See AP 1135-0117-16

Chapter 11

GENERATORS, ROTAX, BA1500 SERIES

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RESTRICTED

Introduction

1. Generators in the BA1500 series have been designed to provide a power output of 66 kVA at 208-volts a.c. The excitation is from a regulated 28-volt d.c. supply. In one particular application, two of these generators are driven in tandem from a common gearbox, the latter forming part of the engine installation. The generator shaft is therefore suitably splined to provide a particular alignment with the gearbox. In addition, the stator is suitably dowelled into the casting. This arrangement ensures that phase "A" on one machine reaches peak voltage as phase "A" of the second machine peaks, with a resultant synchronized phase rotation.

4. The end housing assembly accommodates the rotor ballrace and supports the mounting plate to which is fitted the brushgear assembly, in which it should be noted, the brushes are offset at an angle in the direction of rotor rotation (i.e. reaction brushgear). The end housing assembly also provides an inlet for the blast air.

Operation

5. The generator rotates in a clockwise direction. To give excitation to the four-pole rotor, regulated 28-volt d.c. is supplied via the six carbon brushes and the two slip rings, positive (+) input being connected to terminal (X), and negative (−) to terminal (X1), (*fig.* 2). Terminals A, B and C, which

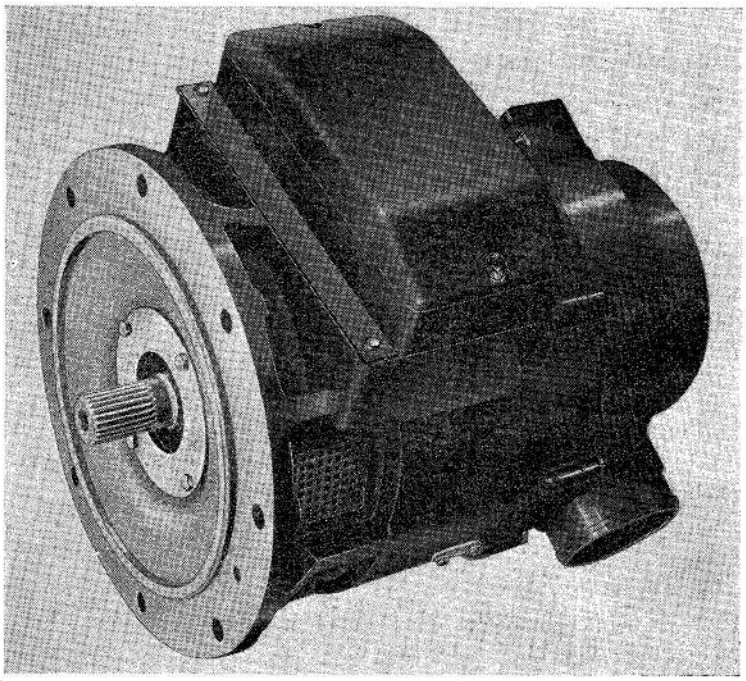

Fig. 1. Type 159 generator

DESCRIPTION

2. Essentially, the generator comprises four principal assemblies, viz, main housing, end housing, rotor and stator.

3. The main housing assembly accommodates the 3-phase stator assembly and provides a housing for the roller bearing which supports the rotor assembly at the drive end of the machine. The output terminal block is fitted to an integral extension of the main housing.

are connected to the 3-phase stator, carry the normal output, terminal (N) being neutral. A current transformer, comprising three cored toroidally wound coils is fitted around the terminals at the star-point and forms part of the Merz-Price protection system.

INSTALLATION

6. The mounting flange (*fig.* 1) is an integral part of the main housing and

embodies eight equally spaced 0·468 in. $^{+0\cdot010}_{-0\cdot002}$ in. dia. fixing holes to accommodate the necessary fixing bolts for securing the generator to the engine gearbox.

Electrical connections

7. External electrical connections are made to two independent terminal blocks. The terminal block for the two input terminals is positioned directly below and adjacent to the brushgear assembly. The terminal block for the seven output terminals is positioned at the opposite end of the machine. Both terminal blocks are fitted with a cover that can be readily removed for the purpose of connecting leads and inspecting connections.

Lubrication

8. On assembly of the generator, the roller and ball bearings are packed with grease; this will only require to be renewed during re-assembly after repair.

SERVICING

9. Make a general inspection of the generator to ensure that it is secure on its mounting and that no damage has been sustained. Inspect electrical connections to ensure that they are clean and secure; ensure that the air inlet connection is secure and that the air exit gauzes are free from obstruction.

10. Ascertain, by shining a lamp into the air outlet gauzes and by examining the brushgear, whether there are any signs of oil having found its way into the machine. If oil is present, it indicates that the oil seal has broken down and the generator should be withdrawn as unserviceable.

Brushgear

11. Remove the brushgear cover and examine the brushes for condition and wear; cracking and chipping renders a brush unserviceable. Measure the length of the brushes at the centre of the contact arc. The minimum permissible brush length is 0·400 in. and any brush which has worn so close to this minimum that it is considered unlikely to give a satisfactory performance until the next servicing should be regarded as unserviceable.

12. Ensure that the brushes are free but not slack in their boxes. If they are tight as a result of carbon deposits having formed in the boxes, these deposits should be removed. Measure the brush spring pressure, using a spring balance (*Ref. No.* 1*H*/97). The pressure at the tip of each brush trigger as it is lifted from the brush should be 22 to 26 oz. Examine the slip-rings for burns, scores, and carbon deposits. If necessary they should be cleaned with a soft rag soaked in lead-free gasoline. On completion of these inspections replace and secure the brushgear cover.

Testing

13. If the serviceability of the machine is suspect, it may be tested as laid down in Appendix A.

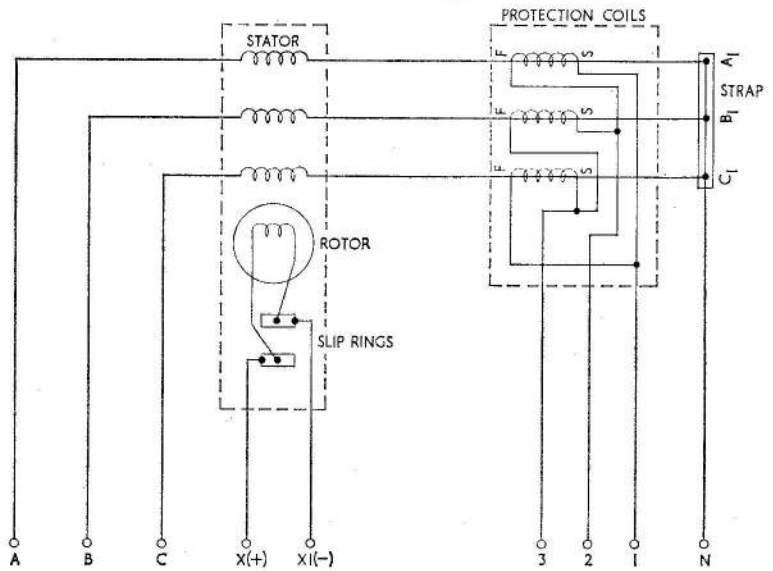

Fig. 2. Diagram of internal connections

Appendix A

STANDARD SERVICEABILITY TEST FOR GENERATORS, ROTAX, BA 1500 SERIES

Introduction

1. The following tests may be applied to the machine before it is put into Service, or at any time when its serviceability is suspect.

Test equipment

2. The following test equipment is required:—

(1) Tester, generator—one in the Mk. 5 series.

(2) Balance, spring, 0-4 lb. (Ref. No. 1H/97).

(3) Insulation resistance tester, Type 0557/A.P.5047 (250-volt).

(4) Insulation resistance tester, Type A (Ref. No. 5G/1621) (500-volt).

The generator should be driven in a clockwise direction. Blast air should be applied to the air inlet at a pressure of 20 lb/min. at an estimated pressure head of 5 in. water gauge at ground level, and a 28-volt d.c. supply connected to the rotor through a suitable regulating resistor. Care should be taken to avoid breaking the rotor circuit when the excitation exceeds 5 amp.

Note . . .

If the oil seal is in position during testing, care should be taken to ensure that it is adequately lubricated with the appropriate grade of engine oil.

Testing

3. Before mounting the generator on the test set, check for freedom of rotating parts by turning the rotor by hand without using a coupling. There should be no excessive end play in the bearings; a slight radial play which can just be felt by hand is permissible.

Brushgear

4. Check the brush length and brush spring pressure. The brush length should be not less than 0·4 in., and the spring pressure should lie between 22 and 26 oz.

Phase sequence

5. When mounted and connected as in para. 2, the a.c. output phase sequence should be A, B, C relative to the terminal markings.

Open-circuit test

6. With the machine driven at 7,500 r.p.m. and the output open-circuited, set the line voltages to an average value of 208 volts by adjustment to the rotor current, which should be as follows:—

Type	*Rotor current (amp.)*
159 (Rotax BA1501)	26 to 29
BA1502	43 to 47

Short-circuit test

7. Connect the a.c. output terminals A, B and C to the primary windings of three current transformers, and short-circuit the other end of the primary windings to form a star point, using short lengths of heavy cable throughout. Connect the a.c. output terminals 1, 2 and 3 of the protection unit to the terminal of three O-1A ammeters, and short-circuit the other terminals of the ammeters to form a star point, using short lengths of 10 amp. cable throughout.

8. With the generator driven at 7,500 r.p.m. and the rotor current increased until the average line current is 183 amp., the rotor current should be as follows:—

Type	*Rotor current (amp.)*
159 (Rotax BA1501)	55·5 to 58·5
BA1502	48 to 51

The average line current from the protection coils should be between 0·650 and 0·700 amp.

Protection coil test

9. Measure the resistance between all three lines (numbered 1, 2 and 3 on the terminal block). In each instance the value should lie between 1·235 and 1·480 ohms.

Insulation resistance test

10. The insulation resistance, when measured with the machine still warm between the following points using a 250- or 500-volt insulation resistance tester as indicated, should be not less than 0·05 megohm.

(1) With a 250-volt tester
Between terminal X and frame.

(2) With a 500-volt tester
Between stator windings and frame.
Between star point and terminal 1, 2, or 3.

Appendix 1

GENERATOR, TYPE 159 (ROTAX BA1501)

LEADING PARTICULARS

Generator, Type 159	*Ref. No.* 5*UA*/6434
Output—	
Voltage	208*V a.c.*
Phase	3
Power factor	0·9
At 250 *c/s and* 7,500 *r.p.m.*	20 *kVA*
At 400 *c/s and* 12,000 *r.p.m.*	66 *kVA*
Excitation voltage	28*V d.c.*
Rating	*Continuous*
Cooling—	
Blast air	20 *lb/min.*
Estimated pressure head	6 *in. W.G. (ground level)*
Maximum altitude	25,000 *ft.*
Temperature range	−40 *deg. C to* +50 *deg. C*
Rotation (viewed from drive end)	*Clockwise*
Brush grade	*H*.100
Brush length (new)	0·875 *in.*
Brush length (minimum permissible)	0·400 *in.*
Brush spring pressure	22–26 *oz.*
Weight	83 *lb.*

1. The generator, Type 159 (Rotax BA1501) is identical to that described and illustrated in the main chapter.

Appendix 2

GENERATOR, ROTAX, TYPE BA1502

LEADING PARTICULARS

Generator, Type BA1502	*Ref. No. 5UA/8048*
Output	
Voltage	208*V a.c.*
Phase	3
Power factor	0·9
At 250 c/s and 7,500 r.p.m.	20 *kVA*
At 400 c/s and 12,000 r.p.m.	66 *kVA*
Excitation voltage	28*V d.c.*
Rating	*Continuous*
Cooling—	
Blast air	20 *lb/min.*
Estimated pressure head	6 *in. W.G. (ground level)*
Maximum altitude	25,000 *ft.*
Temperature range	−40 *deg. C* to +50 *deg. C*
Rotation (viewed from drive end)	*Clockwise*
Brush grade	*H*.100
Brush length (new)	0·875 *in.*
Brush length (minimum permissible)	0·400 *in.*
Brush spring pressure	22–26 *oz.*
Weight	81·25 *lb.*

1. The BA1502 machine is mechanically identical with the Type BA1501 generator. It differs electrically, however, in that the BA1502 has a fully chorded symmetrical wave wound stator.

2. This has been introduced to improve the output characteristics by providing a purer sinusoidal wave form to eliminate the extraneous harmonic content affecting suppression on associated equipment.

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Printed for H M Stationery Office by Chorley & Pickersgill Ltd Leeds
P32388/281846/471 2500 7/63 Gp 375