Chapter 14

VOLTAGE REGULATOR, TYPE 125
(E.E. TYPE AE7306)

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LEADING PARTICULARS

Voltage regulator, Type 125	**Ref. No. 5UC/7392**
Voltage control	... 200*V r.m.s.*, 3 *phase, to within* ±2%
Frequency	400 *c/s* ± 1%
Output range	... 0·1 *to* 7*A*
Normal output	1·5*A*
Reactive load sharing	*to within* 2·5 *kVAR of mean load*
Rating	*Continuous*
Cooling	... *Natural*
Altitude range	0 *to* 60,000 *ft.*
Temperature range	–65°*C to* 70°*C*
Weight	7 *lb*
Dimensions (*including A.V. mounts*)—	
Length	$11\frac{7}{16}$ *in.*
Width	$8\frac{9}{16}$ *in.*
Height	$5\frac{1}{2}$ *in.*

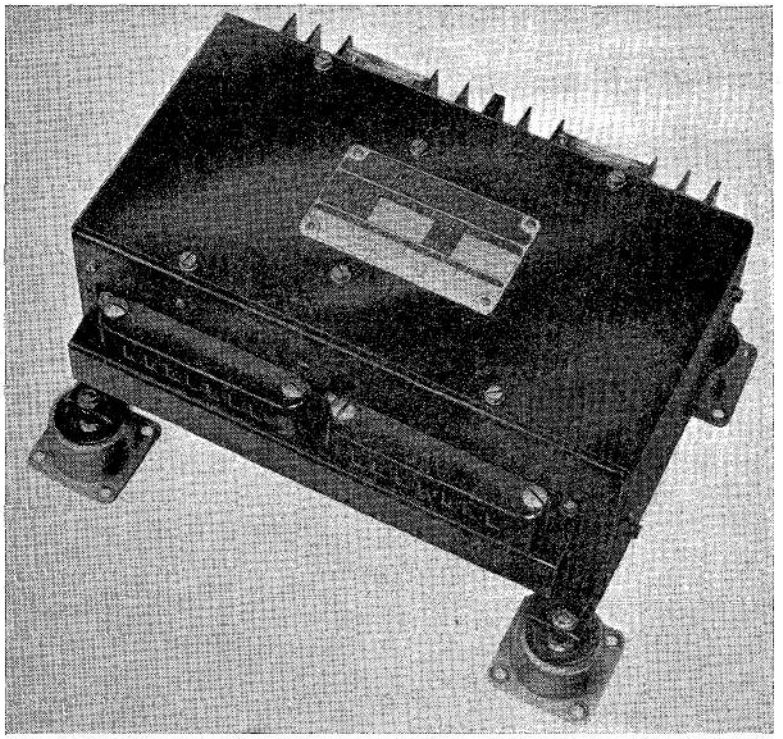

Fig. 1. Voltage regulator, Type 125

Introduction

1. The regulator controls the output of a 40 kVA a.c. generator to within the limits quoted in Leading Particulars, in a single or multi channel aircraft electrical system.

DESCRIPTION

General

2. The unit consists of an aluminium alloy base assembly which is in the shape of a rectangular box having its two shortest sides and top open. All the electrical components are housed inside the base and completely enclosed by a cover which fits over the top and around the shortest sides. The base is usually fitted with four flexible anti-vibration feet.

3. There are five main assemblies all fixed to the base: main transformer assembly, reference and first stage amplifier assembly, pulse generator and phase controller assembly demodulator assembly, and transductor assembly.

Main transformer assembly

4. This is mounted at one end of the base floor. It is a single phase 4/1 step down transformer (T1 see wiring diagram fig. 3) whose primary is connected across phases A and B of the generator output. The secondary winding is divided into three: SEC 1, SEC 2 and SEC 3.

Reference and first stage amplifier assembly

5. This is a printed circuit panel mounted on four pillars secured to the base floor. The panel consists of a 3-phase, star/delta connected step down transformer, T3, T4 and T5, which is connected to a 3-phase bridge rectifier circuit comprising six silicon diodes D1–D6. The d.c. output is connected to a network consisting of resistors R5–R10, R13 and R19, Zener diodes ZD1 and ZD2, transistor Q1 and capacitor C3, via smoothing capacitor C6 and inductor L1.

6. These items are mounted on one side of a panel made of epoxy bonded glass board and connections are made by printed circuit on the reverse side.

Pulse generator and phase controller assembly

7. This is also a printed circuit panel mounted above the reference and first stage amplifier panel to the same four pillars. The panel consists of a single phase rectifier bridge D7–D10, resistor R18 and smoothing capacitor C5; a pulse generating circuit comprising transistors Q2 and Q3, resistor R11 and R12 and diodes D13 and D14; a pulse limiting circuit comprising Zener diodes ZD5 and ZD6, silicon diodes D15 and D16 and resistors R14–R17; two silicon diodes D17 and D18 and Zener diode ZD7.

Demodulator assembly

8. This printed circuit panel is mounted on one of the base sides and consists of a single phase step down transformer T2 whose secondary is centre tapped; the output is connected to a network comprising two silicon diodes D11 and D12, three resistors R2–R4, two capacitors C1 and C2, and two Zener diodes ZD8 and ZD9.

Transductor assembly

9. This is mounted on a partition fixed between the sides of the base. It is a completely enclosed unit consisting of a core and four windings—two reference windings and two control windings. One control winding is connected to the reference and first stage amplifier circuit, whilst the other is connected to the demodulator panel circuit; the reference windings are connected to the pulse generator and phase control panel circuit.

Other components

10. A capacitor assembly, consisting of two capacitors connected in parallel (C4) is secured to one of the base sides at the main transformer end.

11. On the opposite side to the capacitor assembly are fixed three silicon diodes D19–D21 and two silicon controlled rectifiers SCR1 and SCR2; all are inter-connected to form a rectifier bridge. These items, together with two Zener diodes ZD3 and ZD4, are mounted on the inner face of the base side in two groups, and protrude through two slots in the base side. To dissipate heat generated by the diodes and SCR's, two heat sinks are secured to the outer face of the box side. To protect the ends of the diodes and rectifiers the two groups are each fitted with an acrylic sheet cover.

12. A relay (S1) having four sets of normally closed contacts, and resistor (R1) are fixed to the partition next to the transductor

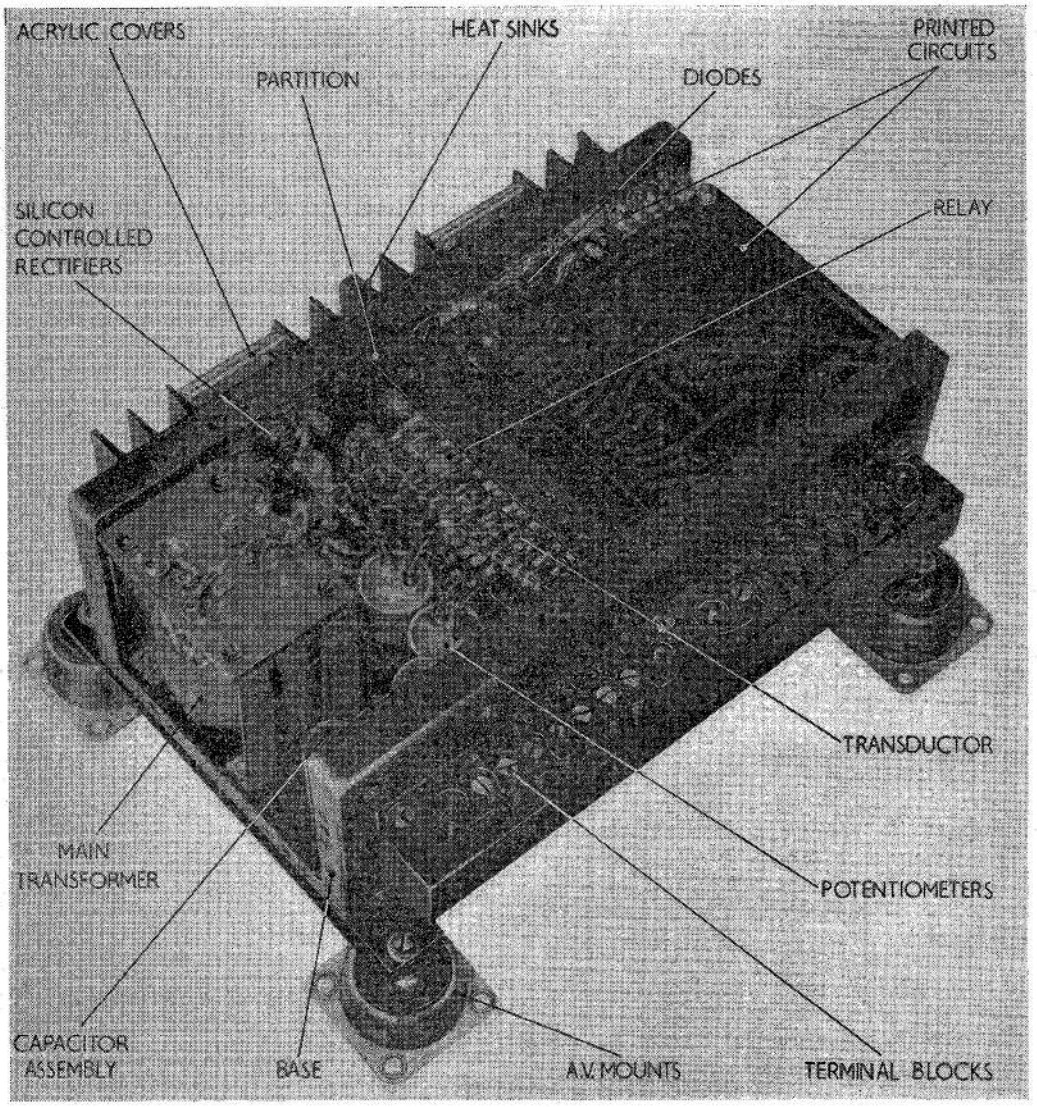

Fig. 2. View with cover removed

assembly. On the other side of the partition and fixed to the base floor are potentiometers P1, P2 and P3; these are preset at the factory and locked.

13. Fitted externally to the same side as the capacitor assembly is a sheet aluminium channel to which are mounted two terminal blocks. All leads from the electrical equipment of the regulator are brought out through the base side into the channel and connected to the terminal blocks.

OPERATION

14. The regulator comprises six principal circuits (these should not be confused with the five main assemblies described in paras. 5–9): phase controlled rectifier bridge, pulse generator, pulse width modulator, reference circuit, first stage amplifier and demodulator.

Rectifier bridge

15. The phase controlled rectifier bridge consists of silicon diodes D19–D21 and

silicon controlled rectifiers SCR1 and SCR2. This is the main circuit and gains its supply from secondary winding SEC 1 of main transformer T1.

16. The rectifier bridge normally feeds the exciter field of the generator with a sequence of uni-directional pulses which vary in width in accordance with the phase of periodic firing, or switching on, of the two SCR's triggered by the pulse generator circuit.

Pulse generator and pulse width modulator

17. The pulse generator circuit consists of transistors Q2 and Q3 which produce a square wave form; this is applied to the transductor T6 which acts as a pulse width modulator and is controlled by two d.c. windings. The transductor output is applied to a pulse limiting circuit comprising Zener diodes ZD5, ZD6, silicon diodes D15 and D16 and resistors R14–R17. This produces the series of uni-directional pulses to fire the SCR's.

18. The two d.c. control windings of the transductor are fed respectively from the reference circuit through the first stage amplifier and the demodulator circuit.

Reference circuit and first stage amplifier

19. The reference circuit is fed by the three single phase transformers connected in star/delta, the primary windings of which are connected directly to the generator output. The transformer secondary output is rectified and smoothed and then applied to a sensing and amplifier circuit consisting of reference Zener diodes ZD1 and ZD2, resistors R7–R10, and transistor amplifier Q1.

20. Relative changes in the generator output voltage are compared with the pre-set reference, and the error signal is amplified and fed to the control winding of the transductor. A pre-set potentiometer P2 enables the setting of the reference to be varied and provides a means of accurately adjusting the output voltage of the generator.

Demodulator

21. The demodulator circuit transformer primary is connected across phase A, B of the generator line output, and load resistor R1 is connected to an external transformer in phase C of the load busbars. The transformer secondary is connected via two blocking rectifiers D11 and D12 to resistors R2 and R3 and potential divider P1. The electrical centre of P1 is connected through R1 to the centre tapping of the transformer. This circuit feeds capacitors C1 and C2 which in turn feed the control winding of the transductor.

22. With no signal from the current transformer the potentials produced across each half of potential chain R2, P1, R3 for each cycle are equal and opposite owing to the effect of the blocking rectifiers. Thus the net voltage appearing across C1 and C2 is zero and no current flows in the transductor control winding.

23. If a signal is obtained across R1 from the current transformer the voltage produced will be in phase with that produced by the transformer. Thus only reactive load is sensed by the circuit and real load has virtually no effect. Depending on the current direction, the voltage produced will be added to the voltage of one loop of the sensing circuit and subtracted from the other, and therefore for a complete cycle voltage appearing across the capacitor is approximately equal to $\sqrt{2}x$ the difference between loop voltages.

Operation of principal circuits in conjunction with relay

24. The starting relay S1 has four sets of normally closed contacts which, during run-up, provide a circuit between terminals 2 and 3. This allows the generator to run-up on the residual voltage present in the machine, provided that the external exciter control relay contacts ECR are closed.

25. The starting relay coil is fed by SEC 3 on the main transformer through rectifiers D17 and D18 and Zener diode ZD7. When the generator output reaches approximately 160 volts (no more than 180 volts) ZD7 fires and energizes the relay coil. The relay contacts open thus energizing the pulse width modulator circuit.

26. During run-up a large undervoltage is sensed by the reference circuit and thus a full pulse width is applied to the SCR's, giving them a 180° "firing angle", and allowing the generator to attain its working output voltage as quickly as possible. As the voltage approaches the correct value sensed

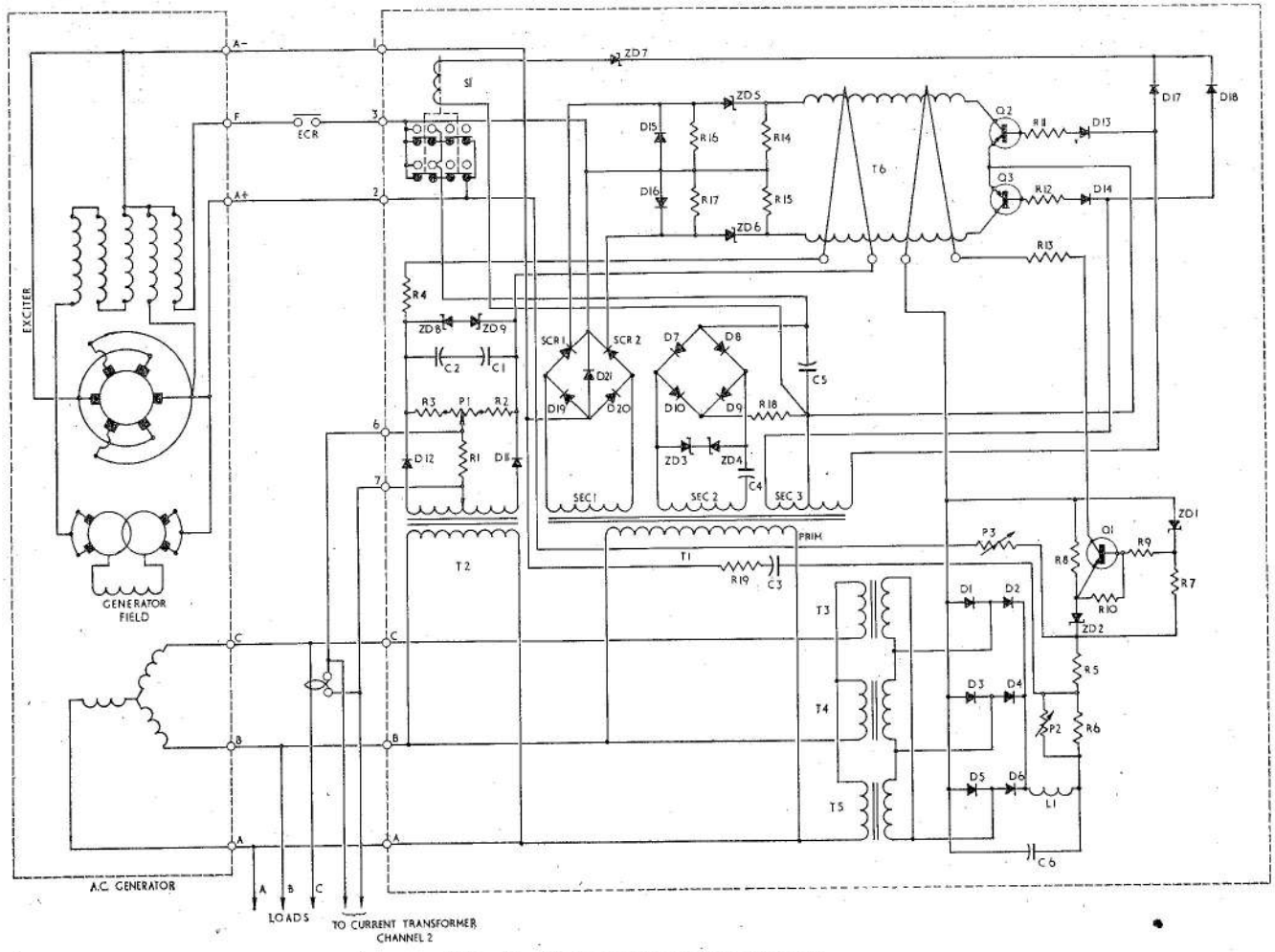

Fig. 3. Schematic wiring diagram

Key to Fig. 3

C1	CAPACITOR	50 MFD 15V	
C2	CAPACITOR	50 MFD 15V	
C3	CAPACITOR	10 MFD 100V	
C4	CAPACITOR	2 MFD 200V (2 off)	
C5	CAPACITOR	250 MFD 15V	
C6	CAPACITOR	10 MFD 100V	
D1–D18	SILICON DIODES TYPE CV 7040		
L1	VARIABLE INDUCTOR ADJUSTED TO 12 mH		
P1–P3	POTENTIOMETERS 500 ohms ¼W each		
Q1	TRANSISTOR	BCZ11	
Q2–Q3	TRANSISTORS	OC205	
R1	RESISTORS 20 ohms 21 W		
R2–R3	RESISTORS 1.2 K ohms 1½ W each		
R4	RESISTOR 10 K ohms ½ W		
R5	RESISTOR 270 ohms ½ W		
R6	RESISTOR 680 ohms ½ W		
R7–R8	RESISTORS 680 ohms ½ W each		
R9	RESISTOR 100 ohms ½ W		
R10	RESISTOR 330 ohms ½ W		
R11–R12	RESISTORS 2.2 K ohms 1 W each		
R13	RESISTOR 1.8 K ohms ½ W		
R14–R15	RESISTORS 100 ohms 1 W each		
R16–R17	RESISTORS 180 ohms ½ W each		
R18	RESISTOR 22 ohms 1 W		
R19	RESISTOR 330 ohms ½ W		
S1	RELAY BS210 B3P–1, PLUG-IN TYPE		
SCR1–SCR2	SILICON CONTROLLED RECTIFIERS		
SEC1–SEC3	MAIN TRANSFORMER SECONDARY WINDINGS		
T1	MAIN TRANSFORMER SINGLE PHASE		
T2	TRANSFORMERS SINGLE PHASE		
T3–T5	TRANSFORMER 3 PHASE STAR/DELTA		
T6	TRANSDUCTOR		
ZD1–ZD2	ZENER DIODES X2A68		
ZD3–ZD4	ZENER DIODES 10Z12		
ZD5–ZD6	ZENER DIODES VR35F		
ZD7	ZENER DIODE SZ20C		
ZD8–ZD9	ZENER DIODES CV7139		

by the reference circuit, the pulse width shortens and the excitation is reduced to the normal value for correct generator output.

27. When the generator is running normally, under or over voltages sensed by the reference circuit, increase or decrease the width of pulses fed to the SCR bridge, and thus the regulator adjusts the generator excitation accordingly. Suitable damping of the control system is provided by differential feed-back from the exciter output through potentiometer P3, capacitor C3 and resistor R19 to the input of the reference circuit across resistor R5. This limits the number of overshoots or undershoots of the line voltage during sudden heavy load switching.

SERVICING

28. Little servicing can be effected on this unit other than to examine for damaged components, frayed or perished insulation, security of all connections. In addition, an examination should be made on the box and covers for corrosion and a check made to ensure that the anti-vibration mounts have lost none of their resiliency. The unit should be removed and serviced in accordance with the appropriate Bay Servicing Schedule.

29. Generally, defective electrical components cannot be repaired and therefore should be replaced by new ones. Should any items on the printed circuit panels be found faulty, the whole panel should be renewed rather than an attemp made to renew any particular item. If any soldering is necessary on the unit ensure that the usual precautions are carried out with regard to the small electrical components on the panels.

Testing

30. Details of the tests which may be applied to verify the serviceability of the regulator will be found in Appendix A to this chapter.

APPENDIX A

STANDARD SERVICEABILITY TEST
for
VOLTAGE REGULATOR, TYPE 125

Introduction

1. The following tests should be applied to the voltage regulator before it is put into service, and at any time when the serviceability is suspect, or when any components have been renewed or disconnected.

TEST EQUIPMENT

2. The following test equipment, or suitable equivalents, is required:—

(1) Type AE2039 a.c. generator to provide a 200V, 3-phase a.c. supply.

(2) A 200V, 3-phase 400 c/s variable a.c. supply.

(3) Type AE918 a.c. generator, used as a synchronous motor.

(4) A 0-30V, 5A d.c. supply.

(5) Load bank rated at 0-50kVA at 0·8 p.f. and 0-40kW.

(6) Current transformer, E.E. Type AE5712.

(7) 100 ohm, 5A rheostat.

(8) Voltmeter V1; range of 160-270V at 400 c/s and accurate to within $\pm 1\frac{1}{2}$V.

(9) Voltmeter V2; range of 0-100V d.c. and accurate to within $\pm$1V.

(10) Ammeter A1; range of 0-200A at 400 c/s and accurate to within $\pm$2A.

(11) Ammeter A2; range of 0-10A d.c. and accurate to within $\pm$0·05A.

(12) Ammeter A3; range of 0-5A d.c. and accurate to within $\pm$0·1mA.

(13) Multimeter, Type 12889.

Note . . .

When performing the tests given in para. 3, 4, 5 and 6 the lid should not be fitted to the unit. All subsequent tests should be performed with the lid fixed in position.

Wiring check

3. Check for correct internal connections between the terminals listed, using a multimeter. If the values obtained are not within the limits quoted do not carry out any further tests, but trace and rectify the cause and check the wiring again

Terminals	Resistance value
A—B	2·8 $\pm$ 0·3 ohm
A—C	120 $\pm$ 10 ohm
B—C	120 $\pm$ 10 ohm
3(+)—1(−)	Not less than 10 megohms
3—2	Short circuit

Note . . .

In para. 4 to 8 the unit should be connected as shown in fig. 4. Unless detailed otherwise S1 should be closed, S3 and S4 open; switch S2 should be closed when the generator has been run up to speed.

Setting of reactive load sharing trimmer (P1)

4. Run the Type AE2039 a.c. generator up to a speed of 6000 rev/min on no load, and set the voltage reading of V1 to 200V using the reference trimmer P2. Connect a multimeter (set on the 2·5V d.c. range) across turret lugs 5 and 6 of the transductor assembly. Adjust the trimmer P1 until zero reading on the multimeter is obtained, then switch the multimeter to the 50μA d.c. range and re-check that the meter reading is zero. Lock the trimmer in this position.

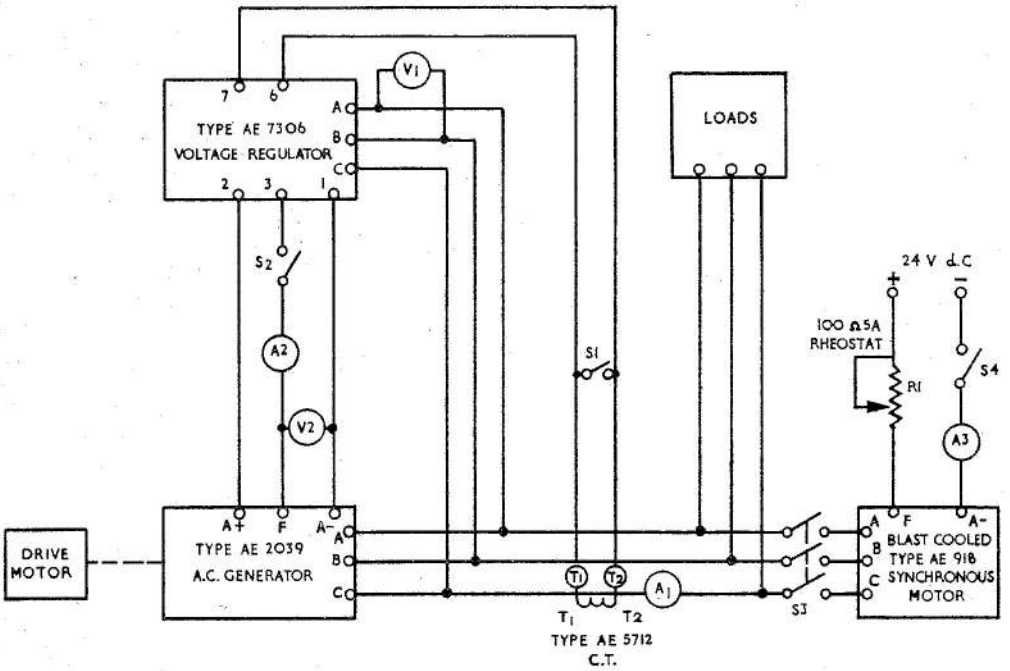

Fig. 1. Test circuit

Note . . .

If a zero reading is initially shown on the multimeter in the test detailed in para. 4, the trimmer P1 should be adjusted so that a voltage indication can be obtained.

Setting the damping trimmer (P3)

5. Run the Type AE2039 a.c. generator up to a speed of 6000 rev/min and load the generator with a 10kVA, 0·8 p.f. (lag) load. Switch a 30kVA, 0·8 p.f. (lag) load onto the generator and then switch back to the 10kVA, 0·8 p.f. (lag) load. Trimmer P3 should be adjusted to the position which gives no more than one overshoot and no undershoot of the line voltage (when switching loads) in addition to the initial disturbance caused by switching the load. Lock the trimmer in the position which satisfies this test.

Setting of reference trimmer (P2)

6. (1) *Synchronous motor run-up procedure.* Run the Type AE2039 a.c. generator up to a speed of 6000 rev/min and check that V1 indicates 200 ± 4V. Close S3 and allow the Type AE918 generator to run-up to speed as an induction motor and adjust R1 so that a value of 100 ohms is in circuit, then close S4. Observe the value of current indicated by A1 and increase the current of A3. As the current indicated by A3 approaches 3A observe A1 until the current of A1 falls to a lower value; when this occurs the generator Type AE918 has pulled into synchronism.

Note . . .

The test detailed in para. 6, sub-para. (1) should be completed within a period of 15 minutes, during which time the value of current indicated by A3 should not exceed 5A. Blast cooling air should be applied to the Type AE918 generator at a rate of 12 lb. of air/min whilst the test is in progress.

(2) *Setting of trimmer.* When the test in sub-para. (1) is satisfied adjust the reference trimmer P2 in conjunction with R1 to produce a line voltage V1 of 200V and an output current A2 of 0·3A. Lock the trimmer at this setting. When

performing this test ensure that current readings of 0·3A is not maintained for more than 10 seconds; at the conclusion of the test allow the synchronous motor to run down by opening switches S3 and S4.

Test of reactive load sharing circuit

7. (1) Run the generator Type AE2039 up to a speed of 6000 rev/min, open switch S1 and apply reactive loads of 0, 5 and 30kVAr. The voltage V1 should fall as the load is increased.

(2) Reverse the current transformer secondary connections and repeat the test detailed in sub-para. (1). Voltage V1 should rise as the load is increased.

(3) In the test detailed in sub-para. (1) and (2), with 5kVAr load applied, the voltage should not rise or fall more than between 2 to 6V r.m.s. With 30kVAr load applied the voltage should not rise or fall more than 40V r.m.s.

(4) Reverse the current transformer secondary connections to the conditions detailed in sub-para. (1) and apply a load of 25kW. Voltage V1 should not vary by more than 3V r.m.s.

Voltage regulation test

8. (1) Record the line voltage under the following load conditions:—0, 10, 20, 30, 40, 30, 20, 10, 0kVA at 0·8 p.f. (lag) and 40kW. The line voltage should remain at 200 ± 2V.

(2) Record the line voltage with a load of 50kVA, 0·8 p.f. (lag). The line voltage should not fall below 196V.

Insulation test

9. Measure the leakage current of the unit at 28V d.c. by connecting a 0-50μA industrial grade ammeter and a 0·5 megohm resistor in series with the positive probe; take readings across the following points:—

(1) All terminals and frame.

(2) Terminal A and terminals 1, 2, 3.

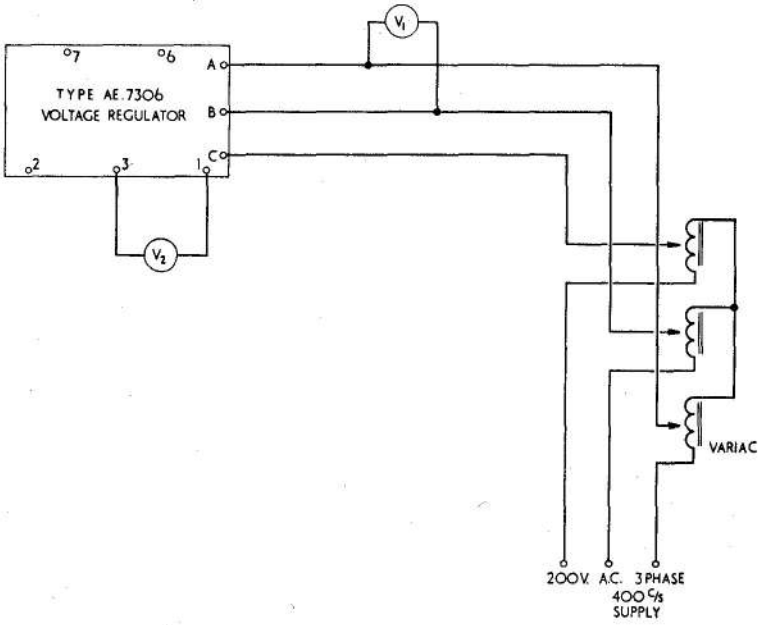

Fig. 2. Starter relay test circuit

(3) Terminal A and terminals 6, 7.

Repeat the test with the polarity reversed. For all tests the leakage current should not be greater than 5μA.

Note . . .

When applying the voltage, increase the value gradually from zero to 28V and back to zero again.

Starter relay test

10. (1) Connect the regulator as shown in fig. 5. Raise the voltage of the 3-phase 400 c/s variable supply slowly and record the line voltage V1 at which the starter relay operates (pulls-in) as indicated by deflection on V2. The pull-in voltage should not exceed 180V at room temperature.

(2) Reduce the voltage of the variable supply slowly and record the line voltage V1 at which the relay re-operates (drops-out) as indicated by V2 falling to zero. The drop-out voltage should not exceed 135V at room temperature.

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Chapter 15

VOLTAGE REGULATOR REFERENCE UNIT, E.E., TYPE AE7523, Mk.1
AND
VOLTAGE REGULATOR AMPLIFIER UNIT, E.E., TYPE AE7518, ~~Mk.1~~

Cancelled AL No 35

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Voltage regulator reference unit, E.E., Type AE.7523, Mk. 1 Ref. No. 5UC/7071

*Voltage regulator amplifier unit, E.E., Type AE.*7518, *Mk.* 1	*Ref. No. 5UC/*6937
Associated generator	*E.E., Type AE.*2054
Busbar voltage	200*V a.c.* (*r.m.s.*)
Busbar frequency	400 *c/s*
Phases	3
Regulation (*over full climatic and load range*)	±4*V* (*r.m.s.*) ±1% *of choke rectified voltage*
Transient response:—	
Maximum load change	±5*kVA*, 0·8 *to* 1·0 *p.f.*
Voltage deviation	20*V* (*r.m.s.*) (*maximum*)
Duration of transient	20 *m.s.* (*maximum*)
Regulator load	1 *ohm nominal*
Regulator output	3*A nominal*
Time rating	*Continuous*
Cooling air	*Up to* 1·0 *lb/minute at temperatures up to* +85°*C* (*continuous*)
Ambient temperature range	—65°*C to* + 110°*C*
Altitude range	0–60000 *ft.*
Weight (*AE.*7523)	2 *lb.* 7 *oz.*
Weight (*AE.*7518)	8 *lb.* 15 *oz.*

Introduction

1. The magnetic amplifier/voltage regulator units (E.E. Type AE7518 and AE7523) forms part of an aircraft electrical system which controls and protects the Type AE2054, 200V, 400 c/s, 3 phase, 20 kVA, a.c. generator. The unit provides a close control of the generator output and ensures a fast recovery from transient load switching.

DESCRIPTION

Voltage regulator reference unit

2. A light alloy cover and base assembly secured together with screws, washers and clinch nuts, house the components which in turn are secured in position either to the base assembly or cover assembly. Holes in the base plate enable the unit to be secured to associate equipment and one large hole bleeds off blast air being fed to the amplifier unit. Protruding from one end of the cover is a control lock which is attached to the potentiometer; screws passing through the cover are utilized to stabilize components which are secured to the base assembly.

Component assembly

3. The component assembly comprises the following: temperature compensating coil, potentiometer (R5), unitor plug potentiometer bracket assembly, resistor encapsulation (R6, R2, R7, R3, R1, R4), transformer (200/50V 2VA 400 c/s), transductor assembly (No. 1), rectifier encapsulation (REC 2), rectifier assembly (REC 1), voltage reference tube (T1, T2) bracket assembly, capacitor (0·25 μF 400V) and unitor plug.

Temperature compensating coil

4. The temperature compensating coil comprises a spindle on which is wound copper wire; copper strips are secured to the ends of the wire which enables the component to be connected to associate equipment. Shrouding the assembly (except for the ends of the copper strip) is a moulding in which are four holes which permit the component to be secured in position by c'sk. hd. screws, which have an anchorage in the base assembly of the transformer described in paragraph 8.

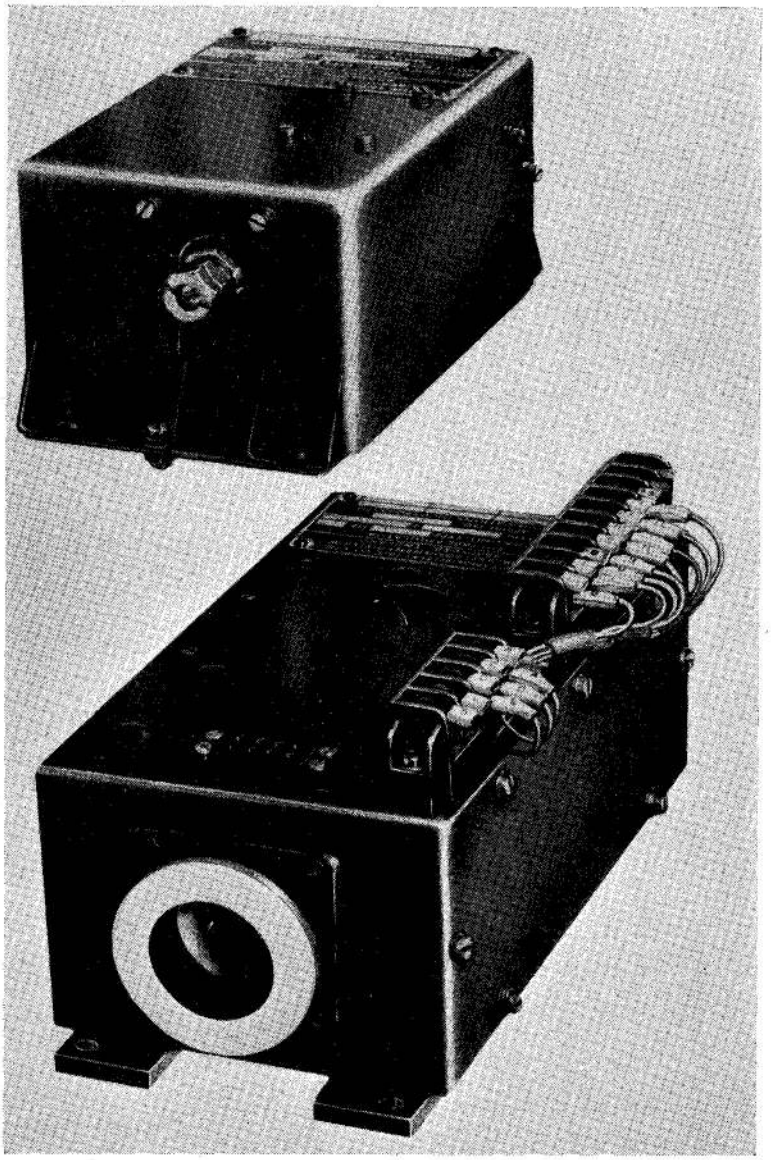

Fig. 1. General view of units

Potentiometer

5. The potentiometer is secured to the unitor-potentiometer bracket assembly by a tabwasher, packing washer and a pre-set control lock device, which is positioned on the spindle of the potentiometer to prevent variance of the potentiometer setting.

Unitor plug/potentiometer bracket assembly

6. A light-alloy, unitor plug bracket riveted to the light alloy potentiometer bracket provides a mounting for an eight way unitor plug. (The unitor plug is secured to the bracket with ch. hd. screws, spring washers and nuts). Also secured to the potentiometer

bracket is a terminal board and two spring clips; these clips provide a mounting for the capacitor. Leads from the capacitor terminate at eyelet tags anchored in the board. The bracket assembly is secured to the base assembly with c'sk. hd. screws, nuts and spring washers.

Resistor encapsulation

7. Housed within the resistor encapsulation are six resistors which are totally enclosed within a moulding. Projecting from one end of the encapsulated assembly are turret lugs which are used to connect the assembly in circuit. Projecting from the other end of the encapsulation is a stud and location dowel, the stud and dowel locate in the base assembly and the encapsulation is held in position by a nut and spring washer positioned on the stud.

Transformer

8. The 200/50V, 50 c/s, single phase transformer is capable of delivering 40 milliamperes at 0·75 power factor. The ends of the primary and secondary windings terminate at double ended tags which permit a soldered joint on connection of the unit in circuit to other equipment. The unit is secured to the base assembly by c'sk. hd. screws which pass through the temperature compensating coil encapsulation (see paragraph 4).

Transductor

9. The transductor is an encapsulated assembly which is connected in circuit by means of turret lugs. Within the moulding are two bobbin and laminated assemblies around which are wound three windings, the ends of each winding are secured to the turret lugs stated above. C'sk. hd. screws engaged in inserts (moulded in position in the assembly) secure the transductor to the base assembly.

Rectifier encapsulation

10. The encapsulated assembly comprises an insulated board on which are mounted six silicone diodes (three each side of board). Wire leads from the diodes finish at terminal lugs and flexible wires secured to the lugs emerge from the encapsulation via an insulated block which is attached to the insulated board. Spacers positioned in the encapsulated assembly permit the passage of screwed studs which are anchored in the transductor assembly; nuts and spring washers secure the rectifier encapsulation in place.

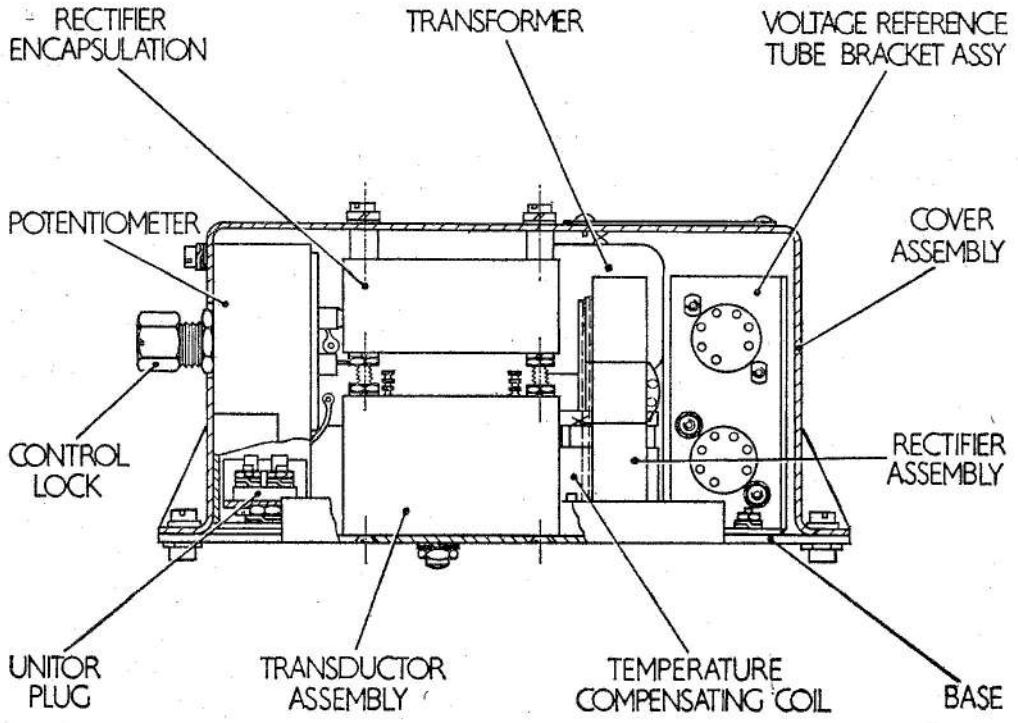

Fig. 2. Sectional view of reference unit

Rectifier assembly

11. Fixed in a light alloy metal bracket (which is secured to the base assembly with c'sk. hd. screws, nuts and spring washers) is the rectifier encapsulation. The encapsulation comprised four silicone diodes, the leads of which are secured to turret lugs which are positioned in an insulation board. A moulding shrouds the diodes and insulated board.

Voltage reference tube bracket assembly

12. Secured to a light alloy bracket with tapped spacers, plain washers, spring washers, ch. hd. screws and nuts, are two valve bases. Positioned in the bases are two reference tubes which are protected by spring-loaded metal screens which are clipped on to the valve bases. The bracket is secured to the base assembly with c'sk. hd. screws, spring washers and nuts.

Voltage regulator amplifier unit

13. The components are positioned on and are secured to a light alloy base and cover assembly. Secured to one end of the cover is a manacle flange duct which enables a blast air supply pipe to be clamped to the unit, louvres punched in the end of the cover (opposite end to manacle flange) provides an exit for the blast air supply. Straps which form part of the base assembly (drilled to permit the passage of studs or bolts) enables the unit to be mounted in position on installation. Access to the unit can be obtained by the removal of a plate attached to the cover assembly or by removal of the cover assembly from the base assembly. Anchor nuts positioned on the light alloy components provide the means of anchoring the screws used in securing components in place.

Component assembly

14. The component assembly comprises the following: transductor assembly, input transformer assembly, damping transformer assembly, resistor and capacitor encapsulation (R3 to R9, 2μF capacitor) terminal blocks (5 way and 10 way), resistor and bracket assembly (R1, R2) and unitor socket.

Transductor assembly

15. The transductor windings are housed within a moulding; protruding from one end of the moulding are turret lugs which enables the unit to be connected to associate equipment. The unit is secured to the base assembly with shakeproof washers and c'sk. hd. screws which are anchored in tapped inserts moulded in the feet of the transductor.

Input transformer assembly

16. The transformer is a 3 phase, 400 c/s, 200/17 volt step down transformer which is capable of delivering a current of 35A at 0·75 p.f. The primary winding is connected in a delta configuration and the secondary in a star configuration; the ends of the windings finish at turret lugs which allows the connection of wire leads. The transformer is secured to the base assembly with c'sk. hd. screws, spring washers and thin nuts.

Damping transformer assembly

17. The transformer is totally enclosed in a moulding except for the inserts, the outer periphery of the core and turret lugs. The turret lugs provide a terminal for the primary and secondary windings of the (step up) transformer and also enable the unit to be connected to associated equipment. Inserts moulded in position provide an anchorage for c'sk. hd. screws which secure the transformer assembly to the base assembly. The screws are locked in place with red anti-track enamel.

Resistor and capacitor encapsulation

18. Positioned on an insulated board are seven resistors and one capacitor. Flexible leads from the resistors and capacitors terminate at turret lugs which are also used to connect the encapsulated assembly to associate equipment. A moulding shrouds the resistors, capacitor, insulation board and housed in the moulding are three inserts which locate in the board. The encapsulated assembly is secured to the cover assembly with c'sk. hd. screws which are locked in position with red anti-track enamel.

Terminal blocks

19. The terminal blocks are of moulded construction and are designed to accommodate quick release terminal tags which are sleeved and identified. The block is secured to the cover assembly with ch. hd. screws and washers.

Resistor and bracket assembly

20. Two resistors (with brackets fitted) are

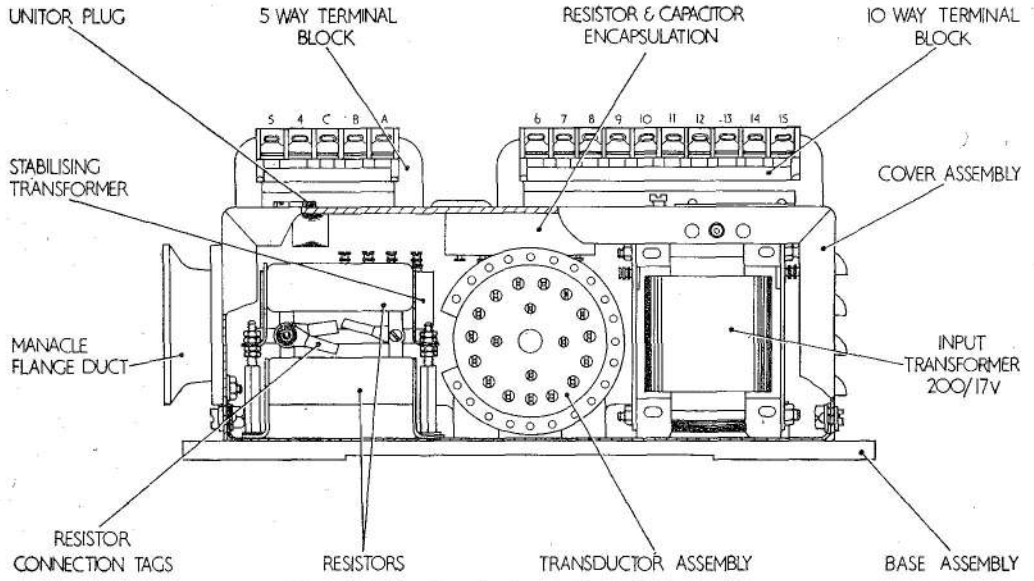

Fig. 3. Sectional view of amplifier unit

positioned one above the other by means of pillars; c'sk. hd. screws secure one resistor to the base assembly by engaging in the pillars and the other resistor is positioned on the stud section of the pillars by thin nuts. Tags enable the resistors to be connected to associate equipment.

Unitor socket

21. Positioned within a cutaway of the cover assembly is a unitor socket. The socket is secured to the cover with ch. hd. screws, spring washers and nuts.

OPERATION

Reference should be made to fig. 4 when reading paragraph 22 and fig. 5 when reading paragraph 23.

Voltage regulator reference unit

22. The a.c. voltage of the generator is tapped and fed into the voltage reference

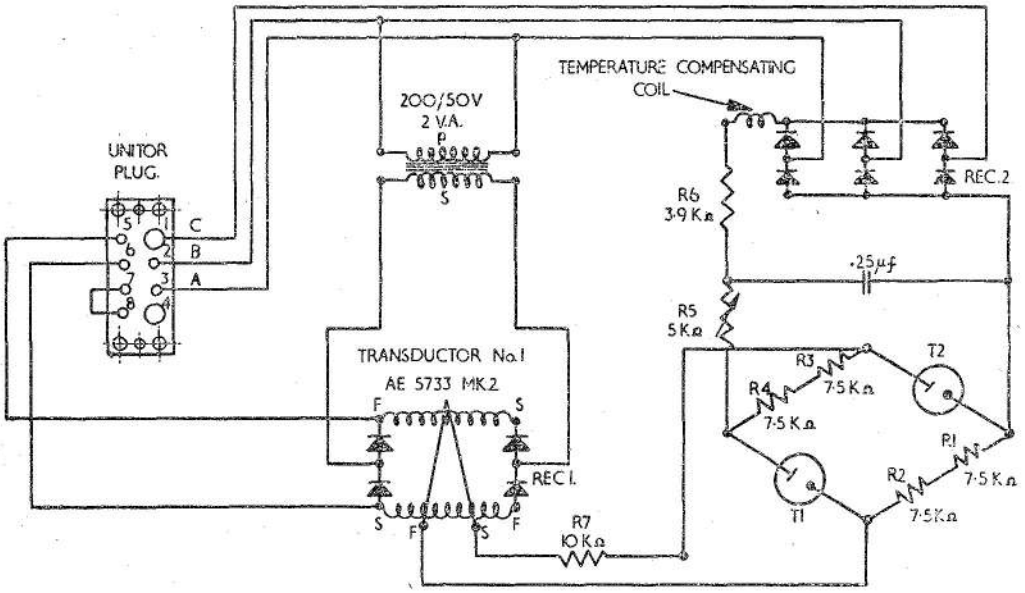

Fig. 4. Schematic diagram of reference unit

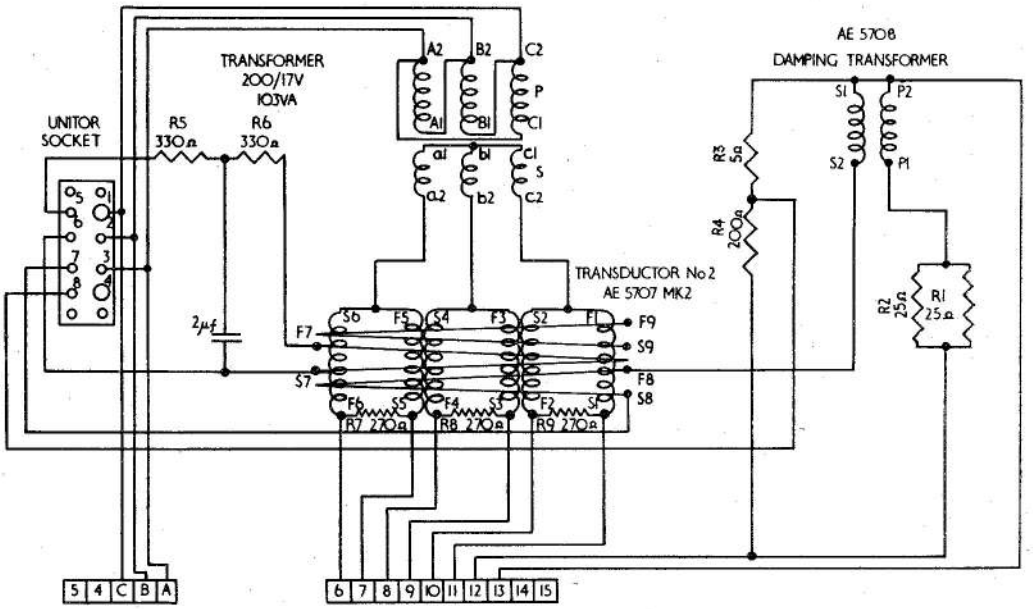

Fig. 5. Schematic diagram of amplifier unit

unit via the unitor plug. The voltage is applied to the rectifier bridge and to the step down transformer. The output from the rectifier bridge is fed via a temperature compensating coil, resistor capacitor smoothing circuit and a variable resistor to a trigger tube-resistor bridge network, the output of which feeds a control winding on transductor No. 1. With an increase in the generator voltage an increased current will flow through the trigger tube-resistor bridge, which will cause a potential difference at the junction of the resistors and trigger tubes (since the voltage drop across the tubes is constant). When the current rises in the control winding the impedance of the main winding increases and the output from the transductor main winding decreases. The increased voltage from the main windings is then applied to one of the control windings on the transductor (No. 2) in the voltage regulator amplifier unit.

Voltage regulator amplifier unit

23. The tapped output of the generator which is fed into the voltage regulator amplifier unit via the unitor plug is applied to the step down transformer, the output of which is fed into the main windings of transductor No. 2. The output of transductor No. 2 is controlled by two control windings, one of which is fed by the output of transductor No. 1. The effect of this control winding is to increase the regulator supply to the generator exciter fields by permitting a larger output from the transductor main windings, thus decreasing the self excitation of the generator by reducing current flow in the fields, hence a reduction in the generated terminal voltage. The stabilizing transformer primary winding is fed from the exciter armature and fields circuit; a change in exciter voltage causes a change in the output of the secondary of the stabilizing transformer which feeds the second control winding on transductor No. 2. The action of the second control winding is to counteract the change produced by the first control winding which is fed from transductor No. 1, thus the stabilizing transformer slows down the action of the transductor (No. 2) reducing overshoot and damping tendency to oscillation.

Note . . .

The output from transductor No. 2 main winding is rectified by a rectifier unit in the control system of the generator before injection into the exciter armature field circuit.

SERVICING

Procedure

24. Check the security of all external fixing screws and locking devices and examine for mechanical damage and corrosion.

TESTING

Note . . .

Tests stated in paragraphs 26 to 28 apply only to type AE7523 unit. Tests stated in paragraphs 29 to 32 apply only to type AE7518 unit.

Supplies and meters

25. The a.c. supply should have a regulation of less than one volt (r.m.s.) and is to be free from sub-harmonics greater than 0·2 volt (r.m.s.) and harmonics greater than 2% of the fundamental. A precision grade meter should be used for the line voltage (r.m.s. 400 c/s) otherwise industrial grade meters are to be used.

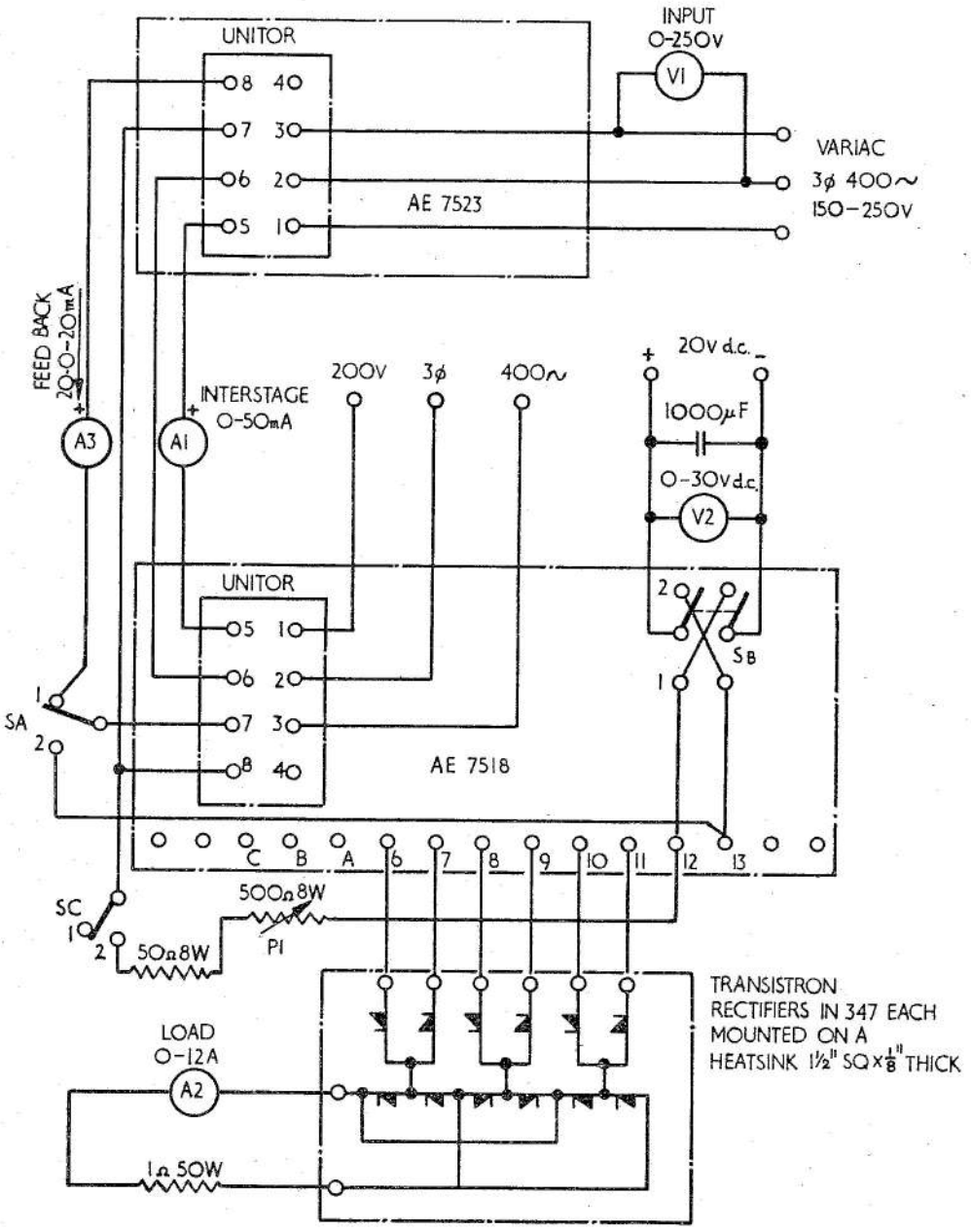

Fig. 6. Functioning test circuit

Setting up procedure (AE7523)

26. The unit is to be connected to the test circuit shown in fig. 6 using a slave AE7518 unit of proven serviceability. The switches SA, SB and SC are to be set to position 1 and the reading of V2 adjusted to 20V. With reading 200 volts the trimmer on the AE7523 unit is to be set to give an inter-stage current as indicated on A1 of 18 mA.

Functioning test (AE7523)

27. With the unit connected as stated in paragraph 26 the reading of V1 is to be varied from 160 to 260 volts by means of the variac. Ten readings of V1 and A1 are to be taken in the voltage variation stated above and a static characteristic obtained which is to be within the limits indicated in fig. 7.

Insulation resistance test (AE7523)

28. Using a 500 volt insulation resistance tester check that the insulation resistance measured between each of the unitor plug terminals and the frame is not less than 5 megohms.

Wiring check (AE7518)

29. The unit is to be tested for correct internal connections by measuring the resistance between the terminals detailed below.

Note . . .

The prefix U denotes unitor socket terminals.

Terminals	*Resistance*
A-B, B-C, C-A	$4{\cdot}7 \pm 0{\cdot}5$ ohms
A-U3, B-U2, C-U1	Short circuit
12-13	$13{\cdot}3 \pm 0{\cdot}7$ ohms
U6-U5	677 ± 35 ohms

Functioning tests (AE7518)

30. Connect the unit in the circuit detailed in fig. 6 using a slave AE7523 unit of proven serviceability. Operate each of the switches SA, SB and SC to position 1 and adjust the reading of V2 to 20 volts. The feed back current is to be within +5 and +8mA. By adjusting the voltage reading of V1 with the variac, set the interstage current (indicated by A1) to 18 mA. If the output is less than 3·0A close switch SC and using P1 increase the feedback current indicated by A3 so that the output current shown on A2 is 3·0A. The required change in A3 must not be more than 14 mA. Vary the interstage current over the range 0 to 30 mA in at least 10 suitable increments, taking readings of output and interstage currents. The characteristic obtained is to be within the limits outlined in fig. 8.

31. Change switch SA to position 2, open switch SC to position 1; set V2 to 20V and adjust the reading of V1 until the output current is 3·0A. Operate switch SB to position 1 and check that the load increases momentarily. Operate switch SB to position 2 and check that the load current decreases momentarily.

Insulation resistance test (AE7518)

32. Using a 500 volt insulation resistance tester check that the insulation resistance measured between each terminal and case is not less than 5 megohms.

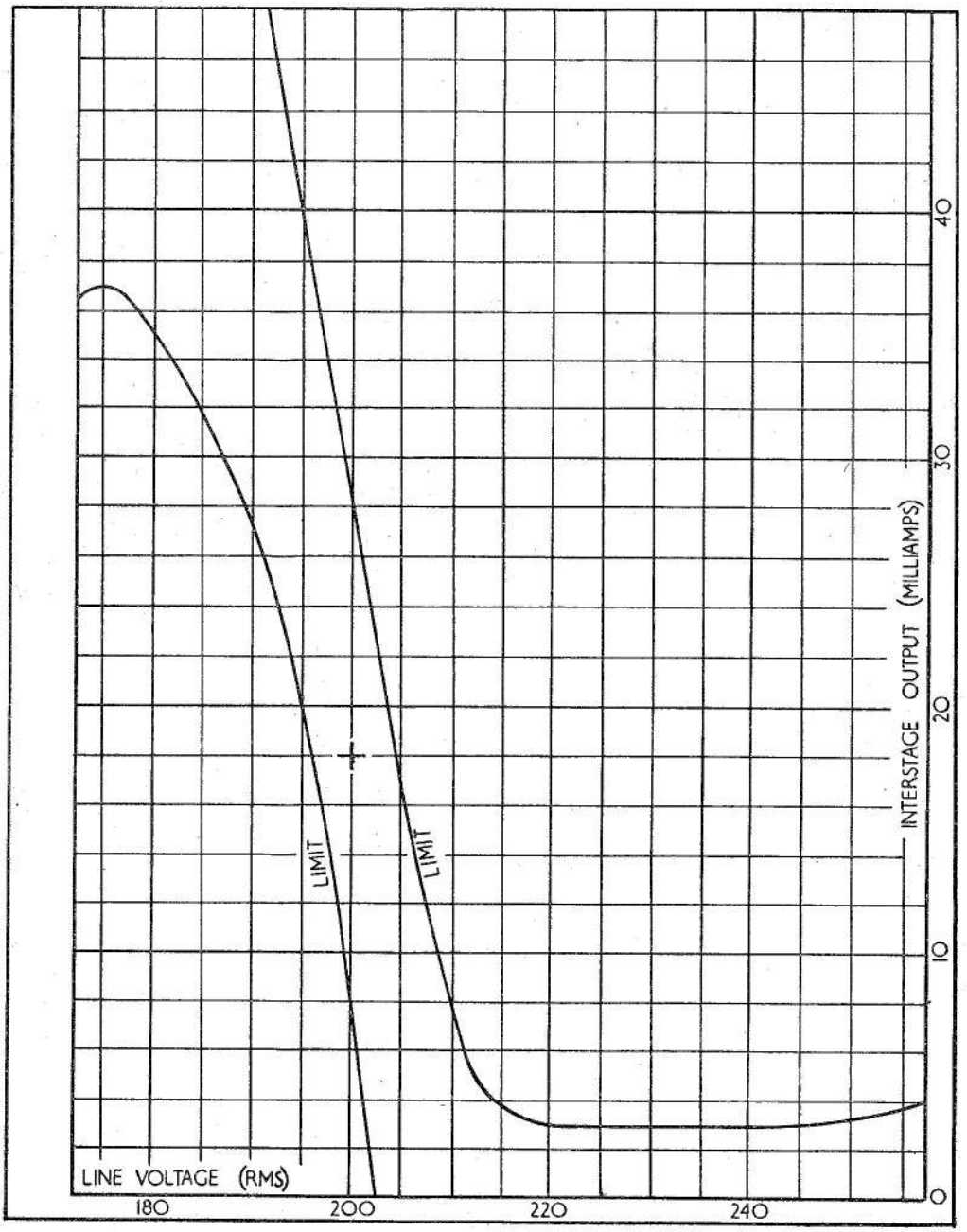

Fig. 7. Characteristic limits (reference unit)

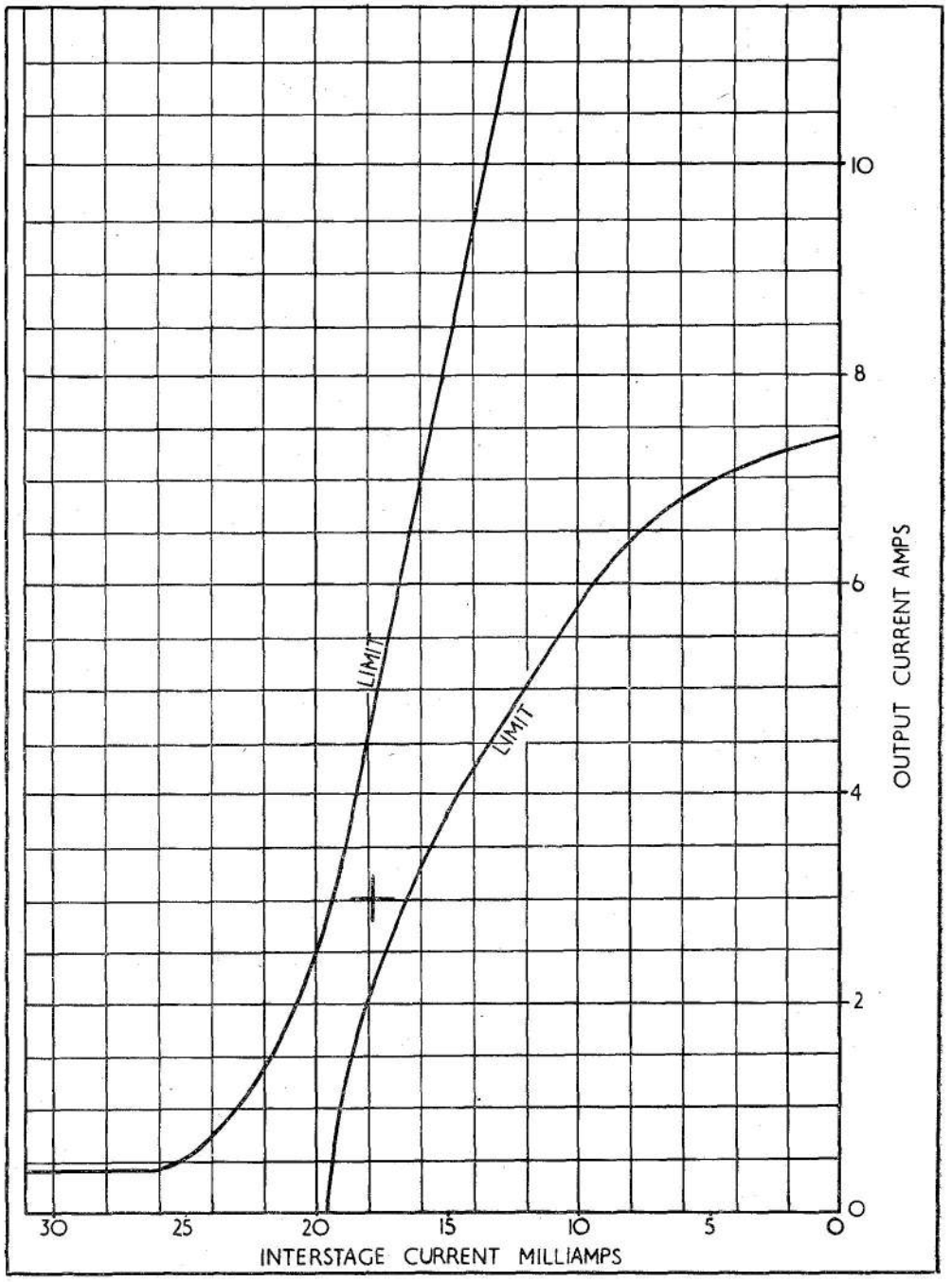

Fig. 8. Characteristic limits (amplifier unit)

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