

## Design Tip for QUIETIR™

### QUIETIR™ Soft Recovery Diodes Help in Designing More Reliable Alternators with Improved EMI Performances

By Ugo Robino

#### Topics covered:

*The Problem*  
*The Solution*  
*Benefits*  
*Conclusions*

#### 1. THE PROBLEM

The expansion of electrical/electronic equipment increases the need for easy availability of electric energy anywhere, any time. That's why more and more alternators are used to work as emergency or stand-alone generators. The common power range is from a few hundred watts to some tens of KW (more precisely, KVA). In the usual arrangement, the current to feed the rotor which then behaves as a magnet is supplied by an auxiliary rotor. This being a set of rotating windings can only supply an AC current, therefore, a rectifying stage is required to supply the main rotor with the proper DC current. (See figures 1 and 2.)

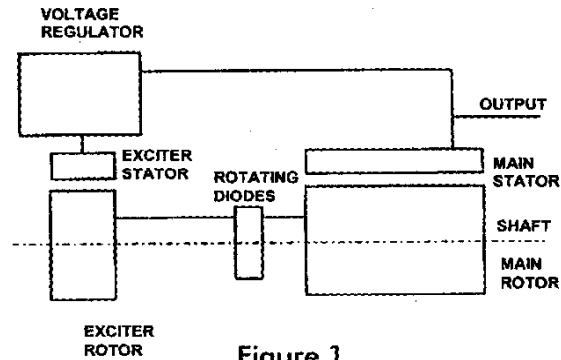


Figure 1

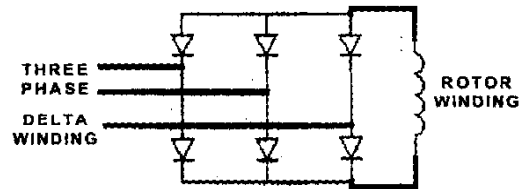


Figure 2

Such a rectifying bridge must:

- Be mechanically and electrically sturdy and reliable to withstand:
  - centrifugal forces and vibrations,
  - the high temperature inside the alternator,
  - the voltage-current transients caused by the inductive circuit (rotor and auxiliary rotor).
- Reduce or eliminate voltage spikes at switch-off (and switch-on) because such EMI pollutes the electricity supplied by the generator, and because they may become so harmful as to destroy the rectifiers themselves.

### 2. THE SOLUTION

IR recently cooperated with one of the largest, most advanced manufacturers of alternators to assess the best characteristics of diodes for use in rotating bridges and, consequently, select the best-fitted devices.

Standard recovery, fast, and ultrafast diodes of most reputed suppliers were also compared. The test is difficult and time-consuming as it requires access and the ability to connect probes to live, rotating parts inside the generators.

Samples of the *QUIETIR* (soft recovery) high-voltage devices had the best compromise of low forward voltage drop and lowest voltage transient at the recovery phase.

### 3. BENEFITS

Voltage spikes in the rotor circuit are reduced by 50% compared to the solution with standard recovery diodes at all levels of power being generated.

This reduction is maintained while the forward voltage drop during the conducting phase remains close to the value of a standard diode (1 to 1.1 V). This is the key advantage of *QUIETIR* Soft Recovery Diodes versus all ultrafast diodes with comparable blocking voltage.

### 4. CONCLUSIONS

The *QUIETIR* soft recovery diodes of the EWF, ETF, EPF series allow alternators to be designed with:

- Improved compliance with the most severe EMI limitations.
- Better safety margins for self-generated voltage spikes.
- More efficient use of silicon, hence, cost advantage versus ultrafast solutions.