Chapter 3 A C POWER SUPPLIES AND DISTRIBUTION

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Introduction

1. This Chapter describes the generation, control, distribution and servicing of the normal and standby a.c. power supplies. Detailed information regarding the components employed is in the Air Publications referred to in Chap. 1 of this Section; the same Chapter also illustrates the location and means of access to the components.

Modification standard

2. This Chapter includes Mod 38, 168, ◀237, 244, 347, 421, 669, 809 and 1077.▶

General

3. Power for the a.c. electrical services is normally provided by an air turbo-alternator (A T A). When the A T A is not on line, power is provided for certain essential services by an inverter. The 3-phase, 400

Hz outputs of the ATA and inverter are regulated at 200V by their respective control units and are switched to the a.c. busbars by two contactor units. The contactors are both mechanically and electrically inter-locked to ensure that one source of supply cannot be paralleled with another. When on line the ATA output is connected to three sets of busbars for distribution to all a.c. services. Alternatively, when the ATA output is off line, the inverter output is connected to two sets of the busbars for distribution to the essential a.c. services only. The system also provides for the control of compressed air from the engine air bleed system to the turbine of the ATA, manual and automatic selection of the inverter, manual resetting of the alternator field circuit after the operation of a protection circuit, and connection of an external a.c. ground supply to all three sets of busbars for servicing purposes. The operational condition of the system is shown by an indicator on the pilot's instrument panel.

Note...

The three sets of a.c. busbars are known as the normal 200V busbars, the essential services 200V busbars and the essential services 115V busbars; the latter are fed from the essential services 200V busbars via a 3-phase step-down transformer. When the ATA is on line its output feeds all three sets of busbars and, when the ATA is off line, the inverter output feeds the two sets of essential services busbars. With an a.c. ground supply connected to the aircraft all three sets of busbars are supplied and the ATA and inverter outputs are isolated from the busbars.

Function

4. The a.c. supplies required prior to starting the aircraft engines are provided by the inverter. When the engines are started and run at approximately 50 per cent of their maximum r.p.m., the engine air bleed system supplies compressed air at a pressure sufficient to drive the ATA at 24,000 r.p.m. At this speed the output of the alternator is controlled at 200V, 400 Hz before being switched on line by two contactors which also, simultaneously, switch the inverter off line. The inverter continues to run off load until the aircraft becomes airborne and the alighting gear is retracted, when the d.c. supply to a relay in the inverter start panel is disconnected by two microswitches as the undercarriage doors are locked closed. Should the output from the alternator fail at any time, the inverter is automatically switched back on line to provide supplies for the essential services. When the alighting gear is lowered the undercarriage door lock microswitches restore the d.c. supply to the relay in the inverter start panel, thereby causing the inverter to start and run off load. When the speed of both engines is reduced to less than 50 per cent of their maximum r.p.m. the consequent fall in the output of the alternator causes the contactors to switch the ATA off line and, simultaneously, switch the inverter on line.

Description

Air turbo-alternator

5. An air turbo-alternator (ATA), idented R-AU and mounted forward on the starboard side of the radio bay floor, generates power for the a.c. electrical services when driven by compressed air from the engine air bleed system as described in A.P.101B-1201-1A, Cover 2, Sect. 3, Chap. 13. The same chapter also describes the alternator cooling system, which is fed by air tapped from the ram air supply to the radio bay air conditioning system, and a mechanically-operated overspeed trip which shuts down the ATA in the event of the turbine overspeeding. When the engines are running at 50 per cent ± 5 per cent, or more, of their maximum r.p.m. the speed of the ATA is governed at 24,000 r.p.m. by a hydraulic servo-operated governor controlling variable area air nozzles. When operating at 24,000 r.p.m. the ATA generates a 200V, 3-phase, 400 Hz output of 15 kVA.

6. The alternator has three windings, a star-connected main winding designed to produce an a.c. output of approximately 200V, a delta-connected secondary winding which produces an a.c. output of approximately 30V for alternator excitation and control purposes, and a field tickler winding which is energized by a 25V d.c. supply fed from the aircraft busbar via the 'open' contacts of the ATA valve selector switch and two voltage dropping resistors. The current flowing in the field winding produces a magnetic field which induces the required e.m.f. in the secondary winding which, in turn, controls the output of the main winding. The current in the field winding is at its minimum (approximately 1A) for initial excitation of the alternator and during normal operation is controlled by the associated control unit, up to a maximum of 20A, in relation to the load current of the alternator output.

ATA control unit

7. A control unit, idented R-AN and mounted on a shelf above the ATA in the radio bay, comprises three transformers, two voltage-sensitive bridges, three magnetic amplifiers, a 3-phase choke, and various rectifier bridges, resistors and capacitors which are connected with a field shorting contactor, located on the

underside of the shelf above the control unit, to form the following integrated circuits for the control of the A T A output and the protection of the a.c. system.

(1) *Voltage regulation circuit.* This circuit controls the flow of current in the d.c. field winding of the alternator in relation to the output of the alternator secondary winding. Any fluctuation in the secondary winding output causes a proportionate but inverse variation in the current flowing in the d.c. winding. The resultant change in the magnetic strength of the field winding causes the output of the secondary winding to return within the limits required for it to regulate the output of the main winding at 200V ± 4V.

(2) *Control circuits.* If under voltage and/or under or over frequency conditions exist at the a.c. busbars, the condition is sensed by an associated control circuit which causes a main contactor (*para* 9) to hold the A T A output off line until the voltage and/or frequency error is rectified; when this is effected the contactor will bring the output back on line. The circuits operate when the following conditions apply and affect the system as detailed:-

(a) If the A T A output voltage does not attain 192V, or falls to 190V, the supply is held off line by the open contacts of the contactor. As, on being regulated, the output voltage rises to 192V, the contacts of the contactor close and connect the supply on line.

(b) If the frequency of the A T A output varies outside the limits of 380-420 ◀ Hz, the contactor opens and holds the ▶ output off line until the frequency is controlled within the limits of 384- ◀ 416 Hz when the contactor closes and ▶ connects the output on line.

Note...
Operation of the main contactor does not shut down the A T A.

(3) *Protection circuits.* These circuits sense any excessive increase in the A T A output voltage and/or load current difference between phase outputs and, by means of a field short contactor, close down the alternator. The circuits operate when the following conditions apply:-

(a) The mean line voltage is 210V or more; this provides over voltage protection.

(b) A variance of ± 20 per cent of the full load current, i.e. ± 8.5 A, exists between phases or between any phase and earth; this provides protection against unbalanced loading of the alternator, line to earth and line to line faults, and open-circuited main feeders.

Note...
A thermal overload protection circuit is also incorporated in the control unit but is not employed.

Alternator reset switch

8. If the alternator is closed down due to the operation of a protection circuit, the field shorting contactor can be reset by a single-pole switch, marked A.T.A. RESET ON – OFF, located on the starboard switch panel at the pilot's station. If, after the contactor has been reset, the protection circuit again shuts down the alternator, the reset should be tried once more and, if the fault is persistent, no further attempt should be made until the fault has been rectified.

Main contactor

9. The main contactor, idented R-AM, comprises two relays housed in a single unit which is secured to the underside of a shelf above the A T A control unit. The contacts of one relay switch the voltage and frequency-controlled output of the A T A to the normal 200V a.c. busbars. The contacts of the other relay switch the a.c. ground supply, if connected, to the normal 200V a.c. busbars and cause the A T A/Inverter changeover contactor (*para* 13) to isolate the outputs of both the A T A and the inverter from the busbars.

10. The contacts of the contactor have a continuous rating of 35A at 200V, and have a rupturing capacity of 250A at 60,000 ft. The operating coils of the solenoids are continuously rated at 29V.

A T A shut-off and regulating valve

11. The flow of compressed air from the engine air bleed system to the turbine of the A T A is controlled by a combined shut-off and regulating valve. The valve, idented R-EJ, incorporates a solenoid and a pneumatically-operated regulator and is fitted in the air bleed ducting immediately up-stream of the entry into the turbine casing. When the engines are running the pressure of the air flowing to the A T A is limited to 50 lb/in² by the regulator of the valve. When it is required to shut-down the A T A the solenoid of the valve is energized to close the valve; this is effected by selecting a single-pole changeover switch (L), located on the starboard switch panel C-H and marked A T A VALVE, OPEN–SHUT, to SHUT.

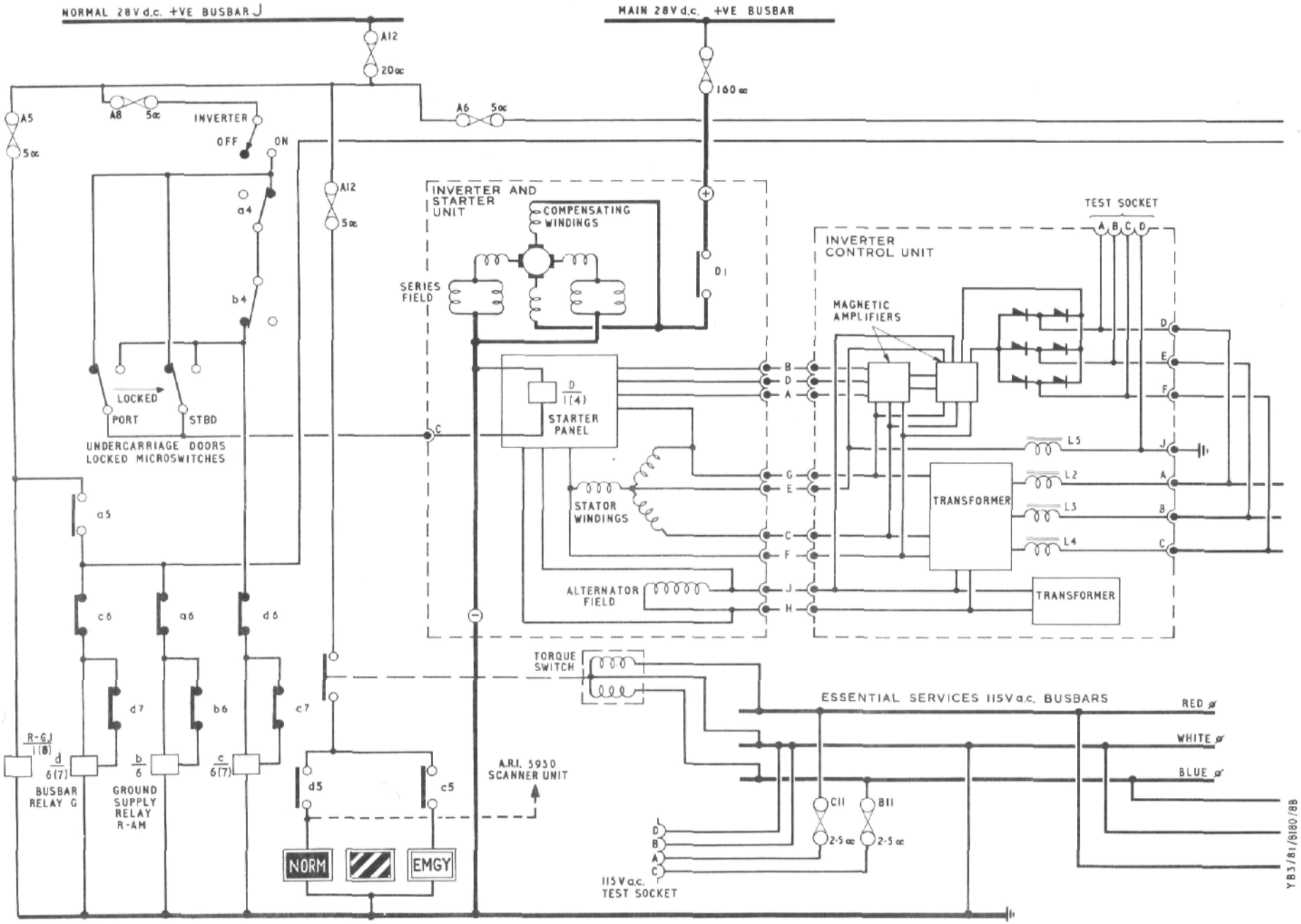


Fig. 1. AC power supplies and distribution – theoretical

◀Supply fuse A12 included▶

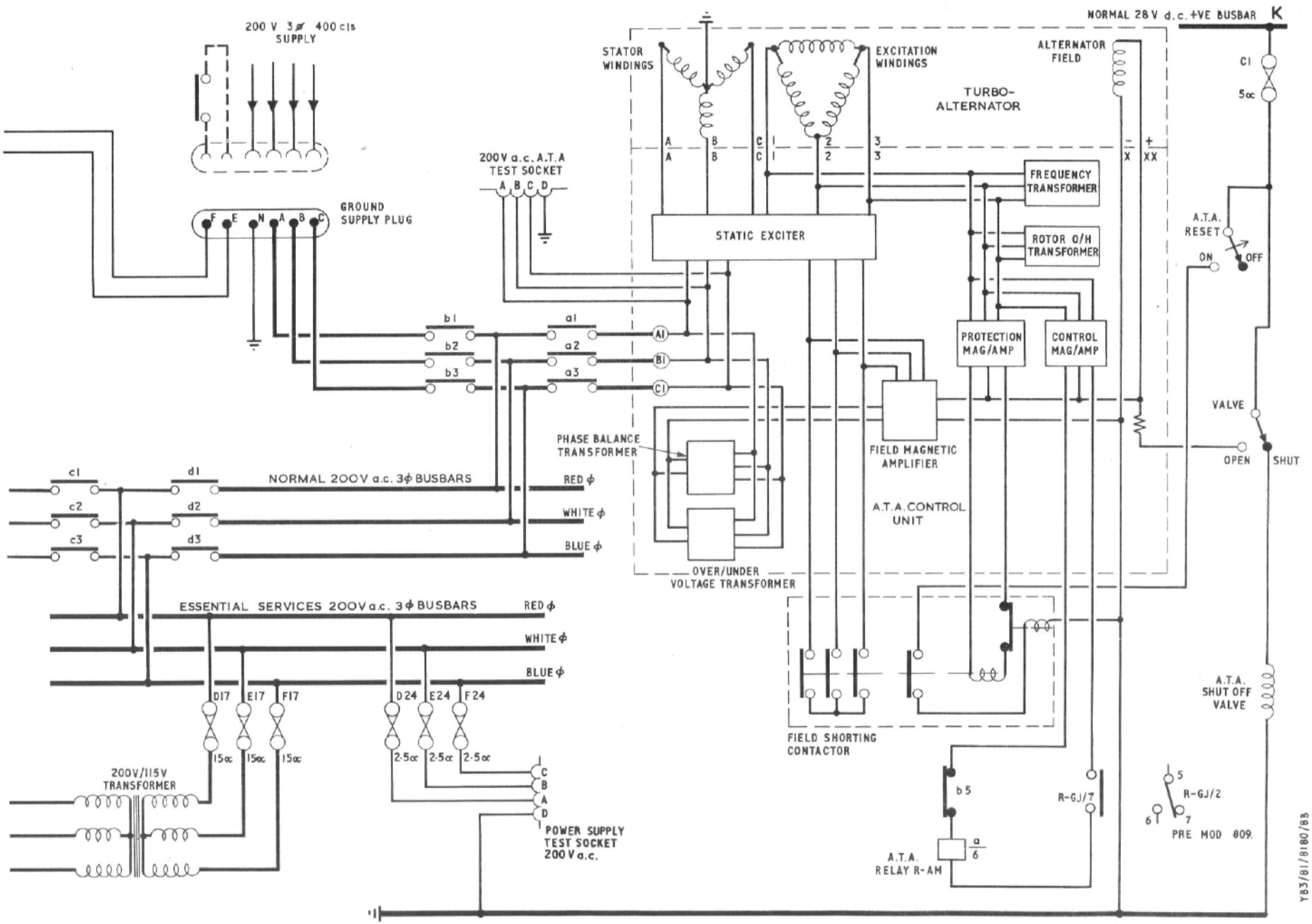


Fig. 1a. AC power supplies and distribution – theoretical
◀ Mod 809 included ▶

Note...
The ATA valve selector switch is also used to connect a d.c. supply to the field tickler winding of the alternator when the switch is set to OPEN *(para 24).*

Inverter

12. When the ATA is not on line and no external a.c. supply is connected to the aircraft, the supplies to the essential a.c. services are provided by an inverter, idented R-AA and mounted on the radio bay floor immediately aft of the access door. Operation of the inverter is selected by a single-pole switch, marked INVERTER, ON – OFF, located on the starboard switch panel. The inverter has a 3-phase output which is controlled at 200V, 400 Hz by a control unit idented R-AB and mounted adjacent to the inverter. The output of the inverter is switched to the essential services 200V busbars (*para* 3) which, in turn, provide the supplies at the essential services 115V busbars via a 3-phase step-down transformer. A test socket and two trimmer resistors are provided on the control unit to facilitate testing and adjustment of the voltage and frequency output of the inverter.

ATA/Inverter changeover contactor

13. A contactor, idented G and located in the a.c. distribution box in the radio bay, comprises two relays which automatically switch the supplies at the busbars according to the condition of the a.c. system. When the output of the ATA, or an a.c. ground supply, is connected to the normal 200V busbars, one of the relays connects the supply to the essential services busbars and causes the second relay to isolate the inverter from the essential services busbars. Alternatively, with no ATA output or a.c. ground supply on line, the second relay connects the inverter to the essential services busbars and causes the first relay to isolate the normal busbars from the essential services busbars.

Indicator

14. A three-position magnetic indicator, located on the starboard side of the pilot's instrument panel and marked A.C. SUPPLIES, indicates the operational condition of the a.c. system. The supply for the operation of the indicator is fed from the normal 28V d.c. busbar when the contacts of a torque switch, idented H and located in the a.c. distribution box, are closed by a supply fed from the essential services 115V busbars. This supply is switched by the relay contacts of the ATA/Inverter changeover contactor to cause the indicator to show NORM (in white letters on a black background) when the ATA output or a.c. ground supply is on line, EMGY (in black letters on a white background) when the inverter output is connected to the essential services busbars, and black and white diagonal stripes when no a.c. supplies are available.

Relay R-GJ

15. The d.c. supply required to energize the relay which connects the normal 200V busbars to the essential services busbars is taken from fuse A5 in the a.c. distribution box. Should this fuse be consumed when the ATA is on line, power will be disconnected from the essential services busbars. To enable the inverter to be brought on line to supply the essential services, the contacts of the associated relay in the main contactor are caused to switch the ATA off line by a relay, R-GJ, which is secured underneath a shelf above the a.c. distribution box in the radio bay.

16. The solenoid of this relay is normally energized by a direct supply from fuse A5 and its contacts form part of the solenoid circuit of the main contactor relay which switches the output of the ATA on and off line. If fuse A5 is consumed relay R-GJ is de-energized and its contacts open circuit the supply to the main contactor relay which, in turn, switches the ATA output off line thereby permitting the inverter to be brought on line.

Undercarriage door locked microswitches

17. To ensure that the inverter is immediately available in the event of an ATA failure during take-off and landing, the d.c. supply to the inverter starter relay is sequenced by two microswitches. The contacts of the microswitches are connected in parallel and are operated by the door lock mechanism of each undercarriage unit. When the aircraft becomes airborne and the undercarriage doors are locked closed, the d.c. supply to the inverter starter relay is disconnected and the inverter shut down. The opening of the door locks as the undercarriage is lowered causes the contacts of the microswitches to reconnect the supply to the inverter starter relay, thereby causing the inverter to start and run off load.

AC ground supply plug

18. To facilitate the connection of 200V, 3-phase, 400 Hz ground supply to the aircraft busbars when servicing, a heavy-duty plug connection is fitted beneath a hinged panel on the port side of the fuselage immediately forward of the bomb bay door. As d.c. equipment is employed to control the a.c. supplies, a d.c. supply must be available, either from the aircraft battery or from a ground supply trolley, when an a.c. ground supply is connected.

Test sockets

19. To facilitate the connection of test equipment to the supplies of the a.c. system a test socket is provided at each of the following positions in the radio bay:-

(1) A test socket, marked POWER SUPPLY TEST SOCKET, 200V A C, is mounted on panel R-F which is located on the front of the shelving on the port side of the radio bay. Tappings taken from the 3-phases of the essential 200V a.c. busbars are brought out to the pins of the socket.

(2) Two test sockets are mounted side-by-side on a bracket attached to the shelf above the A T A. One socket, identified R-FX and marked 200V a.c. A T A TEST SOCKET is connected to the regulated output of the A T A. The other socket on the bracket, identified R-GQ and marked 115V TEST POINT, is connected to the essential services 115V a.c. busbars.

(3) Leads, connected to the controlled 3-phase output of the inverter, are brought out to a test socket on the case of the inverter control unit, which is located on the port side, aft of the radio bay access door.

Operation (fig 1 - 1a and 2 - 2a)

20. To assist in the description of the circuit operation, the relays incorporated in the contactors are annotated with arbitrary letters and their contacts with arbitrary figures. The relays of the contactor R-AM are annotated a and b and their contacts from 1 to 6 inclusive. The relays of the A T A/Inverter changeover contactor G are annotated c and d and their contacts from 1 to 7 inclusive. Each relay contact is defined in the following paragraphs by its relay letter followed by the contact number.

21. As d.c. supplies are required to control the system, a 28V d.c. ground supply must be connected to the aircraft. Economy contacts are incorporated in relays b, c and d to minimize the current required to hold them energized. The contacts employed are b6, c7 and d7 respectively.

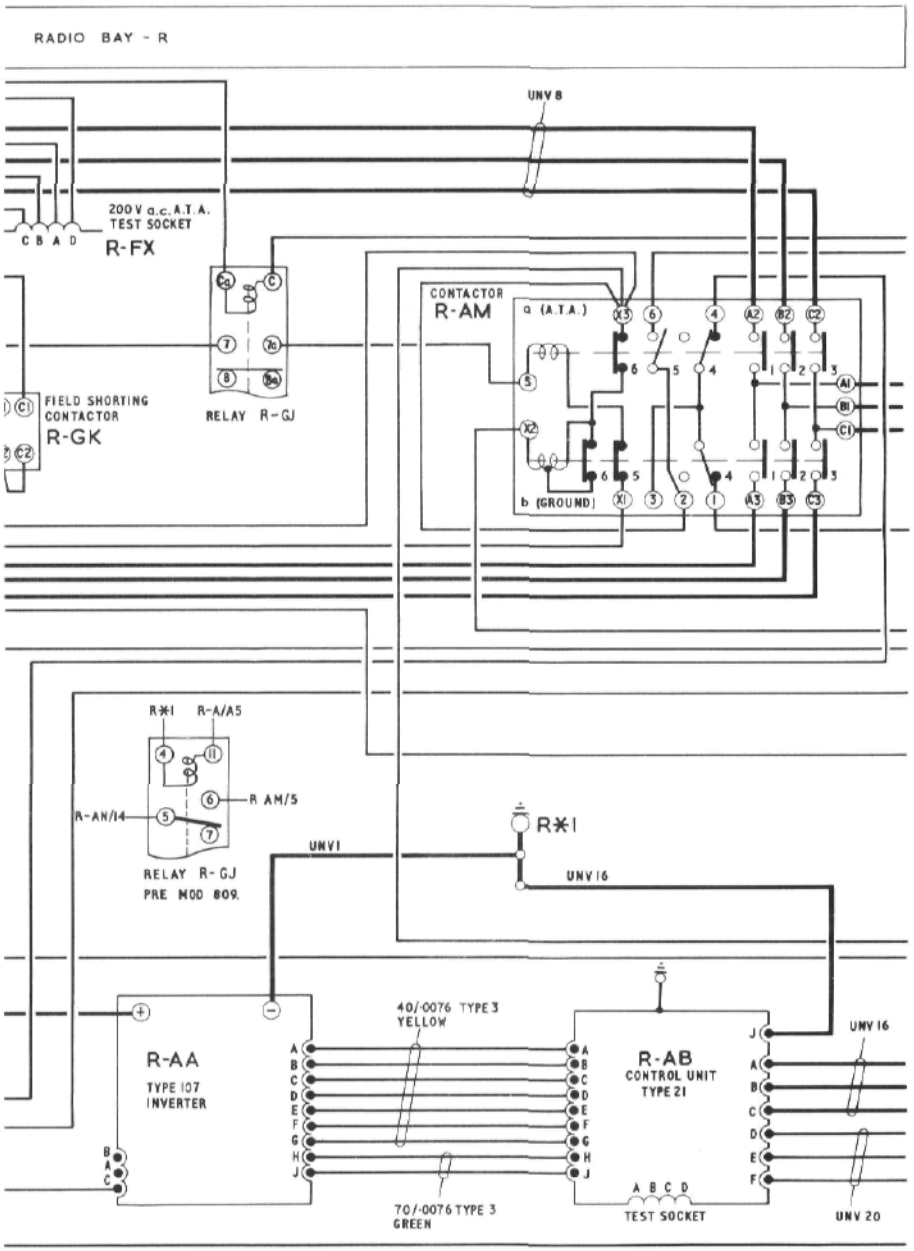
Essential supplies

22. With the aircraft on the ground and a supply available at the normal 28V d.c. busbar, a supply is fed from fuse A5, in distribution box R-A, to the solenoid of relay R-GJ. Selection of the inverter control switch A, on the starboard switch panel C-H, to ON connects a d.c. supply from fuse A8, in the dist. box R-A, via contacts 4–5 of the undercarriage door locked microswitches WS-AC (stbd) and WP-AJ (port), to the solenoid of the starter relay in the inverter R-AA. The supply from fuse A8 is also fed, via the inverter control switch and contacts a4, b4 and d6, to the solenoid of relay c. The contacts of the inverter starter relay connect a supply from the main d.c. busbar to the +ve terminal of the inverter, which then starts and runs. The output of the inverter is controlled at the correct voltage and frequency by the control unit R-AB, and is connected to the essential services 200V busbars by contacts 1, 2 and 3 of relay c. A 3-phase supply, tapped from the essential services 200V busbars, is fed, via the fuses D17, E17 and F17 in the dist. box R-A, to the 200V/115V step-down transformer R-AK which then provides the supply at the essential services 115V busbars.

23. The operating coils of the torque switch H in the dist. box R-A are energized when a supply is available at the essential services 115V busbars, and its contacts connect a d.c. supply from fuse A12, in the dist. box R-A, via relay contacts c5, to the solenoid connected across terminals 2 and 3 of the indicator AE, thus causing an EMGY indication to be shown.

Normal supplies

24. When, with the engines running at 50 per cent of their maximum r.p.m., the A T A valve selector switch (L on panel C-H) is selected from SHUT to OPEN, the d.c. supply fed from fuse C1 (panel C-Q) to the solenoid of the A T A shut-off and regulating valve is transferred to the field tickler winding of the alternator. The valve then regulates the pressure of engine bleed air applied to the turbine of the A T A and the energized field tickler winding provides the initial excitation of the alternator. When the output of the alternator is at the correct voltage and frequency, a d.c. supply is fed from terminal 13 of the control unit R-AN via contacts b5 to the solenoid of relay a, the return line being completed via contacts R-GJ2(6-5). Contacts a4 disconnect the supply to the solenoid of relay c which, in turn, causes contacts c1, 2 and 3 to disconnect the inverter from the essential services busbars, and contacts c5 to disconnect the d.c. supply to the indicator AE. Contacts a6 isolate relay b, contacts a1, 2 and 3 connect the A T A output to the normal 200V busbars, and contacts a5 connect a d.c. supply from fuse A5 in the dist. box R-A, via contacts c6, to the solenoid of relay d. Contacts d1, 2 and 3 then connect the supply at the normal 200V


RADIO BAY - R
UNV 8
200 V a.c. A.T.A.
TEST SOCKET
C B A D
R-FX
CONTACTOR
R-AM
a (A.T.A.)
b (GROUND)
FIELD SHORTING
CONTACTOR
R-GK
RELAY R-GJ
R*1
R-A/A5
R-AN/14
R AM/5
RELAY R-GJ
PRE MOD 809.
UNV 1
R*1
UNV 16
R-AA
TYPE 107
INVERTER
40/-0076 TYPE 3
YELLOW
70/-0076 TYPE 3
GREEN
R-AB
CONTROL UNIT
TYPE 21
A B C D
TEST SOCKET
UNV 16
UNV 20

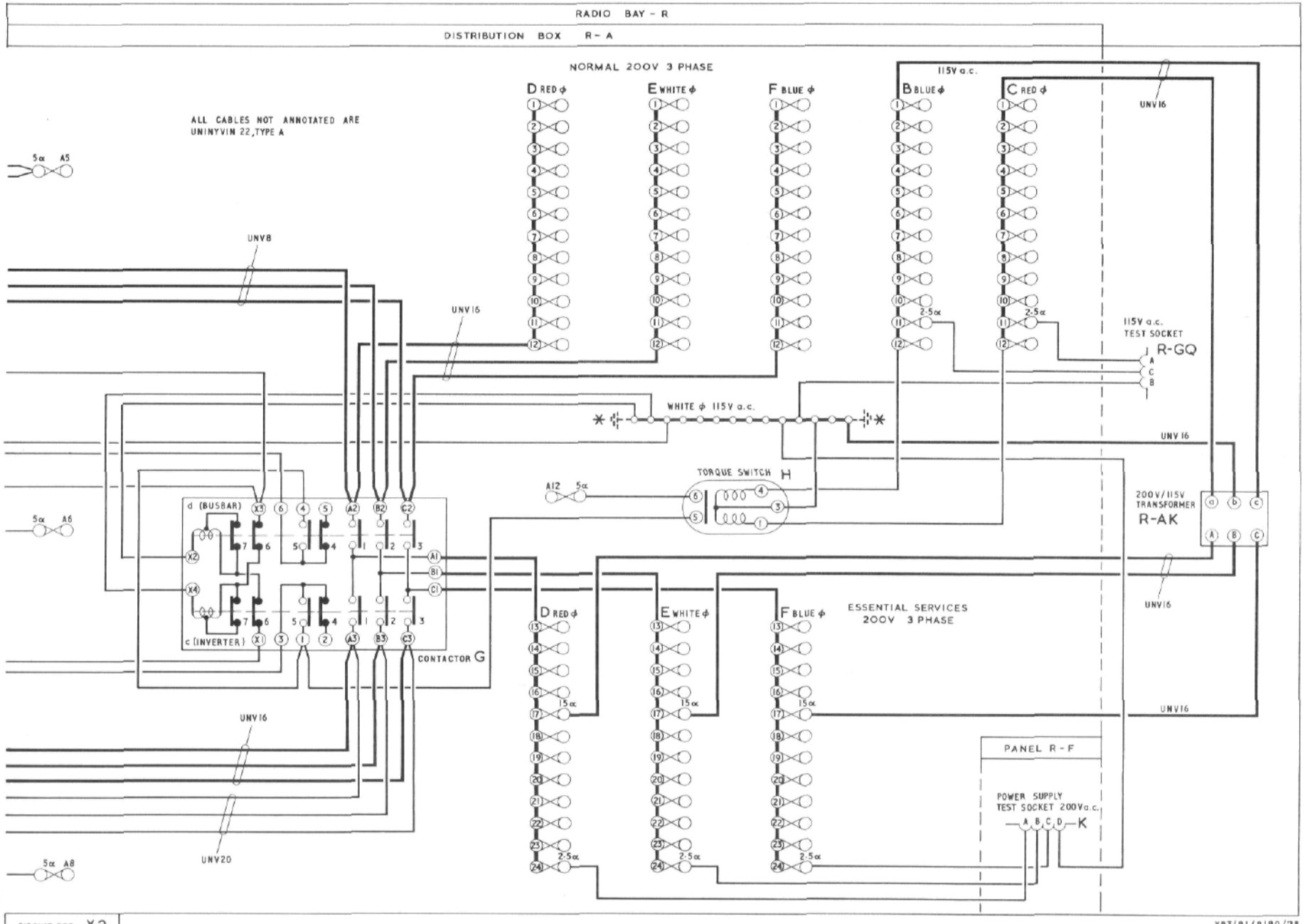


Fig. 2a. AC power supplies and distribution

◀ Fuse A8 corrected to 5A ▶

busbars to the essential services busbars and contacts d5 connect the d.c. supply fed from fuse A12 in the dist. box R-A, via the contacts of the torque switch H to the solenoid connected across terminals 1 and 3 of the indicator AE, thereby causing a NORM indication to be shown.

25. When the aircraft becomes airborne and the undercarriage units are retracted, contacts 4-5 of microswitches WS-AC and WP-AJ disconnect the d.c. supply to the inverter starter relay. The contacts of the relay then disconnect the supply from the main d.c. busbar thus causing the inverter to be shut down.

26. When the undercarriage is lowered contacts 4-5 of microswitches WS-AC and WP-AJ reconnect the d.c. supply from fuse A8 to the solenoid of the inverter starter relay. The contacts of the relay then reconnect the supply from the main d.c. busbar to the inverter, which starts and runs off-load in readiness for connection to the essential services busbars when the ATA is switched off line.

Emergency supplies

27. Failure of the ATA causes the d.c. supply from terminal 13 of the control unit R-AN to cease thus de-energizing the solenoid of relay a. Contacts a1, 2 and 3 then disconnect the output of the ATA from the normal 200V a.c. busbars, contacts a5 disconnect the d.c. supply to the solenoid of relay d, and contacts a4 connect the d.c. supply fed from fuse A8, in the dist. box R-A, via the inverter selector switch A and contacts b4 and contacts d6, to the solenoid of relay c. A supply, tapped between contacts b4 and d6, is fed via contacts 6-5 of microswitches WS-AC and WP-AJ to the inverter starter relay. The contacts of the relay then reconnect the supply from the main d.c. busbar to the inverter, thereby causing it to start and run. Contacts d1, 2 and 3 disconnect the normal 200V a.c. busbars from the essential services busbars, and contacts d5 disconnect the d.c. supply to the solenoid connected across terminal 1 and and 3 of the indicator AE. The inverter output is then connected to the essential services busbars as described in para 22 and the indicator AE caused to show an EMGY indication as described in para 23.

28. In the event of fuse A5, in the dist. box R-A, being consumed when the ATA is on line, the solenoids of relay R-GJ (*para* 15) and relay d are open-circuited. Contacts R-GJ2(6-5) then open-circuit the solenoid of relay a, thereby causing the ATA to be switched off line, the inverter to be switched on line and the indicator AE to show EMGY as described in para 23.

Ground servicing supplies

29. When the socket of a 3-phase, 200V, 400 Hz, supply trolley is connected to the ground supply plug A-AR, an interlock circuit is completed and a 28V d.c. supply is fed from fuse A6, in the dist. box R-A, via contacts a6, to the solenoid of relay b and, via contacts c6, to the solenoid of relay d. Contacts b1, 2 and 3 then connect the 3-phase external supply to the normal 200V a.c. busbars, and contacts d1, 2 and 3 connect the essential services busbars to the normal busbars. Contacts b4 and 5 open-circuit the solenoid circuits of relays c and a respectively, thereby holding the inverter and ATA off line. With a supply available at the the 115V busbars, the torque switch H is energized and its contacts connect a d.c. supply from fuse A12, in the dist. box R-A, via contacts d5, to the solenoid connected across terminals 1 and 3 of the indicator AE thereby causing a NORM indication to be shown.

SERVICING

Notes...

(1) Before disconnecting any electrical connections in the a.c. system, render the system electrically safe by removing fuses A5, A6, A8 and A12 from the a.c. distribution box R-A, fuse C1 from the normal d.c. fuse panel C-Q and, if disconnecting the inverter, fuse J2 at the main d.c. positive busbar of the starboard generator control panel A-B. Insert dummy fuses, complete with streamers, in the vacated fuse holders as described in Chap. 1 of this Section.

(2) Electrical connections in the a.c. system are secured by terminal nuts and plain washers, terminal screws and captive washers, or Cannon connectors. Before disconnecting an electrical connection ascertain that the cable end is correctly marked with the terminal and circuit reference identifications.

(3) Before removing any item of equipment in the a.c. system ensure that the earthing strip, if fitted, is disconnected.

(4) All items of equipment in the a.c. system are bolted to the aircraft structure with the exception of the inverter and the inverter control unit. The inverter is bolted to an adapter plate which is bolted to the radio bay floor. The control unit is secured by spigots and a catch assembly to a tray mounted on four anti-vibration mountings which are bolted to the radio bay floor.

Function test

30. To test the a.c. system for correct operation, the following test equipment is required:-

28V d.c. ground supply

200V, 3-phase, 400 c/s a.c. ground supply

0-250V a.c. voltmeters (3 off)

350-450 c/s 200V frequency meter

200V phase rotation indicator

Loading mats

31. Ensure that fuses A5, A6, A8 and A12 in the a.c. distribution box R-A, C1 in the normal d.c. fuse panel C-Q, and J2 of the main positive d.c. busbar on the starboard generator control panel A-B are intact and are of the ratings given in Chap. 2, Table 1 of this Section.

Test procedure

32. The inverter and indicator should be tested previous to the engine ground run as follows:-

(1) Ensure that the inverter control switch and battery master switch are selected OFF.

(2) Connect a 28V d.c. supply to the d.c. ground supply plug and ensure that the a.c. supplies indicator on the pilot's instrument panel shows black and white diagonal stripes (OFF). Depress the cancel push switch on the centralized warning panel.

(3) Select the inverter control switch to ON and ensure that the inverter in the radio bay starts up and the a.c. supplies indicator shows EMGY.

(4) Check that readings of 200V ± 4V, 400 c/s ± 8 c/s are available between the following pins of the 200V a.c. test socket on panel R-F.

Pins A and B

Pins A and C

Pins B and C

(5) Check that readings of 117V ± 3V, 400 c/s are available between the following pins of the 115V a.c. test socket:-

Pins A and B

Pins C and D

Pins A and C

(6) Connect a 200V, 400 c/s supply to the a.c. ground supply plug and ensure that the inverter continues to run and the a.c. supplies indicator shows NORM.

(7) Select the inverter control switch OFF. Check, using the phase rotation indicator, that the line voltages of the a.c. ground supply reach their maximum positive values at the pins of the 200V a.c. test socket on panel R-F in the order A, B and C.

(8) Select the inverter control switch ON.

(9) Manually depress both undercarriage door locked microswitches simultaneously and ensure that the inverter shuts down and the a.c. supplies indicator still shows NORM. After 3 seconds release the microswitches and ensure that the inverter starts up and the indicator still shows NORM.

(10) Disconnect the a.c. ground supply and ensure that the a.c. supplies indicator shows EMGY.

(11) Manually depress both undercarriage door locked microswitches simultaneously, ensure that the a.c. supplies indicator continues to show EMGY, then release the microswitches.

(12) Select the inverter control switch OFF and ensure that the a.c. supplies indicator shows black and white diagonal stripes.

(13) Disconnect the d.c. ground supply unless an engine ground run is to be effected immediately.

During engine ground run

WARNING...

At all times when the engines are running on a.c. supply must be on line and an emergency battery connected to provide the a.c. and d.c. requirements of the fire protection systems.

Note...

During engine ground run ensure that the jet pump which cools the alternator is working correctly. Check the oil level in the A T A before and after running engines.

(14) Connect the 28V d.c. ground supply to the d.c. ground supply plug, select the battery master switch to ON and depress the cancel push switch on the centralized warning panel.

(15) Ensure that the A.T.A. VALVE and RESET switches are selected to SHUT and OFF respectively and select the inverter control switch to ON. Ensure that the a.c. supplies indicator shows EMGY.

(16) Start up both engines and ensure that both generator warning lamps on the centralized warning panel extinguish.

(17) Ensure that all a.c. loads are switched off and select the A.T.A. VALVE switch to OPEN. Slowly accelerate both engines together until the a.c. supplies indicator shows NORM; this should occur when the speeds of the engines are between 45 and 55 per cent of their maximum r.p.m. Check, using the phase rotation indicator, that the line voltages reach their maximum positive values at the pins of the 200V a.c. test socket on panel R-F in the order A, B and C.

(18) Slowly decelerate both engines together until the a.c. supplies indicator shows EMGY; this should occur when the speeds of the engines are between 37 and 47 per cent of their maximum r.p.m.

(19) Slowly decelerate both engines to ground idling r.p.m. and select the A.T.A. VALVE switch to SHUT.

(20) Using external loading mats apply a preset load of 20A to each line of the alternator output. Select the A.T.A. VALVE switch to OPEN and slowly accelerate both engines together until the a.c. supplies indicator shows NORM; this should occur when the speeds of both engines are between 55 and 65 per cent of their maximum r.p.m.

(21) Slowly decelerate both engines together until the a.c. supplies indicator shows EMGY; this should occur when the speeds of both engines are between 52 and 62 per cent of their maximum r.p.m.

(22) Decelerate both engines to ground idling r.p.m. Select the A.T.A. VALVE switch to SHUT and switch off the loading mats.

(23) Repeat operations (20) to (22) inclusive with a balanced load of 10A applied to each line of the alternator output. In this case, however, the changes of the indicator display on both acceleration and deceleration of the engines should occur when the speeds of both engines are between 49 and 59 per cent of their maximum r.p.m.

(24) Shut down one engine and repeat operations (20) to (23), inclusive.

Note...
When accelerating the engine the indicator display should change from EMGY *to* NORM *at the r.p.m. stated for both engines. When decelerating, however, the change of the indicator display from* NORM *to* EMGY *should occur between 53 and 63 per cent of maximum r.p.m. with 20A loads applied and between 48 and 58 per cent of maximum r.p.m. with 10A loads applied.*

(25) Start the stationary engine.

(26) With no load on the alternator select the A.T.A. VALVE switch to OPEN and slowly accelerate both engines together until the a.c. supplies indicator shows NORM.

(27) With the ATA on line execute a slam acceleration of both engines together and ensure that the a.c. supplies indicator still shows NORM. Decelerate both engines to ground idling r.p.m. and select the A.T.A. VALVE switch to SHUT. The a.c. supplies indicator should then show EMGY.

Note...
This test may cause the overspeed trip mechanism of the ATA to operate, in which case it must be manually reset as detailed in Book 1, Cover 2, Sect. 3, Chap. 13 of this Volume.

(28) Using the loading mats apply a 20A load to each line of the ATA output. Select the A.T.A. VALVE switch to OPEN and slowly accelerate both engines together until the a.c. supplies indicator shows NORM, then repeat operation (27).

(29) Select the A.T.A. VALVE switch to OPEN and accelerate both engines until the a.c. supplies indicator shows NORM. Adjust the loading mats to apply a balanced load of 10A to each line of the A T A output, then select the engine blow valves switch to OPEN and, after 2 seconds, with the blowing system switch selected to AUTO, set the aileron droop seltor to 10 deg. During these selections check that the voltage and frequency of the A T A output remain stable.

(30) Select the aileron droop selector to NORMAL and, after 20 seconds, select the engine blow valves switch to CLOSE. During these selections check that the voltage and frequency of the A T A output remain stable.

(31) Accelerate both engines to 93.5 per cent of their maximum r.p.m. and repeat operations (29) and (30).

(32) Switch off the loading mats, shut down the engines and select the A.T.A. VALVE switch to SHUT. Ensure that the a.c. supplies indicator shows EMGY and the generator warning lamps on the centralized warning panel illuminate. Depress the cancel push switch on the cenralized warning panel to cancel the operation of the attention warning lamps and audio warning unit of the centralized warning system.

(33) Select the inverter control switch to OFF and ensure that the a.c. supplies indicator shows black and white diagonal stripes.

(34) Select the battery master switch to OFF and disconnect the d.c. ground supply.

TABLE 1 List of fuses for a.c. supplies

Fuse ident	Rating in amps	Service
Distribution box R-A		
Red phase		
Normal 200V supplies		
D 1	20	Supply to sub-fuse block A, panel N-F
D 2	5	ARI 18107
D 3		Spare
D 4	5	HF (SSB) installation
D 5	10	Windscreen heating
D 6	2.5	Windscreen wiper
D 7	2.5	Windscreen heating control
D 8	2.5	Auxiliary air-intakes anti-icing
D 9	10	Camera crate blower-heaters
D10	10	Bullpup installation
D11	2.5	Engine thrust indication (Mod 70)
D12		Spare
Essential services 200V supplies		
D13	5	HF (SSB) Radio (standby)
D14		Spare
D15	10	Doppler navigation system
D16	10	Attack system – ARI 5930
D17	15	Supply to 200/115V transformer for 115V busbars
D18	2.5	IFIS lighting
D19	2.5	Autopilot
D20	2.5	Cooling fans – Doppler navigation equipment
D21	2.5	Yaw damper
D22		Spare
D23	2.5	Windscreen wiper
D24	2.5	200V a.c. test socket, panel R-F
White phase		
Normal 200V supplies		
E 1	20	Supply to sub-fuse block B, panel N-F
E 2		Spare
E 3		Spare
E 4	5	HF (SSB) installation
E 5	10	Windscreen heating
E 6	2.5	Windscreen wiper
E 7	2.5	Windscreen heating control
E 8	5	Doppler navigation system
E 9	10	Camera crate blower-heaters
E10	10	Bullpup installation
E11		Spare
E12		Spare
Essential services 200V supplies		
E13	5	HF (SSB) Radio (standby)
E14		Spare
E15	2.5	Doppler navigation system
E16	10	Attack system – ARI 5930
E17	15	Supply to 200/115V transformer for 115V busbars
E18	2.5	IFIS lighting
E19	2.5	Autopilot
E20	2.5	Cooling fans – Doppler navigation equipment
E21	5	ARI 5848
E22		Spare
E23	2.5	Windscreen wiper
E24	2.5	200V a.c. test socket, panel R-F
Blue phase		
Normal 200V supplies		
F 1	20	Supply to sub-fuse block C, panel N-F
F 2		Spare
F 3		Spare
F 4	5	HF (SSB) installation
F 5	10	Windscreen heating

TABLE 1 *(continued)*

Fuse ident	Rating in amps	Service
F 6	2.5	Windscreen wiper
F 7	2.5	Radio altimeter
F 8	5	Doppler navigation system
F 9	10	Camera crate blower-heaters
F10	10	Bullpup installation
F11		Spare
F12		Spare
		Essential services 200V supplies
F13	5	HF (SSB) Radio (standby)
F14		Spare
F15	2.5	Doppler navigation system
F16	10	Attack system – ARI 5930
F17	15	Supply to 200/115V transformer for 115V busbars
F18	2.5	IFIS lighting
F19	2.5	Autopilot
F20	2.5	Cooling fans – Doppler navigation equipment
F21		Spare
F22		Spare
F23	2.5	Windscreen wiper
F24	2.5	200V a.c. test socket, panel R-F
		Essential services 115V supplies
		Blue phase
B 1	2.5	Fuel contents
B 2	2.5	Artificial horizon and direction indicator
B 3	2.5	Jet pipe temperature, port
B 4	2.5	Fire detection circuit, fuel tanks
B 5	2.5	Fire detection circuit, port engine
B 6	2.5	Airstream direction detector (pre-Mod 714)
B 7	2.5	Fuel flow
B 8	5	IFIS (feed to sub-fuses N & Q in J.B. R-AW)
◀B 9	2.5	Weapons installations – protective relay unit
B10	2.5	Weapons installations – protective relay unit ▶
B11	2.5	115V a.c. test socket, R-GQ
◀ B12	5	IFIS, ADC power supplies ▶
		Red phase
◀ C 1	5	IFIS, ADC power supplies ▶
C 2	2.5	Artificial horizon and direction indicator
C 3	2.5	Jet pipe temperature, stbd
C 4	2.5	Fire detection circuit, bomb bay
C 5	2.5	Fire detection circuit, stbd engine
C 6	2.5	Airstream direction detector (pre-Mod 714)
C 7	2.5	Explosion suppression (Mod 79)
C 8	5	IFIS (feed to sub-fuses M & P in J.B. R-AW)
C 9	2.5	Fuel contents
◀ C10	2.5	Weapons installations – protective relay unit ▶
C11	2.5	115V a.c. test socket, R-GQ
◀ C12	2.5	Weapons installations – bomb distributor ▶
		Panel N-F
		Red phase
		Normal 200V supply fed from fuse D1 in dist box R-A
A 1	5	Attack system – strike sight
A 2	10	Attack system – ARI 5930
A 3	2.5	ARI 18165

TABLE 1 *(continued)*

Fuse ident	Rating in amps	Service
White phase		
Normal 200V supply fed from fuse E1 in dist box R-A		
B 1	5	Attack system – strike sight
B 2	10	Attack system – ARI 5930
B 3	2.5	ARI 18165
Blue phase		
Normal 200V supply fed from fuse F1 in dist box R-A		
C 1	5	Attack system – strike sight
C 2	10	Attack system – ARI 5930
C 3		*Spare*

Fuse ident	Rating in amps	Service
Junction box R-AW		
Blue phase		
115V supply fed from fuse B8 in dist box R-A		
N	3	} 115V supply for IFIS and autopilot
Q	3	
Red phase		
115V supply fed from fuse C8 in dist box R-A		
M	3	} 115V supply for IFIS and autopilot
P	3	
R		Spare
S		*Spare*

LIST OF APPENDIXES

Appendix 1 AC POWER SUPPLIES (Mod 856)

ILLUSTRATION

1. On aircraft with Mod 856 incorporated, fuse A8 in distribution box R-A is fed from fuse F11 on panel R-C (*Chap. 2, App. 1, this Section*), and the switching supply for the inverter is thus fed off busbar H as shown in fig 1. As d.c. supplies for the ATA are fed off busbar J, this change obviates the complete loss of a.c. power in the event of a busbar failure.

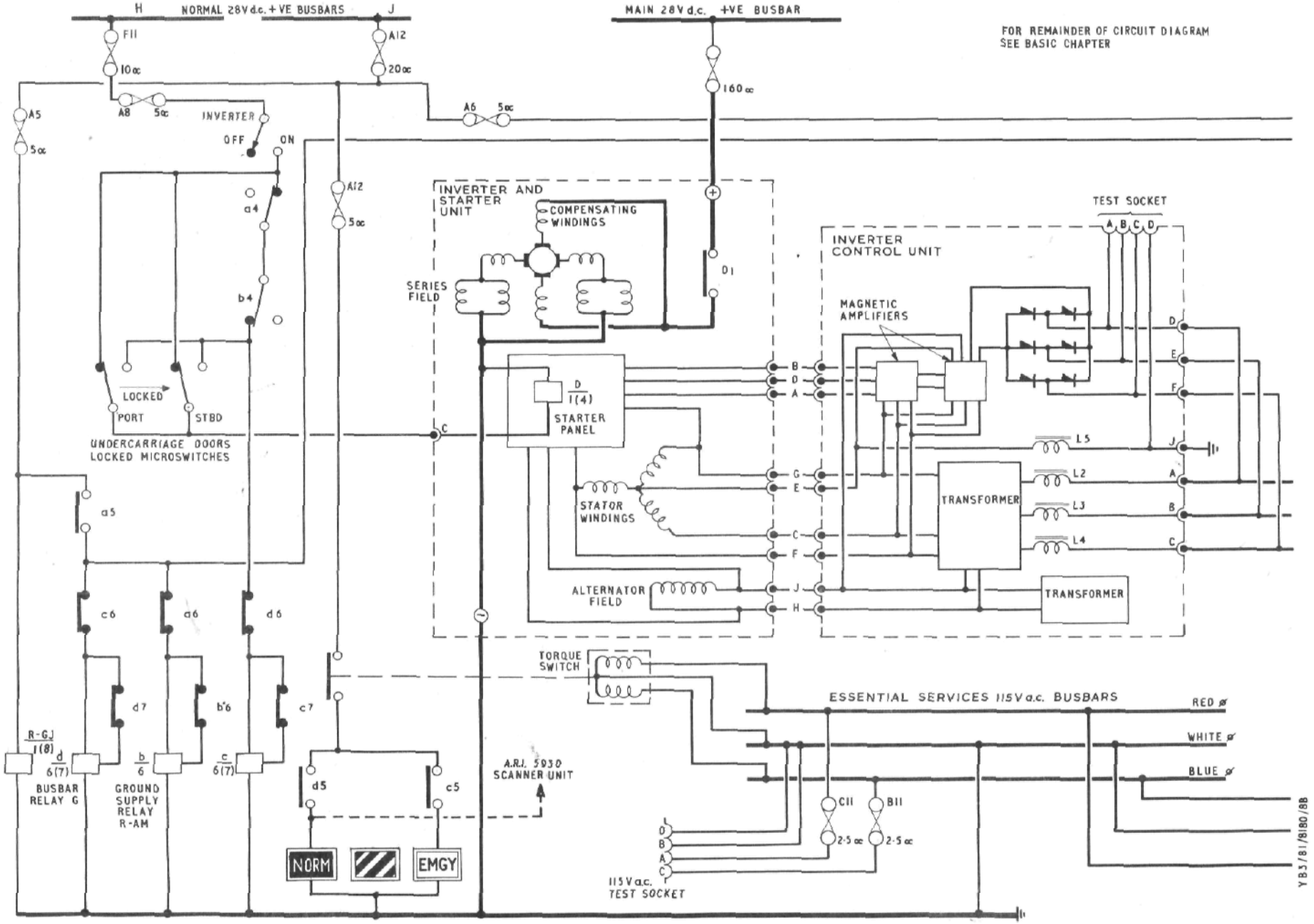


Fig. 1. AC power supplies and distribution (post-Mod 856) – theoretical