GROUP A — POWER SUPPLIES

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. This group contains information on the d.c. and a.c. power supplies for the aircraft electrical system. The specialist Air Publication references for the components used are listed below:—

Equipment	Air Publication
Generator, Type O2	4343A, Vol. 1, Sect. 3, Chap. 6
Voltage regulator and cut-out unit, Type B	4343B, Vol. 1, Sect. 1, Chap. 19
Battery, Type C	4343A, Vol. 1, Sect. 11, Chap. 1
Ground/flight switch, Type C	4343C, Vol. 1, Sect. 1, Chap. 5
Socket, Type E2	4343C, Vol. 1, Sect. 5, Chap. 9
Suppressor, Type P and Type W2	4343C, Vol. 1, Sect. 5, Chap. 10
Inverter, Type 100A	4343B, Vol. 1, Sect. 16, Chap. 6
Control panel, Type 12	4343B, Vol. 1, Sect. 7, Chap. 13
Relay, Type 9B, No. 1	4343C, Vol. 1, Sect. 3, Chap. 52
Relay, Type S	4343C, Vol. 1, Sect. 3, Chap. 8
Circuit breaker, Type A	4343B, Vol. 1, Sect. 10, Chap. 6
Torque switch, Type B, EAP 2312	4343C, Vol. 1, Sect. 4, Chap. 1
Magnetic indicator, Type B	1275A, Vol. 1, at a later date

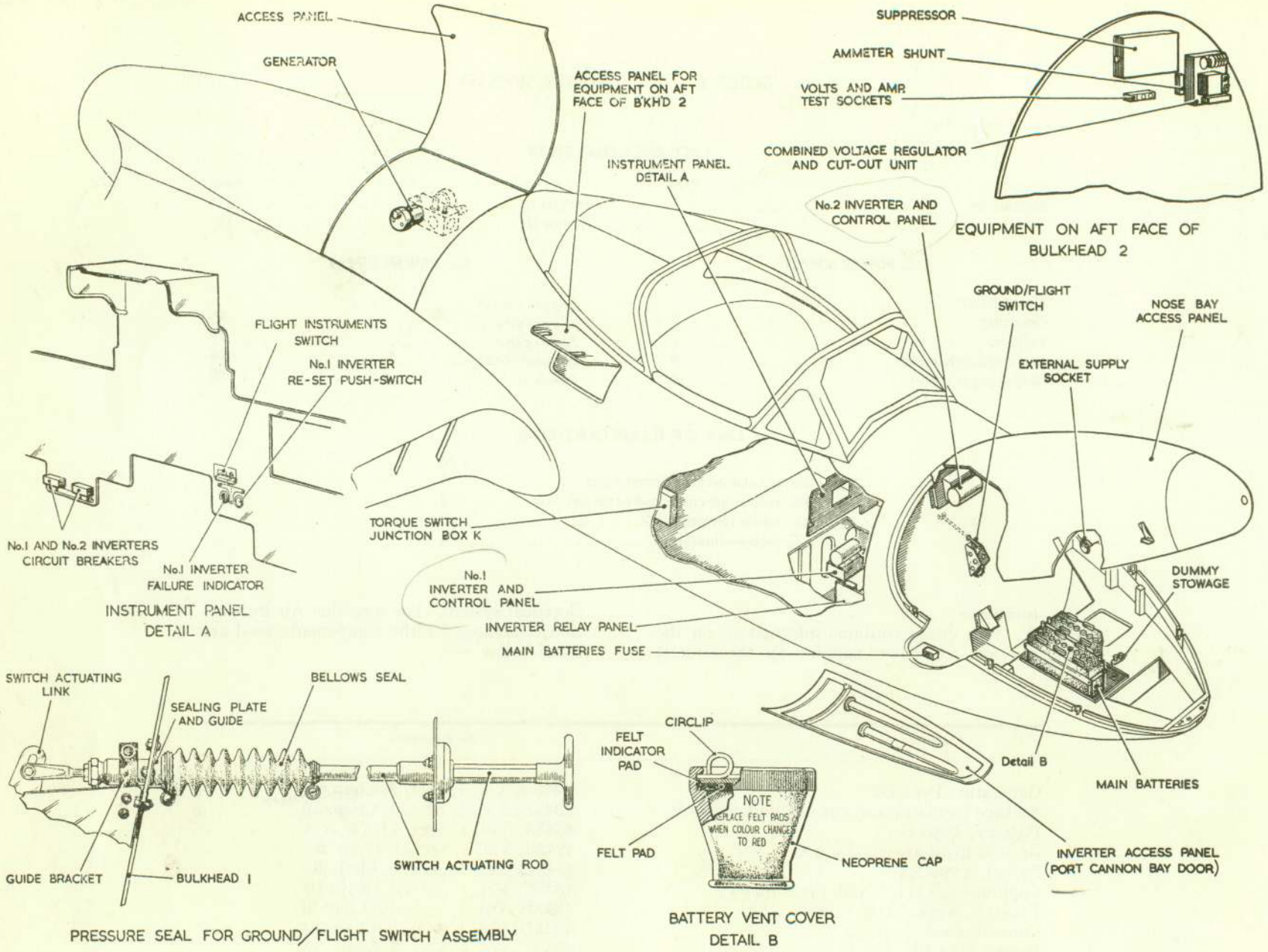


Fig. 1. Location and access of components

D.C. POWER SUPPLY

Description

Generator

2. A single, negatively-earthed, shunt-wound generator is mounted on top of the forward engine wheelcase to supply all the aircraft electrical d.c. circuits under flight conditions. The generator output is rated at 100 amp. at 30 volts, this being regulated to between 27 volts and 28·5 volts by a combined voltage regulator and cut-out unit mounted on the aft face of bulkhead 2.

3. Between the generator and voltage regulator is connected a suppressor to eliminate any radio interference which sparking at the generator brushes may produce, and an ammeter shunt across which is wired an ammeter test socket.

4. From terminal L of the ammeter test socket, a voltmeter test socket is wired direct to earth. Both these sockets, the shunt and suppressor are fitted adjacent to the voltage regulator on the aft face of bulkhead 2. Access to these components is gained via the starboard ammunition bay door, just aft of the cabin canopy.

5. The regulated d.c. supply from the voltage regular is connected, via the ground/flight switch in the nose compartment, to T.B.2 situated on the starboard cabin wall opposite the instructor pilot's seat. This T.B. is the main point of distribution to the various electrical services, the majority of which originate inside J.B.1. T.B.2 is therefore connected to T.B.1, inside J.B.1, which serves the four fuse-blocks. The earth return to the generator is by way of the earth point on bulkhead 2.

6. A conventional red warning lamp circuit is wired across T.B.1 and terminal 1 of the voltage regulator to provide an indication to the pilot's of generator power failure, the lamp being mounted on the instrument panel.

Batteries

7. Two 12-volt, 40 ampere/hour lead-acid batteries are connected in series, and are secured to the battery tray in the nose compartment of the aircraft by wing nuts and special washers. They are connected to T.B.2 via a 120-amp. fuse, the decompounding coil of the regulator and the ground/flight switch.

8. Whenever the battery leads are disconnected they should be secured to the dummy stowage for safety, the stowage being adjacent to the inboard battery.

Note . . .

The cap on the non-spillable vents of the batteries contain a felt pad soaked in Sodium Bicarbonate and an orange-coloured indicator pad, both secured in the cap by a circlip. These caps are to be fitted at all times to neutralise the acid vapour from the batteries. Both pads must be renewed when the indicator pad turns RED."

External supply socket

9. Provisions is made to connect an external d.c. supply to the aircraft for test purposes via a socket fitted to the skinning at the port side of the nose of the aircraft. This socket is connected to T.B.2 via the ground/flight switch.

Ground/flight switch

10. The ground/flight switch is fitted in the nose of the aircraft, it being operated by a rod and lever mechanism which terminates below the centre of the instrument panel in the cabin. The switch is mounted with its OFF or GROUND position uppermost, whilst the knob on the end of the operating rod in the cabin bears the notice IN FOR FLIGHT, OUT FOR GROUND.

Note . . .

The switch actuating rod passes through the forward pressurised cabin bulkhead. A special bellows seal is therefore used to obviate pressure leakage (fig. 1).

Servicing

11. The servicing instructions for all the components used in the d.c. power supply system will be found in the specialist Air Publications, listed in para. 1.

12. The ammeter shunt fitted is a 100 amp. shunt having a voltage drop of 50 milli-volt. When checking the reverse current required to open the cut-out, the following calculation must be made.

13. If an ammeter 50–0–200 (Stores Ref. 5Q/4340) is used, plugged into the ammeter test socket, the ammeter reading must be divided by two. If a Type D testmeter (Stores Ref. 10S/10610) is used, set on its 15 milli-amp. range, the reading obtained on the 150 scale must be multiplied by two-thirds, or on the 75 scale by one and one-third. The reverse current value should be between 12 and 25 amp.

14. The voltage, with the engine turning at normal cruising speed, should be periodically checked. Adjustment may be made by rotating the trimmer resistor screw of the voltage regulator in the appropriate direction until the testmeter indicates 28 volts. Adjustment should not normally be necessary as the regulator is pre-set before installation.

Removal

15. The generator may be removed from the engine top accessories gearbox, with the co-operation of an engine tradesman, by first disconnecting the cooling duct from the generator, disconnecting the electrical cables, ensuring that the aircraft has been rendered electrically safe (General Information, para. 16), removing the four nuts and washers securing the generator to the top accessories gearbox, and easing the generator outboard.

16. The normal splined drive of the generator is supplemented by an additional drive (Stores Ref. 36KK/1724). On refitting the generator to the engine, the splined drive should be lightly coated with approved graphite compound, and the generator face lightly coated with a suitable jointing compound.

17. The means of removal of the voltage regulator and other associated equipment in the d.c. power supply installation is self-evident, and needs no further comment. The

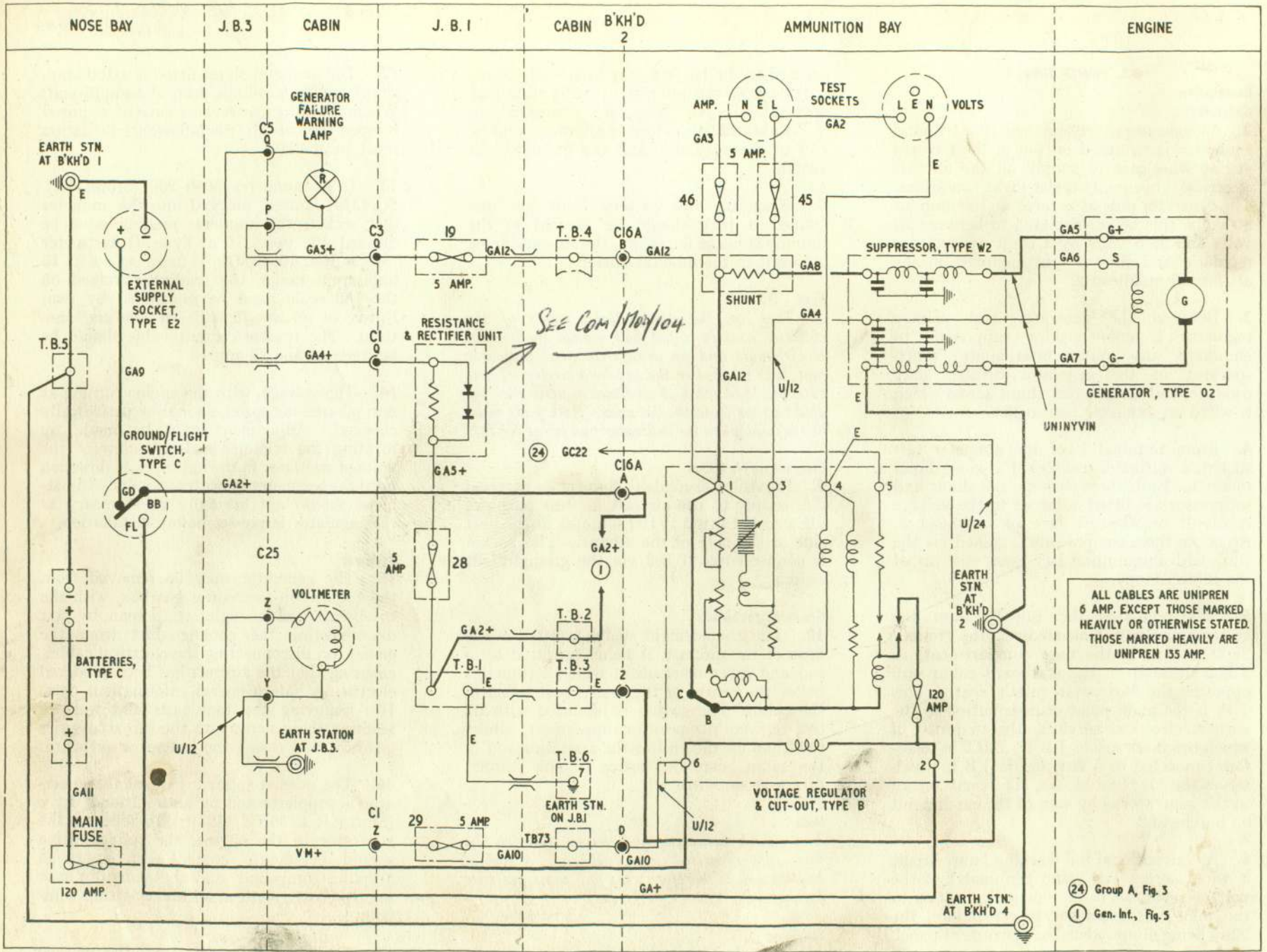


Fig. 2. D. C. supply (generator and batteries)-GA

ground/flight switch installation, however, is peculiar to this aircraft in that, although a standard Type C switch is employed, the manner of operation of the switch is by a rod and lever mechanism.

18. To remove the switch, first set it, from the cabin, to its GROUND position, by pulling the operating rod out. At the switch, remove the split pin, washer, distance piece and pin attaching the connecting rod to the switch lever. Disconnect the electrical connections and remove the two 2 B.A. nuts, bolts and washers securing the switch to the bracket. When refitting, use a new split pin.

19. The external supply socket is let into the aircraft nose skinning, it being supported by a block and plate, and secured by three 0·25 in. nuts, bolts and washers. On removal of these bolts, and the necessary electrical disconnections made, the socket may be removed.

A.C. POWER SUPPLY

Description

Inverters

20. Two inverters, mounted as single units with their respective control panels, are fitted in the aircraft. No. 1 inverter is mounted in the forward cannon bay whilst No. 2 inverter is fitted to the forward face of bulkhead 1 in the nose bay. The three-phase a.c. output of each inverter is controlled at 115 volts, 400 c.p.s., phase B being earthed.

21. Normally No. 1 inverter supplies the a.c. power, but should the output from this inverter fail, No. 2 inverter automatically closes on to the a.c. bus-bar to supply the required a.c. power, and No. 1 inverter is automatically shut down. The circuit is shown theoretically in fig. 4, whilst fig. 3 shows the actual circuit routing chart.

22. Whenever No. 1 inverter is supplying the a.c. power a magnetic indicator, fitted to the instrument panel, is energised, its resultant black flag merging with the black paint finish of the instrument panel. Whenever No. 1 inverter is disconnected from the a.c. bus-bar, however, the magnetic indicator de-energises and its resultant white flag indicates that No. 1 inverter has failed.

23. The sequence of inverter operation can be followed by reference to fig. 4. The sequence, under all conditions, is fully automatic once the flight instrument switch fitted to the instrument panel has been selected ON. With the circuit as shown neither inverter is functioning. Closing the flight instrument switch directs a supply to energise No. 2 inverter relay via a suppressor and contacts 8-8a of relay C. With No. 2 inverter relay energised the circuit to No. 2 inverter is completed from circuit breaker 6 via the now closed contacts 3-3a of No. 2 inverter relay. The a.c. output from the inverter is then connected to the a.c. bus-bar across the normally closed contacts 2a-2 and 4a-4 of relay C.

24. When the aircraft engine is started and the generator voltage rises sufficiently to close the cut-out, a generator-operated relay becomes energised drawing its supply from the cut-out terminal 5 via fuse 22. As this relay energises, its contacts 3-3a close to complete No. 1 inverter relay circuit via the reset push-switch, a suppressor and the normally closed contacts 2-2a of relay B. No. 1 inverter relay contacts 1-1a are closed to complete the circuit to No. 1 inverter from circuit breaker 2. (The action of the generator-operated relay therefore ensures that AT NO TIME WILL BOTH INVERTERS BE DRAWING CURRENT FROM THE MAIN BATTERIES).

25. At the same time as No. 1 inverter relay is energised a d.c. supply is connected to terminal 4 of a torque switch. When No. 1 inverter output has stabilised the torque switch contacts 4-5 close and both relay C and relay A become energised.

26. Relay C energising causes its contacts 7a-7 to close completing the magnetic indicator circuit which then shows BLACK. Also contacts 2a-2 and 4a-4 open to disconnect No. 2 inverter output from the a.c. busbar but contacts 1a-1 and 3a-3 close to connect No. 1 inverter output to the bus-bar thus maintaining the a.c. power supply. Contacts 8a-8 open to open-circuit No. 2 inverter relay which results in No. 2 inverter stopping.

27. Relay A energising causes its contacts 1a-1 to close to maintain No. 1 inverter relay coil circuit and its contacts 3-3a to close to energise relay B. Contacts 1-1a of relay B close to complete its own hold-in circuit so that should No. 1 inverter output fail and the torque switch contacts 4-5 consequently open, the action of relay A de-energising will open-circuit No. 1 inverter relay to stop that inverter.

28. Under those conditions relay C will also be de-energised and its contacts revert to the positions shown in fig. 4 resulting in No. 2 inverter relay re-energising to complete No. 2 inverter d.c. exitation circuit and the magnetic indicator de-energising to show WHITE to signify No. 1 inverter failure. No. 2 inverter then supplies the a.c. power.

29. As the aircraft becomes airborne and the alighting gear is retracted, operation of the port undercarriage door lock microswitch (Group F) completes the circuit to energise a relay which, on closing its contacts 3-4, energises the hold-in relay. This causes the hold-in relay contacts 3-4 to close to complete the relays own hold-in circuit and its contacts 5-6 to close. These latter contacts short circuit the flight instrument switch so that it no longer controls No. 2 inverter. (It will be noticed that the action of these two relays, i.e., the alighting gear operated and hold-in relays, form an automatic selector circuit should the pilot have forgotten to select the FLIGHT INSTRUMENT switch to ON before take-off).

30. When the aircraft lands and the cut-out contacts open the generator operated relay will be de-energised and its contacts will open. This will cause relays A, B and C and No. 1 inverter relay to be de-energised resulting in the magnetic indicator reverting to WHITE, and No. 1 inverter stopping. As relay C contacts 8a-8 close due to the

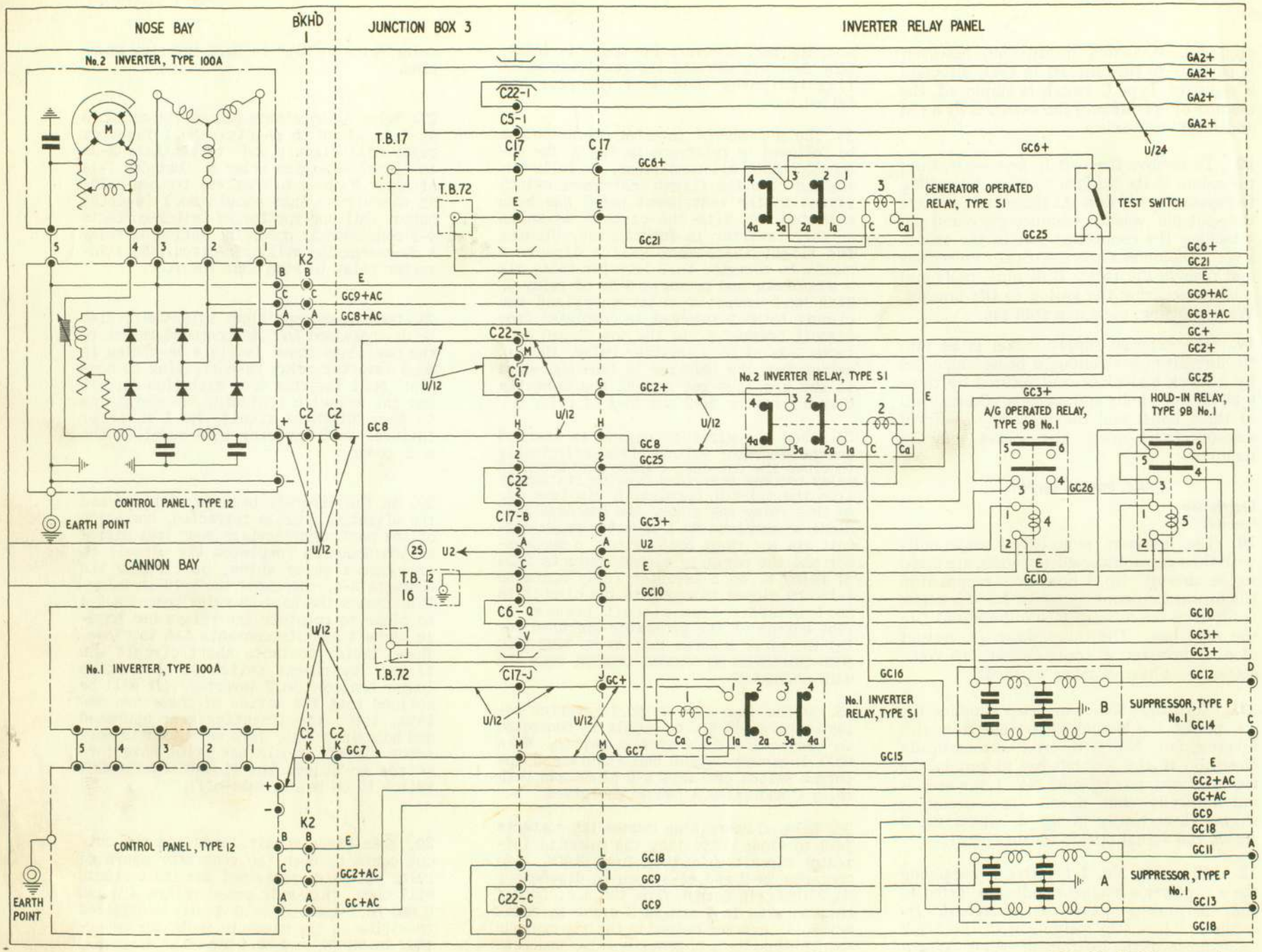
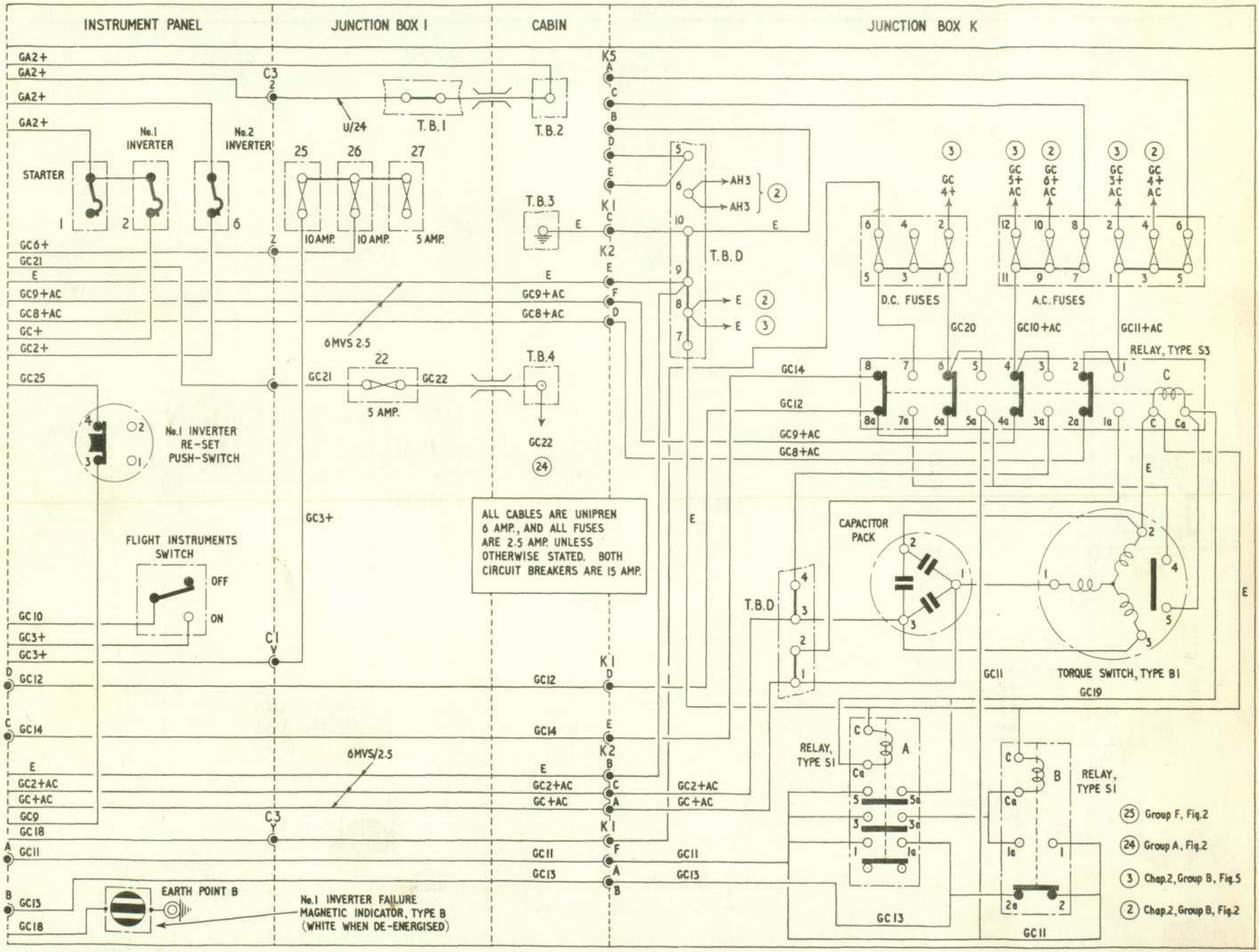


Fig.3. A.C. supply



(inverters) - GC

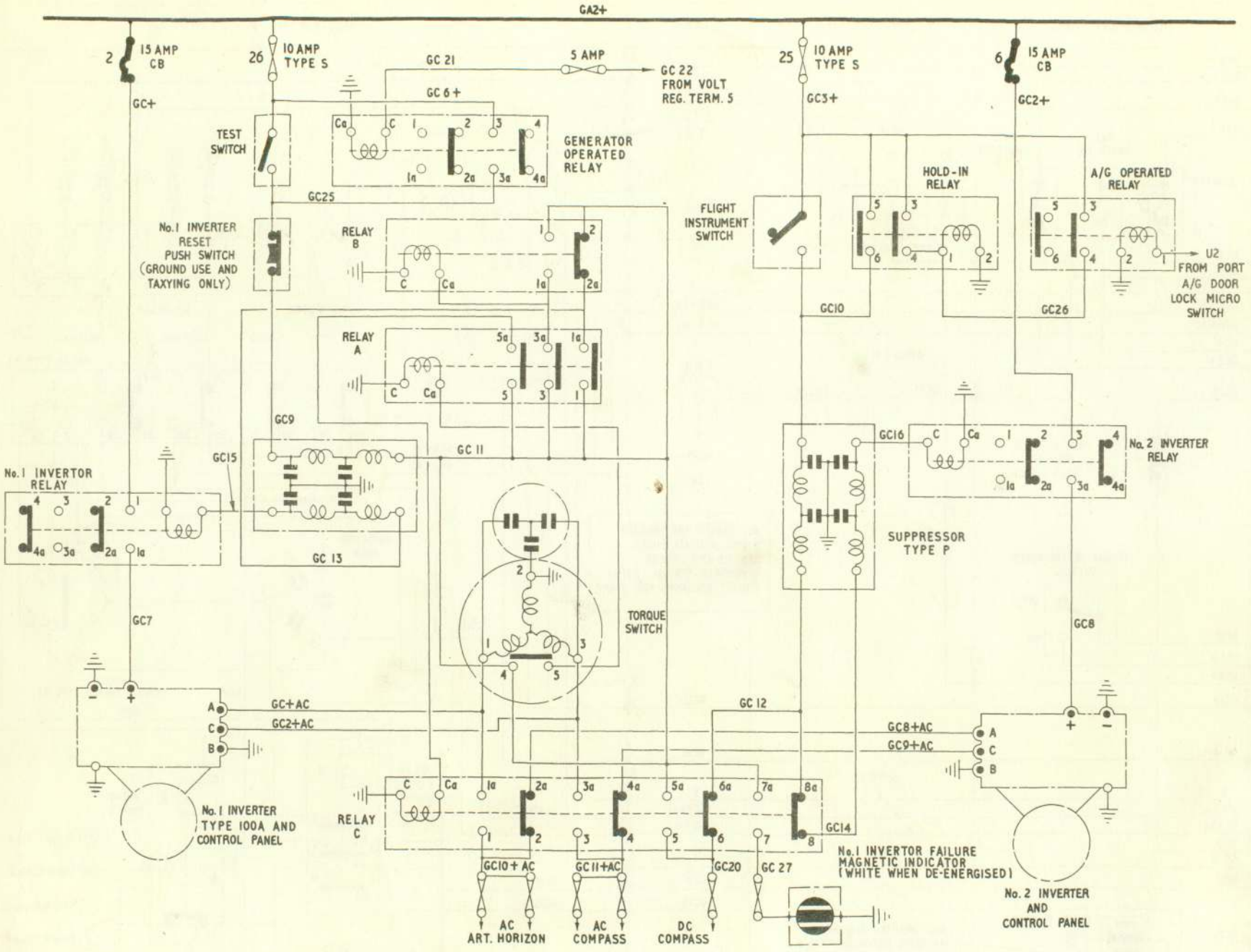


Fig. 4. A.C. supply theoretical

relay being de-energised No. 2 inverter relay will again be energised and No. 2 inverter will re-start and supply the a.c. bus-bar.

31. To stop No. 2 inverter after the aircraft has landed and the generator cut-out has opened, both under the "normal" condition described in the previous paragraph and under "No. 1 inverter failed during flight" condition, the FLIGHT INSTRUMENT switch must be moved to OFF and the ground/flight switch selected to GROUND. This latter action is necessary to de-energise the hold-in relay.

32 It may be found, with the a.c. power supply system selected and No. 2 inverter running, then automatically No. 1 inverter taking over due to the generator-operated relay being energised, that during taxying of the aircraft prior to take-off the generator-operated relay will momentarily de-energise due to the cut-out opening as a result of varying engine R.P.M. If this condition should arise, depicted by the magnetic indicator reverting from BLACK to WHITE, then No. 1 inverter may be reset by operating the reset push-switch fitted adjacent to the magnetic indicator on the instrument panel.

Warning . . .
This reset push-switch must NOT be used during flight when No. 1 inverter has failed or incorrect operation of the magnetic indicator may result.

SERVICING

33 Servicing information for all the components in the a.c. power supply system appears in the specialist Air Publications listed in para. 1.

Ground testing

34 A test of the system may be made with the aircraft on the ground and the engine stopped as follows:—

Note . . .
Prior to these test temporarily connect a shorting link between terminals A and B of the alighting gear port leg lock micro switch, situated on the radius rod of the port oleo leg.

(1) With the aircraft batteries disconnected, an external 27 to 28·5 volt d.c. supply connected to the aircraft and the ground/flight switch set to GROUND, operation of the flight instrument switch will cause No. 2 inverter to run. The magnetic indicator will show WHITE.

(2) At the inverter relay panel, located on the starboard fuselage wall forward of the starboard instrument panel, switch ON the test switch. This switch short-circuits the generator-operated relay contacts 3-3a; No. 1 inverter will then run, No. 2 inverter will automatically stop and the magnetic indicator will change to BLACK.

(3) Press the reset push-switch on the instrument panel to simulate No. 1 inverter failure, and check that the magnetic indicator reverts to WHITE and that No. 1 inverter stops and No. 2 inverter again runs. Release the reset push-switch and check that the magnetic indicator again shows BLACK.

(4) Switch OFF the test switch and check that the magnetic indicator reverts to WHITE (this shows that No. 1 inverter has cut out and that No. 2 has cut in), and switch OFF the flight instrument switch to stop No. 2 inverter. Set the flight instrument switch ON to re-start No. 2 inverter, manually depress then release the plunger of the port undercarriage door lock micro switch on the port wheel door and switch OFF the flight instrument switch: No. 2 inverter will continue to run. Select the ground/flight switch to FLIGHT and check that No. 2 inverter stops. Move the flight instrument switch to OFF, remove the external supply from the aircraft, set the ground/flight switch to GROUND and reconnect the aircraft batteries.

Note . . .
Remove the shorting link from terminals A and B of the alighting gear port leg lock micro switch.

REMOVAL

35 All the components in the a.c. power supply installation are easily removed, the method of removal being obvious.