the failure of one UPS unit or one group of UPS units while maintaining Normal Mode operation.

3) 2N: Parallel UPS that can tolerate the failure of one half of its UPS units while maintaining Normal Mode operation.

D) UPS Operational Modes:

1) Normal Mode: Stable mode of operation that the UPS attains under the following conditions:

a) Ac input supply is within required tolerances and supplies the UPS.

b) The energy storage system remains charged or is under recharge.

c) The load is within the specified rating of the UPS.

d) The bypass is available and within specified tolerances (if applicable).

2) Stored Energy Mode: Stable mode of operation that the UPS attains under the following conditions:

a) Ac input power is disconnected or is out of required tolerance.

b) All power is derived from the energy storage system or, in the case of a DRUPS, from the integrated Diesel engine or a combination of both.

c) The load is within the specified rating of the UPS.

3) Bypass Mode: Mode of operation that the UPS attains when operating the load supplied via the bypass only.

E) UPS Input Dependency Characteristics:

1) Voltage and Frequency Dependent (VFD): Capable of protecting the load from power outage.[3]

2) Voltage Independent (VI): Capable of protecting the load as required for VFD, above, and in addition from:

a) Under-voltage applied continuously to the input

b) Over-voltage applied continuously to the input[4]

3 The output of the VFD UPS is dependent on changes in ac input voltage and frequency and is not intended to provide additional corrective functions, such as those arising from the use of tapped transformers.

4 An output voltage tolerance band narrower than input voltage window shall be defined by the manufacturer. The output of the VI UPS is dependent on Ac input frequency and the output voltage shall remain within prescribed voltage limits (provided by additional corrective voltage functions, such as those arising from the use of active and/or passive circuits).

3) Voltage and Frequency Independent (VFI): Independent of voltage and frequency variations and capable of protecting the load against adverse effects from such variations without depleting the stored energy source.

4) Single-normal-mode UPS: A UPS that functions within the parameters of only one set of input dependency characteristics. For example, a UPS that functions only as VFI.

5) Multiple-normal-mode UPS: A UPS that functions within the parameters of more than one set of input dependency characteristics. For example, a UPS that can function as either VFI or VFD.

F) Bypass: Power path alternative to the ac converter.

1) Maintenance bypass (path): Alternative power path provided to maintain continuity of load power during maintenance activities.

2) Automatic bypass: Power path (primary or stand-by) alternative to the indirect ac converter.

a) Mechanical Bypass: control is via a switch with mechanically separable contacts

b) Static Bypass (electronic bypass): control is via an electronic power switch, for example transistors, thyristors, triacs or other semiconductor device or devices.

c) Hybrid Bypass: control is via switch with mechanically separable contacts in combination with at least one controlled electronic valve device.

G) Reference Test Load: Load or condition in which the output of the UPS delivers the active power (W) for which the UPS is rated.[5]

Note: EPA previously removed the backfeeding allowance based on a stakeholder comment on Draft 2, which recommended removal based on the lower repeatability of backfeeding versus the use of a dedicated test load. However, EPA understands that backfeeding gives test houses an alternative to purchasing large dedicated test loads that may increase testing burden. EPA believes that avoiding a heavy testing burden at these high loads is warranted and has reverted back to IEC 62040-3 to allow backfeeding during testing as long as it meets the definition of Reference Test Load for UPSs with output power greater than 100 kW. This level has been suggested by stakeholders as a reasonable cutoff, beyond which test loads significantly increase in price.

H) Unit Under Test (UUT): The UPS undergoing the test, configured as though for shipment to the customer, and including any accessories (e.g., filters or transformers) necessary to meet the test setup as specified in Section 4 of the ENERGY STAR Test Method.

I) Power Factor: Ratio of the absolute value of active power *P* to the apparent power *S*

J) 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. For UPSs, acceptable variations within a product family include:

1) Number of installed modules;

2) Redundancy;

3) Input and output filters; and

4) Number of rectifier poles

5) Energy storage system capacity.

5 This definition permits the UPS output greater than 100 kW to be backfed into the input AC supply when in test-mode and subject to local regulations.

Note: The Draft 3 definition of Product Family inadvertently limited the definition to Modular UPSs. The sentence “For UPSs, product families consist of product models that meet the definition of Modular UPS as specified herein” has been removed in favor of the list of acceptable variations within the product family.

K) Abbreviations:

1) A: Ampere
2) ac: Alternating Current
3) dc: Direct Current
4) DRUPS: Diesel coupled rotary UPS
5) RUPS: Rotary UPS
6) THD: Total Harmonic Distortion
7) UPS: Uninterruptible Power Supply
8) UUT: Unit Under Test
9) V: Volt
10) VFD: Voltage and Frequency Dependent
11) VFI: Voltage and Frequency Independent
12) VI: Voltage Independent
13) W: Watt
14) Wh: Watt-hour

2 SCOPE

2.1 Included Products

2.1.1 Products that meet the definition of an Uninterruptible Power Supply (UPS) as specified herein including Static and Rotary UPSs and Ac-output UPSs and Dc-output UPSs/Rectifiers are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.2. Products eligible for qualification under this specification include:

i) Consumer UPSs intended to protect desktop computers and related peripherals, and/or home entertainment devices such as TVs, set top boxes, DVRs, Blu-ray and DVD players;

ii) Commercial UPSs intended to protect small business and branch office information and communication technology equipment such as servers, network switches and routers, and small storage arrays;

i) Data Center UPSs intended to protect large installations of information and communication technology equipment such as enterprise servers, networking equipment, and large storage arrays; and,

ii) Telecommunications Dc-output UPSs/Rectifiers intended to protect telecommunication network systems located within a central office or at a remote wireless/cellular site.

Note: EPA has included further clarification of the scope of included Dc-output UPSs/Rectifier products.

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:

i. Products that are internal to a computer or another end-use load (e.g., battery-supplemented internal power supplies or battery backup for modems, security systems, etc.);

ii. Industrial UPSs specifically designed to protect critical control processes and industrial manufacturing operations;

Note: Based on stakeholder feedback, EPA has removed "rough handling and abusive environments" to eliminate ambiguity from the description of UPSs designed specifically for industrial applications.

iii. Utility UPSs designed for use as part of electrical transmission and distribution systems (e.g. electrical substation or neighborhood-level UPSs);

iv. Cable TV (CATV) UPSs designed to power the cable signal distribution system outside plant equipment and connected directly or indirectly to the cable itself. The “cable” may be coaxial cable (metallic wire) type or fiber-optic or wireless (e.g., “Wi-Fi”); and,

v. UPSs designed to comply with specific UL safety standards for safety-related applications, such as emergency lighting, operations or egress, or medical diagnostic equipment.

3 QUALIFICATION CRITERIA

3.1 Significant Digits and Rounding

3.1.1 All calculations shall be carried out with directly measured (unrounded) values.

3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using directly measured or calculated values without any benefit from rounding.

3.1.3 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

3.2 Energy Efficiency Requirements for Ac-output UPSs

3.2.1 Single-normal-mode UPSs: Average loading-adjusted efficiency (Eff_{AVG}), as calculated per Equation 1, shall be greater than or equal to the Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), as determined per Table 2, for the specified output power and input dependency characteristic, except as specified below.

i. For products with output power greater than 10 kW and communication and measurement capability, as specified in Section 3.6, average loading-adjusted efficiency (Eff_{AVG}), as calculated per Equation 1, shall be greater than or equal to the Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), as determined per Table 3, for the specified input dependency characteristic.

Equation 1: Calculation of Average Efficiency for Ac-output UPSs

$$Eff_{AVG} = t_{25\%} \times Eff|_{25\%} + t_{50\%} \times Eff|_{50\%} + t_{75\%} \times Eff|_{75\%} + t_{100\%} \times Eff|_{100\%}$$

Where:

- *Eff_{AVG} is the average loading-adjusted efficiency,*
- *$t_{n\%}$ is the proportion of time spent at the particular n% of the reference test load, as specified in the loading assumptions in Table 1.*
- *$Eff|_{n\%}$ is the efficiency at the particular n% of the reference test load, as measured according to the test method.*

Table 1: Ac-output UPS Loading Assumptions for Calculating Average Efficiency

Output Power, P, in kilowatts (kW)	Input Dependence	Proportion of Time Spent at Specified Proportion of Reference Test Load, $t_{n\%}$			
		25%	50%	75%	100%
P ≤ 1.5 kW	VFD	0.2	0.2	0.3	0.3
	VI or VFI	0	0.3	0.4	0.3
1.5 kW < P ≤ 10 kW	VFD, VI, or VFI	0	0.3	0.4	0.3
P > 10 kW	VFD, VI, or VFI	0.25	0.50	0.25	0

Note: Several stakeholders commented on the loading profiles proposed in Draft 3 and the recent stakeholder memo. One requested change would provide a more heavily loaded profile for UPSs with output power greater than 200 kW, while another provided a more heavily loaded profile for UPSs with output power less than or equal to 1.5 kW intended for commercial use (VI and VFI).

Due to limited data, EPA has not revised the loading profile for UPSs with output power greater than 200 kW in the Final Draft. EPA continues to welcome feedback and data to help improve loading profiles in a future Version 2.0 of the specification. EPA did include changes to the loading profile for VI and VFI UPSs with output power less than equal to 1.5 kW in Table 1. EPA proposed this change in the stakeholder memo released on February 3, 2012 and did not receive concerns in response..

Table 2: Ac-output UPS Minimum Average Efficiency Requirement

Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), Where: **• P is the Output Power in watts (W), and** **• ln is the natural logarithm.**			
Output Power	**Input Dependency**		
	VFD	**VI**	**VFI**
P ≤ 1500 W	0.967		$0.0099 \times \ln(P) + 0.815$
1500 W < P ≤ 10,000 W	0.970	0.967	
P > 10,000 W	0.970	0.950	$0.0099 \times \ln(P) + 0.805$

In response to stakeholder comments made during the webinar on February 15, EPA has modified the VFI efficiency level, only raising the requirement at output powers less than or equal to 10 kW. EPA believes that there is a natural break point around 10 kW where UPS products transition from single phase to three phase, altering their efficiency levels. When combined with the new loading profile for VFI and VI UPSs < 1.5kW, this change highlights top performing products and enables an adequate range of products currently on the market to be labeled as ENERGY STAR.

EPA has also reduced the required efficiency levels for VFD and VI products less than or equal to 1.5 kW to account for unit-to-unit variation in testing.

Per stakeholder feedback, EPA also analyzed the impacts of the revised requirements on UPSs with 120 V output and concludes that an adequate proportion of UPSs at that low output voltage will be able to qualify with the levels presented in Table 2, above, such that no separate requirement for low-voltage UPSs have been included in the Final Draft.

Also, in response to a stakeholder request to include instructions to round the efficiency results to the first decimal place if expressed as a percentage (per Section J.4.c of IEC 62040-3), EPA has added a digit to the efficiency requirements, requiring rounding to the third decimal place (first decimal place when expressed as a percentage) for reporting purposes, per section 3.1.

Table 3: Ac-output UPS Minimum Average Efficiency Requirement for Products with Metering and Communications Capability

Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), Where: **• P is the Output Power in watts (W), and** **• ln is the natural logarithm.**			
	Input Dependency		
Output Power	**VFD**	**VI**	**VFI**
P > 10,000 W	0.960	0.940	$0.0099 \times \ln(P) + 0.795$

Note: EPA has retained a metering incentive for Ac-output UPS models with output power greater than 10 kW in the Final Draft. Upon further review of the dataset, EPA has reduced the efficiency credit to 1% instead of 2% to ensure meaningful savings.

3.2.2 Multiple-normal-mode UPSs:

i. If the Multiple-normal-mode UPS system does not ship with its highest input dependency mode enabled by default, its average loading-adjusted efficiency (Eff_{AVG}), as calculated per Equation 1, shall be greater than or equal to the Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), as determined per Table 2, for the specified output power and default input dependency mode provided by the Multiple-normal-mode UPS.

ii. If the Multiple-normal-mode UPS system ships with its highest input dependency mode enabled by default, its average loading-adjusted efficiency (Eff_{AVG}), as calculated per Equation 2, shall be greater than or equal to the Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), as determined per Table 2, for the specified output power and lowest input dependency mode provided by the Multiple-normal-mode UPS.

iii. For products with output power greater than 10 kW and communication and measurement capability, as specified in Section 3.6, average loading-adjusted efficiency (Eff_{AVG}), as calculated per Equation 1 or Equation 2, as determined above, shall be greater than or equal to the Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), as determined per Table 3, for the specified input dependency characteristic.

Equation 2: Calculation of Average Efficiency for Multiple-normal-mode Ac-output UPSs

$$Eff_{AVG} = 0.75 \times Eff_1 + 0.25 \times Eff_2$$

Where:

- *Eff_{AVG} is the average loading-adjusted efficiency,*
- *Eff_1 is the average loading-adjusted efficiency in the lowest input dependency mode (i.e., VFI or VI), as calculated per Equation 1.*
- *Eff_2 is the average loading-adjusted efficiency in the highest input dependency mode (i.e., VFD), as calculated per Equation 1.*

Note: EPA received additional stakeholder comments that only those Multiple-normal-mode models that require the benefit of their highest input dependency mode to qualify be required to ship with that mode enabled by default. EPA agrees that Multiple-normal-mode UPSs that meet ENERGY STAR efficiency requirements for Single-normal-mode UPSs when operating in their lowest input dependency mode should not be required to ship in the highest input dependency mode.

3.3 Energy Efficiency Requirements for Dc-output UPSs/Rectifiers

3.3.1 Average loading-adjusted efficiency (Eff_{AVG}), as calculated per Equation 3, shall be greater than or equal to the Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), as determined per Table 4. This requirement shall apply to complete systems and/or individual modules. Manufacturers can qualify either, subject to the following requirements:

i. Complete systems that are also modular shall be qualified as Modular UPS Product Families with a particular model of module installed,

ii. Qualification of individual modules will have no bearing on the qualification of modular systems unless the entire systems are also qualified as specified above.

iii. For products with output power greater than 10 kW and communication and measurement capability, as specified in Section 3.6, average loading-adjusted efficiency (Eff_{AVG}), as calculated per Equation 3, shall be greater than or equal to the Minimum Average Efficiency Requirement (Eff_{AVG_MIN}), as determined per Table 5.

Note: EPA has maintained the eligibility for both Dc-output UPS systems and rectifier modules to separately qualify for ENERGY STAR in the Final Draft. Also, since Dc-output UPS users would likewise benefit from energy metering for PUE measurement, EPA has extended the metering incentive to Dc-output UPSs/Rectifiers in the Final Draft.

Equation 3: Calculation of Average Efficiency for All Dc-output UPSs

$$Eff_{AVG} = \frac{Eff|_{30\%} + Eff|_{40\%} + Eff|_{50\%} + Eff|_{60\%} + Eff|_{70\%} + Eff|_{80\%}}{6}$$

Table 4: Dc-output UPS/Rectifier Minimum Average Efficiency Requirement

Minimum Average Efficiency Requirement (Eff_{AVG_MIN})
0.955

Table 5: Dc-output UPS/Rectifier Minimum Average Efficiency Requirement for Products with Metering and Communications Capability

Output Power	Minimum Average Efficiency Requirement (Eff_{AVG_MIN})
P > 10,000 W	0.945

3.4 Power Factor Requirements

3.4.1 The measured input power factor at 100 percent of the reference test load shall meet the minimum level specified in Table 5 for all VFI and VI normal modes required for qualification.

Table 5: UPS Minimum Input Power Factor Requirement

Minimum Power Factor Requirement
0.90

Note: In response to stakeholder comments on Draft 3, EPA will not apply the power factor requirement to VFD modes, as the load is connected directly to the source and the UPS does not impact power factor. Also, EPA has clarified in both the specification and the test method that the power factor shall be measured at the input of the UPS and at 100 percent of the (resistive) reference test load.

3.5 Standard Information Reporting Requirements

3.5.1 A standardized Power and Performance Data Sheet (PPDS) shall be completed for each ENERGY STAR qualified UPS or Product Family and posted with other product information on the Partner's website.

3.5.2 Templates for the PPDS can be found on the new ENERGY STAR product specification development web page for Uninterruptible Power Supplies at http://www.energystar.gov/index.cfm?c=new_specs.uninterruptible_power_supplies.

Note: The above link will be updated to refer to the Partner Resources page once the specification is finalized.

The PPDS contains the following information:

i. General characteristics (e.g., manufacturer, model name and number);

ii. Electrical characteristics (energy conversion mechanism, topology, input and output voltage and frequency)

iii. Average efficiency used for qualification;

iv. Efficiency at each loading point and power factor test results, in each applicable normal mode, and for both the maximum and minimum configurations for modular UPS product families;

v. Metering and communications ability (data displayed on the meter, data provided via the network, and available protocols);

vi. Battery/stored energy device characteristics;

vii. Physical dimensions; and

viii. Recycling and other environmental information.

Note: Based on stakeholder feedback, EPA has made further edits to the proposed PPDS reporting requirements and the way these data are displayed to end-users. Please note that EPA is still finalizing the PPDS fields and is continuing to develop the widget. Stakeholders will have the opportunity to review and comment on prototype versions of the PPDS within the next weeks when EPA sends a separate mailing focused on the PPDS.

3.5.3 EPA may periodically revise this template, as necessary, and will notify Partners of the revision process. Partners should always use the most recent version of the data sheet posted to the ENERGY STAR website.

3.6 Communication and Measurement Requirements

Note: EPA is retaining the metering incentive for UPSs with output power greater than 10 kW in the Final Draft and extending it to Dc-output UPSs/Rectifiers. However, as stated earlier in the spec, the incentive has been reduced to 1 percentage point to provide ENERGY STAR recognition for the highest-performing models. Since Draft 3, EPA has continued discussing the metering requirements with stakeholders during calls and webinars, and additional changes to the metering requirements are highlighted below.

3.6.1 Ac-output UPSs and Dc-output UPSs/rectifiers with output power greater than 10 kW may qualify for a 1 percentage point efficiency incentive, as reflected in the requirements in Sections 3.2.1, 3.2.2, and 3.3.1, if sold with an energy meter possessing the following characteristics:

i. The meter is either shipped as an independent, external component bundled with the UPS at the point of sale or is integral to the UPS.

ii. The meter measures UPS output energy in kWh in each Normal Mode.

iii. The meter can communicate the measurement results over a network using one of the following protocols: Modbus RTU, Modbus TCP, or SNMP (v1, 2, or 3)

Note: Per stakeholder suggestions, EPA has incorporated communication requirements into the Final Draft, specifying that the meter must use one of the following common protocols: Modbus RTU, Modbus TCP, or SNMP (v1, 2, or 3). At this time, EPA will not require meters to provide a display, though manufacturers are encouraged to provide one if possible.

iv. If the meter is external to the UPS, it meets the requirements in Section 3.6.2.

v. If the meter is integral to the UPS, it meets the requirements in Section 3.6.3.

3.6.2 Requirements for External Meters: External meters bundled with the UPS shall meet one of the following requirements for the UPS to obtain the metering efficiency incentive:

i. Meet Accuracy Class 2 or better (i.e., Class 1, Class 0.5 S, or Class 0.2 S), as specified in IEC 62053-21[6], IEC 62053-22[7], or ANSI C12.2[8];

ii. Exhibit a relative error in energy measurement less than or equal to 2 percent compared to a standard under the conditions specified in Section 3.6.4, with the exception of current, which shall be tested at 25 percent and 100 percent of the meter's maximum current; or

6 International Electrotechnical Commission (IEC). IEC standard 62053-21. "Electricity metering equipment (a.c.) - Particular requirements - Part 21: Static meters for active energy (classes 1 and 2)." Ed. 1.0
7 International Electrotechnical Commission (IEC). IEC standard 62053-22. "Electricity metering equipment (a.c.) - Particular requirements - Part 21: Static meters for active energy (classes 0,2 S and 0,5 S)." Ed. 1.0
8 American National Standards Institute. ANSI standard C12.1. "American National Standard for Electric Meters: Code for Electricity Metering." 2008.

Note: Since the meter is in this case being tested without current transformers, it cannot be tested at the UPS loading points. Rather it shall be tested at environmental and electrical conditions of the efficiency test, except that there shall be two loading points, defined by 25 percent and 100 percent of the meter's maximum current, such that a 10 ampere meter would be tested at the output voltage of the UPS, and at 2.5 amperes and 10 amperes.

iii. Exhibit a relative error in energy measurement less than or equal to 5 percent compared to a standard when part of a complete measurement system (including current transformers that could be integrated with the meter and UPS) under the conditions specified in Section 3.6.4.

Note: EPA has developed the proposed accuracy requirements based on existing standards for metering accuracy (requirements for Class 2 in ANSI C12.2 and IEC 62053-21) and capabilities of existing equipment, as described by stakeholders. Because UPS meters are used in a controlled environment, they do not need to be evaluated against all the criteria (e.g., power factor, harmonics, load imbalance) in the more general IEC 62053 and ANSI C12.1 meter standards. This allows external meters that already comply with IEC and ANSI Class 2 or better to receive the incentive, while enabling the use of meters that have the required accuracy but have not been fully tested to the other requirements of these standards.

Note: In the Final Draft specification, in the case of an external meter, EPA is requiring that only the meter be sold with the UPS unit. EPA agrees with stakeholders that meter accessories (e.g., current transformers) vary with each installation and are often sold separately, and therefore need not be bundled with a meter to receive the metering incentive; nonetheless, EPA is providing manufacturers the option to test the meter in a typical configuration in Paragraph 3.6.2iii, above. To ease installation, EPA proposes that manufacturers may direct end users to available meter accessories for purchase via a URL on the PPDS.

3.6.3 Requirements for Integral Meters: Integral meters shall meet the following requirements under the conditions specified in Section 3.6.4 for the UPS to obtain the metering efficiency incentive:

i. Exhibit a relative error in energy measurement less than or equal to 5 percent compared to a standard when part of a complete measurement system (including current transformers integrated with the meter and UPS).

Note: In the case of integrated/internal meters that are built into a UPS, there is no known standard to reference. EPA therefore proposes an overall 5 percent accuracy requirement for the whole metering system, inclusive of current transformers, etc. Together, the options for external or integral meters provide manufacturers the option to choose between adding to their existing system capabilities with an internal meter or bundling an external meter. EPA has also included fields in the PPDS for reporting metering related capabilities and accuracies.

3.6.4 Environmental and Electrical Conditions for Meter Accuracy: The meter shall meet the requirements specified in Section 3.6.2 or 3.6.3 under the following conditions:

i. Environmental conditions: Consistent with the ENERGY STAR test method and the standards referenced therein.

ii. Electrical conditions: Consistent with each of the loading points in the ENERGY STAR test method and the standards referenced therein

3.6.5 For purposes of third-party certification, communications and measurement requirements necessary to receive the metering efficiency incentive shall not be reviewed when products are initially qualified or during subsequent verification testing. Instead, manufacturers shall maintain documentation on file that products meet these requirements. EPA reserves the right to request this documentation at any time.

Note: EPA has added section 3.6.5 to highlight that meters are not intended to be subject to third party certification and verification.

4 TESTING

4.1 Test Methods

4.1.1 When testing UPSs, the test methods identified in Table 6 shall be used to determine ENERGY STAR qualification.

Table 6: Test Methods for ENERGY STAR Qualification

Product Type	Test Method
All UPSs	ENERGY STAR Test Method for Uninterruptible Power Supplies, Rev. Apr-2011

4.2 Number of Units Required for Testing

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 Modular UPS Product Family, the manufacturer shall select the maximum and minimum configurations to serve as Representative Models—i.e., a modular system shall meet the eligibility criteria in both its maximum and minimum non-redundant configurations. If the maximum and minimum configuration Representative Models meet the ENERGY STAR qualification criteria at their respective output power levels, all intermediate configuration models within a Modular UPS Product Family may be qualified for ENERGY STAR.

Note: Previously, EPA proposed that manufacturers test the minimum and maximum configurations of a Modular UPS as determined by the physical capabilities of the chassis. Stakeholders commented that an entire Product Family could be disqualified because one or more member models of the Product Family do not qualify, so EPA has modified the Modular UPS Representative Model requirements such that manufacturers may determine both the minimum and maximum configurations for testing. Stakeholders indicated support for this proposal.

In cases such as the ones mentioned by stakeholders, where one or more of the Modular UPS Representative Units does not meet the ENERGY STAR requirement or intermediate models within the Product Family do not qualify, manufacturers are still welcome to qualify each of the Modular UPS configurations as individual models, with each one tested and qualified separately. Using Product Families for qualification is intended to decrease qualification burden, but EPA acknowledges that it may not be practicable in all cases.

iii. For qualification of a UPS Product Family where the models are related by a characteristic other than the number of installed modules, the highest energy using configuration within the family shall be considered the Representative Model with the exception of battery part variations—the manufacturer may select any battery for the test, within the requirements of the test method. Other products within a family do not have to be tested for qualification, but they are expected to meet relevant ENERGY STAR levels and may be subject to verification testing some time after initial qualification.

Note: EPA has clarified that manufacturers need not test the product with the largest battery (and therefore the highest energy consumption due to battery maintenance current), due to the burdens of populating a UPS chassis with the maximum allowable number of batteries for the test.

4.2.2 A single unit of each Representative Model shall be selected for testing.

4.2.3 All tested units shall meet ENERGY STAR qualification criteria.

5 EFFECTIVE DATE

5.1.1 Effective Date: The Version 1.0 ENERGY STAR UPS specification shall take effect on **August 1, 2012**. 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 stakeholder 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.