Instruction Manual

Installation
Operation
Maintenance

Voltage Regulator System
Automatic/Manual Redundant
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REDUNDANT VOLTAGE REGULATOR SYSTEM

GENERAL DESCRIPTION

The purpose of the redundant voltage regulator system is to continue normal operation of the generator in the event the voltage regulator fails, without operator intervention. This is accomplished by including two voltage regulators and the necessary monitoring and switching equipment in a package usually identified as a "redundant regulator". The operator chooses which regulator is to control the generator; the other is available to take over if the primary one fails. The redundant voltage regulator system monitors the generator and transfers to the back-up regulator in the event of low terminal voltage, excess terminal voltage, high field excitation, or abnormally low field excitation. Provisions are included for indication of which regulator is operating and failure of the primary regulator.

FUNCTION OF SYSTEM

The redundant regulator system operates from a source of alternating current that does not depend upon the generator voltage, usually a permanent-magnet auxiliary generator. Operation of the redundant regulator system is initiated by an external contact that must close at about 90 % of rated generator speed and remain closed until the speed falls to 80 to 90 % again. A time-delay signal prevents the system from transferring to the back-up regulator before the primary regulator has brought the generator up to normal operating voltage. A green indicator light and the closing of a dry (voltage-free) contact indicate which of the regulators is in control. After the generator has reached normal operating voltage, the operator can change the voltage set point of the operating regulator. At the same time, the set point of the back-up regulator will also be changed. The operator can choose to switch to the opposite regulator as the primary without significantly affecting the generator (assuming the second regulator is functional). In the event of failure of the selected regulator, the generator voltage will rise or fall, if the generator is not in parallel with another power source. If it is operating in parallel with another generator or with a larger power system, failure will appear as low or excess excitation. Regardless of which of the four possible failure conditions was detected, it will cause the selected regulator to be disconnected and the back-up regulator to be connected to the power source and the generator. Normal operation will resume. The opposite green indicator light will now be illuminated and the opposite dry contact will be closed to indicate the operating regulator. The red "regulator failure" indicator light will also be illuminated and the dry "failure" contact will be closed. Reset of the system and return to the initial operating mode can be initiated at any time.

SELECTION OF AVR BY SYSTEM OPERATOR

Previous to start up, the system operator can choose which AVR is to be the primary AVR simply by selecting with the Selector Switch (SS). The system operator may switch from AVR1 to AVR2 or vice versa after the unit is running at rated speed and load.
Depress the Transfer Switch (TS), switch the SS, and then release TS to accomplish this. The TS should be held in for approximately 3 to 5 seconds to allow the secondary AVR time to warm up.

AUTOMATIC SELECTION OF AVR

The redundant Regulator System is designed to switch automatically from one AVR to the other AVR if a fault occurs. A fault would be viewed as an overvoltage or undervoltage output from the generator, or also an under or over excitation of the exciter field of the generator.

IMPORTANT COMPONENTS THAT MAKE UP THE SYSTEM

KEY	DESCRIPTION
AVR1 & AVR2	Automatic Voltage Regulator
EL	Excitation Limiter
ART (formerly TR)	Arming Relay Timer (initial start delay)
SCLT (formerly TD)	Short Circuit Time Delay
27/59	Under/Over Voltage Relay
MOP	Motor Operated Potentiometer
TVAR1 & TVAR2	Trim Voltage Adjust Rheostat

A BRIEF EXPLANATION OF THE FUNCTION OF THE COMPONENTS

The Automatic Voltage Regulator (AVR) controls the output voltage of the generator. The AVR is controlled by the Motor Operated Potentiometer (MOP), which sends the AVR a preset signal.

The Trim Voltage Adjust Rheostats (TVAR) are each in series with one of the Potentiometers (dual) in the MOP. The TVAR's are used to balance any resistance difference between the dual potentiometers in the MOP and lead resistance between the MOP and AVR's. The TVAR's may have to be reset at the job site, but once they are set they should not have to be reset again.

The function of the Excitation Limiter (EL) is to monitor the excitation current from the AVR to the generator exciter field. If the field reaches the upper or lower limit, a form "C" contact will trip, causing the AVR's to switch from the primary to the secondary AVR automatically.

This is done because failure to maintain the proper excitation level is viewed as an AVR failure. The upper and lower limits must be set at the job site where the unit is installed.

The function of the 27/59 device or Under/Over Voltage Relay is to monitor the output voltage of the generator. If the voltage exceeds or does not meet a nominal preset voltage limit for over or under voltage, the output contacts of the 27/59 change state, causing the primary AVR to switch to the secondary AVR. Over or under voltage output from the generator is viewed as an AVR failure. This failure could be caused by the loss of sensing voltage (overvoltage) or the loss of power for the AVR (undervoltage).

The function of the Arming Relay Timer (ART) is to make sure that after the speed switch is closed there is a time delay before activating the failure detection circuits. This is to prevent the system from transferring to the back up regulator before the primary regulator has brought the generator up to normal operating voltage.

The Short Circuit Lockout Time Delay Relay (SCLT) is used in conjunction with the Under Voltage Relay and Over Excitation Relay. The time delay is necessary in the case of large loads being put on line, which typically cause the generator voltage to dip and excitation to increase. This should not be viewed as a fault.

VAR/PF CONTROLLER OPTION

A VAR/PF controller measures the real and reactive components of the generator line current by sensing the generator output voltage and current. This controller then provides an output signal that is introduced into the voltage regulator.

Selecting the *VAR control mode* causes the voltage regulator to change it's output until the programmed reactive load current is reached.
Selecting the *PF control mode* results in the voltage regulator changing it's output until the selected power factor is reached.

On regulator panels with this option, there is an additional terminal block for connection to a VAR/PF controller. Refer to the redundant regulator panel schematic and generator connection diagram (888-xxxxx-xx) in your manual for proper hook up information.

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