AP 113D-0104-16

ROTARY INVERTER TYPE 100A AND 100C

GENERAL AND TECHNICAL INFORMATION REPAIR AND RECONDITIONING INSTRUCTIONS

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence

Sponsored for use in the

ROYAL NAVY by DGA(N)

ROYAL AIR FORCE by D AIR Eng (RAF)

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Publications authority : ATP/MOD (PE)

Service users should send their comments through the channel prescribed for the purpose in:

Naval Aircraft Maintenance Manual (RN)

AP100B-01 Order 0504 (RAF)

AMENDMENT RECORD SHEET

To record the incorporation of an Amendment List in the publication, sign against the appropriate A.L. No. and insert the date of incorporation.

A.L.No.	AMENDED BY	DATE
1	INCORPORATED	
2		5/2/74
3		9 8 75
4	Jan Medical	23.6.76
5	DJ Robinson	20-5-80
6	J Robinson	23 9 80
7	Rees	3-4-87
8	Rees	15-2-90
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Chapter 1

ROTARY INVERTER, TYPE 100A

CONTENTS

ILLUSTRATIONS

LEADING PARTICULARS

Rotary inverter, Type 100A ... ... Ref. No. 5UB/4938

Inverter unit only -

Input ... ... 22·5-23·5V d.c.

Output ... ... 162W, 0·81 p.f., 115V, 3-phase, 400 Hz a.c.

Inverter with control panel, Type 12 -

(Matched pair for Naval air use) ... ... Ref. No. 5UB/6507

Input ... ... 25-28V d.c.

Output ... ... 150W, 0·8 p.f., 115V, 3-phase, 400 Hz a.c.

Phase sequence (at output socket of inverter) 1-2-3

D.C. brushes - 6SC 4288

Grade F2C (Part No. N125843) ... ... Ref. No. 5UB/5958

► Spring tension ... ...4·8-5·8 oz ◄

LEADING PARTICULARS (contd.)

A.C. brushes -	
Grade F2B	Ref. No. 5UB/5959
Spring tension	0.75-2 oz
Shunt field resistor (40 ohms)	Ref. No. 5UB/5920
or Type ZA4801/1	Ref. No. 5UB/6058
Rotation (viewed from commutator end)	Counter-clockwise
Weight	6 lb
Used with -	
Control panel, Type 12 (see AP113D-0721-16)	Ref. No. 5UC/4939

Modification state

The equipment described in this chapter incorporates relevant Service modifications up to an including Lucas Aerospace Mod. No. LG2044.

Introduction

1. The rotary inverter Type 100A (fig. 1) is a 4-pole, compound wound machine. With an input of 22.5 - 23.5V d.c., the inverter will give a nominal output of 115V, 400 Hz, three phase a.c., 200VA (0.81 power factor) at a speed of 12,000 rev/min. Inverters with modifications R7116 and R7167 embodied have slip-ring and commutator end frames manufactured from aluminium: pre-modification inverters are fitted with magnesium alloy end frames. Modification LG2044 introduces a capacitor (Dearborn type LP9A1E47EK or as an alternative Waycom type WIMA TROPYFOL M) to replace the now obsolete capacitor introduced by modification R7212.

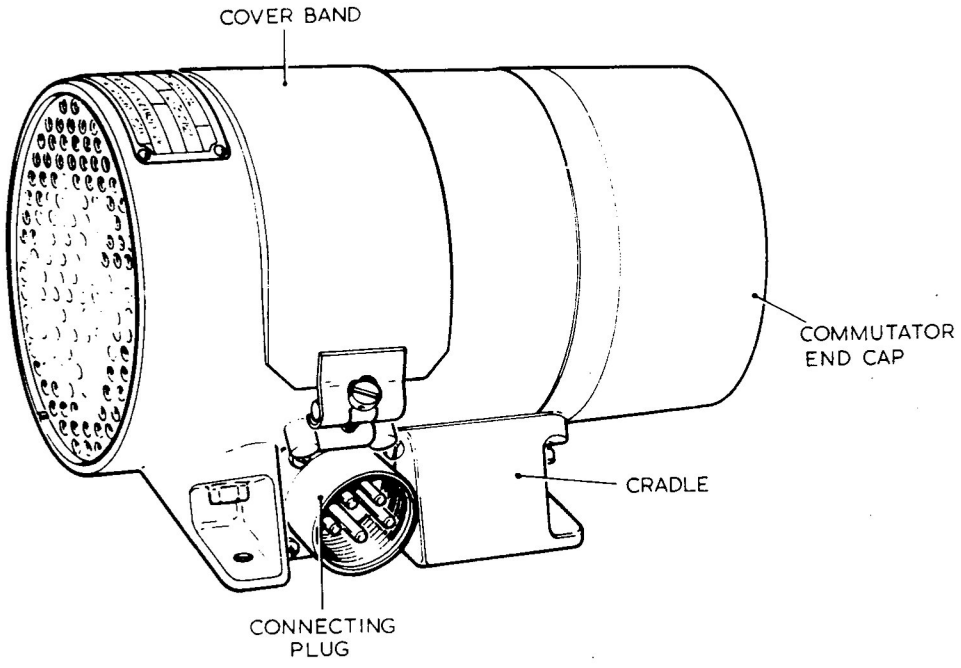


Fig. 1 Rotary inverter Type 100A

DESCRIPTION

2. The inverter unit is supported in a cradle which has four mounting holes, equally disposed to give four possible mounting positions of the inverter relative to the control panel (fig. 1). If preferable, the control panel may be mounted remote from the inverter unit.

Inverter unit

3. The armature shaft, carrying the commutator and slip ring assemblies (see fig. 2), is supported by two bearings, one housed in the commutator end frame and the other in the slip ring end frame. The bearings at both the commutator and slip ring ends are selected to give a clearance on the ► armature shaft and in the housings of 0·0001 to 0·0004 in for new inverters or 0·0001 to 0·0006 in for inverters that have been in use and serviced. ◄

4. The commutator end bearing cap is secured to the end frame by four cheese-head screws with spring washers, and is enclosed by the end cap, which is held to the end frame by two cheese-head screws with plain and spring washers. The end cap is perforated to assist ventilation.

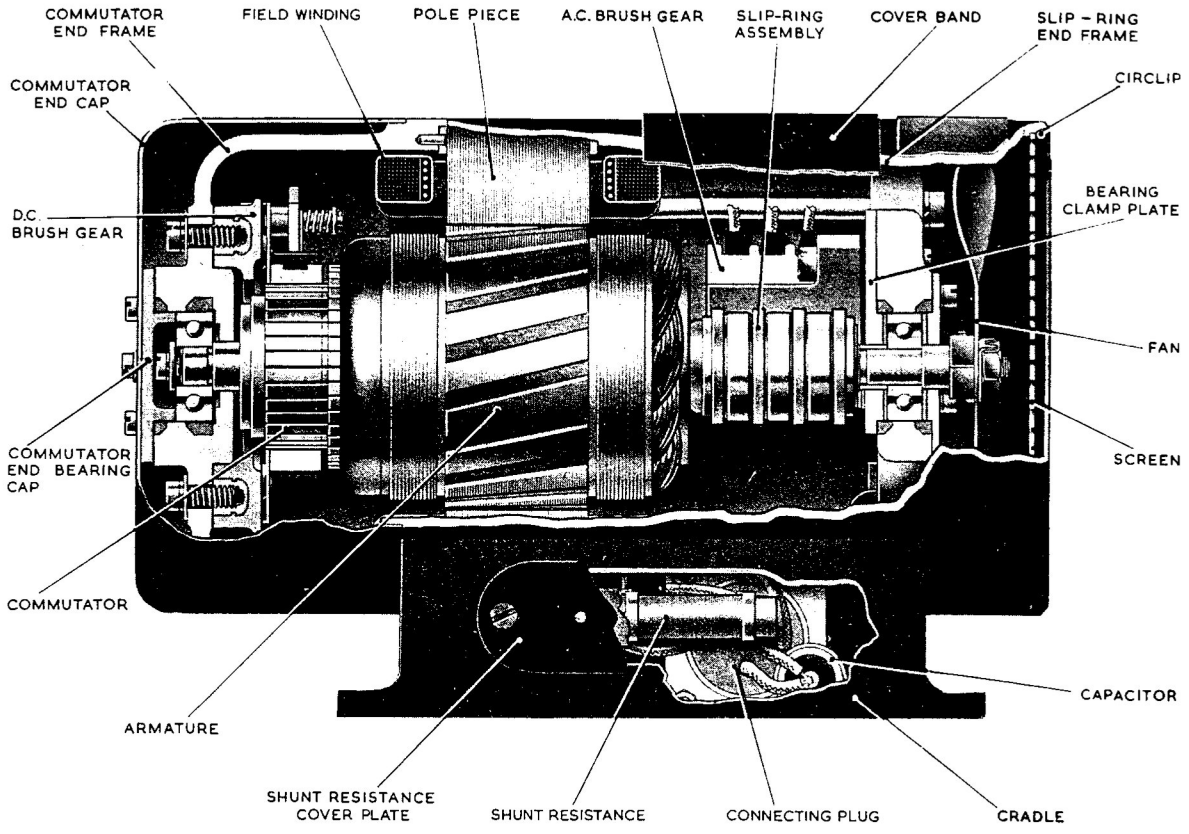


Fig. 2 Rotary inverter Type 100A (sectional view)

5. At the a.c. end, the bearing clamp plate is secured to the slip ring end frame by four cheese-head screws with plain and spring washers. The bearing cap is secured to the other side of the end frame by four cheese-head screws and washers, and a fan is fitted to the end of the armature and secured by hexagonal nut and lock washer. Since the bearing is located by the fan boss, no attempt should be made to run the machine without the fan fitted. A perforated screen is held in position by a circlip sprung into the end frame.

6. Cooling of the machine is effected by the fan at the slip ring end, circulation of air being assisted by the perforations at each end of the inverter unit and the four holes in the slip ring end frame. The extension of the frame, which forms the yoke is slotted to permit the passage of air. The base plate has a central perforated section to allow ventilation of the resistor and capacitor units mounted within the cradle.

7. The d.c. brush gear is secured to the commutator end frame by two cheese-head screws with plain and spring washers; the fixing screws pass through slotted holes in the end frame which allow for adjustment of the brush position. Brush pressure is maintained by springs which are coiled round the trigger posts and bear on the brush triggers. Access to the d.c. brush gear is gained through holes in the commutator end frame on removal of the end cap.

8. The four-pole pieces are mounted in the bore of the yoke which is integral with the slip ring end frame, and carry the field windings wound in compound coils. A circuit diagram is shown in fig. 4.

9. Both input and output windings are carried in common slots, the three-phase a.c. winding being that nearest the shaft, with the d.c. winding above it. At the output end, the conductors are brought out to the slip rings, phase-1 to ring one, phase-2 to ring two, and phase-3 to ring three, in that order; ring one being that nearest the armature. Two bands, each consisting of ten turns of wire are used to retain the conductors against centrifugal stresses.

10. Access to the slip ring assembly is gained by removing the cover band. Brush pressure is maintained by coil springs; the outer ends of the springs bear on small copper strips held in position by and forming electrical connection to the brush terminals.

Cradle

11. The cradle houses the connecting plug, capacitor and shunt field resistor as shown in fig. 3. The resistor is fitted with three copper tapping clips, each 0·028 in thick; access to the resistor is gained by removing the two cheese-head screws, with plain and spring washers which secure the cover plate on which it is mounted, or alternatively by removing the base plate when the capacitor can also be reached. A plug for connecting the inverter to the control panel, Type 12, is fitted to the cradle on the opposite side from the shunt resistor.

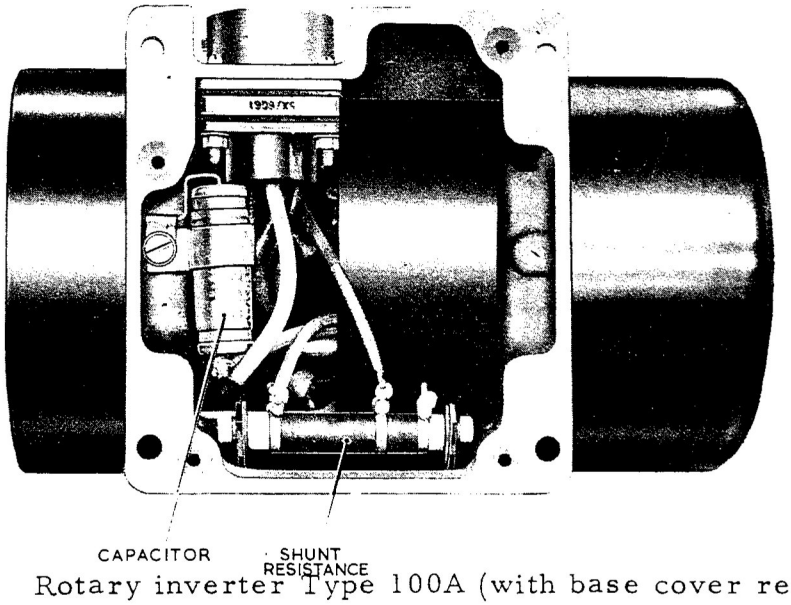


Fig. 3 Rotary inverter Type 100A (with base cover removed)

SERVICING

Initial testing

12. When it is necessary to determine the serviceability of the unit prior to bay servicing, the tests detailed in Chap. 2 (R. A. F.) or Chap. 2-1 (R. N.) should be applied.

Special tools

13.

Ref. No.	Description	Purpose/Remarks
5UA/1206	Extractor, fan, complete with pads	Fan removal

Dismantling

14. The inverter may be mounted directly on the control panel or as a separate unit; it is assumed that the inverter has been disconnected from the control panel and the control panel serviced in accordance with AP113D-0721-16.

15. (1) Remove the brush cover band assembly.

(2) Remove the commutator end cap, which is secured by two cheese-head screws with plain and spring washers.

(3) Remove the circlip and screen.

(4) Disconnect the two yellow leads and the one red lead from the d. c. brush gear assembly.

(5) Remove the six a. c. brushes and discard. This is done by turning

the small slotted pins at the top of the brush boxes, one quarter of a turn, and carefully withdrawing the brush assembly.

(6) Remove the four d.c. brushes from their boxes and discard.

(7) Remove the shunt resistance cover plate and base cover plate.

CLEANING

16. The inverter should be cleaned externally using a cloth moistened with trichloroethane (Ref. No. 33D/2201949) and all traces of carbon dust must be removed using a controlled supply of dry compressed air.

BAY SERVICING

17. The inverter should be serviced as follows:

(1) Examine all visible components for signs of mechanical damage, corrosion and security of attachment.

(2) Check all electrical connections for security of attachment.

(3) Examine the capacitor for signs of wax seepage and the shunt field resistor for signs of overheating.

◀ (4) Remove nut and lockwasher which secure fan; remove fan and collar from armature, using extractor and pads (ref. para. 13).

(5) Remove two clamp bolts securing cradle to commutator end housing; pull commutator end housing, complete with armature, from cradle.

(6) Examine the commutator and slip rings for signs of burning, pitting and scoring.

(7) Examine the armature (that which is visible without further dismantling) for signs of overheating and thrown solder.

(8) Check the armature for freedom of rotation. Particular attention should be given to the run of the bearings, where no roughness should be experienced. ▶

ASSEMBLY

18. (1) Fit new a.c. brushes.

(2) Fit new d.c. brushes and reconnect the leads. The yellow leads are connected to the terminal nearest the yellow spot on the backplate, and the red lead to the terminal nearest the red spot.

◀ (3) Pre-bed brushes as detailed in Servicing Technique No. 2 (AP113A-0308-1, Chap. 3, para. 14 and 15).

(4) Refit commutator end housing, complete with armature to cradle and secure with two clamp bolts.

(5) Refit fan and collar to armature; secure with lockwasher and nut.

(6) Refit the screen and secure with circlip.

(7) Refit the commutator end cap and secure with two cheese-head screws, plain and spring washers.

(8) Complete brush bedding as detailed in Servicing Technique No. 2 (AP113A-0308-1, Chap. 3, para. 16 to 19). ▶

(9) Refit the brush cover band assembly, secure with cheese-head screw and wire lock.

(10) Refit the shunt resistor cover plate and the base cover plate.

TESTING (R.N.)

19. Testing of the inverter and control panel as a matched pair (R.N. only) should be applied in accordance with the instructions detailed in the following references. The test equipment required is listed in Chapter 2-1.

(1) Chapter 1, para.24 (6) to (8).

(2) Chapter 2-1 - standard serviceability test.

TESTING (R.A.F.)

20. The inverter should be tested in conjunction with a control panel Type 12 which it is assumed has been serviced and tested in accordance with AP113D-0721-16.

TEST EQUIPMENT

21. The following items of test equipment, or suitable equivalents, are required.

General

Ref. No.	Description
5G/1112740	Tester, insulation resistance, Multirange Mk.2
10W/15942	Resistor, 1 k ohm

Fig. 5

Ref. No.	Description	Purpose/Remarks
5Q/234	Voltmeter, 0-40V d.c.	V1
5CW/4189	Switch, two pole, on-off	S1
5UB/4939	Control panel, Type 12	-
5CW/6172	Switch, phase selector	S2
5CW/898	Switch, push, Type B No.1	S3, S4
5QP/4350451	Voltmeter, 0-150V a.c.	V2
5Q/1003731	Frequency meter	F1
5G/565	Inductive loading unit	See Note
5G/3210	Phase rotation indicator	-
--/----	Variable d.c. supply, 20-35V	-

Note ...

For information on the inductive loading unit refer to AP120E-0403-1.

TEST PROCEDURE

Insulation resistance tests

22. Measure the insulation resistance between the following points:

(1) Pin 1 and the frame, using the insulation resistance tester set at the 500V range.

(2) Pin 5 and the frame, using the insulation resistance tester set at the 250V range.

The value obtained in each case should be not less than 2 megohms.

23. The capacitor mounted in the base of the inverter should now be

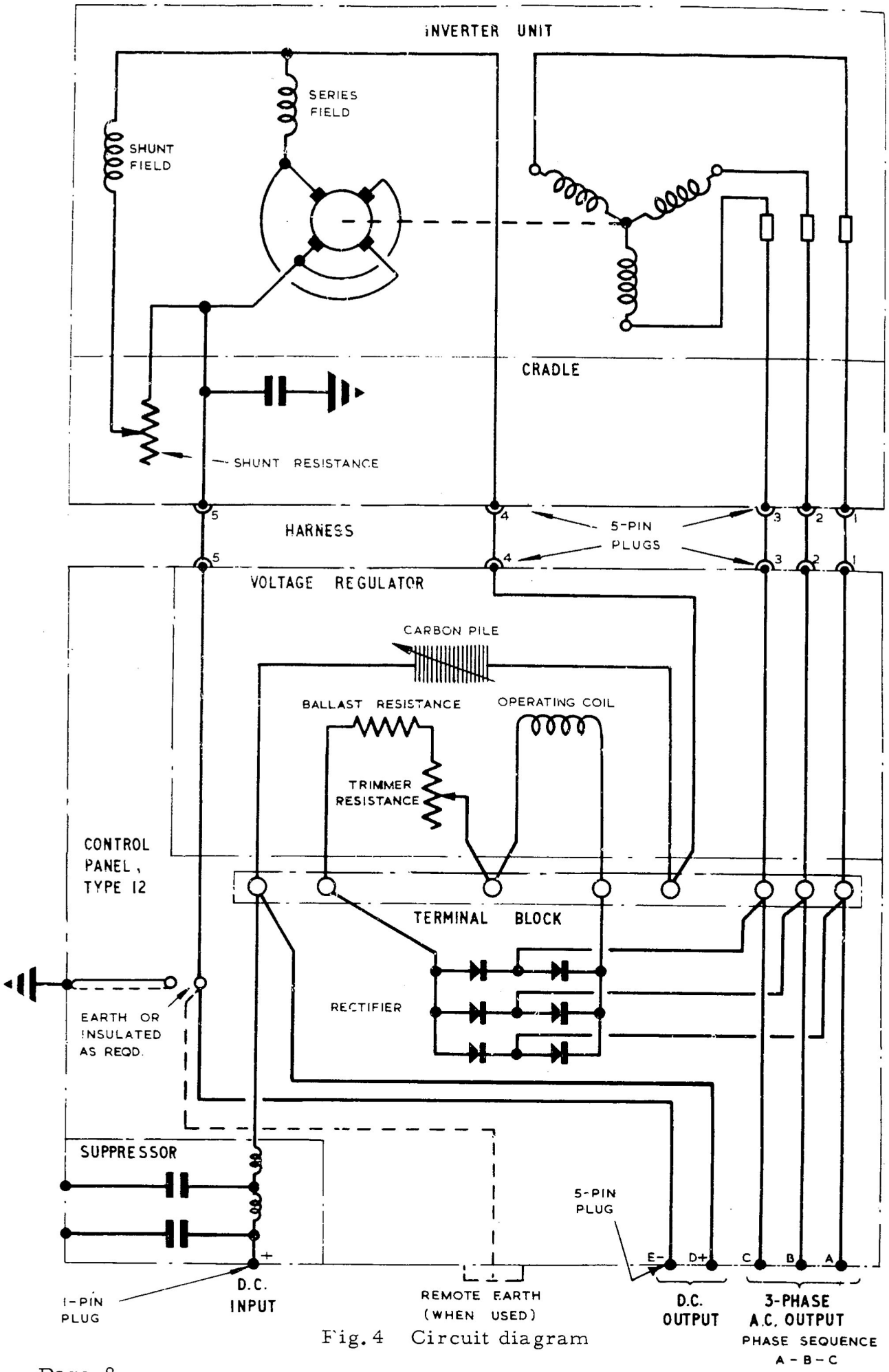


Fig. 4 Circuit diagram

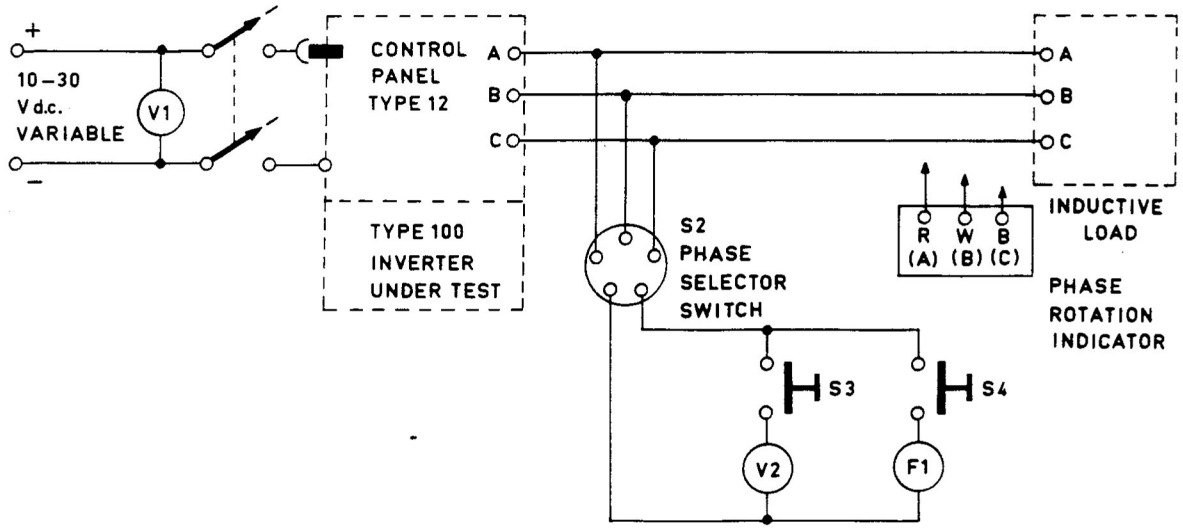


Fig. 5 Test circuit

discharged by connecting a 1 k ohm resistor between pin 5 and the frame.

Functional tests

24. The inverter should be connected to the test circuit shown in fig. 5 and the following procedures carried out.

Note ...

The test circuit is identical to that used for testing inverters Type 100B and 100D as detailed in AP113D-0120-16.

(1) Adjust the input voltage V1 to 27V d.c.

(2) Switch on and run continuously for one hour on no load. Check that phase sequence is A-B-C using the phase rotation indicator (ref. para. 21).

(3) Check that the a.c. output voltage V2 is within the limits of 119V and 121V. Adjustment may be made using the trimmer resistance on the control panel, if necessary.

(4) Check that the output frequency is 395 Hz. Adjustment may be made using the shunt field resistor mounted in the base of the inverter.

(5) Connect the inductive loading unit to the output terminals and check that the a.c. output voltage does not fall below 115V.

(6) Check that the frequency remains within the limits of 395 Hz ± 2 Hz when the load is switched on and off. This procedure should be repeated several times.

Note ...

Should the frequency fall on load, adjustment may be obtained by moving the d.c. brush gear in a clockwise direction. Should the frequency rise on load the d.c. brush gear should be moved in a counter-clockwise direction.

Chapter 1-1

ROTARY INVERTER TYPE 100C

LEADING PARTICULARS

Rotary inverter, Type 100C	Ref. No. 5UB/8352
Inverter unit only	
Input	22·5V to 23·5V d.c.
Output	162W, 0·81 p.f., 115V, 3-phase, 400 Hz a.c.
Inverter with control panel, Type 12	
(matched pair)	Ref. No. 5UB/8885
Input	25V to 28V d.c.
Output	150W, 0·8 p.f., 115V, 3-phase, 400 Hz a.c.
Phase sequence (at output socket of inverter)	1-2-3
D.C. Brushes -	
Grade KC5EG11 (Part No. N125843/1)	Ref. No. 5UB/8348
Spring pressure	... 4·8 oz to 5·8 oz
A.C. Brushes -	
Grade F2B	Ref. No. 5UB/5959
Spring pressure	... 0·75 oz to 2 oz
Shunt field resistor (40 ohms)	Ref. No. 5UB/5920
or Type AZA.4801/1	Ref. No. 5UB/6058
Rotation (viewed from commutator end)	Counter-clockwise
Weight	6 lb
Used with control panel Type 12	Ref. No. 5UC/4939

◀ Modification state

The equipment described in this chapter incorporates relevant Service modifications up to and including Lucas Aerospace modification No. R.7212. ▶

General

1. The inverter Type 100C is similar to the inverter Type 100A described in Chapter 1 but introduces a new grade of d.c. brushes KC5EG11 to Mod. No. Elect. B/611 (Lucas Aerospace R6361). The new grade of brush is of the film forming type, and the general information is given in AP113A-0301-1 (formerly AP4343, Vol. 1, Sect. 1, Chap. 1 para. 5-6 and 11-18) should be referred to during commutator servicing and brush bedding.

2. Details of the modified inverter and the matched set comprising inverter Type 100C and control panel Type 12 are given in the Leading Particulars.

3. ◀ The servicing, testing and repair and reconditioning for the Type 100C is the same as that for the Type 100A inverter detailed in Chapters 1, 2 and 2-1 and in Repair and Reconditioning. ▶

RAFSC .....ENG SI
Volume.....4, Part.....6
Section.....2
Command Mod Elect/0108/Trg C
MOD Authy AF/MODS/7073/68
Dated: 22 Dec 1970

INDUCTIVE LOADING PANEL (5G/565) INTRODUCTION OF CAPACITORS TO GIVE STABLE FREQUENCY SETTING UP CONDITIONS FOR INVERTER TYPE 100C FOR USE WITH MK 3, MK 4, MK 5 JET PROVOST

Introduction

1. This modification introduces three capacitors (10C/23432) into the circuit of the Inductive Loading panel to facilitate the testing of Inverters Type 100C fitted to Jet Provost Mark V aircraft, whilst retaining the facility for testing Inverters Type 100C fitted to Jet Provost Mark III and IV aircraft. These capacitors then simulate the AC capacitive cockpit lighting load in the Jet Provost Mark V aircraft.

Embodiment

2. By all units servicing Inverters Type 100C for use on Jet Provost Mk (3) (4) and (5) aircraft, within 1 month of receipt of parts.

Special Arrangements for Embodiment

3. Nil.

Time Required for Embodiment

4. a. Aircraft Fitter Electrical - 3 manhours.

b. Sheet Metal Worker - 1½ manhours.

Drawings

5. Figure 1 - General Arrangement.
Figure 2 - Relay Mounting Bracket.
Figure 3 - Switch Mounting Plate.
Figure 4 - Circuit Diagram.

Parts Required

6.

Sect/Ref		Nomenclature	
5CW/6851		Switch magnetic relay type 10B	1
5CW/7541		Switch single pole ON/OFF	1
30B/9611592		Aluminium Alloy Sheet 20swg	15 in 2 ar
		(Screws wood ½" x nob	6
As available		(Screws metal brass 4BA x 1"	6
		(Nuts brass 4BA	3
5E/4183 3928	Or	Cable elect Uninyvin 20	AR
5K/9107065		Sleeves binding No 1	AR
5X/9462951		Tags crimping 4BA No 0	AR
10C/23432		Capacitor Type 8056	3

Parts Removed Redundant

7. Nil.

Information on the Supply of Modification Parts

8. Parts should be available from unit resources. Those parts not available are to be demanded.

Sequence of Operations

9. The following is the sequence of operations:

a. Using item Ref No 30B/9611592 manufacture relay mounting bracket and switch mounting plate (Figs 2 and 3).

b. Remove the four fixing screws from the first panel and remove the panel, complete with attached components from the case.

c. On the right hand side of the case, cut a hole, 2" x $\frac{3}{4}$" in the position shown in Figure 1 to receive the switch ref 5CW/7541.

d. Mount the relay, 5CW/6851, onto the bracket (Fig 2) and fix into the loading panel case in the position shown in Fig 1.

e. Attach switch, 5CW/7541, to its mounting plate (Fig 3) and fix in position on the loading panel case (para C).

f. Connect capacitors, 10C/23432, to relay terminals 1, 3 and 5 as s shown in Figure 3.

g. Referring to Figure 4 connect the relay, switch and loading panel terminal block using 5E/4183 or 3928 with tags 5X/9462951 and sleeves 5K/9107065. Loom the cables and secure at each end to adjacent structure.

h. Drill an entry hole in the case to suit local installation. Through this hole pass supply leads from a suitable 28V supply, fused to 2.5 amp, and connect to the relay and switch.

j. Refit the front panel to the case and reconnect to the test circuit.

k. Suitably mark the selector positions Inductive/Capacitive On and Inductive On Only as detailed in Fig 4.

Inspection After Modification

10. Ensure that the relay operates when the switch is moved to the ON position.

Alteration in Weight and Moment

11. N/A.

Record of Modification

12. On the front of the loading panel, adjacent to the identification plate, using suitable paint, inscribe CM/Elect/0108/TC.

Disposal of Redundant Parts

13. No equipment is made redundant by this modification.

Effect on Servicing

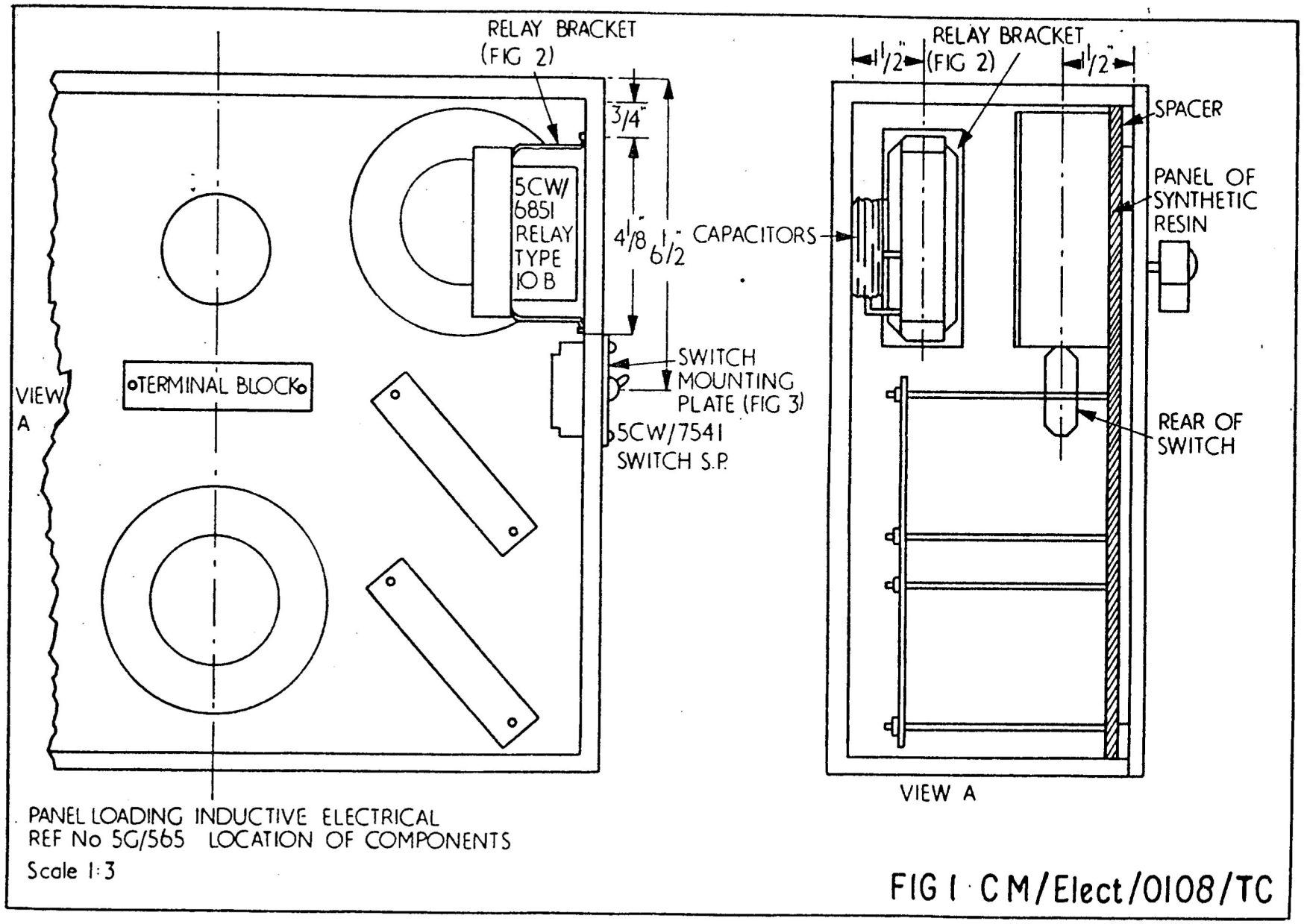
14. This modification affects the servicing schedules AP113D-0721-16 and AP113D-0104-16. A TC supplementary servicing card will be raised for inverters fitted to Jet Provost aircraft.

Effect on Operation

15. Embodiment of this modification affects the setting up of Inverters Type 100C for use in Jet Provost aircraft.

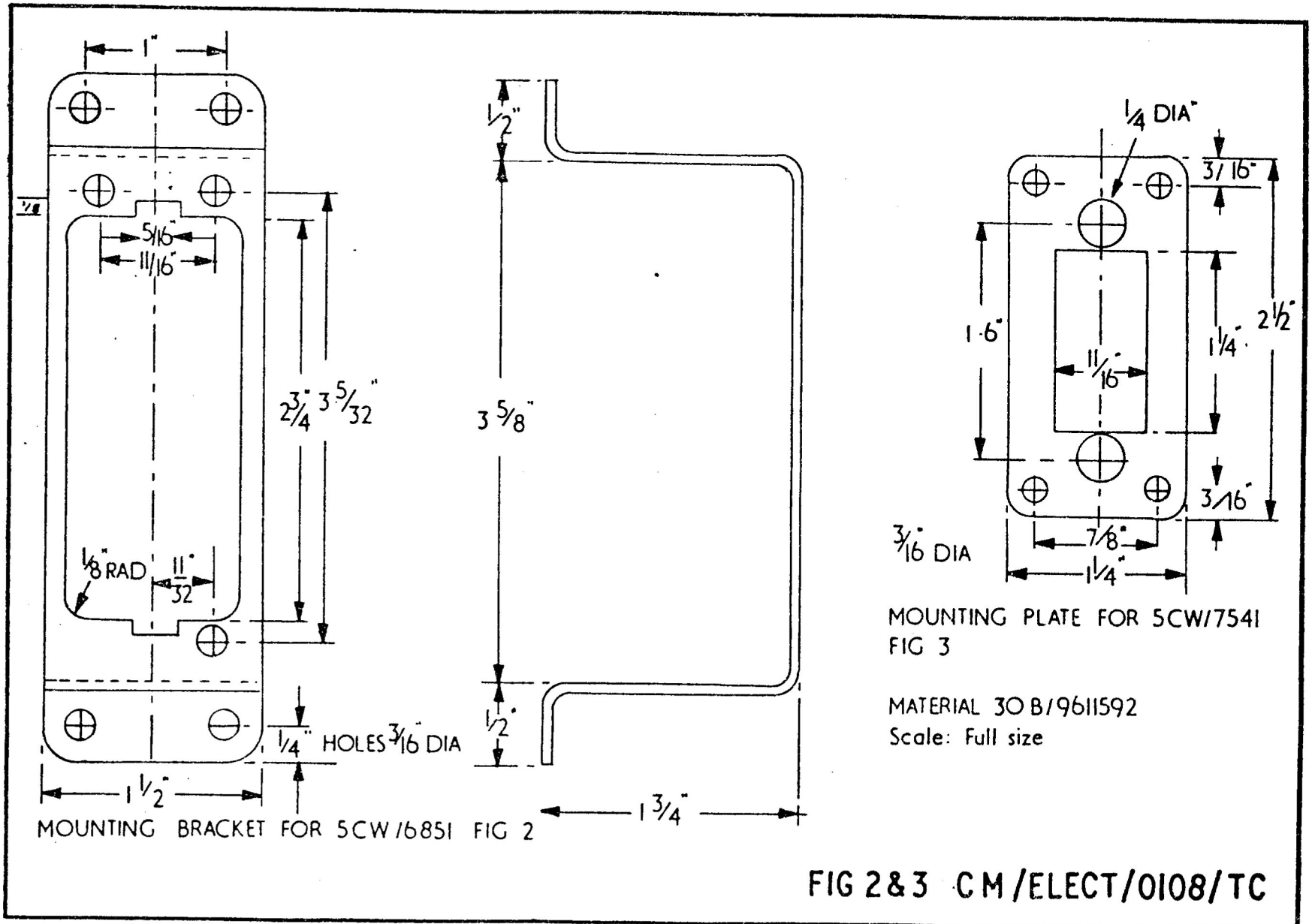
Ref: TC/111002/14/

Date: 18 Jan 70



PANEL LOADING INDUCTIVE ELECTRICAL
REF No 5G/565 LOCATION OF COMPONENTS
Scale 1:3

FIG 1 CM/Elect/0108/TC

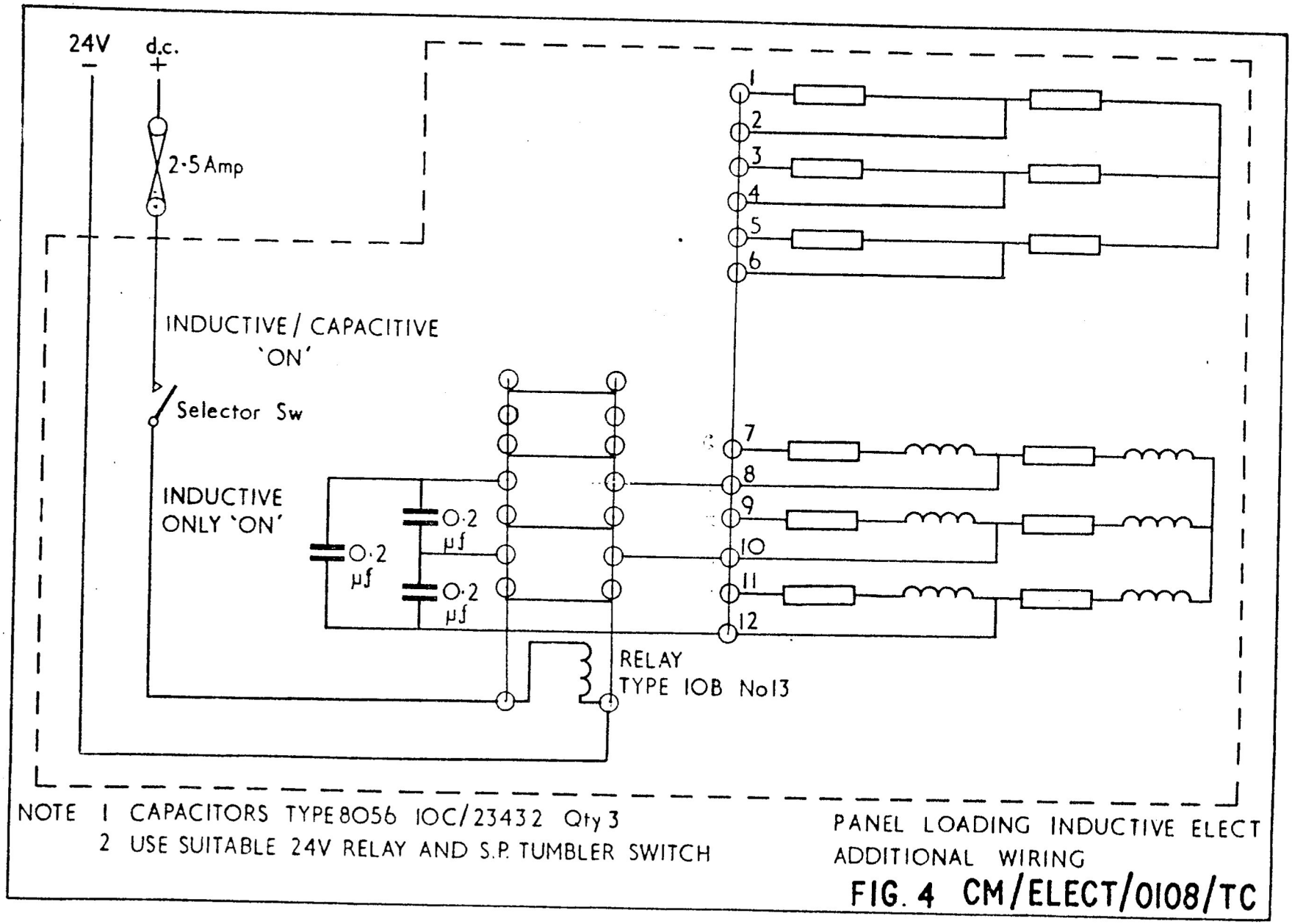


MOUNTING BRACKET FOR 5CW/16851 FIG 2

MOUNTING PLATE FOR 5CW/7541 FIG 3

MATERIAL 30 B/9611592
Scale: Full size

FIG 2&3 CM/ELECT/0108/TC



NOTE 1 CAPACITORS TYPE 8056 10C/23432 Qty 3
2 USE SUITABLE 24V RELAY AND S.P. TUMBLER SWITCH

PANEL LOADING INDUCTIVE ELECT
ADDITIONAL WIRING

FIG. 4 CM/ELECT/0108/TC

Chapter 2

STANDARD SERVICEABILITY TEST for ROTARY INVERTERS TYPE 100A AND 100C (R.A.F. only)

Introduction

1. The following tests should be applied whenever it is necessary to determine the serviceability of the inverter.

Test equipment

2. The test equipment detailed in Chap. 1, para. 21, or suitable equivalents will be required to apply the standard serviceability test.

TEST PROCEDURE

3. The inverter should be connected to the test circuit shown in Chap. 1, fig. 5.

Functional tests

4. Adjust the input voltage to 27V d.c., switch on and run the inverter on no load continuously for one hour. Check that phase sequence is A-B-C using phase rotation indicator (ref. para. 2).

5. Check that the a.c. output voltage is within the limits of 119V and 121V.

6. Check that the output frequency is 395 Hz. Adjustment may be made using the shunt field resistor mounted in the base of the inverter.

7. Connect the inductive loading unit to the output and check that the output voltage does not fall below 115V.

8. Check that the frequency remains within the limits of 395 Hz ± 2 Hz when the load is switched on and off.

9. The tests at para. 7 and 8 should be repeated several times.

Note ...

If the voltage and frequency are not within the limits specified in para. 5, 6 and 8, subject the inverter to the procedures listed in Chap. 1, para. 24.

Insulation resistance tests

10. Measure the insulation resistance between the following points using the insulation tester (ref. Chap. 1, para. 21) set to the 250V range.

(1) Pin 1 and the frame.

(2) Pin 5 and the frame.

The value obtained in each case should be not less than 0·5 megohm.

11. The capacitor mounted in the base of the inverter should now be discharged by connecting a 1 k ohm resistor between pin 5 and the frame.

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F/S Cccc

AL 25

RAFSC.....ENG SI
Volume.....4
Part.....6
Section.....1
Leaflet No.....7

THIS INSTRUCTION HAS HEALTH AND SAFETY IMPLICATIONS

INVERTER TYPE 100C AND TYPE 12 CONTROL PANEL - SETTING UP PROCEDURE FOR MK 3A, 5 AND 5A JET PROVOST AIRCRAFT

References:

A. AP 113D-0104-16
B. AP 113D-0104-16 Chapter 2 Para 3

1. Experience has proved that the setting up instructions and functional tests described in Reference A are not entirely suitable for inverters fitted to Jet Provost aircraft.

2. To assist in standardisation the following procedure is to be adopted when using Inductive Loading Panel, 5G/565 with COMMAND MODIFICATION/ELECT/0108/TC embodied and CALIBRATED in accordance with TABLE 1 for the setting up of 100C Inverters for use in the Jet Provost Mk 3A, 5 and 5A aircraft.

Dem 19/9/85

a. Connect to test circuit as detailed in Reference B.

b. Adjust the input voltage to 19V D.C. and switch ON the inverter.

c. Increase the input voltage until the output voltage is 115V A.C. and check that the input voltage is within the limits 21.00 and 22.50V D.C.

d. With an input of 27.5V D.C. select inductive load ON and run for 20 minutes.

e. Select inductive load OFF, check that the A.C. output voltage is within the limits of 119V and 121V A.C.

f. Check that the output frequency is 400 Hz. Adjust if necessary by varying shunt field resistor.

g. Select inductive load ON and check that the average of the 3 line voltages does not fall below 115V A.C. and frequency does not fall below 395 Hz. Repeat this test several times.

NB The unbalanced load will cause one line voltage to be higher than the others.

TABLE 1

INDUCTIVE LOADING PANEL - CALIBRATION -
USING TESTMETER POWER FACTOR 5QP/4350397

PHASE MONITORED	VOLTAGE SENSING	I MAX (AMPS)	I MIN (AMPS) (REACTIVE)	PF (LAGGING) COS Ø
A	A-C	0.63	0.20	0.95
B	A-B	0.78	0.07	0.995
C	C-B	0.85	0.25	0.96

Results to be obtained at 395 Hz, average 115V A.C per phase.

A. RAFSC/930370/55/EA

B. Servicing Procedure

C. Change of Servicing Requirement

D. EA 12d

E. Dec 77/Aug 85

Chapter 2-1

STANDARD SERVICEABILITY TEST for ROTARY INVERTERS TYPE 100A AND 100C (R.N. only)

Introduction

1. The tests detailed in this chapter may be applied whenever it is necessary to determine the serviceability of the inverter, and its associated control panel Type 12 when the two are subsequently to be used as a matching pair.

Test equipment

2. The following test equipment, or suitable equivalents will be required:

Ref. No.	Description	
5CW/898	Switch, push, Type B, No. 1	
5CW/4198	Switch 2-pole, on/off	
5G/565	Inductive loading unit	See Note
5G/9156675	Insulation tester, Type C	
5G/9531154	Insulation tester, Type A	
5Q/234	Voltmeter 0-40V d.c. (V1)	
5Q/1003731	Frequency meter	
10F/777	Switch 2-pole, 3 way	
6625-99-943-1524	Multimeter, Type 8SX	
	Variable d.c. supply 27 to 35V d.c.	

Note ...
For information on the inductive loading unit refer to AP120E-0403-1.

TEST PROCEDURE

3. The inverter should be connected to the test circuit shown in Chap. 1, fig. 5 but using only the test equipment listed in para. 2 and the following procedures carried out.

4. (1) With an input of 27V run the inverter on no load for one hour. Switch off.

(2) Adjust supply to 19V and switch on inverter.

(3) Increase the supply voltage slowly until the output voltage reads 115V a.c. at V2. The input voltage at V1 must now be 21·75V ± 0·75V.

(4) Increase the supply voltage to 27V, or until the output voltage stops increasing, and check that the output voltage is 120V ± 1V.

(5) Increase the supply voltage to 35V and check that the output voltage is the value obtained in sub para. (4) plus or minus 0·5V.

(6) Decrease the supply voltage to 19V and then increase to 27V.

(7) Switch on full load and check that the output voltage does not fall below 115V.

(8) Switch the load off and check that the output voltage is 120V ± 1V.

(9) Repeat operations at sub para. (7) and (8) three times.

5. If any of the figures quoted in para. 4 are unobtainable the regulator should be adjusted in accordance with AP113D-0003-16 (formerly AP4343, Vol. 1, Sect. 6, Chap. 1) para. 41 to 46.

Note ...

The output voltage at V2 should be adjusted to 115V with the pile screw 1/8th of a turn "out" from the dip position. The input voltage should be set at 27V.

6. Repeat the dip position setting procedure and lock the pile screw 1/8th of a turn "out" from the dip position.

7. Repeat the tests detailed at para. 4 (2) to (9).

8. (1) With an input of 27V check that the output frequency is 395 Hz. Adjustment may be made using the shunt field resistor mounted in the base of the inverter.

(2) Switch on full load and check that the frequency is within the limits 395 Hz ± 2 Hz. Adjustment may be made as described in Chap. 1, para. 24 (6).

(3) Repeat tests as detailed at sub para. (1) and (2) three times.

(4) Increase the input voltage to 35V and with the inverter on no load check that the frequency does not exceed 400 Hz and that the a. c. output voltage does not exceed 121V.

(5) Raise each d. c. brush trigger in turn and check that the sparking at the opposite brush is not excessive.

Insulation tests

9. Measure the insulation resistance between the following points:

(1) All a. c. plug pins and the frame, using a 500V insulation resistance tester.

(2) All d. c. plug pins and the frame using a 250V insulation resistance tester.

The value obtained in each case should be not less than 0·5 megohm.

10. The capacitor mounted in the base of the inverter should now be discharged by connecting a 1000 ohm resistor between pin 5 and the frame.

11. If the inverter and control panel unit fails any of the tests detailed in para. 4 to 9, the inverter should be serviced in accordance with Chapter 1 and Repair and Reconditioning, and the control panel in accordance with AP113D-0721-16.

▶ Note...

For third line repair the inverter 5UB4352358 and the control panel 5UC6369631 are to be returned to stores as individual items. ◀

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REPAIR AND RECONDITIONING for ROTARY INVERTER TYPES 100A AND 100C

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ILLUSTRATIONS

Introduction

1. The following instructions apply to authorised units with the necessary spares and test facilities and are in addition to those detailed in AP113D-0104-1, Chapters 1, 2 and 2-1.

Special tools and test equipment

2. The following tool or a suitable equivalent, will be required in addition to the items listed in AP113D-0104-1, Chapter 1, para.21.

Ref. No.	Description
1H/86	Gauge, tension 100-500 grms

DISMANTLING

3. Reference should be made to AP113D-0104-1, Chapter 1, fig.2 during dismantling.

Cover plates

4. Remove the shunt resistor cover plate and base cover plate. The shunt field resistor and the capacitor are now visible and may easily be removed if necessary.

Brushes

5. (1) Remove the brush cover band assembly.

(2) Remove the commutator end cap which is secured by two cheese-head screws with plain and spring washers.

(3) Remove the circlip and screen.

(4) Disconnect the two yellow leads and the one red lead from the d.c. brushgear assembly.

(5) Remove the six a.c. brushes from their boxes by turning the small slotted pins at the top of the brush boxes one quarter of a turn, and carefully withdraw the brush assembly.

(6) Remove the four d.c. brushes from their boxes.

Bearing caps

6. (1) Remove the commutator end bearing cap which is secured to the end frame by four cheese-head screws with spring washers.

(2) Holding the armature stationary, remove the screw, spring washer and plain washer from the commutator end of the armature shaft.

(3) Similarly, hold the armature stationary and remove the nut and lockwasher which secure the fan.

(4) Remove the fan and collar from the armature shaft using the special extractor and pads.

(5) Remove the remaining bearing cap, which is secured by four cheese-head screws with washers.

Separation of end frames

7. (1) Unscrew and remove the two hexagon head bolts securing the cradle to the commutator end frame.

(2) Loosen the remaining two screws securing the cradle to the slip ring end frame.

(3) Unscrew and remove the two clamp bolts, with plain and spring washers, which secure the commutator end frame in position.

(4) Carefully remove the commutator end frame assembly from the slip ring end frame.

(5) Tighten the two cradle securing screws which were loosened at sub-para.(2).

D.C. brushgear

8. Unscrew and remove the two cheese-head screws, with plain and spring washers, which secure the d.c. brushgear to the commutator end frame, and remove the d.c. brushgear assembly.

Note ...

Since the position of the d.c. brushgear assembly is adjustable, a locating mark should be made on the back plate, and a corresponding mark on the end frame before removal.

Armature

9. Remove the armature from the slip ring end frame, taking care not to lose the spacer at the slip ring end of the armature shaft.

A. C. brushgear

10. Disconnect the a. c. leads, and unscrew and remove the four cheese-head screws, with plain and spring washers, which secure the bearing clamp plate and a. c. brush holders to the slip ring end frame. Collect four nuts. Any shims fitted between the bearing clamp plate and the a. c. brush box assembly must be carefully removed and replaced on assembly.

Bearings

11. The commutator and slip ring end bearings may now be removed from their respective ends of the armature shaft.

Cleaning

12. Clean all components in accordance with Servicing Technique No. 5 (AP113A-0308-1). ▶◀

EXAMINATION AND REPAIR

13. The items listed below should be discarded and new items fitted on assembly:

(1) All d. c. brushes.

(2) All a. c. brushes.

(3) All a. c. brush springs.

(4) Commutator end bearing.

(5) Slip ring end bearing.

(6) All suspect washers and nuts.

14. ◀ In addition to the servicing instructions detailed in AP113D-0104-1, Chapter 1, para. 17, the following checks and examinations should be applied and the necessary repair or replacement action taken: ▶

(1) Check the spring tension of each d. c. brush spring using a tension gauge. The value obtained should be within the limits 136 grms to 164 grms. If corrosion is present (usually in the form of a white deposit) on the brush springs, it may be removed by cleaning with methylated spirit (Ref. No. 34D/312) and a small drop of oil OM13 (Ref. No. 34D/9100570) applied and worked in between the coils.

(2) Examine the commutator and slip rings for signs of wear, burning, pitting, scoring and contamination, and if any unserviceability is evident the defective surface should be skimmed using the commutator/slip ring. ◀ surfacing machine (Ref. No. 4A/2406) as detailed in Servicing Technique No. 3 (AP113A-0308-1) and the dimensions given in Table 1. ▶

(3) Check the resistance values of the a.c. and d.c. windings which should be as follows:

Armature

D.C. windings	0·11 ohm
A.C. windings	3·35 ohms/phase

Field

Series winding	0·032 ohm
Shunt winding	48 ohms

(4) Check the serviceability of the capacitor.

(5) Check that the shunt field resistor is fitted with copper tapping clips, 0·028 in thick and that they are in good order and secure. Unless a new resistor is to be fitted or it is suspected that the setting has been disturbed, it should not be necessary to adjust the position of the clips.

Insulation resistance tests

15. Using a 250V insulation resistance tester measure the insulation resistance between the following points:

(1) Commutator and shaft.

(2) D.C. brush holders and frame.

(3) D.C. red lead to field and frame.

◀ The values obtained should be not less than 10 megohms. ▶

16. Using a 500V insulation resistance tester measure the insulation resistance between the following points:

(1) Slip rings and shaft.

(2) Slip ring and commutator.

(3) A.C. brush boxes and frame.

◀ The values obtained should be not less than 10 megohms. ▶

Schedule of fits, clearances and repair tolerances

17. The schedule of fits, clearances and repair tolerances given in Table 1 should be referred to, in conjunction with fig. 1, during the examination of components prior to assembly.

18. Bearings at both the commutator end and the slip ring end of the armature shaft are to be selected to give the clearance fit detailed in Table 1, Schedule of fits clearances and repair tolerances.

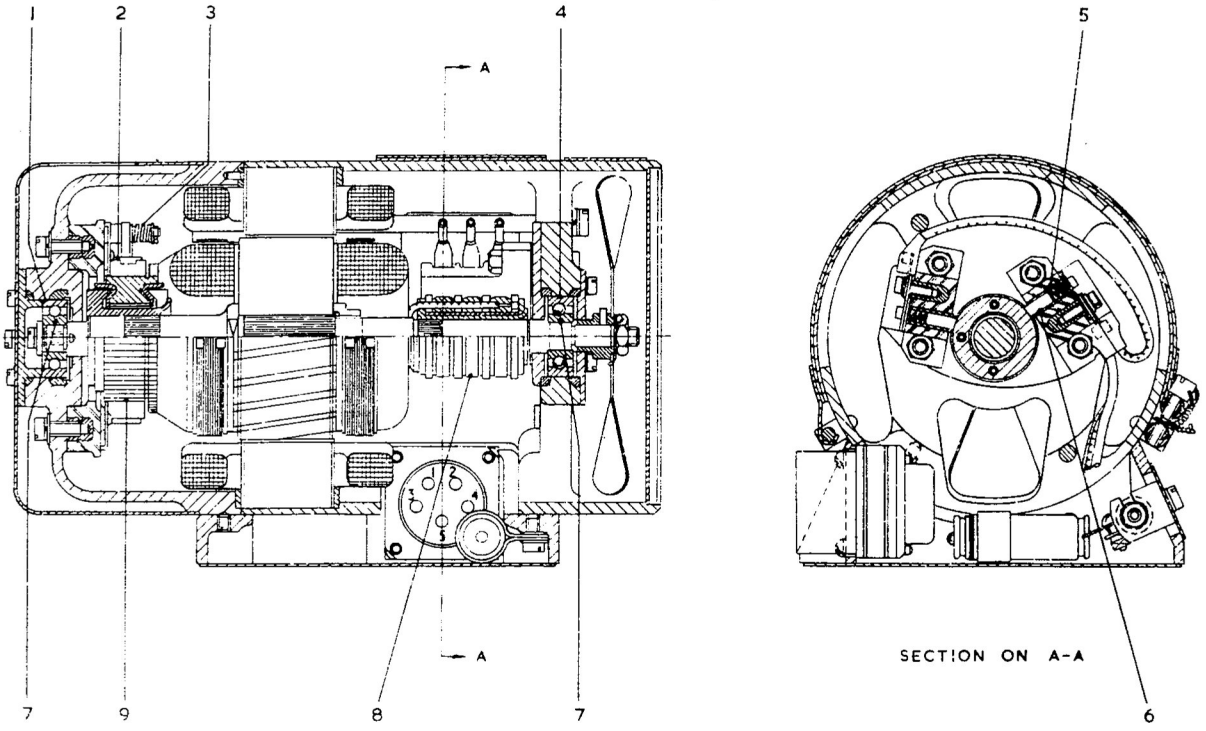

Fig. 1 Rotary inverters Type 100A and 100C (sectional view)

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ASSEMBLY

Bearings

► 19. (1) Apply grease XG-293 (Ref. No. 34B/2241797) in accordance with Servicing Technique No. 1 (AP 113A-0308-1). ◄

(2) Lightly lubricate the bearing housings using oil OM13 (Ref. No. 34D/9431324) and selectively fit the bearings to the respective housing. ◄

A.C. brushgear

20. Fit the a.c. brush holders and the bearing clamp plate within the slip ring end frame and secure, replacing any shims removed during dismantling.

Armature

21. Slip the duralumin spacer on to the rotor shaft and fit the rotor shaft into the bearing at the slip ring end frame.

D.C. brushgear

22. Fit the d.c. brushgear assembly to the commutator end frame and align to the marks made when dismantling (see para. 8) before finally securing.

Note ...

If the armature, field or brush gear has been renewed then the brushgear will have to be adjusted during testing to obtain the optimum condition for commutation. This position can be roughly gauged by adjusting the brushgear so that the centre of the fixing screws, when viewed from the commutator end, are between 1/32 in and 1/16 in from the centre of the adjusting slot in the clockwise direction.

Fitting of end frames

23. Brush bedding is to be carried out in accordance with Servicing Technique No. 2 (AP 113A-0308-1).

(1) Slacken the two hexagon-head bolts which secure the cradle to the slip ring end frame.

(2) Assemble the commutator end frame to the slip ring end frame and secure with the two clamp bolts, but do not fully tighten until completion of preliminary brush bedding.

Bearing caps

24. (1) Fit the slip ring end bearing cap and secure with four 6BA cheese-head screws and spring washers.

(2) Replace the fan-collar and fan, and secure in place with a new locking washer and nut.

(3) Hold the fan-collar firmly and fit the plain washer, spring washer and 4BA screw removed from the commutator end of the armature shaft.

(4) Fit the commutator end bearing cap and secure using four 6BA cheese-head screws and spring washers.

► (5) Fit the screen to the a.c. end of the unit and secure in place with a new circlip. ◄

Brush bedding

25. Fit new a.c. and d.c. brushes and pre-bed the brushes as detailed in Servicing Technique No. 2 (AP113A-0308-1). The type of brushes to be used is given in the Leading Particulars of AP113D-0104-1, Chapter 1 and 1-1.

26. (1) Carry out the operation at para. 23(2) and 24, and fully tighten the clamp bolts.

(2) Secure the cradle into position by means of the four 2BA hexagon-head screws and spring washers.

Brushes

27. (1) Examine the brushes on completion of preliminary brush bedding and replace brush springs and brushes in their respective boxes.

(2) Reconnect the two yellow leads and the red lead to the d.c. brush-gear. The yellow leads are connected to the terminal nearest the yellow spot on the back plate, and similarly the red lead to the terminal nearest the red spot.

(3) Reconnect the a.c. leads to their respective brushes. The top of the a.c. brushgear mouldings are colour spotted to correspond with similar markings on the a.c. connecting leads.

Note . . .

It is important for the maintenance of brush pressure that the terminal screws should be kept firmly tightened down as these screws also hold the small copper strips upon which the brush springs bear.

► 28. Deleted. ◄

29. Refit the a.c. brush cover band assembly, fully tighten the cheese-head securing screw, and wire lock.

30. Refit the commutator end cap and secure with two cheese-head screws, plain and spring washers.

31. Refit the shunt resistor cover plate and base cover plate.

32. Complete the brush bedding as detailed in Servicing Technique No. 2 (AP113A-0308-1).

TESTING (R.N.)

33. On completion of repair and reconditioning test the inverter as detailed in AP113D-0104-1, Chapter 1, para. 19, with the exception that the insulation resistance should be not less than 2 megohms.

TESTING (R.A.F.)

34. In addition to the tests detailed in AP113D-0104-1, Chapter 1, para. 20 to 24, the following test should be carried out on the inverter on the completion of repair and reconditioning.

(1) Run the inverter on no load with the a.c. brushes lifted and with the input voltage adjusted to give a rotor speed of approximately 15,000 rev/min for a period of three minutes. During this test including the run-up and run-down periods, there must be no excessive vibration or mechanical noise.

(2) Insulation resistance values should be not less than 2 megohms.

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TABLE 1

Schedule of fits, clearances and repair tolerances for rotary inverters Type 100A and 100C

Ref. Fig. 1	Parts and Description	Dimension new (in)	Permissible worn dimension (in)	Clearance new (in)	Permissible worn clearance (in)	Remarks
	BALLRACE IN COMMUTATOR HOUSING					
1	Commutator housing - Inside diameter	$\frac{0.86640}{0.86590}$	0.8667	$\frac{0.0001}{0.0004}$	$\frac{0.0001}{0.0006}$	By selective assembly.
	Ballrace - Outside diameter	$\frac{0.86615}{0.86565}$	0.8653			Renew at each overhaul.
	BRUSH GEAR D.C.					
2	Brush length	$\frac{0.592}{0.572}$ LS	-	-	-	Minimum brush length is 0.387 in measured on long side. Renew at each overhaul.
3	Spring - Spring pressure	$\frac{5.8}{4.8}$ oz $\frac{164}{136}$ grm				Spring pressure is measured when top of short side of brush is level with top of brush box.
	BALLRACE IN SLIP RING HOUSING					
4	Slip ring housing - Inside diameter	$\frac{0.86640}{0.86590}$	0.8667	$\frac{0.0001}{0.0004}$	$\frac{0.0001}{0.0006}$	By selective assembly.
	Ballrace - Outside diameter	$\frac{0.86615}{0.86565}$	0.8653			Renew at each overhaul.

(continued)

TABLE 1 (contd.)

Ref. Fig. 1	Parts and Description	Dimension new (in)	Permissible worn dimension (in)	Clearance new (in)	Permissible worn clearance (in)	Remarks
BRUSH GEAR A.C.						
5	Spring - Spring pressure	$\frac{0\cdot750}{2\cdot000}$ oz	-	-	-	
		$\frac{56}{19}$ grm				With spring retaining pin just released.
6	Brush length	$\frac{0\cdot353}{0\cdot333}$	-	-	-	Minimum brush length 0·200 in measured on long edge; renew at each overhaul.
BALLRACE ON ARMATURE SHAFT (Commutator end and slip ring end)						
7	Ballrace - Inside diameter	$\frac{0\cdot27570}{0\cdot27520}$	0·2760	$\frac{0\cdot0001}{0\cdot0004}$	$\frac{0\cdot0001}{0\cdot0006}$	By selective assembly
	Armature shaft - Outside diameter	$\frac{0\cdot27545}{0\cdot27495}$	0·2746			Renew at each overhaul.
ARMATURE AND FAN ASSEMBLY						
8	Slip rings - Outside diameter	$\frac{0\cdot877}{0\cdot873}$	0·812			Slip rings to be inspected for score or burn marks.
ARMATURE AND FAN ASSEMBLY						
9	Commutator - Outside diameter	$\frac{1\cdot380}{1\cdot375}$	1·312			Bar to bar lift 0·0001 in max. Total commutator eccentricity not to exceed 0·0008 in
						Depth of mica undercut - 0·02 in. Width of mica undercut - 0·02 in.

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