GROUP A — POWER SUPPLIES

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LIST OF ILLUSTRATIONS

Introduction

1. This group contains information relating to both the d.c. and a.c. power supply systems employed on the aircraft. Specific servicing instructions for the components used in these systems are given in specialist Air Publications, a list of which follows :

Component	Air Publication
Generator, Type 02	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 W2	4343C, Vol. 1, Sect. 5, Chap. 10
Voltmeter, Type 0 to 35 volts	4343A, Vol. 1, Sect. 16, Chap. 3
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 S1 and S3	4343C, Vol. 1, Sect. 3, Chap. 8
Circuit breaker, Type A3	4343B, Vol. 1, Sect. 10, Chap. 6
Torque switch, Type B, EAP 2312	4343C, Vol. 1, Sect. 4, Chap. 1
Magnetic indicator, Type B2	4343E, Vol. 1, Sect. 18 (At a later date)
Battery charging instructions	4343, Vol. 1, Sect. 3, Chap. 2

D.C. POWER SUPPLY

Description

Generator

2. A single negatively-earthed, shunt-wound generator is mounted on the top of the forward engine wheelcase, and is driven by the engine. The output from the generator is rated at 100 amp. at 30-volts, this being regulated to between 27 and 28·5 volts by a combined voltage regulator and cut-out unit.

3. A suppressor is connected between the generator and voltage regulator to eliminate any radio interference which sparking at the generator brushes may produce. Between this suppressor and the voltage regulator is wired an ammeter shunt, across which is connected an ammeter test socket, From terminal L of this test socket a voltmeter test socket is wired direct to earth.

4. Both these sockets, the shunt and the suppressor are fitted adjacent to the voltage regulator on the aft face of bulkhead 2, access to them being gained via the starboard ammunition bay door just aft of the cabin canopy.

5. The regulated d.c. supply from the voltage regulator is connected via the ground/flight switch in the nose compartment to T.B.1 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.1 is therefore connected to T.B.3 inside J.B.1, this being the source of distribution to the fuseblocks. 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.3 and terminal 1 of the voltage regulator to provide an indication of generator power failure, the lamp being fitted to the main 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.1 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 non-spillable vents of each battery are capped, each cap incorporating a felt pad soaked in Sodium Bicarbonate and an orange-coloured indicator pad. Both pads are secured in the cap by a circlip, the indicator pad being uppermost. These caps are to be fitted at all times to neutralize the acid vapour from the batteries. Both pads must be renewed when the indicator pad turns RED.

External supply socket

9. Provision is made to connect an external d.c. supply to the aircraft for ground test purposes via a socket fitted to the skinning at the port side of the nose compartment. This socket is connected to T.B.1 via the GROUND/FLIGHT switch.

Ground/flight switch

10. The GROUND/FLIGHT switch is fitted in the nose compartment, it being operated by a rod and lever mechanism which terminates below the centre of the main instrument panel in the cabin. The switch is mounted with its 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).

Voltmeter

11. A coloured sector voltmeter is mounted on the main instrument panel, and is wired directly across the main batteries. It will show the condition of the batteries, electrically, at all times irrespective of the position of the GROUND/FLIGHT switch except when the cut-out contacts are closed. In the latter case the voltmeter will show the generator output line voltage.

Servicing

12. 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.

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

Note . . .

The testmeter used must be plugged into the ammeter test socket on the aft face of bulkhead 2.

14. If a 50-0-200 ammeter (Stores Ref. 5Q/4340) is used its reading must be halved. 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. at a battery voltage of 23 to 24-volts.

15. The generator voltage, with the engine turning at normal cruising speed, should be periodically checked. Adjustment may be made by turning the trimmer resistor screw of the voltage regulator in the appropriate direction until the testmeter used indicates 28-volts, the generator being under NO LOAD condition (i.e., with the regulator 120-amp. fuse removed). The aircraft voltmeter should not be used for this test. This adjustment should not normally be necessary as the regulator is pre-set before installation.

Removal

16. The generator may be removed from the engine top accessories gear box, in collaboration with an engine tradesman, by first disconnecting the generator cooling

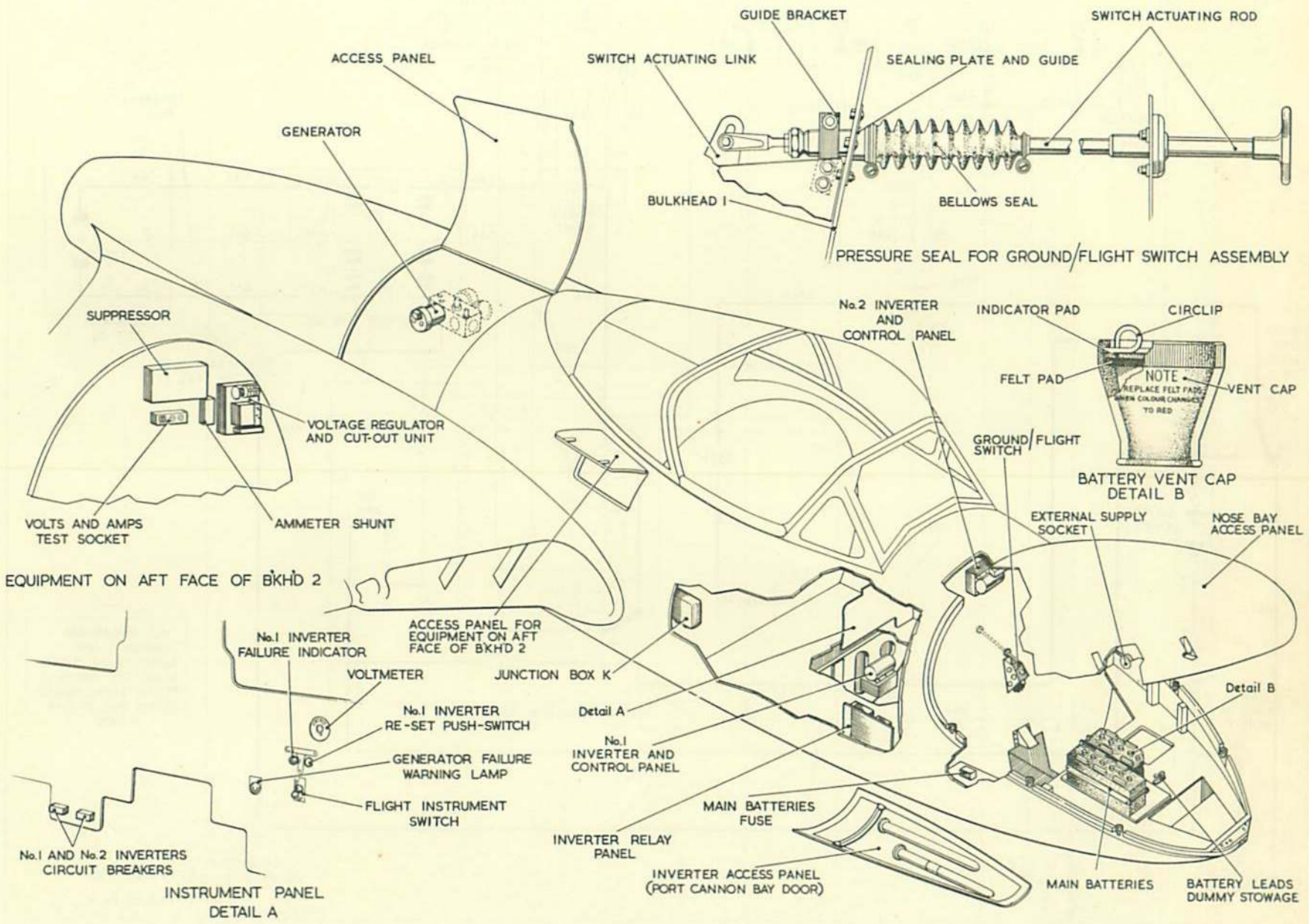

Fig.1. Location and access of components

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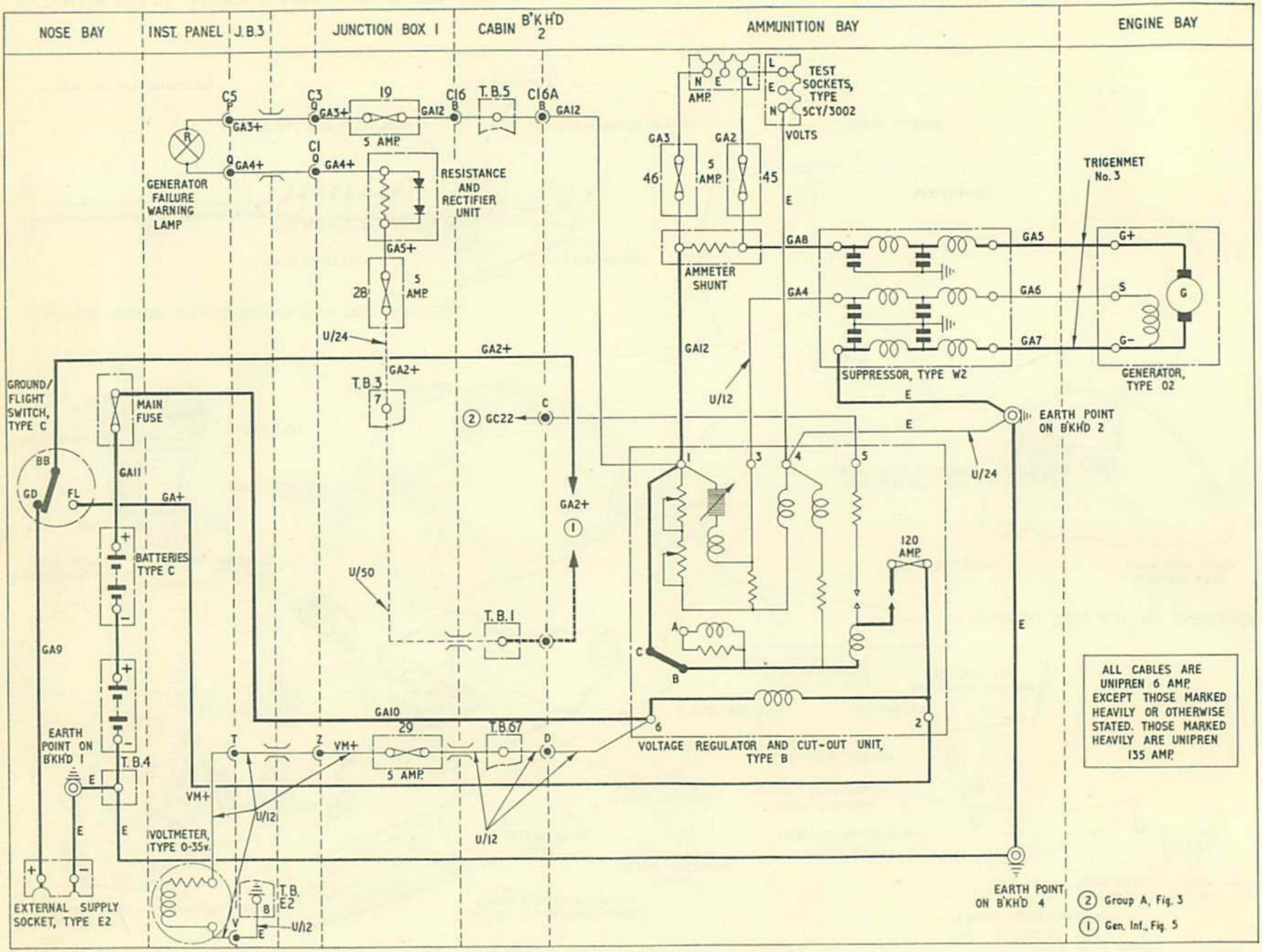


Fig. 2. D. C. supply (generator and batteries) -GA

duct, then the electrical cables, ensuring that the aircraft has been rendered electrically safe (*Gen. Inf. para.* 16), removing the four nuts and washers securing the generator to the top accessories gearbox, and easing the generator outboard.

17. 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.

18. 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 GROUND/FLIGHT switch installation, however, is peculiar to this aircraft in that although a standard Type C switch is employed its manner of operation is by a rod and lever mechanism.

19. To remove the switch first set it, from inside the cabin, to its GROUND position by pulling the operating rod *out*. At the switch in the nose bay 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 BA nuts, bolts and washers securing the switch to the bracket. When refitting use a new split pin.

20. 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

21. 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.

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

23. Whenever No. 1 inverter is supplying 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.

24. 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, which is fitted to the main 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 8a-8 of relay C. With No. 2 inverter relay energized the circuit to No. 2 inverter is completed from circuit breaker 2 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.

25. 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 coil 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 breaker 3. (The action of the generator-operated relay therefore ensures that AT NO TIME WILL BOTH INVERTERS BE DRAWING CURRENT FROM THE MAIN BATTERIES).

26. 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.

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

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

29. Under these conditions relay C will also be de-energised and its contacts revert to the position shown in Fig. 4 resulting in No. 2 inverter relay re-energising to complete No. 2 inverter d.c. excitation circuit. The magnetic indicator is de-energised to show WHITE to signify No. 1 inverter failure. No. 2 inverter then supplies the required a.c. power.

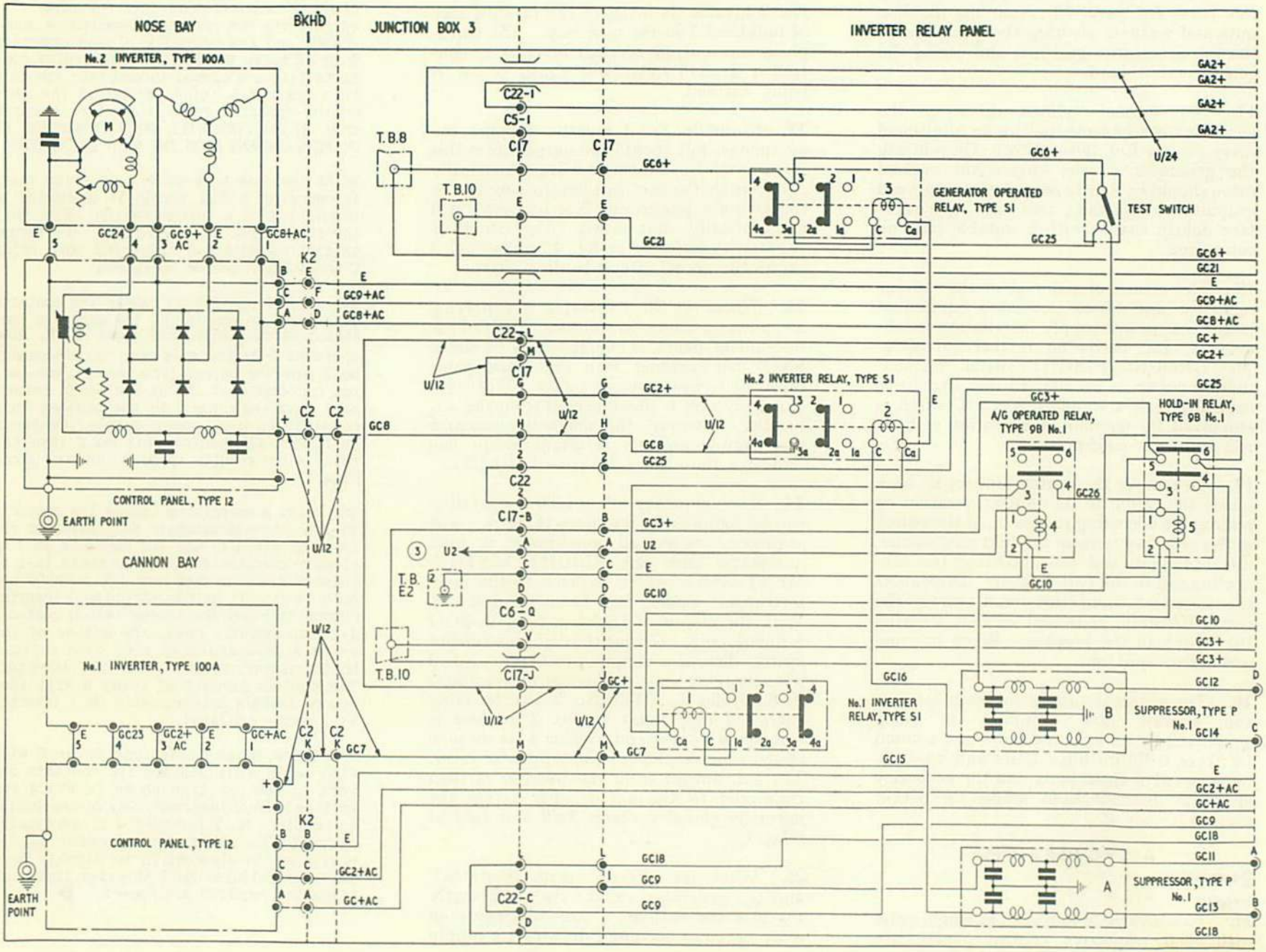
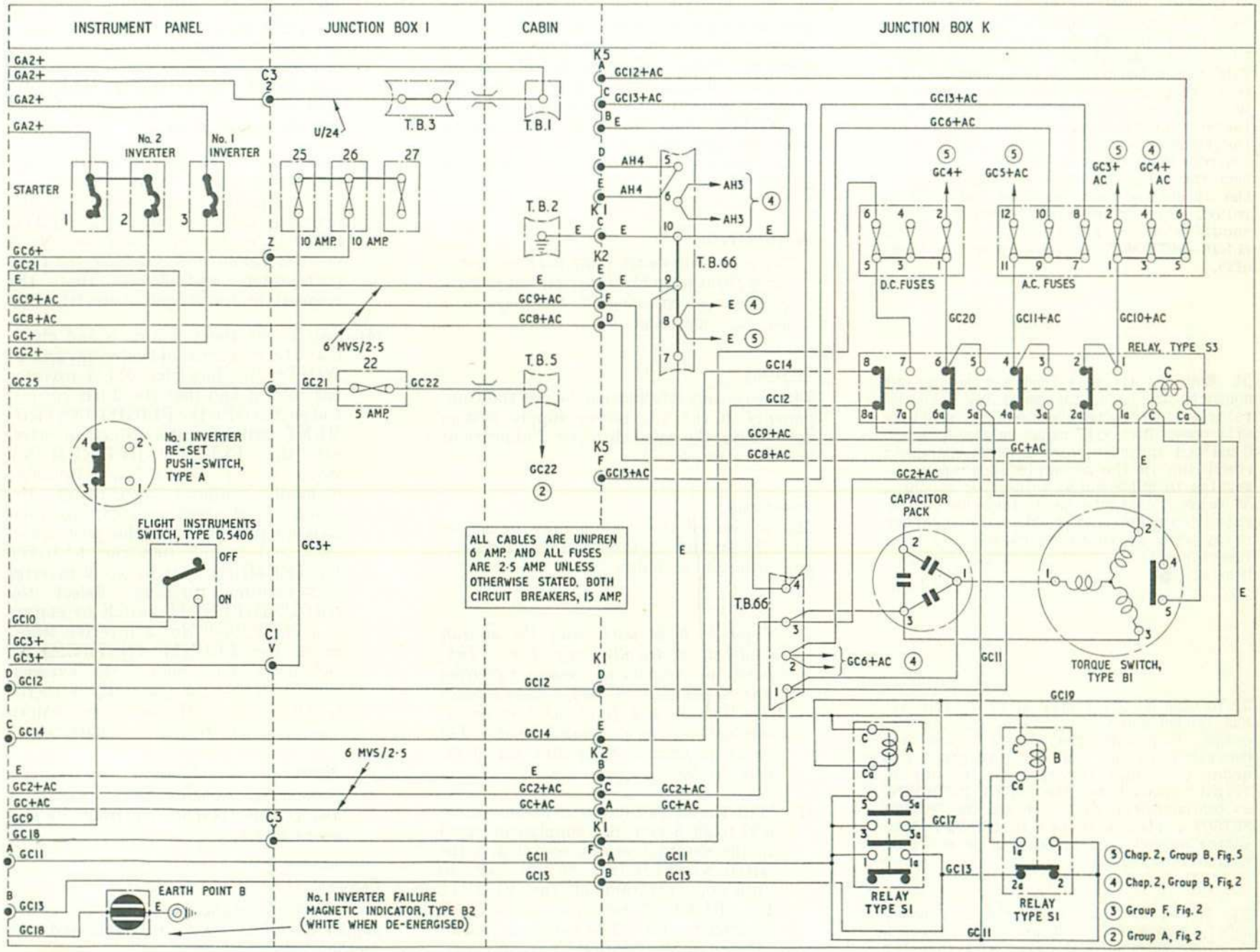


Fig.3. A.C. supply



(inverters) -GC

◀30. As the aircraft becomes airborne and the alighting gear is retracted, operation of the port undercarriage door lock micro-switch (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 relay's own hold-in circuit and 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 forget to select the FLIGHT INSTRUMENT switch to ON before take-off).

31. When the aircraft lands and the cut-out contacts are 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 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. ▶

32. 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 the "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

33. It may be found (with the a.c. power supply system selected and No. 2 inverters 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 momentarily de-energise due to the cut-out opening as a result of varying low 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 erroneous operation of the magnetic indicator may result.

Servicing

34. 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

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

Note . . .

Prior to these tests, with the aircraft rendered electrically safe (Gen. Inf., para. 16), temporarily connect a shorting link of unipren 6 amp. cable between terminals A and B of the port undercarriage leg lock micro switch. The switch is fitted to the radius rod of the port oleo leg.

(1) With the aircraft batteries disconnected, a 27 to 28·5-volts d.c. supply connected to the external supply socket 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 main 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 shut down 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 (to show 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 compress 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 terminals A and B of the port undercarriage leg lock micro switch.

Removal

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

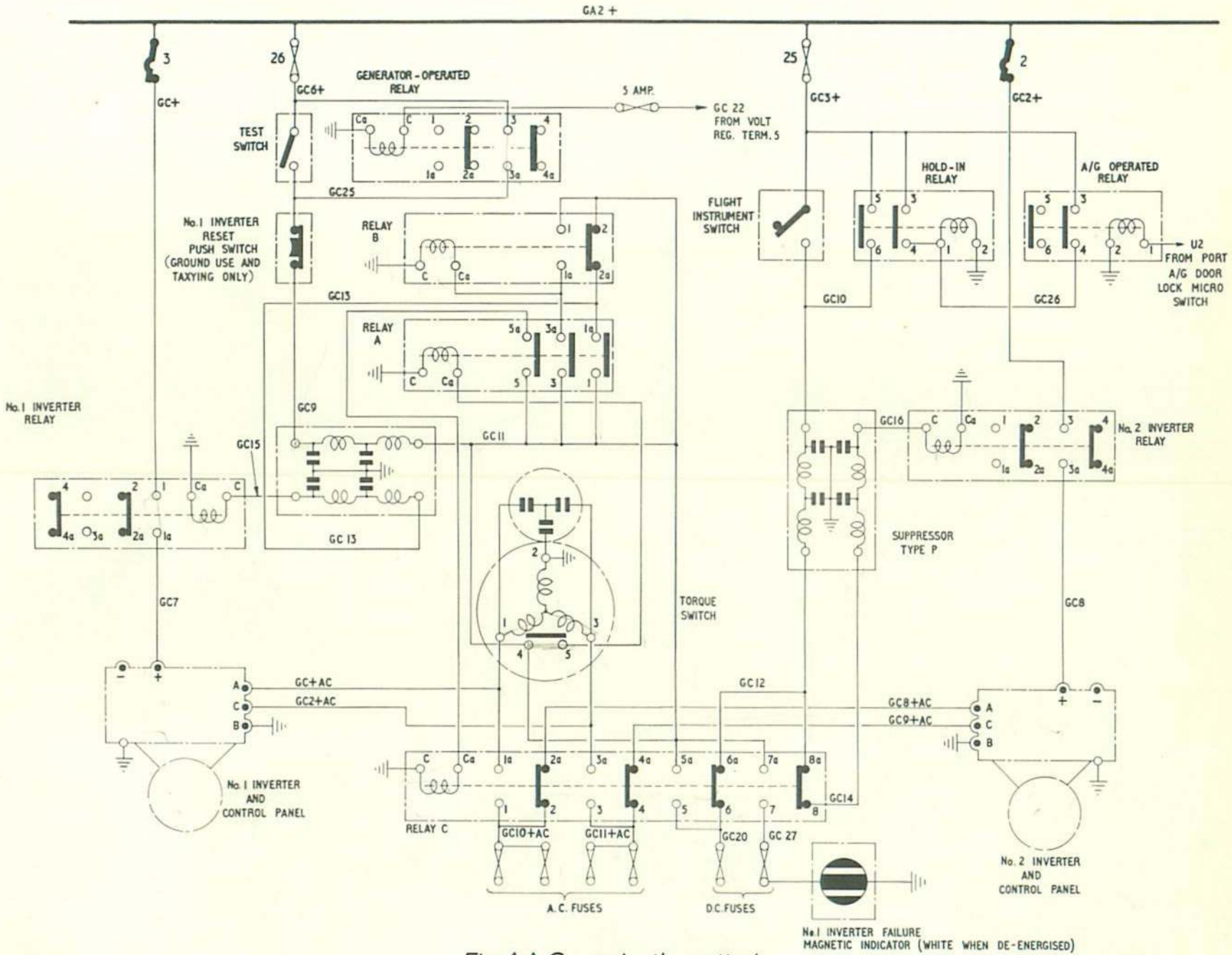


Fig. 4. A.C. supply theoretical