Obsolete

Chapter 29

GENERATOR, TYPE 523 (E.E. TYPE AE 2506)

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LEADING PARTICULARS

Generator, Type 523	*Ref. No. 5UA/6488*
Rotation	*Clockwise (from driving end)*
Rated output	4 *kW*
Rated voltage	30 *V d.c.*
Speed range	5710–9500 *r.p.m.*
Voltage Regulator Type 94	*Ref. No. 5UC/5937*
Regulated voltage	28 *V* (±2·5 *per cent*)
Brushes	
Grade	*E.G. 12*
Length (new)	0·625 *in. on shortest side*
Length (minimum)	0·315 *in. on shortest side*
Spring pressure	$17\frac{1}{2}$ *to* $22\frac{1}{2}$ *oz*
New commutator diameter	3·000–0·010 *in.*
Minimum commutator diameter	2·950 *in.*
Commutator concentric with bearing diameters	*to within* 0.0005 *in. T.I.R.*
Depth of mica undercut	$\frac{1}{32}$ *in.*
Weight	$28\frac{1}{4}$ *lb*

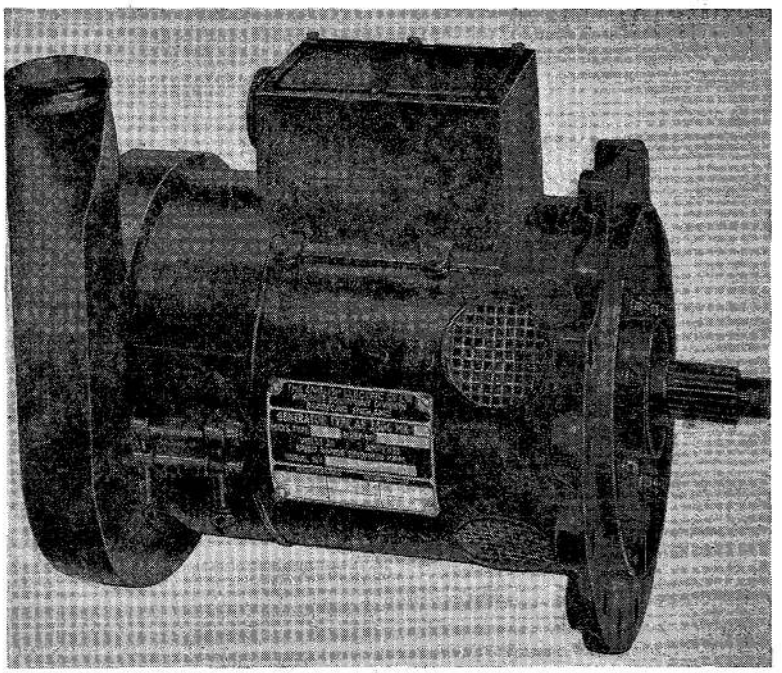


Fig. 1. Generator, Type 523

Introduction

1. The generator, Type 523, is driven through gearing by an aircraft engine, and serves as a power source for the aircraft electrical system in flight. Operating in conjunction with the voltage regulator, Type 94, the generator provides a constant voltage supply over a range of engine speeds.

DESCRIPTION

General

2. The generator (*fig.* 1) is a 6-pole, wave wound machine, embodying interpoles and compensating windings. It is flange mounted on the gearbox, and has a serrated shaft drive. A sectioned view of the machine is shown in fig. 2.

Cooling

3. The machine is self cooled by means of a centrifugal fan mounted at the commutator end. Air is drawn into the body of the machine via five mesh covered ports at the d.e., it passes through the hollow armature shaft and through the yoke, and over the brush gear and commutator, commutator end bearing housing to the fan which discharges the air through a duct forming part of the volute casing. The fan is fabricated from light alloy sheet, the hub being keyed to the shaft commutator end and secured by a $\frac{3}{8}$ in. U.N.F. nut and tabwasher. The stainless steel fan casing is attached to the commutator end endplate by five 4B.A. ch.hd. retaining screws which protrude through an interposed fixing ring into a groove machined in the endplate. The band cover encircling the frame securing the fan casing in position.

Frame

4. The rolled and welded steel frame houses the armature and carries the main poles and interpoles within the central yoke portion of the bore. The commutator and driving end endplates are attached to the ends of the frame, and the terminal box is mounted on its outer surface.

5. The main poles and interpoles are secured by three 2B.A. and two 4B.A. ch.hd. screws respectively. The screw heads are let into the surface of the frame, and locked by spring washers.

Commutator-end endplate

6. The commutator-end endplate is a magnesium alloy casting, secured to the end of the frame by six 4B.A. ch.hd. screws. It supports the brush gear and houses a roller

bearing which is mounted at one end of the armature shaft.

Roller bearing

7. The bearing outer race is a push fit within a steel lined recess in the endplate and is held in position by a bearing cap secured to the endplate by four 4B.A. ch.hd. screws. The inner race is an interference fit on the armature shaft and is held in position against a step on the shaft by a collar which in turn is held by the fan hub (*para.* 3). The outer bearing cap is two thirds, and the bearing one third filled with grease to specification XG. 271 (Ref. No. 34B/9100510).

Brush gear

8. The six brush boxes are equally spaced around one face of the moulded glass filled alkyd brush rocker, and are secured to it by twelve 4B.A. ch.hd. screws, with their heads on the outer side of the brush rocker and locked by springwashers. Four stud inserts are integrally cast in the brush rocker on the face opposite the brush boxes.

9. The brush rocker seats against a machined face in the endplate, and the four stud inserts pass through slots in it and are secured on the outer side by stiff-nuts.

10. The slots permit the brush gear to be adjusted so that the brushes may be rocked into the magnetic neutral plane.

Brush spring assembly

11. The brush spring assembly (*fig.* 3) for each brush box consists of a single coiled strip spring, mounted on a spindle which is supported at each end in the brush box. The captive end of the spring engages a slot in the spindle, axial movement of the spring is limited by the brush box at the outer end, and a spindle retaining circlip at the inner end.

12. The spindle is splined axially and engages in the internally splined outer end of the brush box. A given spring pressure is obtained by rotating the spindle the requisite amount then pushing it home in the outer end, it is locked in position by the circlip.

Drive-end endplate

13. The endplate is a machined magnesium casting, with a flange drilled with 14 holes to accept bolts for attaching the generator to the engine gearbox. An insert in the boss of the casting contains a ball bearing which supports the driven end of the armature shaft. The endplate is mounted on six studs which project from the end of the frame, and secured by stiffnuts. Oil seals are fitted behind all stiffnuts at the drive end of the machine to prevent ingress of oil from the mating gearbox.

Ball bearing

14. The d.e. bearing, which is a push fit in the insert, is held against a shoulder by the inner bearing cap, and secured by four studs and stiffnuts to the endplate.

15. The inner race is an interference fit on the armature shaft, and is held against a step by a collar which is also an interference fit on the shaft.

16. The outer bearing cap is located in a machined bore in the endplate and is an easy fit over the collar, it is secured by a circlip internally fitted in the endplate, both the inner and outer bearing caps are two thirds filled, and the bearing is one third filled with grease to specification XG. 271 (Ref. No. 34B/9100510).

Armature

17. The armature lies within the frame, the machined shaft ends being supported in the bearings. The serrated end of the shaft protrudes through the d.e. endplate to connect to the engine gearbox. The hollow centre portion of the shaft carries the armature stampings and commutator. The 43-slot armature is retrogresive wave wound. The tinned steel binding wire and all connections to the 43-bar commutator are secured by brazing. During manufacture the complete armature is balanced by drilling the coil support at the d.e., milling the rim of the commutator bush and finally by adding brazing to the binding wire.

Terminal box

18. The terminal box casting is provided with four fixing holes to accept screws for attaching to the frame. The cable entry is at the commutator end, through an externally threaded duct rivetted to the box. The top cover is secured by six 4B.A. ch.hd. screws.

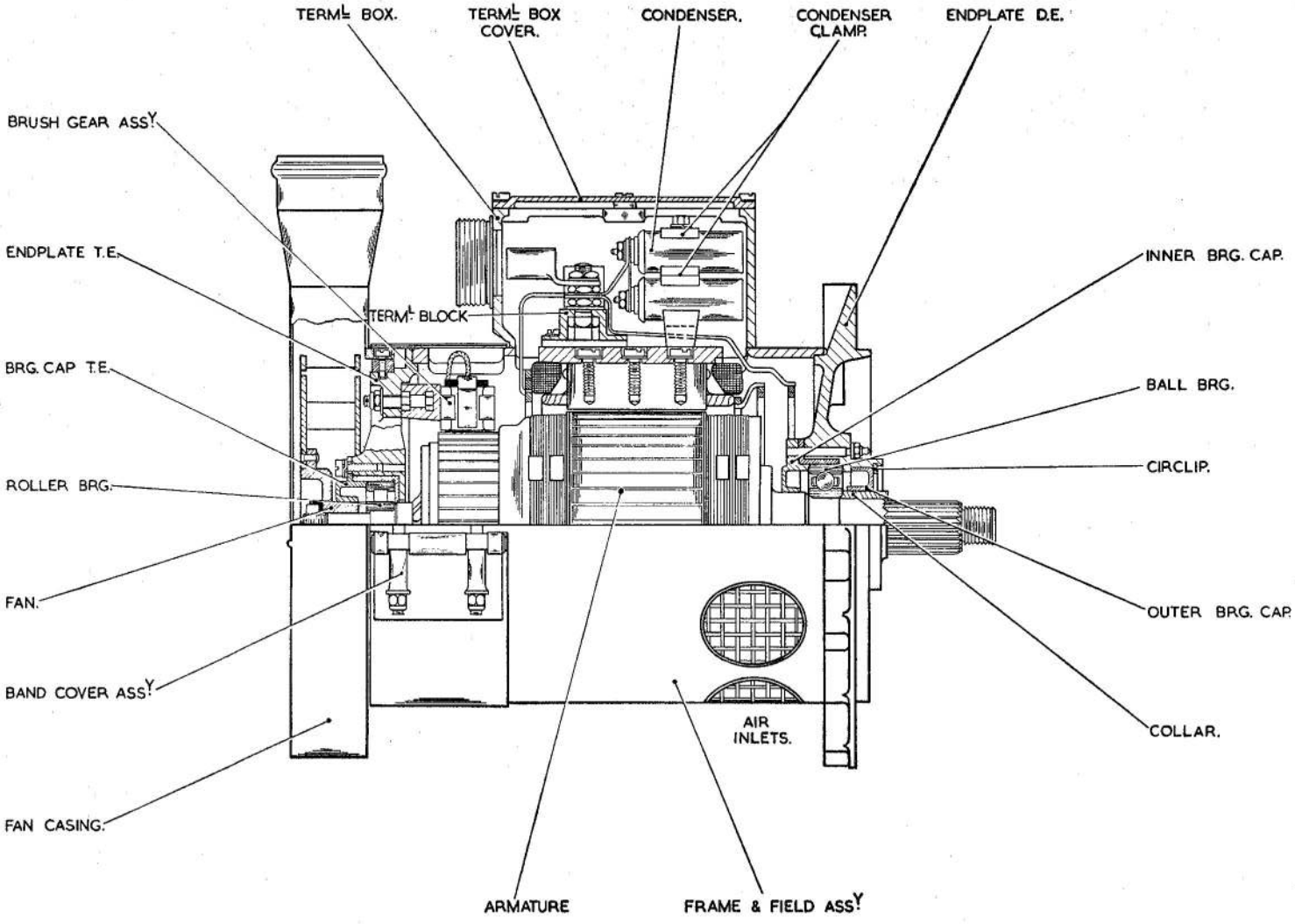


Fig. 2. Sectioned view of machine

19. The contents of the terminal box are mounted on the frame and the terminals located on an insulated terminal block, which also secures the taped strap connectors. These connectors pass through slots cut in the frame to connect the machine windings, also housed are six interference suppression capacitors, secured by clamps.

Terminal connections

20. The terminal connections are shown in fig. 4. Terminals No. 1 and No. 2 are the positive and negative generator output terminals respectively, and No. 4 is the field terminal. The equalizing connection is made to terminal No. 3.

Internal connections

21. The circuit diagram of the generator is shown in fig. 5. The polarity of the main field connection determines the direction of rotation. The resistor, R, is composed of two parallel connected rings of resistance strip. These are secured on insulating mountings within the frame at the drive end. The total resistance of the rings and the compensating windings is approximately 0·0075 ohms. This value of resistance ensures that a voltage difference, the value of which depends upon the load current exists between terminals No. 3 and No. 2.

22. There is one connecting lead to each brush box. The terminal tag is attached to the base by the screw which also secures the pigtail tag of the brush.

INSTALLATION

23. Before installing the generator, ensure that the direction of rotation, as marked on the rotation plate (on top of the machine) is suitable for the engine gearbox. Examine the serrations on the shaft for damage.

OPERATION

24. The generator will normally form part of an aircraft supply system, comprising two or more generators, driven from a gearbox and feeding a common busbar. The power system incorporates voltage regulating circuits, each generator working in conjuction with a Type 94 voltage regulator. By this means, the generator output voltage is maintained at a value of 28 V ($\pm$ 2½ per cent) at all loads up to its rated maximum and over a speed range of 5710–9500 r.p.m.

25. To ensure that the total load of the system is shared equally, between all the generators, an equalizing circuit is employed. The voltage appearing at terminal No. 3 of the generator (*fig.* 4) is proportional to the load, and an equalizing connection is made from this terminal to the voltage regulator.

SERVICING

General

26. Information on servicing, common to all d.c. generators, is to be found in A.P.4343, Vol. 1, Sect. 2, Chap. 1. The following paragraphs should be read in conjunction

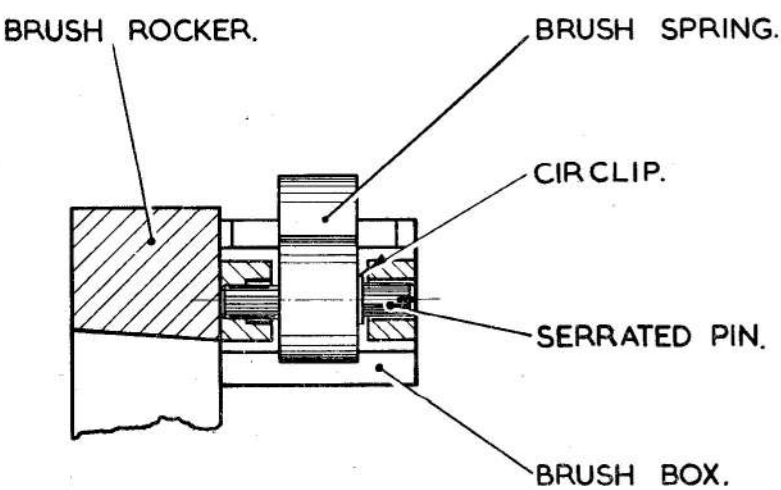
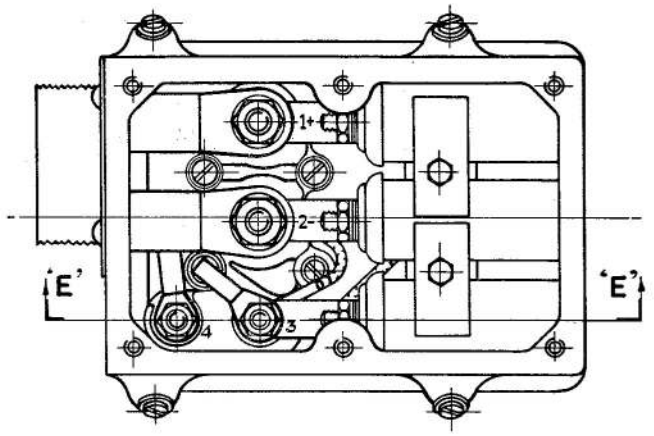
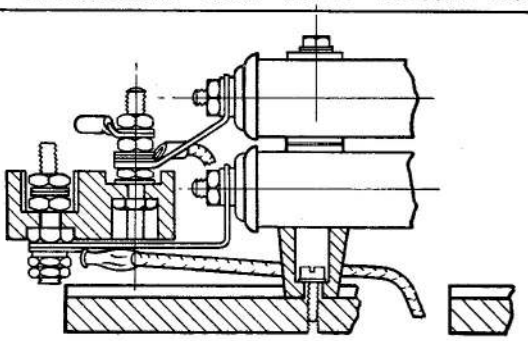


Fig. 3. Brush spring assembly



VIEW OF TERMINAL BOX WITH COVER REMOVED.



SECTION 'E-E'
SHOWING CONDENSER TERMINAL BLOCK CONNECTIONS.

Fig. 4. Terminal connections

with that chapter and with the relevant Servicing Schedule.

27. To examine the machine, the air pipe must be disconnected and the commutator end cover band removed, also the terminal box cover.

28. Clean and examine the frame, commutator, and brush gear, ensuring that all nuts, bolts, screws, and locking devices are secure. Check the insulation of all connecting leads, the straps for damage or deterioration and ensure that the connections are tight. Before replacing the cover band examine it for distortion and renew if necessary. Ensure the fan casing outlet duct is correctly aligned before finally securing the cover band.

Brushes

29. When removing the brushes from their boxes, mark each brush so that it may be replaced in its own box the same way round. This is to ensure that the brush will be bedding correctly.

30. The brushes should be checked at regular intervals to ensure sufficient length and freedom of movement in their respective brush boxes. New brushes should be fitted if the rate of wear indicates that the minimum length (as quoted under leading particulars) may be reached before the next servicing period or examination. When new brushes are fitted, they must be bedded on the commutator for their full thickness and over at least 100 per cent of their axial width.

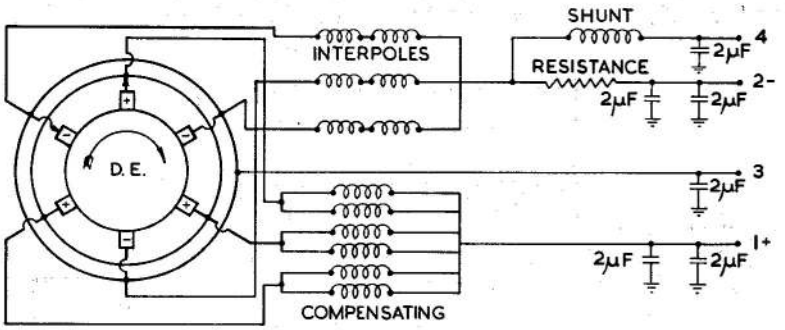


Fig. 5. Circuit diagram

Bedding

31. Brush bedding is carried out before the cooling fan and manifold are fitted. The input to the main terminals 1 and 2 is 10 V at 10 A. A 2 ohm resistance is connected in series with the field to terminals 1 and 4, to control the speed of rotation. With the generator motoring under these conditions no external cooling source is required.

Spring pressure

32. The pressure of each brush spring should be checked to ensure that it lies between the limits (as quoted under leading particulars).

TESTING

General

33. Before installing a new or reconditioned generator, it should undergo the tests described in the following paragraphs. Where possible the generator should be driven by the generator test bench, Mk. 5D (Ref. No. 5G/2924). This testing set is described in A.P.4343S, Vol. 1, Sect. 13, Chap. 1.

34. The armature should first be turned by hand to ensure that it does not foul any leads or fixed parts of the machine. Rotation should be smooth, and there should be no excessive play in the bearings. Slight radial play which can just be felt by hand is permissible. The machine should also be observed for undue vibration during the following running tests.

35. As shown in the test circuit (*fig.* 6) a Type 94 voltage regulator, previously tested for correct operation, should be used. An external trimmer resistor is connected between terminals No. 1 and No. 7 of the voltage regulator, and voltmeter V1 should be on the 0–40 V range. A suitable millivoltmeter V2 is connected across terminals No. 2 and No. 3 of the generator, with its polarity as shown. The fixed load resistor in the test set should be switched out and the variable load rheostat adjusted to the minimum load position.

36. Run the generator in the correct direction of rotation at a speed of 5710 r.p.m. and observe the readings at V1 and V2. If the polarity of the generator is correct, positive readings will be obtained as the voltage builds up.

37. The terminal voltage of the generator (V1) should build up without hesitation to between 27·5 and 28·5 V d.c.

38. If positive readings are not obtained check all connections and ensure that the direction or rotation is correct. Should the polarity prove to be incorrect, or the generator fail to build up, the poles must be re-magnetized.

Re-magnetizing

39. To re-magnetize the poles, disconnect the test circuit and connect a 6-volt battery in series with a single-pole quick-break switch across the generator field terminals. The positive battery lead must be connected to the generator terminal No. 4, and the negative lead to terminal No. 2. Using the switch, make and break, the circuit once only to magnetize the poles. Repeat the tests (*para.* 34–36).

Insulation test

40. With the machine hot from running, measure the insulation resistance between the

generator terminals and the frame, using the standard 250 V. d.c. insulation tester. A reading of at least 50,000 ohms should be obtained.

41. If the insulation resistance is below this figure, the interference suppression capacitors should be disconnected and checked for breakdown.

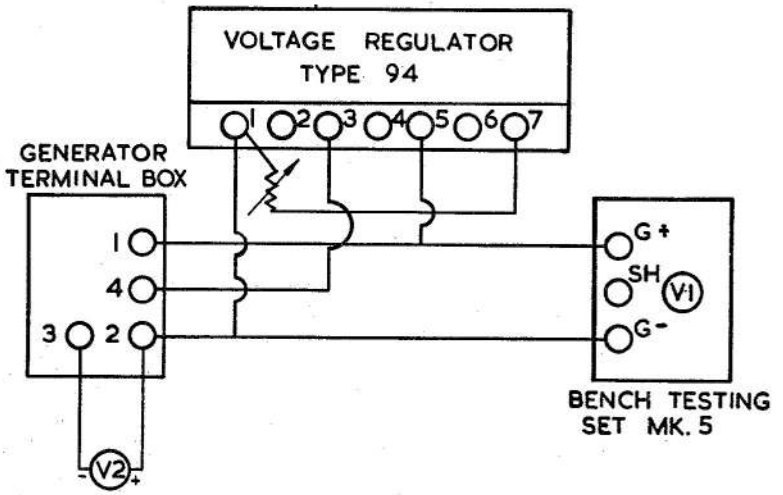


Fig. 6. Test circuit diagram