See AP 113D-0420-16

Chapter 13

TRANSFORMER-RECTIFIER UNIT, FERRANTI, TYPE TR150A

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LEADING PARTICULARS

Transformer rectifier unit, Type TR150A	*Ref. No.*
Output current full load	150*A continuous*
Output current maximum	225*A for* 1 *min.*
Output voltage nominal	28*V d.c.*
Output regulation	4·5–5·0*V*
Input voltage nominal	200*V r.m.s.*, 3-*phase*, 400 *c/s*
Efficiency	85% *at full load*
Overall dimensions, maximum	20·3 × 6·5 × 7·9 *in.*
Weight, maximum	32·5 *lb*

Introduction

1. The transformer rectifier unit Type TR150A is used in conjunction with an English Electric, Type AE2060, Mk. 2, 200V, 3-phase, 300kVA, a.c. generator, to provide a well regulated d.c. output of 28V at 150A.

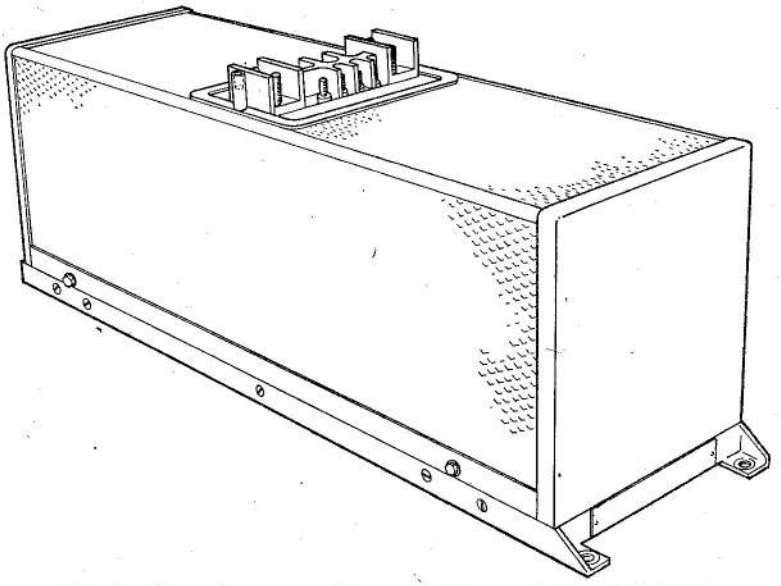

Fig. 1. Transformer rectifier unit, Ferranti, Type TR150A

DESCRIPTION

General

2. The transformer rectifier unit consists of a transformer assembly and a rectifier assembly which are mounted on two light alloy angle section runners, held rigid by cross members and welded end units. Locating dowels are fitted at one end and two fixing holes are provided at the other. A perforated metal cover, permitting full ventilation, is secured by four 4 B.A. screws, two on each side, and two terminal cover securing pillars, on the top adjacent to the terminal block.

3. Provision is made to incorporate a hermetically sealed thermostat into the unit, when it is necessary to have a warning should the temperature of the diodes rise above the permissible maximum. An ammeter shunt is connected in the negative output line, so that the output current may be monitored. Suppressor capacitors for both the input and the output are incorporated into the unit.

Transformer assembly

4. The transformer assembly is centrally mounted to the two cross members and secured by four 2 B.A. csk. hd. screws. Connections to the primary windings are made via terminals L1, L2, L3 of the main terminal block, which is mounted on top of the transformer, and connections to the secondary windings are made via terminals 1–12 of the terminal boards attached to each side of the assembly.

5. Three, 0·25μF, suppressor capacitors, one for each input phase, are fitted to the base of the assembly, and one 2μF suppressor capacitor is fitted on top of the assembly and connected between the main positive output terminal and the frame.

6. The complete transformer comprises two 3-limbed step down transformers, the primary windings of which are connected in series. One primary is open star and the other closed delta. Both transformers have nine secondary windings each, three per phase, connected in triple star to form a six-phase group. The two groups are connected in parallel by joining their neutral points directly to the main positive output terminal, thus forming a twelve-phase output. The output is symmetrical and stable for all loads.

Rectifier assembly

7. The rectifier assembly is in two parts, each part consisting of six hermetically-sealed silicon junction diodes (Type ZR32S), mounted on two plates of high purity aluminium to which thin castellated sheets of similar purity aluminium are connected, to increase the effective cooling area. The two mounting plates are electrically connected at the top by means of a bolt and distance tube.

8. The two sub-assemblies are situated one on each side of the transformer and secured to the main frame by four moulded glass fibre blocks, to insulate the diodes from the frame. Connection between the two

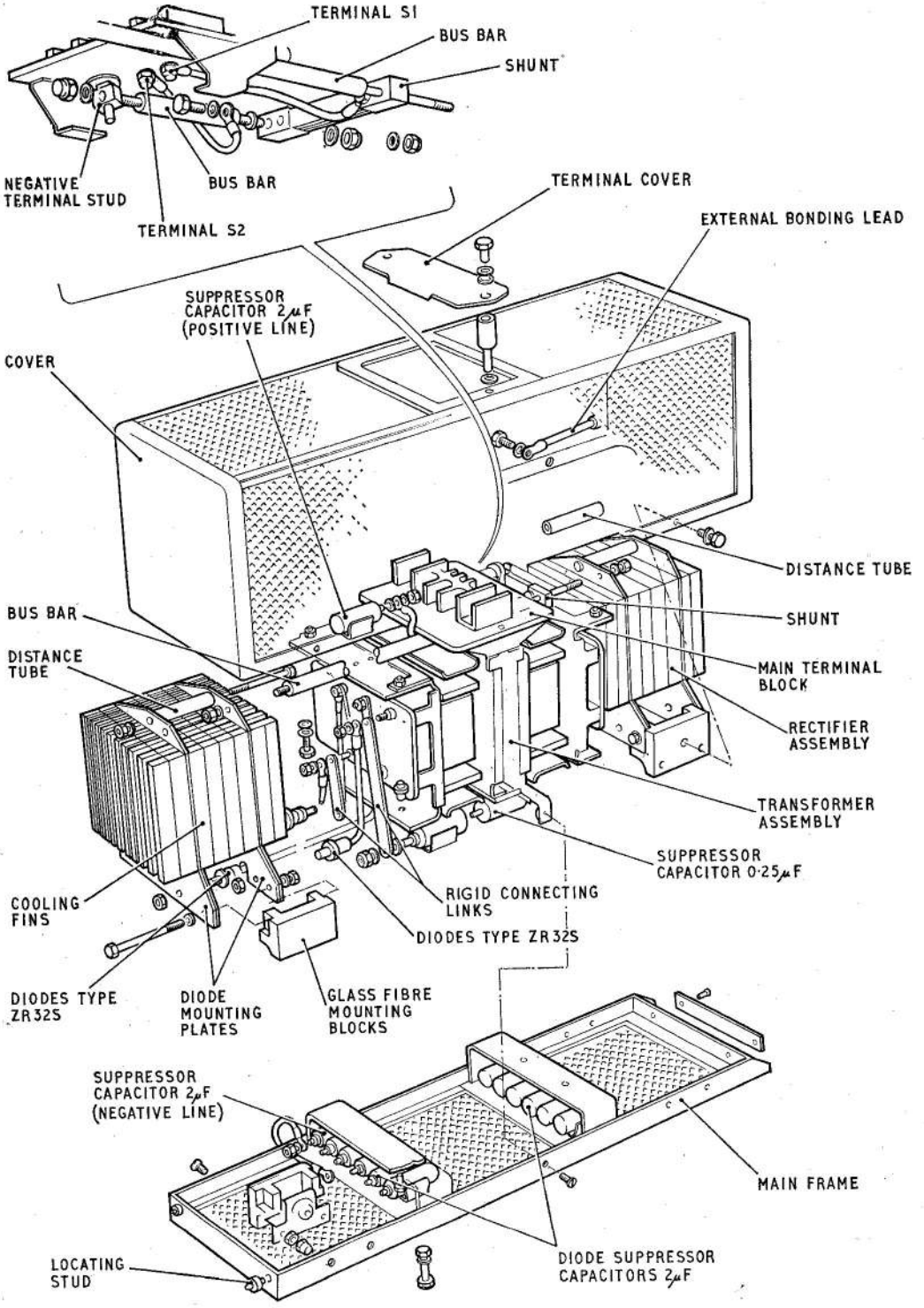

Fig. 2. Exploded view of transformer rectifier unit

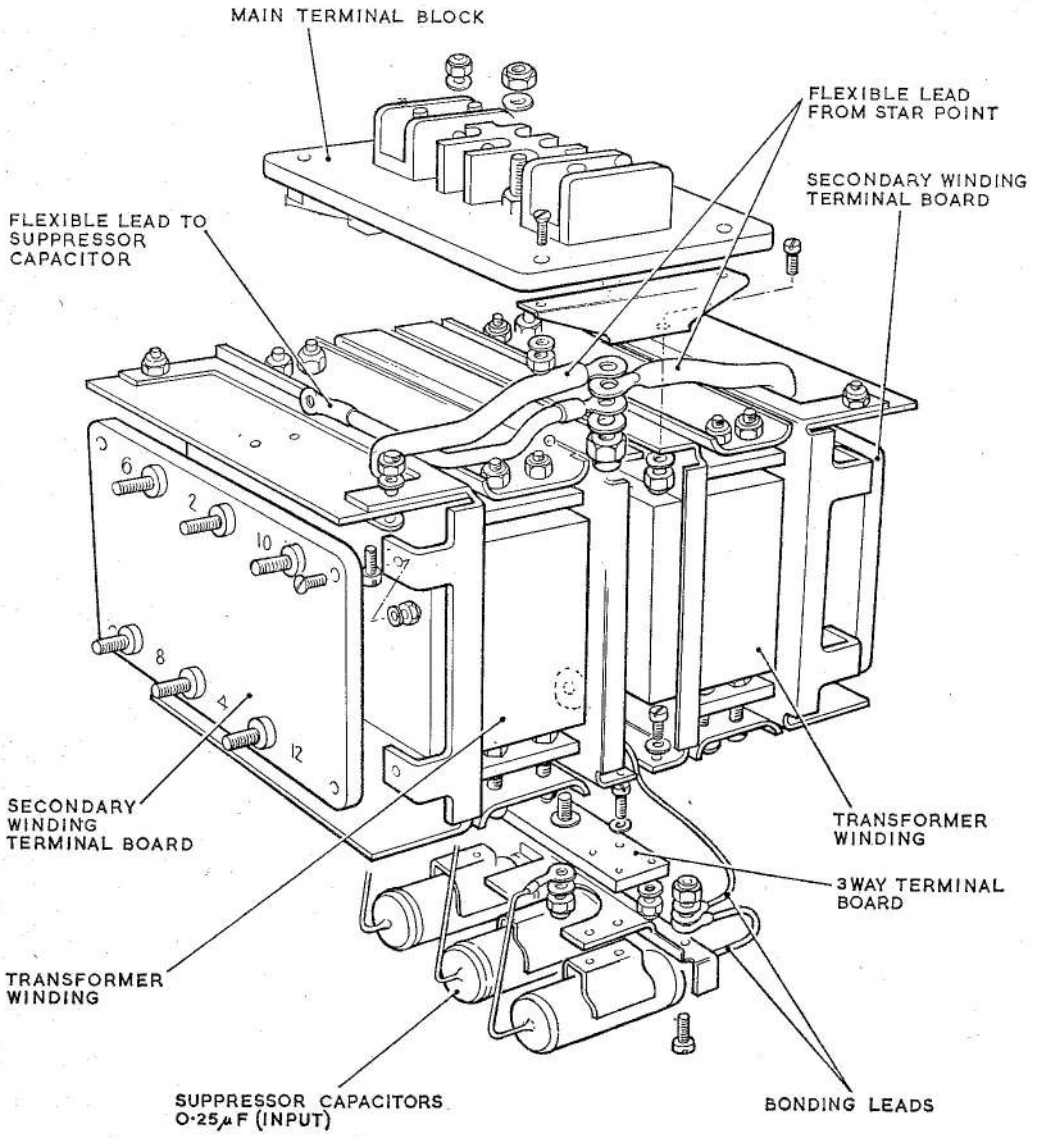

Fig. 3. Transformer assembly

assemblies is made via a busbar, attached to the top of one diode mounting plate of each sub-assembly. The busbar also serves as one connecting point for the ammeter shunt.

9. Counterbored holes at the bottom of both diode fin assemblies provide for fitting of thermostats, if required, connections from the thermostats being made to the terminals T1 and T2 of the main terminal block.

10. Each diode is connected to one phase of the 12-phase output of the transformer giving half-wave rectification to each output phase and therefore providing d.c. with a low ripple factor at the main positive and negative terminals.

Suppressor capacitors

11. Thirteen 2μF suppressor capacitors one for each diode and one for the negative output line are mounted under the cross members of the main frame. The connection to the negative line is made via a flexible lead to the rectifier assembly securing bolt at the fibre glass mounting block. Connections to

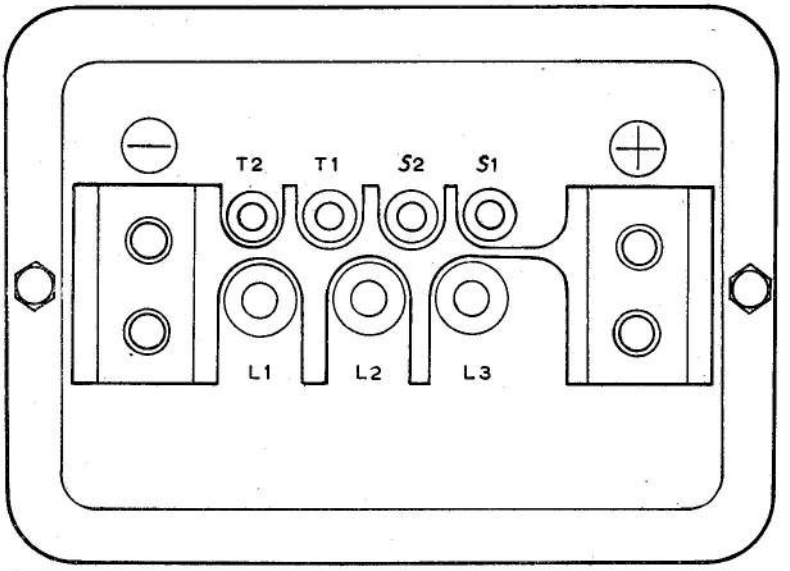

Fig. 4. View of main terminal block

the diode anodes are made via rigid links to the transformer output terminal boards.

Ammeter shunt

12. The ammeter shunt is situated on top of the transformer assembly and adjacent to the main terminal block. Connection from the main negative terminal is made via a second busbar to the shunt. Two flexible leads are connected between the shunt and terminals S1 and S2 of the main terminal block, for the monitoring ammeter. The shunt is capable of dropping 50mV at 200A.

INSTALLATION

13. The transformer rectifier unit should be mounted so that it is self-cooled and does not rely on the use of the aircraft structure as a heat sink.

SERVICING

14. Examine the unit for cleanliness and signs of visible damage, deterioration, and corrosion. Check the security of all connections, securing screws and nuts and examine the insulation of the connecting leads for signs of fraying or deterioration.

Dismantling

15. To dismantle the unit the sequence of operations should be as follows:—

(1) Remove the two 6 B.A. bolts securing the terminal cover and remove the cover.

(2) Remove the two terminal cover pillars and the four 4 B.A. bolts, two on each side of the ventilated cover, and remove the ventilated cover.

(3) Remove the four 4 B.A. bolts securing the two parts of the rectifier assembly to the fibre glass mounting blocks, and remove the two 2 B.A. nuts securing the busbar between the two parts of the rectifier assembly.

(4) Disengage the rectifier assembly from the busbar and lift away from the fibre glass mounting blocks. The rectifier assembly may now be moved away from the transformer assembly for access to the secondary winding terminal boards. Care must be taken during this operation not to strain the flexible connecting leads between the transformer and rectifier assemblies.

(5) Disconnect the rectifier assembly from the transformer assembly by

removing the twelve 2 B.A. nuts at the secondary winding terminal boards. The two parts of the rectifier assembly may now be completely removed for access to the diodes.

(6) Disconnect the rigid connecting links between the twelve suppressor capacitors at the base of the unit and the transformer secondary winding terminal boards, by removing the twelve 2 B.A. nuts at the capacitors. Remove the links, noting their relative positions.

(7) Remove the four 2 B.A. csk. hd. screws and nuts securing the transformer assembly to the base plate cross members, and remove the two 4 B.A. csk. hd. screws securing the transformer assembly to the frame of the base plate. The transformer assembly complete with the shunt may now be removed, giving access to all the suppressor capacitors and terminal boards.

Assembling

16. Assembly is in the reverse order of the dismantling procedure. All lock washers and split pins that have been disturbed should be renewed when the unit is re-assembled.

Testing

17. Details of tests which may be applied to verify the serviceability of the unit will be found in Appendix A to this Chapter.

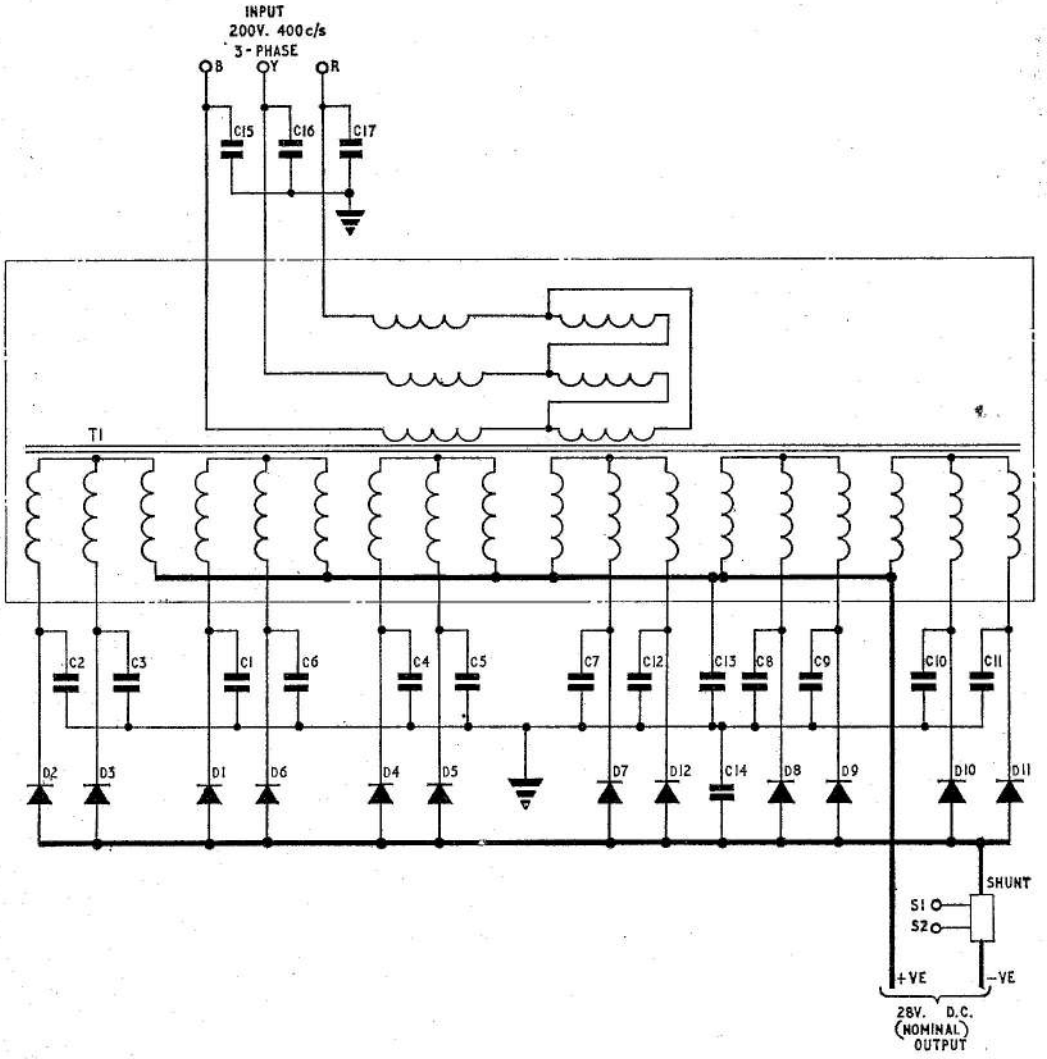

Fig. 5. Circuit diagram

Appendix A

STANDARD SERVICEABILITY TEST
for
TRANSFORMER-RECTIFIER UNIT, FERRANTI, TYPE TR150A

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Introduction

1. The tests detailed in this Appendix should be applied to the unit whenever its serviceability is suspect or before it is put into Service.

TEST EQUIPMENT

2. The equipment listed in Table 1 is required for testing the unit.

TABLE 1
List of test equipment

Item	Ref. No.		Qty.
1		Generator test bench (Mk. 5 series)	1
		or Generator test bench, ROTAX N.T.S.8919	
2		A.C. supply, 200V, 400 c/s (comprising a suitably regulated a.c. generator of at least 10kVA output)	1
3		Moving iron voltmeter 0–250V a.c. (M1)	1
4		Moving coil voltmeter 0–36V d.c. (M2)	1
5		Moving coil voltmeter 0–40mV (M3)	1
6		Moving coil ammeter 0–150A d.c. (M4)	1
7		Moving iron ammeter 0–30A a.c. (M5)	1
8		Variable resistive load	
9		Frequency meter 500 c/s at 200V a.c.	1
10	0557/A.P.48A	Multimeter	1
11	0557/A.P.12924	Insulation resistance tester 500V	1
12	0624/105/16605	Oscilloscope CT316	1

TEST PROCEDURE

3. The test equipment should be connected as shown in fig. 1, the supply switched on and the system allowed to stabilize electrically.

No load test

4. With the input voltage (M1) set at 200V ± 1 per cent and the frequency at 400 c/s ± 2½ per cent and no load connected to the output terminals, the input line current should not exceed 4A (M5). The no load output voltage should be between 29·5V and 32·5V d.c. (M2).

Regulation test

5. Connect the variable load with the input line voltage at 200V and the frequency at 400 ± 10 c/s, adjust the load.

(1) For a current of 20A (M4), the output voltage should be between 27·5V and 28·5V d.c.

(2) For a current of 150A (M4), the output voltage should be between 26·0V and 27·3V d.c.

This reading should be taken within 5 min. of full load being applied.

Output ripple test

6. Connect the oscilloscope across the positive and negative terminals and measure the ripple voltage of the d.c. output.

(1) With a load current of 2A, this should be 3V to 4V, peak to peak.

(2) With full load current, this should be 2V to 3V, peak to peak. In both tests, the ripple voltage should not exceed 7V, peak to peak.

Note . . .

Ripple voltages above the maximum value will indicate a defective output diode.

Shunt calibration

7. Connect the millivoltmeter (M3) between terminals S1 and S2. With a load current of 150A flowing, the reading should be between 36mV and 39mV.

Insulation test

Note . . .

The transformer rectifier unit contains diodes in the d.c. output side, which will break down if subjected to high voltages. Therefore, insulation resistance testers 250V or 500V must not be used to measure the insulation resistance of the d.c. output.

8. Using a 500V insulation resistance tester, measure the insulation resistance between terminals L1, L2, L3, in turn and the frame. The reading should not be less than 5 megohms.

9. Using the multimeter set at the 20 megohm range, measure the insulation resistance between the positive and negative terminals and the frame. The reading should not be less than 5 megohms.

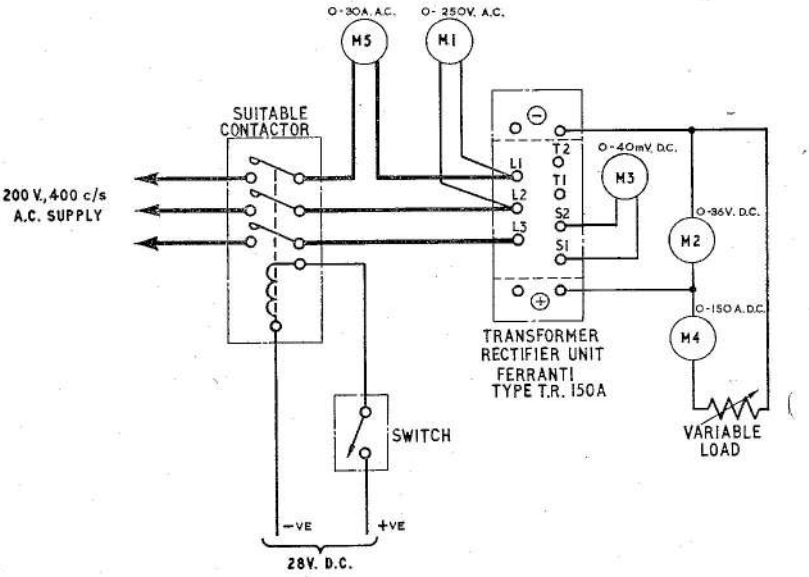

Fig. 1. Test circuit diagram

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