

Obsolete

# Chapter 14 GENERATOR, TYPE 507

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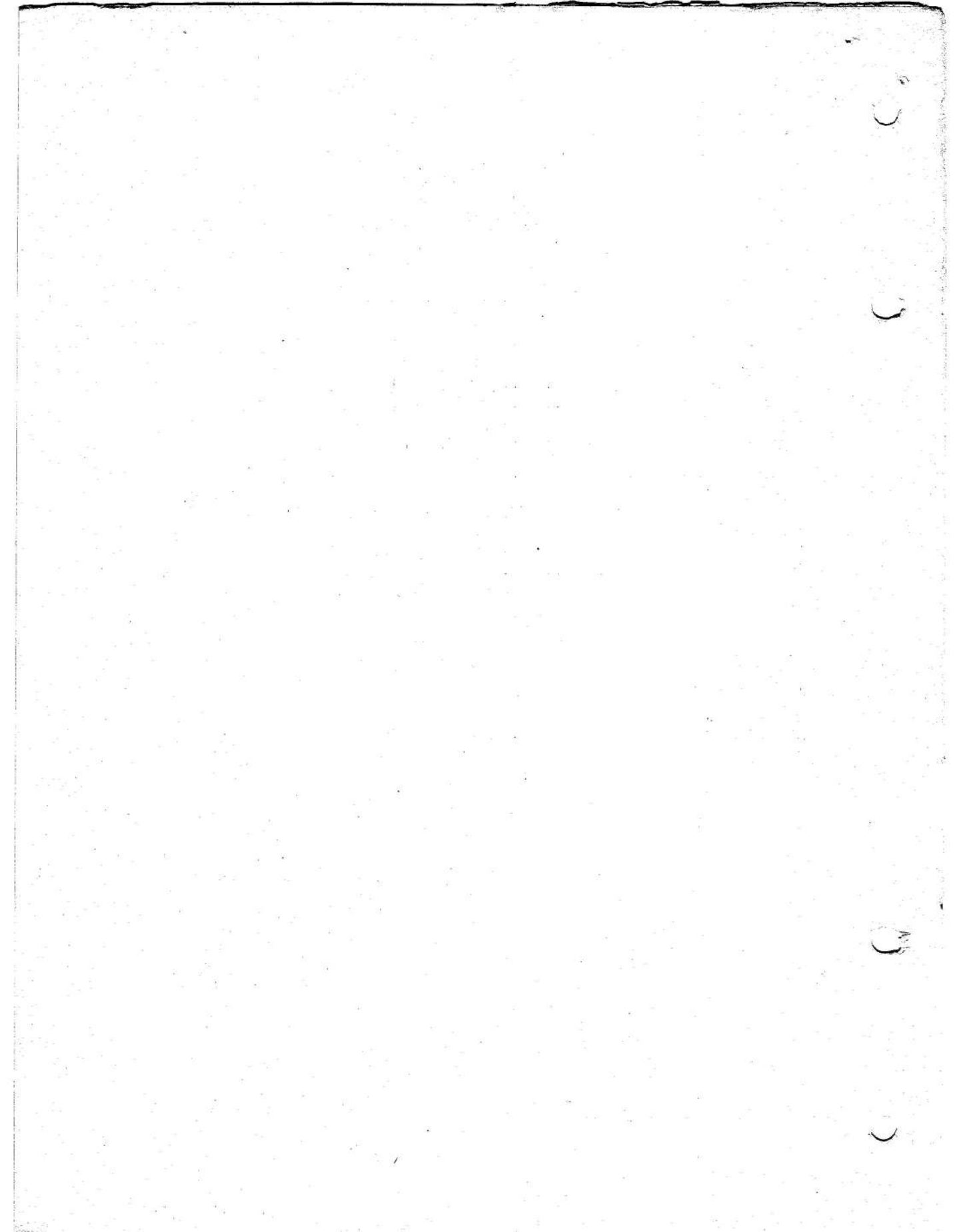
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## LEADING PARTICULARS

Generator, Type 507 ... ..	Stores Ref. 5UA/5838
Rotation ... ..	Clockwise (from drive end)
Generator, Type 507 ... ..	Stores Ref. 5UA/6004
Rotation ... ..	Anti-clockwise (from drive end)
Rated output ... ..	6 kW
Rated voltage ... ..	30 volts d.c.
Speed range ... ..	4,000-10,000 r.p.m.
Voltage regulator Type 94 ... ..	Stores Ref. 5UC/5937
Regulated voltage ... ..	28 volts ( $\pm 2.5$ per cent)
Direction of rotation Looking at driving end ... ..	Clockwise
Weight ... ..	59 lb.
Brushes	
Grade ... ..	KC EGI1
Minimum length ... ..	0.59 in.
Spring pressure ... ..	1 lb. 12 oz. ( $\pm 1$ oz.)



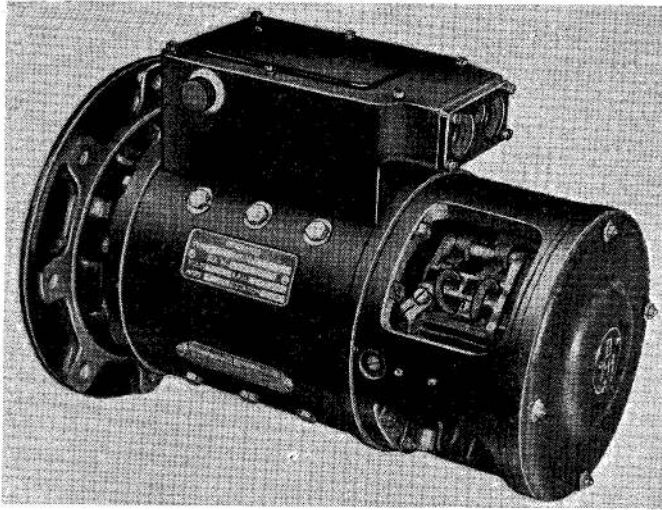


Fig. 1. Generator, Type 507

**Introduction**

1. The generator, Type 507, is driven through gearing from 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 wide range of engine speeds.

**DESCRIPTION****General**

2. The generator (fig. 1) is a four-pole, shunt-wound machine, embodying interpoles and compensating windings. The machine is of normal construction, consisting essentially of a yoke, armature, and two end castings.

3. The machine is blast cooled by air from the slipstream of the aircraft. The air enters the body of the machine through the brush inspection windows, passes through the yoke, and leaves through ports in the driving end casting. The inlet and outlet air pipes are attached to cover bands encircling the commutator end and driving end castings respectively. The exact arrangement of the air pipes and connecting unions differs with the various aircraft installations, and these items are therefore omitted from fig. 1.

**Armature**

4. The armature lies within the yoke and is supported in bearings housed in the end castings, the latter being attached to the yoke by studs. The serrated end of the armature shaft protrudes through the driving end casting to connect to the engine gearbox.

5. The armature stampings and the commutator are mounted on the hollow centre portion of the shaft, the ends of which are machined to take the bearings. Eight holes are drilled axially through the armature stampings in order to reduce weight and to provide a path for cooling air. The stainless steel binding wire, and all commutator connections are secured by brazing.

6. The commutator clamping ring, and the winding support at the driving end, are provided with flanges which serve as balancing rings. When dynamically balancing the armature, holes are drilled radially in

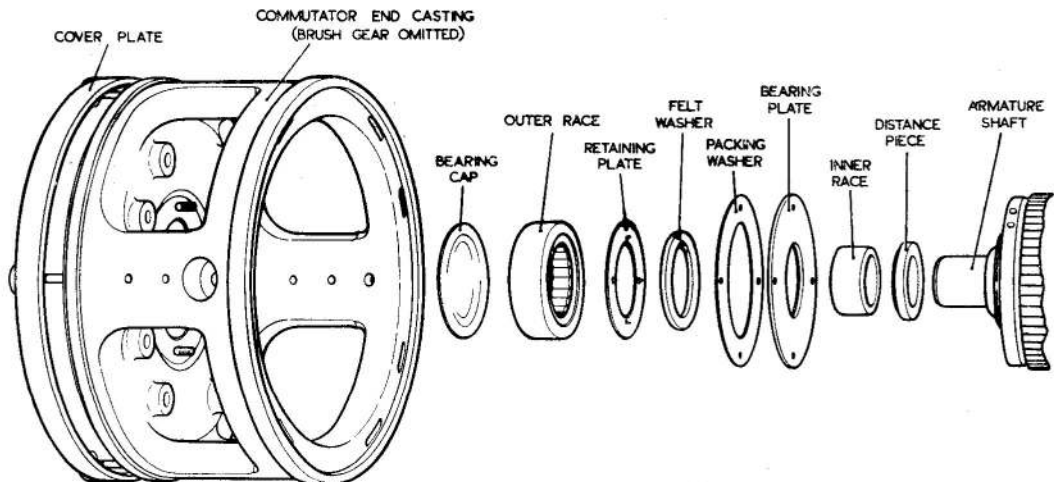


Fig. 2. Commutator end bearing assembly

these rings at suitable points, until an accurate balance is obtained.

#### Commutator end casting

7. This end casting, encasing the commutator, contains the brush gear and houses a roller bearing which supports one end of the armature. An exploded view of the components comprising the bearing assembly is shown in fig. 2.

#### ◀Note . . .

All generators should now be fitted with the "preferred" high speed roller bearing. This has ten rollers whereas earlier bearings had eleven. The part number is RLSEV or RLSEV3 (Stores Ref. 5UA/6219).▶

8. The outer race of the bearing is a push fit within a lined recess in the end face of the casting, and is held in position by a bearing plate bolted to the end face. The outer side of the bearing is protected by a bearing cap which is retained in position by the bearing itself.

9. The inner race of the bearing is an interference fit on the armature shaft, and is spaced from a step in the shaft by a circular distance piece. The shaft and inner race may be withdrawn without removing the bearing plate.

10. Escape of the bearing lubricant is prevented by a felt washer located around the distance piece and behind the bearing plate. A retaining plate, interposed between the outer race and the washer, prevents the latter fouling the rollers.

11. The brush gear consists of four brush boxes, each containing a pair of brushes, arranged at right-angles around the periphery of the commutator. Each box is attached to the end face of the casting by two 2 B.A. bolts encased in insulating bushes. Access to the bolt heads is obtained by removing the cover plate on the end face of the casting.

12. Each brush box is fitted with two coiled brush springs, mounted on a common retaining pin. This pin has a hexagon head seated within a recess in the box casting. The sides of the recess and the head of the pin are drilled to take a split pin. The brush box is also provided with a lug for terminal connection.

#### Driving end casting

13. This casting is provided with a flange drilled with eight holes to accept bolts for attaching the generator to the engine gearbox. The casting houses an enclosed ball bearing which supports the driving end of the armature shaft. The bearing is held between a bearing plate and an oil seal housing. This housing is secured by eight studs, of which four are inserted in the end casting and four pass through the casting to secure the bearing plate. The housing is on the outside of the casting, and locates an oil seal around the shaft, by which means oil from the engine gearbox is prevented from entering the bearing and diluting the grease.

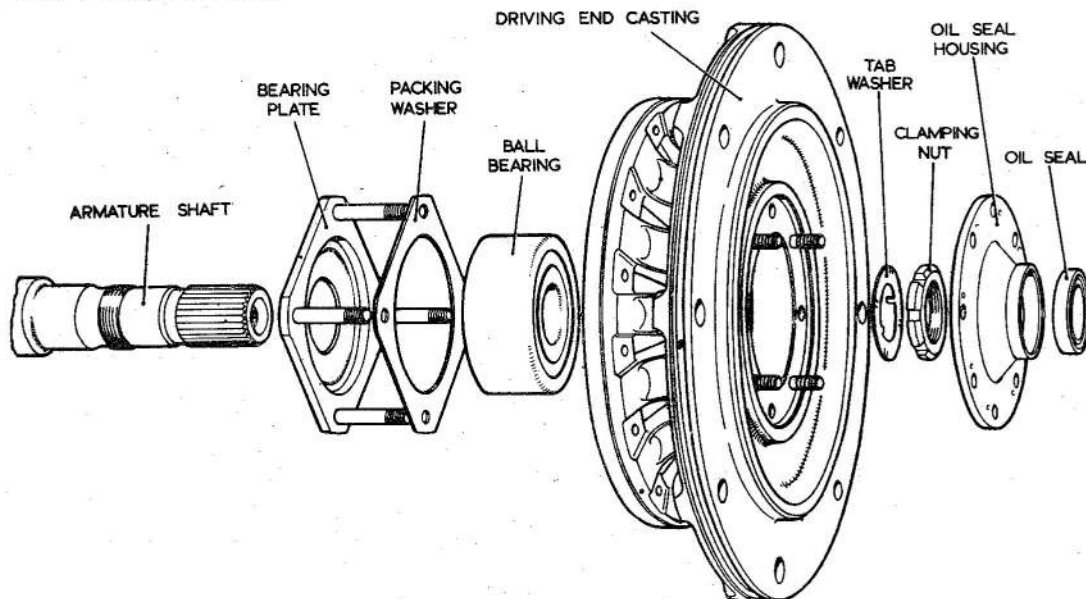


Fig. 3. Driving end bearing assembly

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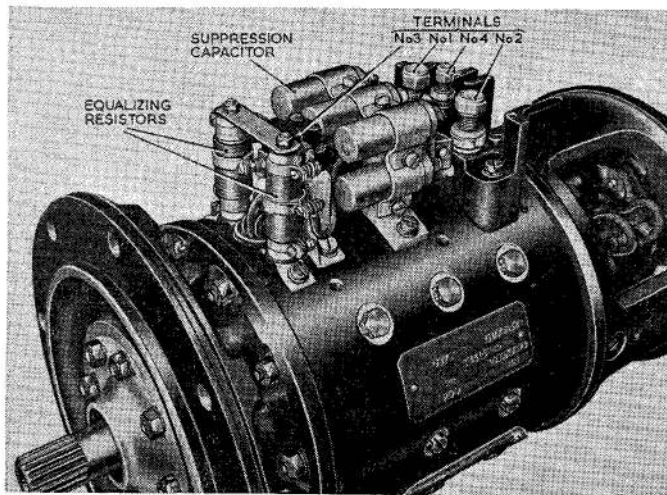


Fig. 4. Terminal connections

14. An exploded view of the components comprising the bearing assembly is shown in fig. 3. Within the oil seal housing, the bearing is held against a step in the shaft by a castellated clamping nut, a portion of the shaft being threaded for this purpose. The clamping nut is locked by a tab-washer.

#### Yoke

15. The cylindrical yoke houses the main pole and interpole pieces, and has the terminal box mounted on its circumference. The two end castings are also mounted on the yoke by means of studs which are an interference fit in its end faces. The pole pieces are secured by  $\frac{1}{4}$  in. B.S.F. hex/hd. screws, their heads being partially let into the outer surface of the yoke.

#### Terminal box

16. The terminal box casting is provided with six feet, by means of which the box is screwed to the yoke. The cable entry is at the commutator end, where three holes are drilled to take the output and field leads. The entry is sealed by a cable washer, secured by a clamping plate which is attached to the box by four screws. An additional cable entry is provided by a union mounted on each side of the box. These unions are sealed by rubber stops and

protecting caps when not used. Access to the terminal box is gained by removing a top cover plate, secured by six screws.

17. The contents of the terminal box are mounted on the yoke of the machine. The moulding supporting the main output terminals and the field terminal is at the commutator end of the box. Two wire-wound resistor bobbins are mounted vertically on a bracket at the driving end of the box. These resistors are provided with adjustable strap connections, pre-set and sealed with paint. A moulding which supports terminal No. 3 is located in line with the cable entry ports in the sides of the box. In the centre of

the box are five interference suppression capacitors, secured to a bracket by a spring clamp.

#### CONNECTIONS

##### Terminal connections

18. The terminal arrangement is shown in fig. 4. Terminals No. 1 and No. 2 are the positive and negative generator output terminals respectively, and No. 4 is the positive field terminal. The equalizing connector to terminal No. 3 (*para. 29*) passes through whichever is the more convenient of the two ports in the sides of the terminal box.

19. The capacitors are connected between the terminals and the frame, two in parallel being connected to each output terminal, and one to the field terminal.

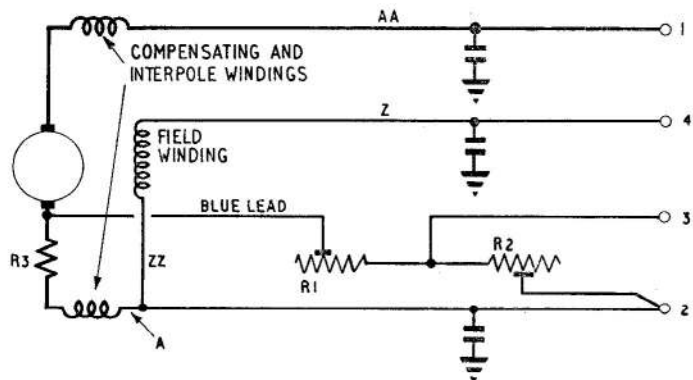


Fig. 5. Generator circuit diagram

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(A.L. 27, Jan. 55)

### Internal connections

20. The circuit diagram of the generator is shown in fig. 5. The resistors R1 and R2 are the bobbins housed in the terminal box, R1 being wound with the thicker gauge wire.

21. There are two resistors R3 (one per pole pair) housed within the commutator end casting. They are of strip form and have resistances of approximately 0.01 ohm, the two resistors for a particular generator being a matched pair differing from each other by not more than 5 per cent. Each resistor is sandwiched between insulators and is attached to the side of the casting by two 4 B.A. hex/hd. screws. One end of the resistor is provided with a bracket for connection to the adjacent negative brush box, whilst the other end terminates in a drilled terminal block.

22. The terminal tag on each of the two negative leads connecting to the interpole windings is drilled and tapped, and is secured to the resistor terminal block by a screw set in the side of the casting. The screw is fully countersunk, and is surrounded by an insulating bush, whilst the head of the screw is protected by a rubber cap. The positive leads to the other two interpoles are secured by screws to lugs on the positive brush boxes.

23. The fifth connection to the brush boxes is the "blue" lead in the diagram, which may be identified on the machine by the blue sleeving at either end. This lead is attached by a screw to the lug on that negative brush box which is nearest to the terminal box.

24. Each pair of positive and negative brush boxes is inter-connected by a taped strap connector attached to the brush box mounting bolts. These straps are located on the end face of the casting, beneath the cover plate.

25. All leads from the windings enter the terminal box through a bushed hole in the yoke. The lettered sleeves on these leads indicate the internal connections to the generator terminals: AA to No. 1, Z to No. 4, A and ZZ to No. 2. The "blue" lead is connected to the strap on the bobbin wound with the thicker gauge wire.

### INSTALLATION

26. Before installing the generator, ensure that the direction of rotation is suitable for the engine gearbox. Remove the protecting ferrule on the serrated shaft and examine the serrations for damage. Ensure that an oil seal is fitted to the generator.

27. Mount the generator on the engine gearbox and secure the bolts. Connect the cables to the terminals and secure the

terminal box cover. Attach the air pipes. Reference should be made to A.P.4343, Vol. 1, Sect. 2, Chap. 1 for information on the care of, and anti-corrosive treatment for these pipes.

### OPERATION

28. The generator will normally form part of an aircraft supply system, comprising two or more generators, each driven by a separate engine, and feeding a common bus-bar. The power system incorporates voltage regulating circuits, each generator working in conjunction with a Type 94 voltage regulator. By this means, the generator output voltage is maintained at a value of 28 volts ( $\pm 2.5$  per cent) at all loads up to its rated maximum, and over a speed range of 4,000—10,000 r.p.m.

29. 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. Full details of the system may be obtained from the relevant Aircraft Handbook, and from A.P. 4343, Vol. 1, Sect. 2, Chap. 5.

### SERVICING

#### General

30. 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 with that chapter and with the relevant Servicing Schedule.

#### Note . . .

*Particular reference should be made to A.P.4343, Vol. 1, Sect. 1, Chap. 1 in relation to the servicing of the commutator.*

31. If the machine is to be run on the test bench, either for brush bedding purposes or for testing, the oil seal must first be removed, since under these conditions the seal is not adequately lubricated. Under normal conditions the seal is in contact with the oil in the engine gearbox. To remove the seal, proceed as follows:—

- (1) Cover the serrations on the armature shaft with tape, transparent, waterproof, colourless, adhesive (Stores Ref. 32B/997). The tape should be wound on commencing at the extremity of the shaft. The layer of tape prevents the seal being damaged when drawn over the serrations.
- (2) Remove the eight  $\frac{1}{4}$  in. B.S.F. nuts securing the oil seal housing and ease off the housing and seal.

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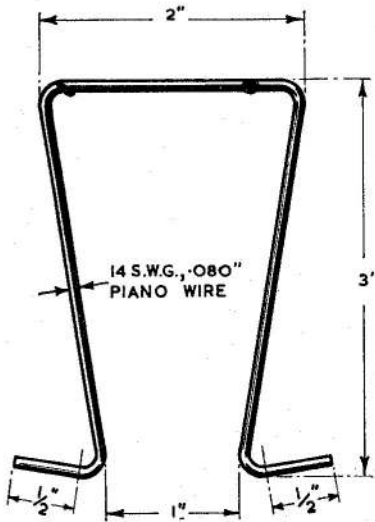


Fig. 6a LIFTING TOOL

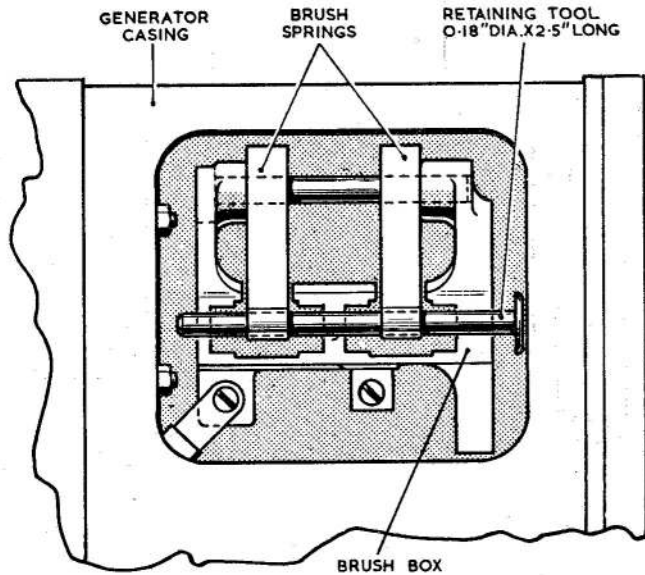


Fig. 6b METHOD OF RETAINING SPRINGS

Fig. 6. Brush spring retaining and lifting tools

- (3) Remove the seal from its recess, and then replace the housing. Ensure that the housing is secured to the driving end casting before running the machine.

**Note . . .**

*Whenever an oil seal has been taken off a machine (even though the seal itself is not thought to be faulty) the seal must be discarded and a new one fitted. For fitting instructions reference must be made to the appropriate servicing schedule.*

- 32.** To examine the machine, the air inlet pipe should be disconnected and the commutator end cover band removed. The terminal box cover should also be taken off.
- 33.** 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 for damage or deterioration, and ensure that the connections are tight. When replacing the cover band, examine it for distortion and renew if necessary.

**◀Brushes**

- 34.** It has been found in the past that the commutator may be damaged by scoring if the brushes are removed and the springs allowed to spring back into their boxes. It is

therefore recommended that simple lifting and retaining tools as shown in fig. 6 be made up.

- 35.** Place the  $\frac{1}{2}$  in. tongues of the lifting tool (fig. 6a) under the springs, lift them clear and withdraw the brushes. Still holding the springs clear of the boxes push the retaining tool under them (fig. 6b) and remove the lifting tool. To replace the brushes the procedure is, of course, reversed. ▶

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

- 37.** Although the absolute minimum brush length is 0.59 in. when measured along the longest side, new brushes should be fitted if the rate of wear indicates that the minimum length may be reached before the next servicing examination. Ensure that a brush is an easy sliding fit in its box.

**Bedding**

- 38.** When new brushes are fitted, they must be bedded on the commutator over their full thickness and over at least 90 per cent of their axial width.

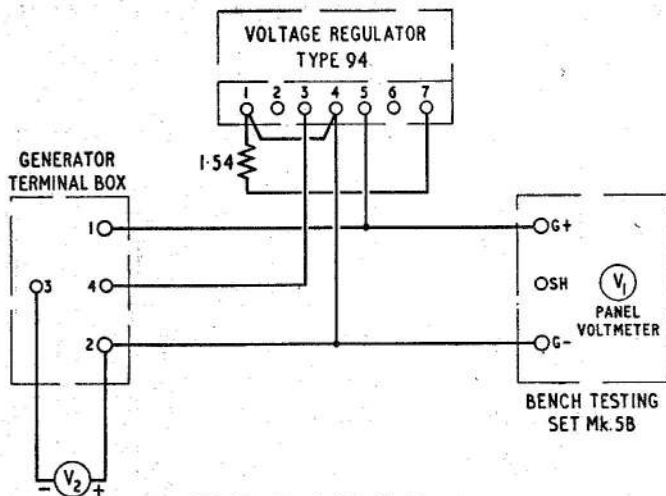


Fig. 7. Test circuit diagram

**Note . . .**

The information on bedding of brushes given in A.P.4343, Vol. 1, Sect. 2, Chap. 1, is not applicable to this generator.

**39.** The method of bedding the brushes is by running the generator, in the normal direction of rotation, for a *minimum period of 12 hours*, even though the brushes may have become fully bedded in less than this time. The purpose of the 12-hour bedding run is to ensure that an adequate film has been built up on the commutator surface. Having removed the oil seal, the machine should be run as a motor on the bench, with 28 volts d.c. applied to the armature and field terminals. The positive and negative supply leads must be connected to machine terminals No. 1 and No. 2 respectively. The positive supply lead must also be connected to the field terminal No. 4 through a 7-ohm resistor, this resistance being necessary to adjust the speed of the machine to the correct value for the bedding run.

**Spring pressure**

**40.** The pressure of each brush spring should be checked to ensure that it lies between 1 lb. 11 oz. and 1 lb. 13 oz. The measurement may conveniently be carried out if a small length of wire, hooked to engage in the loop on the brush spring where it bears on the brush, is attached to a suitable pull-type spring balance.

**41.** Should the pressures of a pair of springs in one brush box be incorrect, an adjustment may be made by rotating the spring retaining pin in the required direction. To do this,

the split pin should first be withdrawn, and the hexagon head of the retaining pin eased clear of the recess in the box casting.

**42.** Since the retaining pin mounts both springs, it is not possible to adjust each spring individually by this method. If only one spring is outside the limits, it will probably have to be renewed, unless an adjustment can be made by taking the faulty spring off the retaining pin completely, rotating the spring through 180 degrees in the required direction, and then replacing it on the pin.

**Bearing lubrication**

**43.** The driving end ball bearing is of the enclosed type, greased during manufacture, and requires no further lubrication during its life. The roller bearing at the commutator end is not enclosed and may be lubricated if called for in the relevant Servicing Schedule. The correct grade of lubricant for this bearing is grease XG-271 (Stores Ref. 34B/9100510).

**TESTS**

**General**

**44.** Before installing a new or reconditioned generator, it should undergo the tests described in the following paragraphs. Where necessary, the generator should be driven by the bench testing set Mk. 5B (Stores Ref. 5G/533). This testing set is described in A.P.4343S, Vol. 1, Sect. 13, Chap. 1. If an oil seal is fitted to the machine, it must be removed before commencing the tests.

**45.** The armature should first be revolved by hand, to ensure that it does not foul any leads or fixed parts of the machine. Rotation should be smooth, and the end play in the bearings should not be excessive. Slight radial play in the bearings, which can just be felt by hand, is permissible. The machine should also be observed for undue vibration during the following running tests.

**Minimum-load test**

**46.** A Type 94 voltage regulator, which has previously been tested for correct operation, should be used in conjunction with the generator for this test. Reference may be made to A.P.4343B, Vol. 1, Sect. 1, Chap. 31 for details of this regulator.

47. The test should be carried out with the generator mounted on the bench testing set and connected as shown in the test circuit diagram (fig. 7). An external trimmer resistor of 1.54 ohms is connected between terminals No. 1 and No. 7 of the voltage regulator. The voltmeter  $V_1$  on the d.c. panel of the testing set should be switched to the 0—40 volt range. This voltmeter will record the voltage across terminals G+ and G—, i.e., the regulated terminal voltage of the generator. A suitable millivoltmeter  $V_2$  is connected across terminals No. 2 and No. 3 of the generator, with its polarity as shown in the diagram. Before commencing the test, the fixed load resistor in the testing set should be switched out and the variable load rheostat adjusted to the minimum load position.

48. Run the generator in the correct direction of rotation (clockwise from driving end) at a speed of 4,000 r.p.m., and observe the readings of voltmeters  $V_1$  and  $V_2$ . If the polarity of the generator is correct, positive readings will be obtained as the voltage builds up.

49. The terminal voltage of the generator (voltmeter  $V_1$ ) should build up without hesitation to between 27.5 and 28.5 volts.

50. If positive readings are not obtained, check all connections and ensure that the direction of 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

51. 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 on the generator. Using the switch, make and break the circuit once only to magnetize the

poles. Repeat the test referred to in para. 46 to ensure that the machine has been correctly magnetized.

#### Full-load test

52. For this test, the voltage regulator is replaced by a resistance of 1.05 ohms, connected between generator terminals No. 1 and No. 4, and millivoltmeter  $V_2$  disconnected. This value of resistance corresponds to the minimum value of regulator resistance. Starting with the machine at *room temperature*, and taking readings on the testing set meters, run the generator for a period of 2.5 min. at the full load output of 200 amp., maintaining this output constant by adjusting the generator speed. At the end of the period, ensure that the speed does not exceed 4,000 r.p.m. Also check that there is no more than pin-point sparking at the brushes.

#### Warning . . .

*The generator is deprived of its normal flow of cooling air when run on the test bench. It is important, therefore, to ensure that the 2.5 min. running period is not exceeded. Otherwise over-heating will occur with possible damage to the machine.*

#### Insulation resistance

53. With the machine hot from the full-load test, measure the insulation resistance between the generator terminals and the frame, using the standard 250-volt insulation resistance tester (Stores Ref. 5G/152). The reading obtained should not be less than 0.05 megohm. ▶

54. If the insulation resistance proves to be below the limit, the interference suppression capacitors should be disconnected and checked for breakdown. Should it be found necessary to renew a capacitor, care must be taken to avoid breaking the spring clamp. Loosen the six securing screws uniformly to remove the clamp, and when replacing it tighten the screws successively by half-turns.

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