



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

## Eligibility Criteria Draft Version 1.1

1 Following is the Draft Version 1.1 ENERGY STAR Product Specification for Uninterruptible Power  
2 Supplies (UPSs). A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.  
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4 **Note:** The U.S. Department of Energy (DOE) published its UPS test method Final Rule (81 FR 89822) on  
5 December 12, 2016 and codified it in Appendix Y to Subpart B of 10 CFR 430. In Draft 1, Version 1.1,  
6 EPA proposes to harmonize all definitions with the test method final rule, except where necessary to  
7 reflect the broader scope of the ENERGY STAR specification. Harmonized definitions are indicated with  
8 footnote references; a lack of a footnote reference indicates that there was no corresponding definition in  
9 the Final Rule. While most of the changes were editorial, the few substantive changes are further  
10 explained in noteboxes.

### 11 **1 DEFINITIONS**

12 For the purpose of this specification the following definitions apply:

13 A) Uninterruptible Power Supply (UPS)<sup>1</sup>: Combination of convertors, switches, and energy storage  
14 devices (such as batteries) constituting a power system for maintaining continuity of load power in case  
15 of input power failure.<sup>2</sup>

16 **Note:** 10 CFR 430, Subpart B, Appendix Y, Section 2.27 begins this definition with “A battery charger  
17 consisting of a”; however, EPA proposes to retain the broader original definition so that UPSs outside the  
18 scope of Appendix Y will remain in scope of the ENERGY STAR specification.

19 1) Power conversion mechanism:

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

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

22 i. Rotary UPS (RUPS) without Diesel: A rotary UPS that does not contain an integral diesel  
23 engine to supply power to the load during an input power failure.

24 ii. Diesel-coupled rotary UPS (DRUPS): A rotary UPS that contains an integral diesel engine  
25 that may be used to supply power to the load during an input power failure.

26 2) Power Output:

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

<sup>1</sup> 10 CFR 430, Subpart B, Appendix Y, Section 2.27, with modifications.

<sup>2</sup> 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.

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

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

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

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

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

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

49 3) 2N: Parallel UPS that can tolerate the failure of one half of its UPS units while maintaining Normal  
50 Mode operation.

51 D) UPS Operational Modes:

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

- 53 a) Ac input supply is within required tolerances and supplies the UPS.
- 54 b) The energy storage system remains charged or is under recharge.
- 55 c) The load is within the specified rating of the UPS.
- 56 d) The Bypass is available and within specified tolerances (if applicable).

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

- 58 a) Ac input power is disconnected or is out of required tolerance.
- 59 b) All power is derived from the energy storage system or, in the case of a DRUPS, from the  
60 integrated Diesel engine or a combination of both.
- 61 c) The load is within the specified rating of the UPS.

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

64 E) UPS Input Dependency Characteristics:

65 1) Voltage and Frequency Dependent (VFD) UPS<sup>3</sup>: A UPS that produces an AC output where the  
66 output voltage and frequency are dependent on the input voltage and frequency. This UPS  
67 architecture does not provide corrective functions like those in voltage independent and voltage  
68 and frequency independent systems.

<sup>3</sup> 10 CFR 430, Subpart B, Appendix Y, Section 2.27.1

- 69 2) Voltage Independent (VI) UPS<sup>4</sup>: A UPS that produces an AC output within a specific tolerance band  
70 that is independent of under-voltage or over-voltage variations in the input voltage without depleting  
71 the stored energy source. The output frequency of a VI UPS is dependent on the input frequency,  
72 similar to a voltage and frequency dependent system.
- 73 3) Voltage and Frequency Independent (VFI)<sup>5</sup>: A UPS where the device remains in normal mode  
74 producing an AC output voltage and frequency that is independent of input voltage and frequency  
75 variations and protects the load against adverse effects from such variations without depleting the  
76 stored energy source.
- 77 F) Single-normal-mode UPS: A UPS that functions in Normal Mode within the parameters of only one  
78 set of input dependency characteristics. For example, a UPS that functions only as VFI.
- 79 G) Multiple-normal-mode UPS: A UPS that functions in Normal Mode within the parameters of more than  
80 one set of input dependency characteristics. For example, a UPS that can function as either VFI or  
81 VFD.
- 82 H) Bypass: Power path alternative to the ac converter.
- 83 1) Maintenance Bypass (path): Alternative power path provided to maintain continuity of load power  
84 during maintenance activities.
- 85 2) Automatic Bypass: Power path (primary or stand-by) alternative to the indirect ac converter.
- 86 a) Mechanical Bypass: control is via a switch with mechanically separable contacts
- 87 b) Static Bypass (electronic bypass): control is via an electronic power switch, for example  
88 transistors, thyristors, triacs or other semiconductor device or devices.
- 89 c) Hybrid Bypass: control is via switch with mechanically separable contacts in combination  
90 with at least one controlled electronic valve device.
- 91 I) Reference Test Load: Load or condition with a power factor of greater than 0.99 in which the output of  
92 the UPS delivers the active power (W) for which the UPS is rated.<sup>6</sup>

93 **Note:** The DOE UPS test procedure Final Rule specifies a near-unity power factor for the reference test  
94 load. This is more specific than the International Electrotechnical Commission (IEC) standard 62040-3,  
95 Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test  
96 requirements, upon which the Version 1.0 ENERGY STAR definition was based. However, both the IEC  
97 standard and the ENERGY STAR specification subsequently require testing with a resistive (i.e., unity  
98 power factor) reference test load, so the end result is the same. Therefore, EPA has updated the  
99 definition to harmonize with the DOE definition.

- 100 J) Unit Under Test (UUT):
- 101 1) For UPSs capable of operating at 115 V and 60 Hz that use National Electrical Manufacturer  
102 Association (NEMA) 1-15P or 5-15P plug<sup>7</sup>: The combination of the UPS and battery being  
103 tested.<sup>8</sup>
- 104 2) For all other UPSs: The UPS undergoing the test, configured as though for shipment to the  
105 customer, and including any accessories (e.g., filters or transformers) necessary to meet the  
106 test setup as specified in Section 3 of the ENERGY STAR Test Method.

<sup>4</sup> 10 CFR 430, Subpart B, Appendix Y, Section 2.27.3

<sup>5</sup> 10 CFR 430, Subpart B, Appendix Y, Section 2.27.2

<sup>6</sup> 10 CFR 430, Subpart B, Appendix Y, Section 2.24

<sup>7</sup> 10 CFR 430, Subpart B, Appendix Y, Section 1, reworded

<sup>8</sup> 10 CFR 430, Subpart B, Appendix Y, Section 2.28, reworded

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**Note:** The scope of the DOE test procedure Final Rule is limited to “battery chargers [including UPSs] operating at either DC or United States AC line voltage (115V at 60Hz) . . . that utilize the standardized National Electrical Manufacturer Association (NEMA) plug, 1-15P or 5-15P, as specified in ANSI/NEMA WD 6-2016” and that “have an AC output”. 10 CFR 430, Subpart B, Appendix Y, Section 1. EPA proposes that all other UPSs be tested to the ENERGY STAR test method, which does not require a battery connection, and thus the UUT definition would not include the battery.

- K) Power Factor: Ratio of the absolute value of active power  $P$  to the apparent power  $S$ .
- L) 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) Type and quantity of input and output filters;
  - 4) Number of rectifier pulses;
  - 5) Energy storage system capacity and
  - 6) For any diesel coupled rotary UPS, the diesel engine’s make, model, and capabilities may vary. If sold in the US, the engine of the representative model must meet the requirements in Section 3.8 below.
- M) 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

## 141 2 SCOPE

### 142 2.1 Included Products

143 2.1.1 Products that meet the definition of an Uninterruptible Power Supply (UPS) as specified herein  
144 including Static and Rotary UPSs and Ac-output UPSs and Dc-output UPSs/Rectifiers are eligible  
145 for ENERGY STAR qualification, with the exception of products listed in Section 2.2. Products  
146 eligible for qualification under this specification include:

- 147 i. Consumer UPSs intended to protect desktop computers and related peripherals, and/or  
148 home entertainment devices such as TVs, set top boxes, DVRs, Blu-ray and DVD players;
- 149 ii. Commercial UPSs intended to protect small business and branch office information and  
150 communication technology equipment such as servers, network switches and routers, and  
151 small storage arrays;
- 152 iii. Data Center UPSs intended to protect large installations of information and communication  
153 technology equipment such as enterprise servers, networking equipment, and large  
154 storage arrays; and,
- 155 iv. Telecommunications Dc-output UPSs/Rectifiers intended to protect telecommunication  
156 network systems located within a central office or at a remote wireless/cellular site.

### 157 2.2 Excluded Products

158 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for  
159 qualification under this specification. The list of specifications currently in effect can be found at  
160 [www.energystar.gov/products](http://www.energystar.gov/products).

161 2.2.2 The following products are not eligible for qualification under this specification:

- 162 i. Products that are internal to a computer or another end-use load (e.g., battery-  
163 supplemented internal power supplies or battery backup for modems, security systems,  
164 etc.);
- 165 ii. Industrial UPSs specifically designed to protect critical control, manufacturing, or  
166 production processes or operations;
- 167 iii. Utility UPSs designed for use as part of electrical transmission and distribution systems  
168 (e.g. electrical substation or neighborhood-level UPSs);
- 169 iv. Cable TV (CATV) UPSs designed to power the cable signal distribution system outside  
170 plant equipment and connected directly or indirectly to the cable itself. The “cable” may be  
171 coaxial cable (metallic wire), fiber-optic, or wireless (e.g., “Wi-Fi”);
- 172 v. UPSs designed to comply with specific UL safety standards for safety-related applications,  
173 such as emergency lighting, operations or egress, or medical diagnostic equipment; and,
- 174 vi. UPSs designed for mobile, ship board, marine or airborne applications.

## 175 3 QUALIFICATION CRITERIA

### 176 3.1 Significant Digits and Rounding

177 3.1.1 All calculations shall be carried out with actual measured (unrounded) values. Only the final result  
178 of a calculation shall be rounded.

179 3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using exact  
180 values without any benefit from rounding.

181 3.1.3 For UPSs capable of operating at 115 V and 60 Hz that use NEMA 1-15P or 5-15P plug,  
182 calculated efficiency values shall be rounded to one tenth of a percentage point, as specified in  
183 Section 4.3.5 of Appendix Y to Subpart B of 10 CFR 430 .

184 3.1.4 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR  
185 website shall be rounded to the nearest significant digit as expressed in the corresponding  
186 specification limit.

**Note:** EPA has clarified in Section 3.1.1 that if rounding is required (e.g., for reporting), then only the final results shall be rounded. This is consistent with other ENERGY STAR specifications. In addition, EPA has replaced the term “directly” with “actual” to maintain consistency with the language across all of the product categories.

In Section 3.1.2, EPA replaced the phrase “directly measured or calculated” with “exact” to maintain consistency with the other product categories in the program.

EPA has added the rounding requirement from Appendix Y to Section 3.1.3 to ensure consistency with the DOE test procedure. As under Version 1.0, EPA proposes that efficiency results for models not covered by DOE shall not be rounded prior to evaluation against the evaluation limits.

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## 197 **3.2 Energy Efficiency Requirements for Ac-output UPSs Tested to the ENERGY STAR** 198 **Test Method**

199 3.2.1 Single-normal-mode UPSs: Average loading-adjusted efficiency ( $Eff_{AVG}$ ), as calculated per  
200 Equation 1, shall be greater than or equal to the Minimum Average Efficiency Requirement  
201 ( $Eff_{AVG\_MIN}$ ), as determined per Table 2, for the specified rated output power and input  
202 dependency characteristic, except as specified below.

203 i. For products with rated output power greater than 10,000 W and communication and  
204 measurement capability, as specified in Section 3.7, average loading-adjusted efficiency  
205 ( $Eff_{AVG}$ ), as calculated per Equation 1, shall be greater than or equal to the Minimum  
206 Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ ), as determined per Table 3, for the specified  
207 input dependency characteristic.

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

$$209 \text{Eff}_{AVG} = t_{25\%} \times \text{Eff}|_{25\%} + t_{50\%} \times \text{Eff}|_{50\%} + t_{75\%} \times \text{Eff}|_{75\%} + t_{100\%} \times \text{Eff}|_{100\%}$$

210  
211 *Where:*

- 212 ▪  $Eff_{AVG}$  is the average loading-adjusted efficiency,
- 213 ▪  $t_{n\%}$  is the proportion of time spent at the particular  $n\%$   
214 of the Reference Test Load, as specified in the  
215 loading assumptions in Table 1, and
- 216 ▪  $Eff|_{n\%}$  is the efficiency at the particular  $n\%$  of the  
217 Reference Test Load, as measured according to the  
218 ENERGY STAR Test Method.  
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**Table 1: Ac-output UPS Loading Assumptions for Calculating Average Efficiency**

Rated Output Power, P, in watts (W)	Input Dependency Characteristic	Proportion of Time Spent at Specified Proportion of Reference Test Load, t <sub>n%</sub>			
		25%	50%	75%	100%
<b>P ≤ 1500 W</b>	VFD	0.2	0.2	0.3	0.3
	VI or VFI	0	0.3	0.4	0.3
<b>1500 W &lt; P ≤ 10,000 W</b>	VFD, VI, or VFI	0	0.3	0.4	0.3
<b>P &gt; 10,000 W</b>	VFD, VI, or VFI	0.25	0.5	0.25	0

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**Table 2: Ac-output UPS Minimum Average Efficiency Requirement for UPS tested to ENERGY STAR Test Method for Uninterruptible Power Supplies**

Minimum Average Efficiency Requirement (Eff <sub>AVG_MIN</sub> ), Where: • P is the Rated Output Power in watts (W), and • ln is the natural logarithm.			
Rated Output Power	Input Dependency Characteristic		
	VFD	VI	VFI
<b>P ≤ 1500 W</b>	0.967		0.0099 × ln(P) + 0.815
<b>1500 W &lt; P ≤ 10,000 W</b>	0.970	0.967	
<b>P &gt; 10,000 W</b>	0.970	0.950	0.0099 × ln(P) + 0.805

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

Minimum Average Efficiency Requirement (Eff <sub>AVG_MIN</sub> ), Where: • P is the Rated Output Power in watts (W), and • ln is the natural logarithm.			
Rated Output Power	Input Dependency Characteristic		
	VFD	VI	VFI
<b>P &gt; 10,000 W</b>	0.960	0.940	0.0099 × ln(P) + 0.795

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229 3.2.2 Multiple-normal-mode UPSs that Do Not Ship with the Highest Input Dependency Mode Enabled  
230 by Default: If the Multiple-normal-mode UPS does not ship with its highest input dependency  
231 mode enabled by default, its average loading-adjusted efficiency ( $Eff_{AVG}$ ), as calculated per  
232 Equation 1, shall be greater than or equal to:

233 i. The Minimum Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ ), as determined per Table 2, for  
234 the rated output power and lowest input dependency mode provided by the UPS, for  
235 models with output power less than or equal to 10,000 W or no communication and  
236 measurement capability as specified in Section 3.7; or

237 ii. The Minimum Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ ), as determined per Table 3, for  
238 the rated output power and lowest input dependency mode provided by the UPS, for  
239 models with output power greater than 10,000 W and communication and measurement  
240 capability as specified in Section 3.7.

241 3.2.3 Multiple-normal-mode UPSs that Ship with the Highest Input Dependency Mode Enabled by  
242 Default: If the Multiple-normal-mode UPS does ship with its highest input dependency mode  
243 enabled by default, its average loading-adjusted efficiency ( $Eff_{AVG}$ ), as calculated per Equation 2,  
244 shall be greater than or equal to:

245 i. The Minimum Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ ), as determined per Table 2, for  
246 the rated output power and lowest input dependency mode provided by the UPS, for  
247 models with output power less than or equal to 10,000 W or no communication and  
248 measurement capability as specified in Section 3.7; or

249 ii. The Minimum Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ ), as determined per Table 3, for  
250 the rated output power and lowest input dependency mode provided by the UPS, for  
251 models with output power greater than 10,000 W and communication and measurement  
252 capability as specified in Section 3.7.

253  
254 **Equation 2: Calculation of Average Efficiency for Multiple-normal-mode Ac-output UPSs**

$$Eff_{AVG} = 0.75 \times Eff_{f_1} + 0.25 \times Eff_{f_2}$$

257 *Where:*

- 258 ▪  $Eff_{AVG}$  is the average loading-adjusted efficiency,
- 259 ▪  $Eff_{f_1}$  is the average loading-adjusted efficiency in the  
260 lowest input dependency mode (i.e., VFI or VI), as  
261 calculated per Equation 1, and
- 262 ▪  $Eff_{f_2}$  is the average loading-adjusted efficiency in the  
263 highest input dependency mode (i.e., VFD), as  
264 calculated per Equation 1.

266 **3.3 Energy Efficiency Requirements for Ac-output UPSs tested to Appendix Y to**  
267 **Subpart B of 10 CFR 430 Test Method**

268 3.3.1 Average loading-adjusted efficiency ( $Eff_{AVG}$ ), as calculated per Appendix Y to Subpart B of 10  
269 CFR 430, shall be greater than or equal to the Minimum Average Efficiency Requirement  
270 ( $Eff_{AVG\_MIN}$ ), as determined per Table 4, for the specified rated output power and input  
271 dependency characteristic.



272 **Table 4: Ac-output UPS Minimum Average Efficiency Requirement for UPSs tested to 10 CFR 430**  
 273 **Subpart B Appendix Y**

Minimum Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ ), Where:			
<ul style="list-style-type: none"> <li>• P is the Rated Output Power in watts (W), and</li> <li>• ln is the natural logarithm.</li> </ul>			
Rated Output Power	Input Dependency Characteristic		
	VFD	VI	VFI
$P \leq 1500 \text{ W}$	0.964		$0.0099 \times \ln(P) + 0.812$
$1500 \text{ W} < P \leq 1875 \text{ W}$	0.967	0.964	

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275 **Note:** In an effort to integrate the DOE uniform test and establish levels associated with this test method  
 276 that are comparable to the Version 1.0 levels, EPA has translated the relevant Table 3 efficiency  
 277 requirements for UPSs to account for the loss in efficiency associated with an attached battery. These  
 278 levels reflect an estimated 0.3 percentage point efficiency loss cause resulting from the battery  
 279 connection required by the DOE Uniform Test Procedure for Uninterruptible Power Supplies (10 CFR  
 280 430, Appendix Y, Subpart B, Section 4). EPA found that the efficiency of UPSs would decrease by 0.1 to  
 281 0.3 percentage points with the battery connected. This conclusion was based on an analysis of ENERGY  
 282 STAR (no battery) and CEC (battery connected) data. EPA adjusted the requirements by the maximum of  
 283 this range to ensure that no previously certified UPSs would be disqualified after re-testing to the DOE  
 284 test method.

285 **3.4 Energy Efficiency Requirements for Dc-output UPSs/Rectifiers**

286 3.4.1 Average loading-adjusted efficiency ( $Eff_{AVG}$ ), as calculated per Equation 3, shall be greater than  
 287 or equal to the Minimum Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ ), as determined per Table 5.  
 288 This requirement shall apply to complete systems and/or individual modules. Manufacturers can  
 289 qualify either, subject to the following requirements:

- 290 i. Complete systems that are also modular shall be qualified as Modular UPS Product  
 291 Families with a particular model of module installed,
- 292 ii. Qualification of individual modules will have no bearing on the qualification of modular  
 293 systems unless the entire systems are also qualified as specified above.
- 294 iii. For products with rated output power greater than 10,000 W and communication and  
 295 measurement capability, as specified in Section 3.7, average loading-adjusted efficiency  
 296 ( $Eff_{AVG}$ ), as calculated per Equation 3, shall be greater than or equal to the Minimum  
 297 Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ ), as determined per Table 6.

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

299 
$$Eff_{AVG} = \frac{Eff|_{30\%} + Eff|_{40\%} + Eff|_{50\%} + Eff|_{60\%} + Eff|_{70\%} + Eff|_{80\%}}{6}$$

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301 **Table 5: Dc-output UPS/Rectifier Minimum Average Efficiency Requirement**

Minimum Average Efficiency Requirement ( $Eff_{AVG\_MIN}$ )
0.955

302 **Table 6: Dc-output UPS/Rectifier Minimum Average Efficiency Requirement for Products with**  
 303 **Metering and Communications Capability**

Rated Output Power	Minimum Average Efficiency Requirement (Eff <sub>AVG_MIN</sub> )
P > 10,000 W	0.945

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305 **3.5 Power Factor Requirements**

306 3.5.1 The measured input power factor at 100 percent of the Reference Test Load shall meet the  
 307 minimum level specified in Table 7 for all VFI and VI Normal Modes required for qualification.

308 **Table 7: UPS Minimum Input Power Factor Requirement**

Minimum Power Factor Requirement
0.90

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310 **3.6 Standard Information Reporting Requirements**

311 3.6.1 Data for a standardized Power and Performance Data Sheet (PPDS) shall be submitted to EPA  
 312 for each model or Product Family..

313 3.6.2 Further details on the PPDS can be found on the ENERGY STAR UPS product development web  
 314 page at [www.energystar.gov/NewSpecs](http://www.energystar.gov/NewSpecs).

315 **Note:** The above link will be updated to refer to the ENERGY STAR web page for UPS at  
 316 [www.energystar.gov/products](http://www.energystar.gov/products) once the specification is effective.

317 The PPDS contains the following information:

- 318 i. General characteristics (e.g., manufacturer, model name and number);
- 319 ii. Electrical characteristics (power conversion mechanism, topology, input and output voltage  
 320 and frequency)Average efficiency used for qualification;
- 321 iii. Efficiency at each loading point and power factor test results, in each applicable Normal  
 322 Mode, and for both the tested maximum and minimum configurations for Modular UPS  
 323 Product Families;
- 324 iv. Metering and communications ability (data displayed on the meter, data provided via the  
 325 network, and available protocols);
- 326 v. Web link to an available public document containing model specific test procedure  
 327 guidelines if applicable;
- 328 vi. Battery/stored energy device characteristics;
- 329 vii. Physical dimensions; and
- 330 viii. Recycling and other environmental information.

331 3.6.3 EPA may periodically revise this PPDS, as necessary, and will notify Partners of the revision  
 332 process.

333 **3.7 Communication and Measurement Requirements**

334 3.7.1 Ac-output UPSs and Dc-output UPSs/rectifiers with rated output power greater than 10,000 W  
335 may qualify for a 1 percentage point efficiency incentive, as reflected in Table 3 and Table 6, if  
336 sold with an energy meter possessing the following characteristics:

- 337 i. The meter is either shipped as an independent, external component bundled with the UPS  
338 at the point of sale or is integral to the UPS.
- 339 ii. The meter measures UPS output energy in kWh in each Normal Mode.
- 340 iii. The meter can communicate the measurement results over a network using one of the  
341 following protocols: Modbus RTU, Modbus TCP, or SNMP (v1, 2, or 3)
- 342 iv. If the meter is external to the UPS, it meets the requirements in Section 3.7.2.
- 343 v. If the meter is integral to the UPS, it meets the requirements in Section 3.7.3.

344 3.7.2 Requirements for External Meters: External meters bundled with the UPS shall meet one of the  
345 following requirements for the UPS to obtain the metering efficiency incentive:

- 346 i. Meet Accuracy Class 2 or better (i.e., Class 1, Class 0.5 S, or Class 0.2 S), as specified in  
347 IEC 62053-21<sup>9</sup>, IEC 62053-22<sup>10</sup>, or ANSI C12.2<sup>11</sup>;
- 348 ii. Exhibit a relative error in energy measurement less than or equal to 2 percent compared to  
349 a standard under the conditions specified in Section 3.7.4, with the exception of current,  
350 which shall be tested at 25 percent and 100 percent of the meter's maximum current; or
- 351 iii. Exhibit a relative error in energy measurement less than or equal to 5 percent compared to  
352 a standard when part of a complete measurement system (including current transformers  
353 that could be integrated with the meter and UPS) under the conditions specified in  
354 Section 3.7.4.

355 3.7.3 Requirements for Integral Meters: Integral meters shall meet the following requirements under the  
356 conditions specified in Section 3.7.4 for the UPS to obtain the metering efficiency incentive:

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

360 3.7.4 Environmental and Electrical Conditions for Meter Accuracy: The meter shall meet the  
361 requirements specified in Section 3.7.2 or 3.7.3 under the following conditions:

- 362 i. Environmental conditions: Consistent with the ENERGY STAR Test Method and the  
363 standards referenced therein.
- 364 ii. Electrical conditions: Consistent with each of the loading points in the ENERGY STAR Test  
365 Method and the standards referenced therein.

9 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

10 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

11 American National Standards Institute. ANSI standard C12.1. "American National Standard for Electric Meters: Code for Electricity Metering." 2008.

366 3.7.5 For purposes of third-party certification, communications and measurement requirements  
 367 necessary to receive the metering efficiency incentive shall not be reviewed when products are  
 368 initially qualified or during subsequent verification testing. Instead, manufacturers shall maintain  
 369 documentation on file that products meet these requirements. EPA reserves the right to request  
 370 this documentation at any time.

371 **3.8 Diesel Coupled Rotary UPS Emissions Requirements**

372 3.8.1 Diesel coupled rotary UPS systems intended for sale in the US must demonstrate that their diesel  
 373 engines are in compliance with Clean Air Act regulations, 40 CFR part 60 subpart IIII. Compliance  
 374 shall be demonstrated via presentation of a certificate of conformity with this regulation at the time  
 375 of qualification.

- 376 i. Systems intended for sale outside the US are not subject to this requirement.
- 377 ii. Only the representative model(s) for testing, as specified in Section 4.2, shall demonstrate  
 378 compliance with Clean Air Act regulations.

379 **4 TESTING**

380 **4.1 Test Methods**

381 4.1.1 When testing UPSs, the test methods identified in Table 7 shall be used to determine ENERGY  
 382 STAR qualification.

383 **Table 7: Test Methods for ENERGY STAR Qualification**

Product Type	Test Method
UPSs capable of operating at 115 V and 60 Hz that use NEMA 1-15P or 5-15P plug	EITHER Uniform Test Method for Measuring the Energy Consumption of Battery Chargers incorporated in Appendix Y to Subpart B of 10 CFR 430, Section 4: Testing Requirements for Uninterruptible Power Supplies  OR  ENERGY STAR Test Method for Uninterruptible Power Supplies, Rev. May-2012
All other UPSs	ENERGY STAR Test Method for Uninterruptible Power Supplies, Rev. May-2012

384

385 **Note:** For the purposes of ENERGY STAR, all currently certified products may remain on the ENERGY  
 386 STAR Certified Products List until Version 2.0 takes effect without further action. Not yet certified UPSs  
 387 capable of operating at 115 V and 60 Hz that use NEMA 1-15P or 5-15P plug, may wish to certify to  
 388 ENERGY STAR using the DOE UPS Final Rule to avoid retesting should they meet the Version 2.0  
 389 eligibility criteria when it takes effect.

390 **4.2 Number of Units Required for Testing**

391 4.2.1 Representative Models shall be selected for testing by either the sampling requirements defined  
 392 in 10 CFR 429.25, which references 10 CFR 429.11, or the following requirements:

393 **Note:** EPA has added DOE sampling requirements as an option for representative model selection.

- 394 i. For qualification of an individual product model, a product configuration equivalent to that  
395 which is intended to be marketed and labeled as ENERGY STAR is considered the  
396 Representative Model;
- 397 ii. For qualification of a Modular UPS Product Family where models vary by number of  
398 installed modules, the manufacturer shall select the maximum and minimum configurations  
399 to serve as Representative Models—i.e., a modular system shall meet the eligibility criteria  
400 in both its maximum and minimum non-redundant configurations. If the maximum and  
401 minimum configuration Representative Models meet the ENERGY STAR qualification  
402 criteria at their respective output power levels, all intermediate configuration models within  
403 a Modular UPS Product Family may be qualified for ENERGY STAR.
- 404 iii. For qualification of a UPS Product Family where the models are related by a characteristic  
405 other than the number of installed modules, the highest energy using configuration within  
406 the Product Family shall be considered the Representative Model with the exception of  
407 energy storage system variations—the manufacturer may select any energy storage  
408 system for the test, within the requirements of the ENERGY STAR Test Method. Other  
409 products within a Product Family do not have to be tested for qualification, but they are  
410 expected to meet relevant ENERGY STAR qualification criteria and may be subject to  
411 verification testing some time after initial qualification.
- 412 4.2.2 A single unit of each Representative Model shall be selected for testing.
- 413 4.2.3 All tested units shall meet ENERGY STAR qualification criteria.

## 414 **5 EFFECTIVE DATE**

- 415 5.1.1 Effective Date: The Version 1.1 ENERGY STAR UPS specification shall take effect on **August 1,**  
416 **2012**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR  
417 specification in effect on its date of manufacture. The date of manufacture is specific to each unit  
418 and is the date on which a unit is considered to be completely assembled.
- 419 5.1.2 Future Specification Revisions: EPA reserves the right to change this specification should  
420 technological and/or market changes affect its usefulness to consumers, industry, or the  
421 environment. In keeping with current policy, revisions to the specification are arrived at through  
422 stakeholder discussions. In the event of a specification revision, please note that the ENERGY  
423 STAR qualification is not automatically granted for the life of a product model.
- 424