Chapter 28

ROTARY INVERTER, B.T.H. TYPE D.A.1, FORM B4/3

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Rotary inverter, B.T.H. Type D.A.1, Form B4/3

Ref. No. 5UB/6728

Input	
Voltage (nominal)	24-*volt d.c.*
Current	6 *to* 7 *amp. (approx.)*
◄ *Output*	
Voltage	115-*volt. single-phase* a.c. ►
Apparent power	33-*volt/amp*
Power factor	0·8
Frequency	400 *c.p.s.*
Speed	12,000 *r.p.m.*
Rating	15 *minute*
a.c. winding	*Single-phase*
Brush grades	
d.c. and a.c. end	*KBEG.*14
Brush spring pressures	
d.c. end	5 *oz.* ± 10 *per cent*
a.c. end	1·25 *oz. to* 1·75 *oz.*
Weight of inverter	5 *lb.*

Introduction

1. The Type D.A.1, Form B4/2 rotary inverter has been designed to provide 115-volt. single-phase, a.c. supply at 400 cycles per second, with a power output of 0·8 lag, when driven from the nominal 28-volt d.c. aircraft supply; the nominal voltage at the inverter input terminals being 24-volt. d.c.

2. The output voltage is controlled within the limits of 115-volt $\pm 2\frac{1}{2}$ per cent, and the output frequency is 400 cycles per second, corresponding to a machine speed of 12,000 r.p.m.

3. The inverter is ventilated, and flame-proof, being self-cooled by a built-in fan. The machine is suitable for operation in any part of the world, including the tropics, and is intended to be installed in the pressurized part of the aircraft. If not installed in the pressurized part of the aircraft, the machine is suitable for operation at altitudes up to 20,000 feet.

DESCRIPTION

General

4. This motor-generator set, which is known as a rotary inverter, comprises a 4-pole compound-wound, stationary-field system. The armature slots carry both the input and output windings, the d.c. conductors being brought out to the commutator end of the armature, whilst the a.c. windings are connected to two collector, or slip rings, at the other end of the armature.

Yoke and field coil unit

5. The yoke is machined from drawn steel tube and carries four forged pole-pieces. A cast aluminium alloy mounting platform is secured to the yoke, and the terminal box

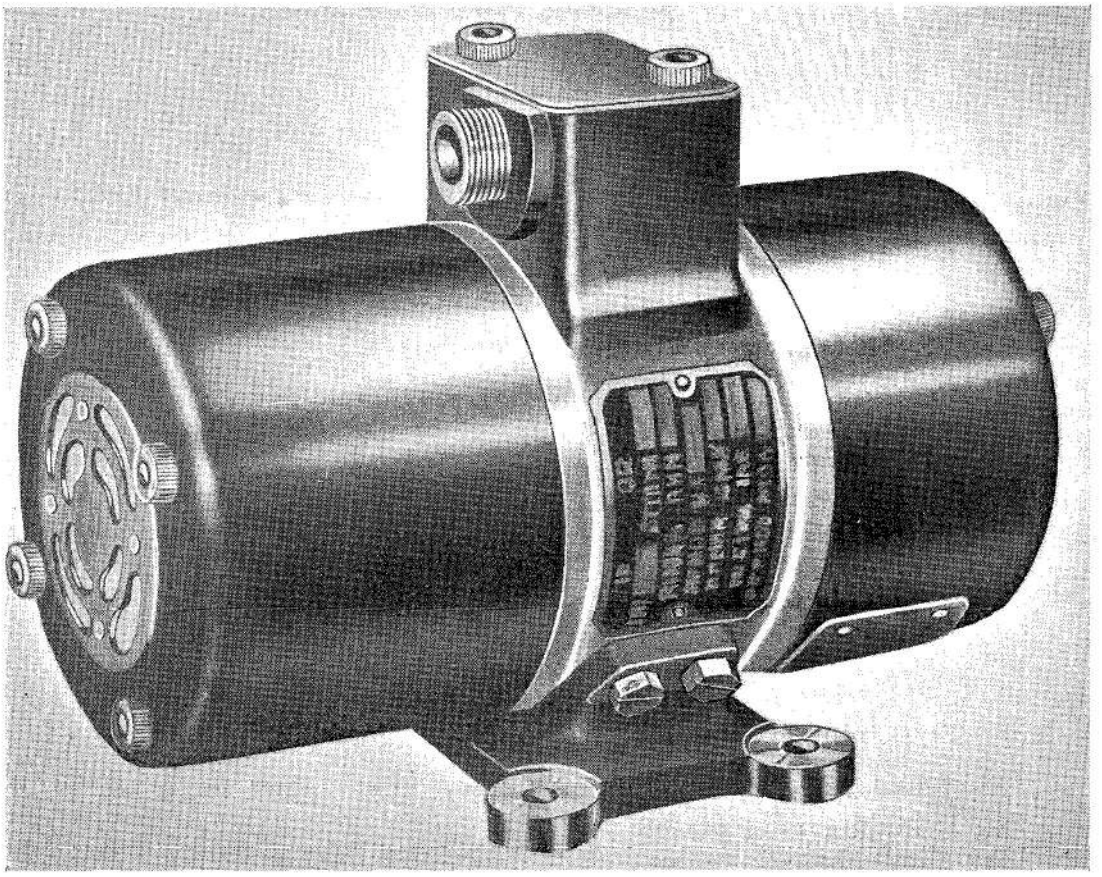

Fig. 1. General view of inverter

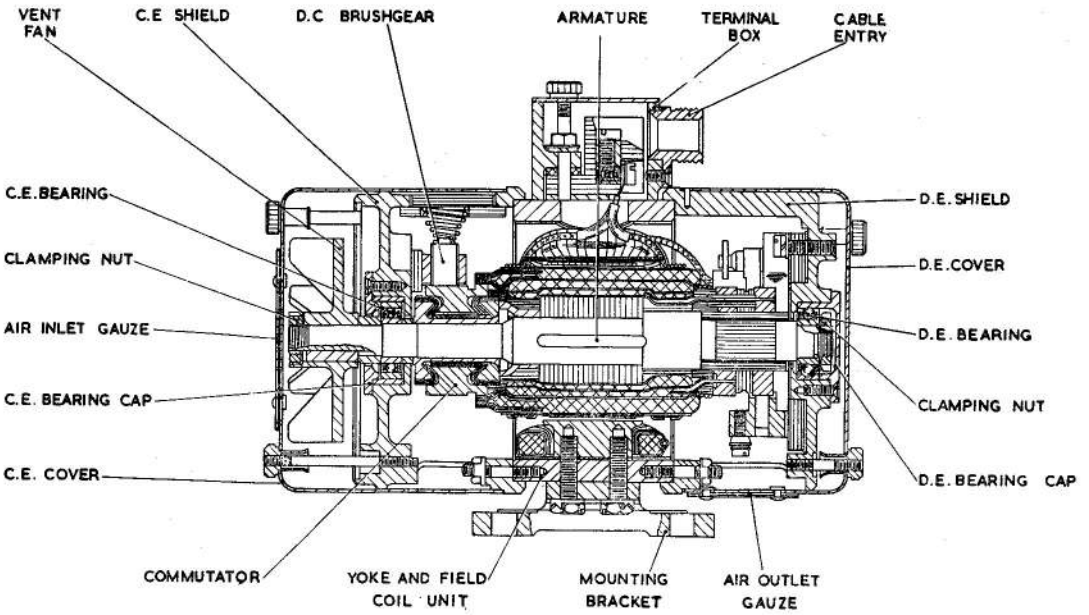

Fig. 2. Sectional view of inverter

is mounted on the opposite side of the yoke. Spigot locations are provided at each end of the yoke for accurate positioning of the castings carrying the d.c. and a.c. brush assemblies.

Armature

6. The armature has a laminated core, slightly skewed in relation to the shaft centre line. Both the d.c. and a.c. windings are wave-wound, and housed in the same slots. Slot wedges are used to hold the windings firmly against centrifugal force. Binding bands are also used to give additional strength. The armature is dynamically balanced to the required limit by the addition of solder to the binding bands.

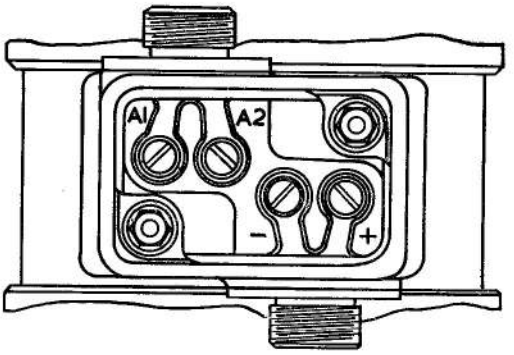

Fig. 3. Inverter terminal box with cover removed

7. The commutator which is a press-fit on the shaft, is of the riveted type. The two cupro-nickel, a.c. collector rings are mounted in an insulated assembly which is a press-fit on the shaft.

Brushgear assembly (d.c. end)

8. The two brush boxes are robust aluminium castings, designed to retain their shape under peak load conditions, and ensures accurate fit of the brushes at all times. The brushgear has ample mass to conduct heat away from the brushes, which are KBEG 14 grade.

9. The brushes are retained against the commutator by tapered spiral coil springs, which are compressed between the brushes and moulded insulation brush fixing bars located across windows in the main casting. This arrangement is self-locking, and permits easy withdrawal of a brush for inspection purposes. The brushgear is adequately insulated and is mounted in an aluminium alloy casting which embodies a bearing housing and liner for the armature bearing. A spigot is provided on the casting for engagement with the mating yoke spigot.

Brushgear assembly (a.c. end)

10. This assembly comprises an aluminium alloy casting embodying the armature bearing

housing, and having a spigot location for the moulded brush carrier, on which are mounted the four aluminium alloy brush boxes, so arranged that two brushes are located at right angles to each other on each collector ring, the brushes being KBEG 14 grade. The necessary brush pressure is provided by coil springs which are manufactured to close tolerances. Leads are taken from the pairs of brushes to the output terminals in the terminal box. For brush length and brush spring pressure see Leading Particulars.

Bearings

11. The armature is mounted on ball journal bearings of adequate size, and are partially packed with low temperature grease XG–275 (Stores Ref. 34B/9100512) during assembly.

Operation

12. No special operating instructions are necessary. When the external supply connections have been made through a suitable switching arrangement, and the supply switched on, the operation of the machine is automatic.

INSTALLATION

13. The inverter may be installed in the aircraft in either a horizontal or vertical plane. Whenever possible the inverter should be mounted with its shaft horizontal so that the ventilating gauzes in the end covers are less likely to be clogged by dirt falling on them. Adequate space should be allowed around the machine to permit the free circulation of cooling air. When installed in a pressurized compartment the inverter will operate up to any altitude, and should the pressurizing equipment fail, will continue to function satisfactorily for sufficient time to allow the aircraft to be brought down to lower altitudes.

SERVICING

General

14. General information on the servicing of inverters is given in A.P.4343, Vol. 1, Section 8.

Brushgear

15. The brushes should be checked periodically to ensure they are an easy fit in their boxes. To avoid the risk of machine failure during operational periods, the brushes must be changed when they reach a minimum length of 7·0 m.m. for the d.c. brushes, and of 9·0 m.m. in the case of the a.c. brushes. The lengths of the d.c. and a.c. brushes when new are 12·0 m.m. and 12·5 m.m. respectively.

Bearings

16. The bearings should not require attention between major overhaul periods, it is estimated that a renewal of bearings will be necessary at intervals of 500 operational hours.

Commutator and a.c. collector rings

17. Keep the commutator and a.c. collector rings free from oil and grease, and if necessary wipe them with a soft clean dry rag. Should they be uniformly blackened by sparking, clean them with very fine glasspaper. It must be emphasized that no attempt be made to remove more than the surface film by this method. If the commutator and slip rings are badly worn, or pitted, due to excessive sparking, or, if flats have developed on the brush track diameter, the machine must be replaced by a new reconditioned one. Any accumulations of brush dust may be removed with a jet of dry compressed air, or with a pair of bellows.

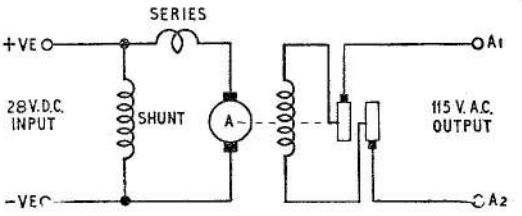

Fig. 4. Circuit diagram

Terminal-box assembly

18. Examine the casting for possible cracks, particularly around the tapped holes. The terminal moulding must be undamaged and its inserts secure. If any cracking or damage is apparent, change the terminal moulding.

Testing

19. The following testing procedure should be carried out after overhauling a Type DA1 inverter.

(1) Ensure that the C.E. casting is set to the inscribed location marks, or, if not marked, set the casting so that the studs are central in the slot, i.e. the brushes are set at the neutral position.

(2) Run the inverter light on 28-volt d.c. input to bed the brushes at both ends, over at least 80 per cent of their brush width, and 100 per cent of their brush arc.

(3) With the machine hot, run it for two minutes at 14,000 rev/min. by increasing the input voltage and check that there is no excessive noise or vibration.

(4) Run the machine for at least 30 minutes with a d.c. supply voltage of 24-volts and a load of 0·29 amperes, at 0·8 leading power factor and, with the machine still hot, ◄ and the imput volts reduced to 21V, ► check the input current, output voltage and speed, which should be as follows:—

Input Current	Output voltage	Speed
6·4 amp. max.	100± 5 per cent	12,000 rev/min ±10 per cent

Note . . .

The brushes may be advanced against the direction of rotation if necessary, in order to bring the machine performance within specified limits.

(5) After the load test, and with the machine hot, measure the insulation resistance between the d.c. and a.c. windings, and between each winding and the frame, using a 250-volt insulation resistance tester. The insulation resistance must not be less than 2 megohms.

(6) After the inverter has been installed in the aircraft, using the same insulation resistance tester as described in the previous paragraph; the insulation resistance must not be less than 50,000 ohms.

P31635 170235/5000 4/62 2000 C & P Gp 375