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NEMA Power Electronics Section Comments

California Energy Commission
2011 Rulemaking Proceedings – Phase II on Appliance Efficiency Regulations
Proposed Draft Regulations for Battery Chargers

Docket Number: 09-AAER-2

Thank you for the opportunity to provide the following comments on behalf of the Power Electronics Section of the National Electrical Manufacturers Association (NEMA), which represents the largest North American manufacturers of Uninterruptible Power Supply (UPS) units.

As stated in the Commission's notice for the May 19 workshop on the subject item, the Scope of the proposed regulations has been changed: "The scope of the staff analysis…focuses on typical residential, commercial and industrial line voltage chargers."

UPS units are not simple battery chargers. They are designed for maximum reliability and for rapid transfer to battery. In addition, UPS units perform additional functions that cannot be disabled or easily and safely measured (even when AC output is off). Hazardous AC and DC currents are present inside the unit as well as sometimes on battery terminals, so a "black-box" test procedure is necessary. Units perform continuous line monitoring for data and event logging purposes. Serial, USB and network communications are used (for data logging and remote wake). Disconnecting cables does not reduce power draw of these functions, so allowances are needed. Finally, common circuitry is used for battery charger and logic power supply.

Almost none of our members' products will comply with regulations as proposed. That said, forcing a complete redesign of our members' entire product lines is not possible in 2 years. Pursuit of this regulation to include UPS units could lead to very few (if any) UPSs for sale in California.

Redesigned units would be optimized for low power consumption when off - this doesn't guarantee energy savings when on, which is the 99.9% case for most UPSs.

There are three popular topologies of UPSs : standby, line interactive and double conversion. Standby topologies are used for the least expensive consumer UPSs (< 1,500VA).

Lowest performance (the Voltage and Frequency Dependent [VFD] category, as defined in IEC 62040-3) is used to power least-critical equipment (desktop computers, home entertainment equipment). These units have a small battery (low power and only 3-5 minutes of runtime at full load) plus dedicated low capacity (24hr) off-line charger, which means low maintenance-mode power. These products come closest to complying with the regulations and require the least circuit modifications to comply (because they have a dedicated charger already).

Line interactive topologies are used for mid-range commercial UPSs (750VA - 5,000VA).

Mid-range performance units (Voltage Independent [VI] category in IEC 62040-3) are used to power more critical equipment (entry level servers, storage and networking).

These units have larger batteries (higher power and 5-10 minutes of runtime at full load) combined with the use of the inverter running backwards as a high capacity (8hr) battery charger. This results in high maintenance-mode power. Making these products comply would likely require adding a dedicated charger similar to that found in standby UPSs. This is expensive and may not result in any real savings (a dedicated charger might only be used when off or lightly loaded, resulting in no real energy savings for most users).

Not all line interactive UPSs can charge batteries with the output off, further complicating testing (as noted above, there are lots of functions that can't be disabled with output on).

Double conversion topologies are used for high end commercial UPSs (1,000VA- 1,000,000VA)

These are the highest performance units (the Voltage and Frequency Independent [VFI] category in IEC 62040-3) used to power the most critical and sensitive equipment (enterprise servers, storage and networking). They have the largest batteries (highest power and 10-15 minutes of runtime at full load) combined with the use of the main rectifier as a high capacity (8hr) battery charger, resulting in high maintenance-mode power.

Making these products comply would likely require adding a dedicated charger similar to that found in standby UPSs. This is expensive and may not result in any real savings (dedicated charger might only be used when off or lightly loaded resulting in no real energy savings for most users)

As above, not all double conversion UPSs can charge batteries with the output off, further complicating testing (there are lots of functions that can't be disabled with output on).

The U.S. Department of Energy is undertaking a rulemaking on battery chargers that appear to have a different approach and process for scoping.

The DOE proposed rule will have a separate category for UPS units. Units will be tested in maintenance mode only. Requirements are to be set only for the maintenance mode and are to be set by testing lots of UPSs and comparing them to each other (not against other types of battery chargers or other battery chemistries).

We recommend that the Commission adopt the DOE approach by

- making a separate category for UPS units,
- focusing testing on the maintenance mode
- placing requirements only is for maintenance mode power (no requirements in other modes and no power factor requirements in any mode)
- only regulate single phase consumer UPSs (not 2 or 3 phase commercial UPSs)

- have different requirements for each topology (and size) of UPS (recognize the fundamental differences between the topologies and the needs for each)

The Commission could consider standard adders for functions that can't be disabled, for example:

- Network interface
- Serial RS-232 interface
- USB interface
- Multi-LED display
- LCD display
- Communications relays
- Line monitoring

So that the following formulas would apply:

- Standby requirements: A + B*Eb + Adders
    - The values for A and B would vary by size (output capacity)
- Line interactive requirements: A + B*Eb + Adders
    - The values for A and B would vary by size (output capacity)
- Double conversion requirements: C + D *Inverter Output Rating + Adders
    - The values for C and D would vary by size (output capacity)

As noted above, the UPS industry would need longer than 2 years to adjust to such requirements.

- 2 years isn't enough to redesign all of our models
- 5 years are needed for consumer (standby)
- 7 years are needed for mid-range commercial (line interactive)
- 10 years are needed for high-end commercial (double conversion)

The Commission should consider exempting commercial UPSs, which are never off. Industrial UPSs (very low volume, highly specialized) should be exempt as well.

An ENERGY STAR program is being developed by the U.S. Environmental Protection Agency (EPA) for UPSs. The program focuses on on-line efficiency (inclusive of maintenance-mode power).

We recommend that the Commission leverage the work underway at DOE and EPA and refrain from trying to write regulations that could drive certain types of UPS units out of the California market.

Thanks again for the opportunity to provide these comments. We look forward to further dialogue with the Commission and its staff on this battery charger proposal. If you have any questions about them, please contact Craig Updyke of NEMA at 703 841 3294 or cra_updyke@nema.org.