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Eaton Corporation would like to respond to the Environmental Protection Agency (EPA) proposed Draft 2 ENERGY STAR® for UPS Specification.

New UPS Groupings and Efficiency Levels

Eaton generally agrees with the EPA Draft 2 proposal to assign different Minimum Average Efficiency Requirements for different output classes and output levels. We do, however, disagree with the current proposed structure of Table 2 for a variety of reasons:

Eaton disagrees with the Table 2 classification of applications below 1500W as "Consumer" only. UPS models from 1000VA to 1500VA, which may range in output power from 800W to 1500W, are very much in use in commercial applications; most often in data closets and network closets. They are typically deployed as protection for a single rack of IT equipment (for example: server + small network switch).

Eaton disagrees with the EPA's premise that consumer purchasers "are interested in a particular output rating and battery lifetime and are not likely to have a strong preference for VFI over other input dependency types." Market statistics do not support this statement. In the North American UPS market under 1500VA, there are product offerings in the VFD, VI, and VFI product classes, with significant pricing differences between product types. VI models cost significantly more than VFD models (purchasers are making the distinct choice to purchase the capability of protection from voltage fluctuation) and VFI or multi-mode models cost significantly more than VI models (purchasers are making the distinct choice to purchase the capability for complete sinewave regeneration and protection from harmonics, line noise, and other electrical abnormalities). At any given output capacity there can be as much as 900% price difference between an entry level VFD model and a fully-featured VFI or multi-mode model. Each of these product capabilities (VFD, VI, VFI) are well represented in the market and each have market shares that cannot be discounted.

Given the above, Eaton is proposing modifications to Table 2 as shown below:

<u>Class</u>	<u>Output Power</u>	<u>VFD</u>	<u>VI</u>	<u>VFI</u>
A. Consumer	< 800 W	97%	95%	85%
B. Mixed Use	$800 \leq P \leq 3000$	97%	96%	$0.0099 \times \ln(P) + 0.805$
C. Commercial	$3000 < P \leq 10,000$	97%	96%	$0.0099 \times \ln(P) + 0.805$
D. Data Center	$P > 10,000$	97%	96%	$0.0099 \times \ln(P) + 0.805$

Changes proposed by Eaton include:

- Reducing the “Consumer” class maximum output power rating to 800W.
- Providing efficiency performance separation between the three product types (VFD, VI, VFI) even in the “Consumer” class.
- Adding a fourth “Mixed Use” output power class. In this wattage range, applications vary considerably from the applications outlined in the consumer UPS definition to the applications outlined in the commercial UPS definition. The 3000 watt mark was chosen as a boundary to a) reflect market offerings, and b) reflect a practical electrical boundary in that 3000VA models are considered “plug and play” with a 30 amp input cord on most models...above 3000VA, models switch to hard-wire inputs and/or much less-common 60A plugs.
- Application definitions would commensurately change to reflect the above.

Multi-mode UPS

We support the EPA’s efforts to incorporate multi-mode UPS in the Energy Star for UPS Specification. Given the EPA’s new definition of single mode UPS, a refinement to the multi-mode UPS definition may be prudent at this time. The current definition of multi-mode, “A UPS that is able to function within the parameters of more than one set of input dependency characteristics” remains valid, but deserves additional clarification regarding normal modes of operation. Eaton proposes the definition of multi-mode to read as follows: “A UPS that is able to function within the parameters of more than one set of input dependency characteristics with each input dependency constituting a normal mode; a ups with multiple normal modes.”

The Draft 2 specification places constraints on multi-mode UPS performance.

- Multi-mode UPS systems must ship with their highest-input dependency mode enabled by default.
- The efficiency of both the highest and lowest input dependency shall be reported on the power and performance datasheet (PPDS).

These requirements were inserted to address industry objections to multi-mode that centered on “concerns” about consumer confusion due to a lack of technical information and understanding of multi-mode UPS operation. With the above two requirements in place, Equation 2 should be adjusted to more consistently reflect how the multi-mode product would operate in the field. We are proposing a new version of Equation 2 that interchanges the 25% and 75% weighting factors (see below). This proposal correctly places greater importance on the highest-input dependency mode (highest efficiency

mode) consistent with the requirements to ship highest-input dependency as the default mode.

Equation 2 (New Proposed Version): Calculation of Average Efficiency for Multi-mode Ac-output UPSs

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

Where:

- *Eff_{AVG} is the average loading-adjusted efficiency,*
- *Eff₁ is the average loading-adjusted efficiency in the lowest-input dependency mode (i.e., VFI or VI), as calculated per Equation 1.*
- *Eff₂ is the average loading-adjusted efficiency in the highest-input dependency mode (i.e., VFD), as calculated per Equation 1.*

Eaton greatly appreciates the EPA's continued effort to recognize multi-mode as a relevant and important technology for UPS energy savings. We believe that the above proposal further solidifies these efforts without unnecessarily depreciating the value of multi-mode to end users.

RoHS Compliance

RoHS compliance should not be part of an UPS efficiency specification.

Power and Performance Datasheet (PPDS)

The EPA proposed PPDS contains too much detail. Eaton believes the PPDS to be a key consumer facing element of the Energy Star for UPS program. As such, the PPDS should be as simple and straightforward as possible. It is equally important that the UPS PPDS be consistent with similar datasheets or performance listings used for other Energy Star products. References to the IEC Standard, as contained in the EPA proposed UPS PPDS, are not relevant particularly since most consumers have little to no knowledge of the IEC standards and/or have little to no access to such standards.

Eaton's proposed Energy Star for UPS PPDS can be found attached. The UPS PPDS should communicate basic identifying characteristics of the UPS product (product identification/model number) while remaining focused on efficiency performance: power profile, Energy Star Efficiency rating, etc. The PPDS should provide space for UPS vendors to highlight additional energy saving features offered by a particular UPS model; this reinforces the desire on the part of the program to maximize on the energy savings opportunities available to consumers. Should there be a need for additional details about a UPS model the consumer can be directed to contact the manufacturer or visit the manufacturer's website.

Communications and Measurements Requirements

Eaton has long since recognized that communications does allow the UPS to become a more integral part of the datacenter with the potential benefit of reducing total energy consumed by the datacenter. However, this is true only to the extent that the communicated data is currently utilized and supported by the datacenter components at any given location or site. A requirement that “every” Energy Star qualified UPS communicate output kWh has the potential of burdening smaller UPS products and markets with unjustified additional cost. Even in the case of larger datacenter UPS’s, a kWh reading at every UPS output has the potential of producing duplicate and un-used measurement data points. The Energy Star for UPS Specification should remain focused on UPS product efficiency and should not require the communication of measurement data that can be achieved by other proven and more effective means at the power system or power distribution levels.

We look forward to further discussions on the proposed Energy Star for UPS Specification.

A handwritten signature in black ink, appearing to read "Miguel Chavez", with a horizontal line underneath.

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