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Power Drive Systems

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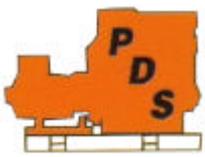
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AUTOMATIC VOLTAGE REGULATOR AVR6e OPERATION, ADJUSTMENT AND TESTING

As supplied by Markon Engineering Company Limited.

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GENERAL DESCRIPTION

The automatic voltage regulator (AVR), is a half-wave, phase-controlled thyristor type AVR circuit. It is designed to maintain the average voltage on its sensing terminals constant for changes in load, power factor, temperatures and speed of the generator. A frequency detector is incorporated to reduce the generator voltage with speed below a certain pre-settable threshold, to avoid damage to frequency sensitive loads and to the generator itself.

TECHNICAL SPECIFICATIONS

Voltage Regulation	±2½% (average)
Power Circuit	Half-wave, phase controlled thyristor with flywheel diode
Power Supply Voltage Range (L1/L2)	173-250 volts a.c. maximum
Frequency Range	45Hz-65Hz
Current Rating	5 amps maximum
Temperature Range	-30°C to +40°C
Build-Up Voltage	12 volts a.c.
Voltage Sensing	Average
Weight	220 grams
Dimensions	180 x 140 x 30mm (Highest component)

VOLTAGE ADJUSTMENT

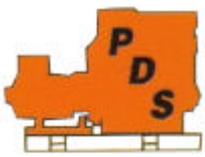
The generator output voltage is set at the factory, but can be altered by careful adjustment of the SET VOLTS potentiometer mounted on the printed circuit board, or external trimmer if fitted. Clockwise rotation increase the voltage.

WARNING

**DO NOT INCREASE THE VOLTAGE ABOVE THE RATED GENERATOR VOLTAGE.
IF IN DOUBT, REFER TO THE RATING PLATE MOUNTED ON THE GENERATOR CASE.**

If a replacement AVR has been fitted or re-setting of the SET VOLTS potentiometer is required, proceed as follow:

1. Before running machine, turn SET VOLTS potentiometer fully anti-clockwise.
2. Turn remote volts trimmer (if fitted) to midway position. If the trimmer is not fitted, terminals R & RR should be linked together.
3. Turn SET STABILITY potentiometer to midway position.
4. Turn SET UNDERSPEED potentiometer fully clockwise.
5. Connect a suitable voltmeter (0-300V a.c.) across line to neutral of the alternator.
6. Start generator set, and run at a no-load condition at nominal frequency e.g. 50-53Hz or 60-63Hz.
7. Carefully turn SET VOLTS potentiometer clockwise until rated voltage is reached.
8. If instability is present at rated voltage, slowly adjust SET STABILITY potentiometer until the voltage is steady, then re-adjust voltage if necessary.
9. Voltage adjustment is now complete. Set underspeed adjustment as described below before stopping machine.



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UNDERSPEED ADJUSTMENT

The AVR incorporates an underspeed protection circuit that reduces the output voltage with frequency when the generator speed falls below a pre-settable threshold. The red light emitting diode (LED), gives indication that the underspeed circuit is operating. The SET UNDERSPEED potentiometer determines the threshold or 'cut in' frequency and is correctly adjusted before leaving the factory.

If a replacement AVR is fitted or re-setting of the underspeed circuit is required, proceed as follows:

1. Adjust SET VOLTS potentiometer as described on Page 2.
2. With machine running at exact rated frequency, e.g. 50Hz or 60Hz, slowly turn SET UNDERSPEED potentiometer anti-clockwise until the red LED is lit. A small drop in voltage will be observed.
3. Now turn potentiometer slowly clockwise until red LED is just not lit.
4. Underspeed setting is now complete.
5. When the machine is run down, the red LED should be lit, indicating that the underspeed protection circuit is operating.

WARNING

UNTIL THE UNDERSPEED POTENTIOMETER IS SET CORRECTLY, UNDERSPEED RUNNING CAN CAUSE SERIOUS DAMAGE TO THE GENERATOR AND AVR. IF IDLING OF THE ENGINE IS REQUIRED DURING COMMISSIONING, REMOVE THE AVR FUSE WHEN THE GENERATOR IS STATIONARY.

STABILITY ADJUSTMENT

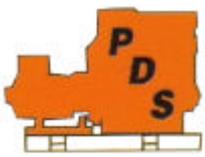
The AVR incorporates a stability circuit to prevent voltage hunting and is correctly set at the factory.

If a replacement AVR has been fitted or re-setting of the SET STABILITY potentiometer is required, all that is normally required is to set the voltage as described on Page 2 and adjust the SET STABILITY potentiometer until the output voltage is steady on and off load. If optimum performance is required, set stability as described above, then proceed as follows:

1. Before starting machine, connect two 100 watt, 220-240 volt lamps (household type), in series across AVR terminals L1 & L2. This provides a fast indication of machine voltage and is better than a voltmeter for this purpose. Connecting two lamps in series is a safety measure should the machine go too high during setting up.
2. Start machine and run at nominal frequency; 50-53Hz or 60-63Hz.
3. Apply load (at least 25%) and remove it again. Observe the response of the lamps. Adjust SET STABILITY potentiometer to give fastest recovery to this load change.
4. Stability setting is now complete.

WARNING

THE TYPE OF LOAD USED FOR THIS TEST MUST NOT BE TOO VOLTAGE SENSITIVE AS LARGE VOLTAGE EXCURSIONS CAN TAKE PLACE UNTIL THE STABILITY CONTROL IS CORRECTLY ADJUSTED.



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BENCH TESTING

Bench testing provides a useful way of checking an AVR for correct functioning without the need to run a generator.

If an AVR is suspected to be faulty, the first step should always be a close examination of the printed circuit board (PCB) for physically damaged components, broken leads, corroded or dry joints, dirt contamination and heavy handed use of the potentiometers. These faults are the cause of nearly all the failures of AVR units returned for repair.

The power devices can be checked with a multimeter on 'OHMS x 1' range as follows, not forgetting to zero the instrument first:

1. Check fuse.
2. Disconnect all external wiring and lay AVR flat on a clean bench with component side up.
3. To check main thyristor and V1 transient suppressor, connect meter +ve to terminal TA and meter -ve to terminal X. There should be no reading or high resistance. Now reverse meter connections and check again; there should be no reading or high resistance.
4. To check flywheel diode and V2 transient suppressor, connect meter +ve to terminal X and meter -ve to terminal XX. The reading should be less than 25 ohms. Now reverse meter connections and check again. There should be no reading or high resistance.

After checking the power devices as described above, the AVR unit may be bench tested as follows. Testing a known 'good' AVR first is desirable, in order to become familiar with the procedure.

PROCEDURE

1. With mains supply isolated, connect AVR unit as shown in Diagram A.
2. Turn SET VOLTS potentiometer fully anti-clockwise, SET STABILITY potentiometer to midway position and SET UNDERSPEED potentiometer fully clockwise.
3. Ensure variable transformer is set at 'minimum volts' position.
4. Switch on mains supply and check neon lamp is lit.
5. Slowly increase voltage to 50 volts but if current exceeds 0.5A, switch off and re-check power devices and look for shorted PCB tracks.
6. If current reading is below 0.5A at 50 volts, the 100 watt lamp should glow dimly if the unit is operating satisfactorily and LED1 should not be lit.
7. Continue to increase the voltage up to 180 volts by which time the 100watt lamp should not be lit.
8. Turn SET VOLTS potentiometer slowly clockwise until the 100 watt lamp is lit.
9. Rotate SET UNDERSPEED Potentiometer slowly anti-clockwise until LED1 is lit. Continue turning until the 100 watt lamp is not lit. This indicates correct functioning of the underspeed circuit.
10. Turn SET UNDERSPEED potentiometer slowly clockwise again until LED1 is just not lit and the 100watt lamp should now be lit. If not, rotate SET VOLTS potentiometer clockwise a fraction and repeat steps 9. and 10.
11. If the AVR responded correctly to all the tests in the procedure, the unit is considered faulty and can be sent in for repair.

