



Diode Failure Scenarios Modes of Failure, Causes and Effects

Failure Mode: One shorted diode. (This is the most common mode of diode failure in brushless generator rotating rectifier assemblies.)

Cause: Over voltage or current. Usually due to out of phase paralleling, a lightning strike or other abnormal transient. This mode of diode failure may also occur if a voltage is imposed upon the terminals of a brushless generator while it is at rest.

Effects: Increased excitation. Exciter rotor and/or voltage regulator failure likely. The exciter rotor may fail due to excessive current, which may occur within seconds depending on load level trying to be achieved. The voltage regulator may fail due to high voltage ripple reflected back through the exciter field (stator). If the voltage regulator is equipped with an over excitation trip feature, these failures may occur before the voltage regulator trips out on over excitation. The generator may be able to maintain a light level of loading without noticing the problem.

Failure Mode: One Open Diode.

Cause: After a diode shorts, it will burn open if no other failure occurs first. There may actually be a broken or loose connection external to diode which will have the same effect as an open diode even though the diode itself has not failed open.

Effects: Increased excitation. Will overload other diodes and exciter rotor winding eventually depending on load. Does not typically cause regulator failure. If the voltage regulator is equipped with an over excitation feature, it may be activated depending on load, regulator compatibility, and the over excitation feature set points.

Failure Mode: Multiple Shorted Diodes.

Cause: The same as for a single shorted diode.

Effects: The same as for a single diode failure except that it is unlikely that the generator will be able to maintain open circuit voltage. Almost certain exciter rotor failure if not shut down immediately.

Failure Mode: Multiple Open Diodes.

Cause: The same as for a single opened diode.

Effects: The same as for single open except that it is unlikely that the generator will be able to maintain rated voltage at no load. Depends on combination of opens.

Failure mode: All Diodes Shorted.

Cause: The same as for a single shorted diode.

Effects: The shorting of all of the diodes in the rotating rectifier assembly will in effect bias the main revolving field's DC excitation voltage, and the generator's terminal voltage will collapse.

- a. If the generator is shunt excited, this collapse in generator terminal voltage will result in a loss of input power to the voltage regulator shutting off excitation. This loss of excitation may, or may not occur fast enough to prevent damage to the exciter rotor.
- b. If the generator is equipped with a PMG or other form of excitation support system, the voltage regulator will go to full forcing. If the voltage regulator is equipped with an over excitation feature, it should trip on over excitation, which may, or may not occur fast enough to prevent damage to the exciter rotor.

Notes:

1. For best protection against further damage, a diode monitor is highly recommended. Diode monitors sense the ripple in the exciter stator and shut down the regulator when a diode fails. The diode monitor doesn't protect the diodes themselves.
2. It is extremely difficult to determine how badly the other diodes in the assembly have been stressed when one or more diodes have been stressed to failure. For this reason, it is recommended practice to replace all of the diodes in the assembly when a failure of one or more diodes occurs.

WBD 09/28/2004