Battery Eliminators; Remote Voltage Sensing and other Operational Features

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For battery chargers we have a few assumptions, the battery charger is there to charge the battery and operate the steady loads when the AC is on. If the charger were to operate the switchgear or transient loads during an electrical outage it then risks becoming the same as a battery. Therefore, if it were a battery why call it a battery eliminator? We could just call the charger the battery too; confusing? Yup!

When using a battery charger for any typical stationary/utility application it is important to note that it is always a “Battery Charger” meant to charge the battery and supervise the behavior and perhaps even the condition of a battery and not eliminate it! This detail is so important that in the current document being produced by the IEEE and NEMA; “WG P2405/NEMA PE5” the terms to be used to classify battery charger filtering levels omits, purposefully the term “battery eliminator”. Instead of this vague term the new document will express filtering levels in terms of Class; 0, 1 and 2 and each class will provide an associated level of filtering with and without a battery connected.

We must all agree that a battery charger is a battery charger and a battery is a battery!

This also means that certain “Battery Dependent Features” do not work well when a battery is not connected to the battery charger. Unfortunately, the term “Battery Eliminator” feeds the myth that these features would still work when the battery is disconnected. That is simply untrue.

Some of the features that require additional consideration when the battery is gone, and the AC is still present *(Side note when the AC is gone and the battery is gone, the charger is no longer available for any service.)* includes the following list; with a brief explanation of the considerations for each feature.

- **Filtering Level to Load**
  - The charger's output filtering without a battery means that the battery's contribution to the filtering LC circuit is diminished by eliminating the capacitance added by the battery. That said, it is possible to see the output ripple to load rise above a desired amount.
- **Remote Voltage Sensing**
  - This feature relies on the battery's terminal voltage in order to re-adjust the charger's output accordingly. If you somehow remove the battery from the charger circuit the "RVS" no longer has a valid reference point to adjust its output.
- **Zero Center Ammeter**
  - Without a battery the output Zero Center Ammeter cannot display a battery discharge current.
- **Battery Open Alarm**
  - If there is no battery you will always get a "Battery Open Alarm".
- **Automatic Equalize due to AC failure**
  - If there is no battery, the charger after an AC power failure will output added current to equalize a battery that is not here.
- **End of Discharge Alarm**
  - EOD alarms are looking for a battery end voltage after discharge. As such if the battery is called upon it will not be there to deliver, and this alarm may indicate an end of discharge even though no discharge had occurred.
- **Battery Discharge Alarm**
  - This alarm would be misled since without a battery the BDA will either not see a discharge event, or it may report the charger current as the battery discharge current. Either way misleading the operator.
- **Temperature Compensation**
  - Without a battery this probe would try to adjust the charger's output current/voltage window to compensate for a battery that is not there.

Why doesn't a battery charger work like a battery?

The battery will begin discharging at the OCV (open circuit voltage) without any external energy source while the charger has the AC input to draw from. When a battery outputs, it outputs current, while the voltage trails off but a charger and or power supply that is not regulated would then output current such that the voltage could exceed normal. The utility battery charger has what is known as a rectangular output making it uniquely qualified to use current to control voltage by means of regulation. Whereas the battery just outputs current while the voltage decays the charger outputs current and looks to the battery for a reference voltage. These are two very different ways of operating.

Further issues exist when trying to operate an inductive device whose true current demands are not always readily available. Those solenoid devices used to operate switchgear or to start motors can demand very large up-front currents that the batteries will deliver but the charger cannot. These currents are not always clearly stated in the switchgear specifications and have been recorded to be as much as 10 times or more of the device's plate rating. The charger is limited to its current limit as the maximum output current available and when current limit is achieved the full voltage may not be available, further detracting from this as a viable possibility.

Remember, in any battery/charger scenario the battery controls the bus voltage and the charger provides the current to maintain that voltage. Sometimes it is unrealistically requested that the charger alone operates switchgear or other transient loads. There is no equation to solve for this repeatedly or consistently because of the many variables involved. The battery charger will operate as a power supply up to its current limit rating within the confines of both the slow start circuit used to protect the load and battery while operating within a step change rate that occurs within 200ms and 500ms. *(See NEMA PE5, Section 5.10)*

Although certain applications may find it practical to use the charger to operate switchgear or other transient loads. And, while it is true that in certain cases these unusual performances may occur, we would not provide that as part of our operating capability because there is no specific standard that determines how this works with consistency or repeatability.

When exploring the issues of Constant Loads vs. Transient Loads, the controls put onto a battery charger are very important features. If a utility type battery charger is not properly regulated it would go into overvoltage and or overcurrent either of which could harm a battery or load. Therefore, if the charger could accommodate the potential wild swings that a battery can perform then the charger could damage the battery.

If a specifier or operator believes that a certain charger will operate their switchgear or other transient loads, then it must remain with the specifier or operator to determine. It is impractical for battery charger manufacturers who have no way of testing, calculating, or determining all the possible variables that may or may not allow switchgear, motors or other transients to operate off of only a battery charger.

In the final analysis, the term "Battery Eliminator" just means that the charger may operate as a regulated power supply without the battery connected with the output ripple not exceeding the NEMA PE5 standards for amplitude. And soon, even the term "Battery Eliminator" will disappear as an acceptable battery charger characteristic description.

We hope this helps clear up some of these questions. However, if you still have more questions please let us know.