AT10.1/AT30 Series Battery Charger
Application Note

ABOUT THAT "BLOCKING" DIODE

Introduction

In our industry, we may occasionally see a specification for an industrial battery charger that has a requirement for a "***blocking diode***". Sometimes the specification is more vague, with wording like..."***The charger shall not discharge the battery during an ac power failure.***" This is often interpreted as requiring a blocking diode.

Some History

The blocking diode requirement has been around for a long time. After WWII, when electronically-controlled chargers first started to appear, the favored design was the magnetic amplifier. "***MagAmp***", as it is still called, is rugged and reliable. It also has a hidden "feature". It cannot produce zero output current, although modern designs can come close. A common technique to overcome this difficulty was to add "loading" resistors on the output terminals. The resistors were sized to absorb the minimum current output at the desired operating voltage.

When a MagAmp is used as a battery charger, the loading resistor can add extra load to the battery during an emergency (e.g. ac power failure). To maximize the battery backup time, manufacturers inserted blocking diodes between the loading resistor and the output terminals of the charger, a simple and effective solution. Eventually, the diode requirement became a de facto law, even for chargers based on other control technologies.

The Downside

You knew there would be one...right? It is easy to see that a blocking diode consumes both dollars ***and*** Watts. It has to be rated to carry the ***full*** output current of the charger ***forever***. In doing so, it wastes energy. In a 50A charger, a blocking diode can continually consume 60 Watts or more, about 1% of the total power output. In addition to the cost of the diode, there needs to be a heat sink, mounting considerations, and of course...additional space in the charger enclosure.

A common perception is that the blocking diode is necessary to prevent discharging the battery in the event of a charger failure. However, the blocking diode isolates the battery ***only*** from the filter capacitors and the rectifier components (SCRs and diodes). Even the so-called polarity diode is ***UN***-protected by the blocking diode. Actually, protection against charger failure is built into the dc output protection (fuse and/or circuit breaker). Since a capacitor or SCR failure is catastrophic, it produces a short circuit. As we know, the original purpose was to isolate the loading resistor.

The Upside

Silicon-Controlled Rectifier (SCR) type charger don't ***need*** blocking diodes, because they don't need loading resistors. The load on the battery during an ac power failure consists only of the current necessary to operate alarms, and in the **AT10.1** / **AT30** Series, the ***main*** control circuit. This current would be present even if a blocking diode were included.

Yes, the **SCR/SCRF** Series battery charger ***does*** have a blocking diode. This product line was designed "back in the day", when many more specifications called for a blocking diode. The **AT10.1 G2** and **AT30** Series charger do ***not*** have one. We think our customers appreciate the lower price and higher efficiency. Long-term reliability is also higher, since there is one less highly-stressed component.