ENERGY STAR Draft 2 Specification for UPSs Comment Summary

Topic	Subtopic	Summary of Comments	EPA and DOE Responses
Ac-output Efficiency Requirements	Efficiency Levels	For UPSs with output power less than 1.5 kW, stakeholders requested that the VFI requirements be a logarithmic curve, the same as for higher-power UPSs because customers differentiate between VFI and VFD. Some stakeholders additionally requested a less stringent requirement for both VI and VFI, to account for testing and manufacturing variation. For UPSs with output power between 1.5 kW and 10 kW, one stakeholder recommended making the VI requirements stricter, as the design of these products is "general purpose" and should be able to meet the same requirement as lower-power units. However, others did not agree and requested that the VFI requirements be loosened. One stakeholder commented that the efficiency levels should be set such that only 25% of the models qualify (not 30%) consistent with the ENERGY STAR program-wide approach unless unit-to-unit variation issues are documented. Alternatively, another stakeholder requested loosening some of the requirements if only one design (even if sold by two manufacturers) qualified. Another stakeholder noted that UPSs currently in the dataset may have been tested with inductive loads and/or without consistent warm-up, potentially increasing their efficiency compared to testing with a resistive load (as specified in the ENERGY STAR test method).	After receiving suggestions from stakeholders to revise the VFI level set in the <1500W range, EPA conducted a market study to determine if UPSs with different dependency characteristics are marketed to different customers. The market survey revealed significant price differences between (for example) VFD and VFI units of the same output power. The significant differences in load protection capabilities between different input dependencies, along with their price differences, has led EPA to revise the VFI requirement in Table 2. The minimum average efficiency shall now be greater than or equal to 0.0099×ln(P)+0.805 for all VFI products regardless of output power (P). EPA has retained the VI and VFD levels for those UPSs with output power ≤ 1500 W. The current levels in Table 2 represent the top 25-30% of models. A preliminary investigation of the cost effectiveness of purchasing an ENERGY STAR labeled unit over a non-ENERGY STAR unit has found annual savings ranging from $5/year for the smallest VFD units to between $5,000 and $14,000/year for the larger VFI units. The levels also ensure that a wide selection of ENERGY STAR qualified UPSs will be available to consumers from a variety of manufacturers. EPA believes that restoring the VFI requirement to a logarithmic line in the ≤ 1500 W range is sufficient to allow different end-uses to be accurately captured without the addition of extra categories or more complex definitions. Lastly, EPA acknowledges the potential for bias in the efficiency reported by manufacturers due to change in the IEC 62040-3 test method (the draft version of the standard did not specify that the test load have a power factor of 1; it did, however, specify that the UPS under test and load be thermally stable). However, it would be difficult to disqualify test results given the limited data for particular combinations of input dependency characteristic and output power; instead, EPA anticipates that the specification based on the 25-30% of the market will allow a significant portion of units to qualify when tested according to the ENERGY STAR test method (based on the final version of IEC 62040-3).
Ac-output Efficiency Requirements	Classification	Small UPSs intended for use in commercial applications, such as data and network closets, may fall within an 800W to 1500W output power range. Stakeholders also emphasized that the market for UPSs under 1500W is well differentiated among input dependency characteristic (VFD, VI, VFI), price, and multi-mode options driven by consumer and commercial needs and interest. Thus, stakeholders suggested that the definitions of ‘Consumer’ and ‘Commercial’ product classes be modified to encompass different power levels and/or consider other characteristics such as connector current ratings and emission limits. Lastly, one stakeholder proposed a 'Mixed Use' product class that encompasses output power from 800 W to 3000 W, a range that contains both consumer and commercial UPSs.	EPA has reviewed suggestions for categorizing UPSs based on connector ratings and radiated emissions but considers these too particular and inconsistent with previous classification efforts (e.g., the EU Code of Conduct) which have relied on commonly reported characteristics such as output power and voltage. To avoid confusion, EPA will remove the terms "Consumer", Commercial" and "Data Center" from the definitions section and tables describing requirements and usage profiles. These terms have always been descriptive, and the minimum average efficiency requirements remain based on output power. Because of this convention, there is no need for a separate "Mixed Use" product class. EPA believes that restoring the VFI requirement to a logarithmic line in the ≤ 1500 W range allows commercial (largely VI or VFI) vs. consumer (VFD) uses to be accurately captured in this range without the addition of extra categories, more complicated definitions, or other complications. With the removal of the category labels ("consumer," etc.), EPA has emphasized that different usage/loading patterns within each output power range are sufficiently captured using only input dependency.

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Ac-output Efficiency Requirements	Loading Profiles	Stakeholders emphasized that a given range of output power is not directly correlated with UPS usage and should therefore be stricken from the loading assumption criteria. Further, stakeholders commented that while the loading assumptions should be based on application class, efficiency requirements be strictly based on output power range and input dependency characteristic. Regarding the individual profiles for 'Consumer' and 'Commercial' UPSs, some stakeholders recommended that the 50% point be more heavily weighted as these products are only ever loaded below <75%, and even then this loading occurs for 8 hours per day, with the rest of the time spent in idle mode. For 'Data Center' UPSs, one stakeholder advised that a more evenly spread loading profile of 20/30/30/20% should be considered given the lack of comprehensive data at this time. To remedy this issue, others expressed further interest in leading an industry survey to inform loading profiles for future specifications. One stakeholder further suggested that EPA develop an online information portal for collection of end user utilization data via manual upload or self-reporting UPSs by developing a standard software plug-in or downloadable application.	EPA received numerous comments from stakeholders concerning changes to the proposed loading profiles in Table 1, some asking that they emphasize lower loading points and others that higher points receive greater weighting. EPA has not changed the loading profiles, as there is not enough data to indicate a shift in either direction. A major goal of future versions of this specification will be to increase the accuracy of these weighting profiles. Based on data submitted by manufacturers, EPA has found that use is correlated with output power and will therefore continue to use output power divisions for the Table 1 loading assumptions. However, EPA acknowledges that not all UPSs with a particular output power will be used in the same way (consumer vs. commercial application). To avoid confusion, EPA will remove the terms "Consumer", Commercial" and "Data Center" from the definitions section and tables describing requirements and usage profiles. EPA believes that a given loading profile represents the typical or average use case for each output power classification. This approach is more straightforward for establishing efficiency levels and conveying product qualification to end users and avoids delineating product efficiency through an explicitly assumed end-use. EPA supports any industry-led efforts to survey UPS utilization to inform future specification revisions and appreciates the suggestion of developing a platform for the collection of efficiency and utilization data. However, until further data are available, EPA will retain the Draft 2 proposed loading profiles.

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Communications Capability & Measurement		Stakeholders support the measurement and reporting of Power Usage Effectiveness (PUE) for data center efficiency metric. However, there is a general consensus among manufacturers that requiring metering within each individual UPS module is not an effective approach in contrast to meters embedded in power distribution and switch gear or standalone meters. This latter approach may provide revenue grade functionality and features with fewer meters across the entire data center, not to mention lower cost and potential increases in accuracy (meters become less accurate at lower load, which could be an issue with individually-metered modules in redundant configurations). In contrast, one stakeholder strongly recommended that UPSs (including individual modules of scalable systems) eligible for ENERGY STAR be required to have revenue-grade metering accuracy, and at a minimum, provide readings of both kW and kWh at the device output emphasizing that the majority of data center operators use UPS meters for reporting purposes. Additionally, the stakeholder suggested that capability to measure device input kW should be strongly considered so that data center operators can accurately calculate losses and efficiency across the UPS during each operational mode. Rather than being burdensome or too costly, this stakeholder noted that resultant reduction in data center energy use (as little as 0.01%) from increased operator awareness should cover the incremental hardware cost of revenue grade meters over the lifetime of the UPS. In response to security concerns voiced during the August 8th webinar, the same stakeholder further noted that metering data can be protected by not publishing the IP address or limiting the communication port address to the operator's network. Accidental interruption of the UPS can also be prevented by modifying system logic or adding a separate metering package that does not have control capability. A second stakeholder commented that the high need to measure and assess energy consumption in data centers warrants an individual metering requirement for Data Center UPSs, while a third noted that enhanced communication capability is useful, but only to the extent it is effectively utilized and supported by other data center components. Since metering and communications capability is tied to a particular behavior to save energy, a fourth stakeholder expressed opposition to any type of credit approach that would reduce the real energy savings labeled units would yield.	EPA's ENERGY STAR Products and Buildings teams have both received numerous comments from stakeholders at webinars and in writing on the subject of UPS metering. The intent of proposed metering language in this specification is to provide end-users with the means to more accurately monitor their data center energy consumption, calculate their PUE, and have the option to participate in the ENERGY STAR Buildings labeling program. The Buildings program provides valuable, transparent, well-established tools that enable data centers to reduce their energy consumption, saving money and reducing harm to the environment. A variety of options have been considered in the development of metering language that applies to UPSs > 10 kW in this specification: 1) Require that all ENERGY STAR UPSs in this output category be sold with an internal or bundled external meter. 2) Require that an alternative model SKU incorporating a meter be made available for every ENERGY STAR qualified UPS model. 3) Provide an efficiency credit incentive to UPSs that are sold with a meter. 4) Require only informational reporting on PUE, data center efficiency, ENERGY STAR Buildings, and the role that metering can play in increasing data center efficiency. EPA proposes to include an efficiency credit incentive. The decision to pursue an efficiency credit and sell a UPS with a meter is left up to the manufacturer. The choice to measure PUE and their overall energy efficiency will be easier for data center operators to make. The ENERGY STAR program will be able to register more data centers in its building efficiency program, fulfilling its goal of overall greater energy savings nationwide. The reasonable level of the efficiency credit maintains ENERGY STAR label integrity.
DC-Output UPSs	Loading Profiles	Stakeholders further commented that the equal weighting of each loading point from 30 to 80%, specified in ATIS-0600015.04.2010, is a realistic reflection of the actual loading profile for telecommunication applications. However, one user indicated that the loading profile may not take into account large variations in loading across different usage periods (night v. day, time of year).	Unless other data is provided, EPA will maintain the equal weightings from 30% to 80% load in the ATIS-0600015.04.2010 test method given that stakeholders indicate that it sufficiently reflects the actual loading profiles of dc-output UPSs in the telecommunications industry. Nonetheless, EPA continues to welcome further information from stakeholders for future specification revisions.
DC-Output UPSs	Output Voltage	For Dc-output UPSs, one stakeholder noted that the efficiency of rectifiers tends to decrease slightly as the output voltage decreases, with 48 V rectifiers achieving about 1 percentage point higher efficiency than similar 24 V rectifiers. Thus, the stakeholder recommended loosening the efficiency requirement to 95% to accommodate 24 V rectifiers. An additional stakeholder requested further clarification on the output power range included in the scope of the specification. Additionally, one stakeholder recommend the addition of a 575 V dc (595 V dc float voltage) test condition.	Due to the lack of comprehensive data for dc-output UPS/rectifiers at lower output voltages (24 V), EPA will not revise the minimum average efficiency requirement of 0.955 in this Version 1.0 of the specification. Nevertheless, EPA considers dc-output UPSs of all output voltages to be within the scope of the specification and continues to seek additional data for the whole spectrum of Dc-output UPS products available on the market.

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Modularity	Ac-output UPSs	While most stakeholders agreed with testing the minimum and maximum configuration for a modular unit, one stakeholder countered that the modular system should meet the ENERGY STAR efficiency requirement in its maximum configuration only, while another requested that the manufacturer be able to specify a subset of the output power range for qualification (the UPS would still be tested at the minimum and maximum configuration within this subset). Furthermore, one stakeholder requested confirmation that the test procedure as it applies to redundant or modular units allow for removal or disabling of redundant components other than converters (i.e. fans, controllers, etc.) provided that tested configuration represent a fully functional UPS.	EPA will continue to require that modular UPSs be tested at both their minimum and maximum output configurations. Furthermore, EPA has clarified that these configurations shall not be manufacturer-specified, but are the minimum and maximum capabilities of the chassis. This ensures that customers who purchase an ENERGY STAR qualified UPS can be assured of its efficient operation even after upgrading it with additional modules. In the most recent test method draft, EPA and DOE have specified that Modular UPSs tested at their minimum and maximum non-redundant configuration shall be tested with redundant components (fans, controllers, etc. for the vacant module slots) functioning according to the unit's as-shipped default behavior.
Modularity	Dc-output UPSs	Stakeholders requested that EPA clarify whether the Dc-output UPS test method applies to the rectifier modules or the entire Dc-output UPS system (multiple rectifiers, controllers, backplane, chassis, etc.).	EPA proposes that dc-output UPS manufacturers have the option to qualify both systems and individual modules. A single module can be tested and qualified without the system and then be sold individually with the ENERGY STAR label, allowing vendors to market highly efficient replacement modules for legacy systems. For dc-output UPS system to receive the ENERGY STAR label, the vendor shall specify exact module models tested in the following configurations: 1. Minimum output power non-redundant configuration as typically shipped to the user (e.g., system with a single rectifier module installed) 2. Maximum output power non-redundant configuration as typically shipped to the user (e.g., system with all the modules installed) The ENERGY STAR qualified system may not be marketed or sold with module models different than those tested.
Multi-Mode UPS	Definition	Another stakeholder specifically suggested that EPA modify the definition of Bypass Mode to include a note that automatic transfer to Stored Energy Mode is not possible and use additional new terms: “Single Normal-Mode UPS” and “Multiple Normal-Mode” UPS.	EPA has revised the terms “Single-Mode UPS” and “Multi-Mode UPS” to “Single Normal-Mode UPS” and “Multiple Normal-Mode UPS” in an effort to more accurately reflect the nuances of testing UPSs with multiple normal modes.
Multi-Mode UPS	Mode Weighting	While a couple of stakeholders agreed with the Draft 2 proposed weighting for calculating the average efficiency of multi-mode UPSs (75% lowest input dependency mode/25% highest input dependency mode), other stakeholders proposed alternative weightings. One stakeholder noted that grid reliability data indicates that UPSs could safely operate in VFD, or highest input dependency mode, for up to 90% of time annually. Stakeholders therefore proposed alternative weightings of 50/50% or 25/75%. Lastly, other manufacturers objected to shipping units with the highest input dependency mode enabled by default because of a lack in grid reliability and consumer demand for operation in lowest input dependency mode may result in manufacturers having to create separate SKUs.	In this initial version of the specification, EPA will retain the Draft 2 proposed weighting for UPSs with multiple normal modes (75% lowest input dependency mode/25% highest input dependency mode) given the lack of data concerning deployed usage.
Multi-Mode UPS	Sub-modes	Stakeholders noted that a UPS may have several modes with the same input dependency characteristic (e.g., two VI modes). For clarity, stakeholders recommended such a unit be tested only in the highest efficiency sub-mode of each tested normal mode (1 test per normal mode, with a maximum of 2 tests). All results should be reported on the PPDS.	EPA has revised Draft 3 to specify that the unit be tested in the highest efficiency sub-mode of each tested normal mode. EPA will require the reporting of the longest transfer time between normal modes in multiple-normal mode UPSs in the PPDS and will provide room for reporting of additional mode-to-mode transfer times.

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Multi-Mode UPS	Transfer Times	A couple of stakeholders distinguished between eco-mode mode and bypass mode. The latter may not have low enough transfer times (< 10 ms) to adequately protect the load; a true "multi-mode" UPSs should have a transfer time less than 4–6 ms, which is the standard for static switches. However, some stakeholders noted that the transfer time may be dependent on the type of fault that causes the transfer.	EPA has added a reporting requirement for the longest transfer time to the revised Power and Performance Datasheet (PPDS).
Power and Performance Data Sheet		Stakeholders' feedback generally indicated that the draft Power and Performance Data Sheet (PPDS) contained too much detail and redundant information for a consumer-facing document and recommended consistency with other ENERGY STAR documents (e.g., CB templates). Additionally, stakeholders noted that IEC 62040 is not widely accessible to end users and as such references to the standard should be clarified, contained in an auxiliary section, or eliminated altogether. Finally, stakeholders noted that EPA should avoid reporting ambiguous data such as battery lifetime. Various verbal and written comments indicated that the following types of information are relevant to the PPDS (though not all stakeholders agreed): • Efficiency at each loading point in each normal mode tested and at minimum and maximum configurations for modular units • Average energy efficiency and the requirements which a product is qualified against • Transition time between normal modes • Reporting of communications and metering capability • Supplemental information regarding the availability of multiple modes and compliance with toxicity and recyclability requirements • Ability to update all information easily	EPA has revised the Power and Performance Data Sheet to include the most salient information for consumers and end users for review. Beyond this static electronic file (PDF, Excel), EPA is exploring ways to add interactivity to aid with presentation of information and selection of an ENERGY STAR product.
Scope and Definitions	Distributed UPS	One stakeholder noted that information regarding the advantages and disadvantages of small distributed UPSs relative to centralized UPSs is readily available to end users through commercial processes, so there is no need for inclusion of distributed UPSs in the ENERGY STAR specification.	EPA will not include distributed UPSs in the Version 1.0 specification.
Scope and Definitions	Excluded Products	One stakeholder called for clearer definitions of included and excluded products, in particular for Industrial UPSs.	EPA has reviewed all the definitions for clarity and removed "rough handling" from the definition of Industrial UPS. EPA welcome stakeholder suggestions for further clarification of excluded product types.
Scope and Definitions	Refurbished UPS	Regarding the proposed inclusion of refurbished UPS in the Draft 2 specification, stakeholders commented that third-party organizations in the battery replacement or service business commonly sell refurbished units. Since these organizations are likely not to be ENERGY STAR partners, it may increase the risk of labeling and certification violations particularly as new versions of the specification take effect raising concern regarding the liability of the original equipment manufacturers. Stakeholders recommended that refurbishment be removed for the specification consistent with other ENERGY STAR IT product specifications. Another stakeholder further expressed that if the product is ENERGY STAR qualified at its date of manufacture it should remain qualified for its entire service life.	EPA has removed "refurbished UPSs" from the scope of the UPS specification. At this time, EPA has not received sufficient interest from stakeholders to warrant inclusion of refurbished or remanufactured models. All UPSs marketed as ENERGY STAR qualified must be third- party certified to the current specification and be listed on the most recent ENERGY STAR Qualified Product List at the time of sale.
Test Method	Reference Test Load	One stakeholder noted that while back-feeding into the power supply should be encouraged during actual operation when able to do so safely and within local regulations, it is does not qualify as a viable load for testing purposes.	Although this note had been drawn from IEC 62040-3, the purpose of the definitions in the ENERGY STAR program requirements is more limited. EPA will therefore remove the footnote to avoid confusion, as the intention of the program is to test with a resistive load. In Section 4.2, DOE has also clarified that back-feeding shall not be used during testing.
Test Method	Sampling	One stakeholder expressed support for the testing of one sample unit as opposed to taking the mean of a statistically relevant sample.	The specification requires that only one sample unit be tested for each Representative Model.

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Test Method	IEC 62040-3 Ed. 2.	One stakeholder commented that there is a need to validate that all definitions, classification, and measurement methods in the specification and references to IEC 62040-3 Ed. 2 are also applicable to Rotary UPS. The stakeholder emphasized it could be misleading to consumers comparing efficiencies between technologies given the lack of a corresponding international standard for Rotary UPS. Overall, stakeholders reaffirmed that the test method should remain identical to IEC 62040-3 Ed. 2, citing the need for harmonization that reduces user confusion and undue test burden due to duplication. Stakeholders noted EPA and DOE's concern regarding verification testing and variability of results due to thermal stability and diagnostic modes, and proposed that vendor involvement in the test will ensure consistency. Lastly, stakeholders commented that the input power requirements should specify frequency, while the output power requirements should not specify the waveform.	EPA reviewed both IEC 62040-3 and IEC 88528-11 (Rotary uninterruptible power systems – Performance requirements and test methods) during the development of the ENERGY STAR test method for UPSs and concluded that the efficiency test method for static UPSs in IEC 62040-3 could be applied to both static and rotary UPSs. Therefore, although the ENERGY STAR test method explicitly references IEC 62040-3, it can be applied to both static and rotary UPSs. DOE understands the concern that deviating from the IEC 62040-3, Ed. 2.0 test method could increase test burden on manufacturers. However, DOE believes some changes are necessary to produce a repeatable, fair ENERGY STAR Test Method. In Draft 3 DOE has removed the stabilization method proposed in Draft 2, and will change the increased sampling rate to a measurement of the accumulated energy. These changes should allow manufacturers to continue manual measurements of the data and not increase test burden. EPA will add requirements that the input frequency be either 50 or 60 Hz. Regarding the output waveform, only the voltage and frequency continue to be specified, though EPA will revise the language to make it clear that the waveshape remains unspecified.
Third-Party Testing and Verification Processes	Challenge Testing	Should a qualified unit be found to fail a test, one stakeholder recommended that EPA establish a formal "Challenge Process" that involves the manufacturer, testing at the specific referenced unit and site, and a "loser pays" principle.	EPA has in place the following "Challenge Process" for all products: 1. CBs determine the credibility of a challenge. In order for a challenge test to be initiated, a CB would have to review credible evidence that the product does not meet the ENERGY STAR spec. 2. If a partner feels that it is being treated unfairly at any time by its CB, it should inform EPA right away. This includes if a partner feels its product has been selected for challenge testing without good reason. EPA will review these cases to ensure CBs are operating according to EPA requirements and their own written procedures. 3. EPA does not have preferences or requirements for how CBs charge clients or otherwise set up contracts, including how they run challenge testing procedures. Many CBs run a "loser pays" scheme for challenge testing. If the CB procedures for challenge testing are a concern for a partner, EPA would encourage the partner to inquire with its CB on how that situation will be handled for each product the CB certifies.
Timeline		Stakeholders commented that Draft 3 specification is warranted since substantive changes from Draft 2 are anticipated.	EPA is releasing a Draft 3 document with the intention of finalizing the specification before the end of the 2011 calendar year.
Toxicity and Recyclability Requirements		Stakeholders commented that requirements based on RoHS may categorically exclude certain products from ENERGY STAR eligibility. Those UPSs that comply with RoHS do so via exemptions and the same UPS model is built in RoHS and non-RoHS variants making tracking exceedingly difficult. Additionally, small UPSs are not subject to RoHS in Europe until 2014. Stakeholders suggested that EPA wait for the release and adoption of the more pertinent IEC 62040-4 standard instead of including potentially conflicting environmental requirements into the V1.0 specification; however, some recommended reporting environmental information on datasheets, including the Power and Performance Datasheet (PPDS).	Given the complexities and variability inherent in RoHS requirements, EPA will exclude toxicity and recyclability requirements from this version of the specification.

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Unit-to-Unit Variation		Manufacturers agreed that charging and periodic test of the energy storage mechanism is the most significant source of variability in UPS input power, though their long-term impact on input power (and therefore efficiency) is negligible. Others noted that checking the status of modules in a modular unit or other internal diagnostics may further impact input power, as could the function of an LCD display or a redundant internal cooling fan; however, these are expected to have minor impact. The effects tend to scale with UPS output power as the stored energy is proportional to the output power to provide a constant discharge time in case of outage. Stakeholders were divided on the best way to disable the mechanisms that cause the variations, with some including instructions in their user guides and/or making them accessible via the front panel controls of the UPS. Others commented that a detailed procedure would be too difficult to define because disconnection or disabling of one mechanism may lead to the activation of another (e.g., an alarm); these stakeholders recommended that an engineer familiar with the operation of the UPS be present to supervise the test.	While DOE agrees that a certain level of manufacturer guidance is necessary, DOE believes that adjusting the UPS's firmware in any manner not explicitly specified in the UPS's user manual should not be allowed. While physically disconnecting the battery is the preferred method for testing, allowing manufacturers to use custom software to disable certain features of the UPS may lead to an inconsistent test environment among manufacturers and potential "gaming" because there is no way to observe exactly what the software is performing. DOE has adjusted their recommendation to not allow the use of custom software to disable features such as battery self-check and trickle charging. At the suggestion of some stakeholders, DOE has also adjusted the efficiency measurement sampling method to a calculation of the average power from a 15 minute accumulated energy measurement. This method should ease manufacturer burden while providing an accurate and repeatable measurement that will average out some, if not all, of the battery charging functions' effects.
UPS Best Practices	Temperature Requirements	One stakeholder suggested that EPA not consider changes to room operating temperature in relation to this V1.0 UPS specification and test method because the impact of higher temperatures on UPS component life and fan power is not clear.	EPA will not require the separability of UPS and batteries in the Version 1.0 specification; however, this characteristic shall be reported on the Power and Performance Datasheet (PPDS) to enable discussions of the tradeoffs between UPS lifetime, fan power, and cooling load between manufacturers and customers.