Recognize the dangers of 3-step charging

By Ernest Kussmaul

Batteries are a storage medium for energy. When they are charged, energy is stored for use at some future time. A battery charger converts alternating current to direct current and supplies it to the battery. The charger is preferably automatic, controlling the current to the battery to re-charge the battery as rapidly as possible and then stop charging when the battery is fully charged.

In order to quickly charge a battery a method known as 3-step charging has been developed: The first step, *bulk charge*, supplies a constant current until the battery terminal voltage rises to 14.5 to 14.7 volts. At this point the charger output voltage is reduced to the *absorption* voltage of 13.7 to 13.8 volts, and charging continues. As the battery becomes charged it accepts less current. When near full charge at a current from 1 to 3 amperes, the charger output is reduced to 13.25 volts. This is the third step known as the *float* step.

Three-step charging is preferred for rapid recharging in applications such as golf carts, electric vehicles, forklifts or any application that has no parasitic loads. Parasitic loads are those accessories such as radios, medical equipment, air compressors, lighting, computers or any devices in a vehicle which require constant electrical power.

When a battery is being charged these devices are a load on the charger and will interfere with the 3-step charging process. *This is the danger of 3-step charging*. It is often possible that the parasitic loads will prevent the charger from completing the *bulk mode* step or returning to *bulk mode* when accessories are turned on. Thus the charger would continuously supply 14.0 to 14.6 volts to the battery for an extended period of time. This results in overcharging the battery, boiling and out gassing.

A preferred method of charging batteries on emergency vehicles is to use a float charger. This type of charger has a controlled, constant output voltage of 13.25 volts and is current-limited to the rated charger output. The batteries are charged when their state of charge is low. Charging continues until the battery voltage rises to the float voltage level. The parasitic loads receive the same voltage and do not affect battery charging.

Float chargers are recommended for installation in emergency vehicles only.

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